Criteria III

Research, Innovations and Extension

3.3.2 Number of papers published per teacher in the Journals notified on UGC website during the last five years

Paper Publication

Submitted to

THE NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL

Details of Research Publication

2015 - 2020

Year	Number of research papers in the journals notified on UGC Website	Number of research papers in peer reviewed journals other than notified on UGC Website	Total
2015 -2016	5	22	27
2016 - 2017	3	16	19
2017-2018	3	8	11
2018-2019	3	9	12
2019-2020	11	8	19
TOTAL			**88**

CARMEL COLLEGE, MALA
Publication of Research Papers in Peer Reviewed Journals

Sl. NO.	Title of Paper	Name of the author/s	Name of journal	Year of publication	Page No.
1	Transgender: A Marginalized and Alienated Community	Sr.Jisha Chakkunny M	Science, Technology and Developments	2020	10
2	A preliminary study on the medicinal plants of Annallur Kole Lands, Chalakudy Thrisur, Kerala	Dr.Bindhu.K.B	International Journal of Creative Research Thoughts	2020	17
3	A new species of Strobilanthes (Acanthaceae) from the Western Ghats, India	Sinjumol Thomas	Taiwania	2020	24
4	Notes on Strobilanthes cuspidata with reinstatement of Endopogon versicolor (Acanthaceae)	Sinjumol Thomas	Plant Science Today	2020	29
5	Hyperparameter Optimization and Regularization on Fashion-MNIST Classification	Greeshma K V	International Journal of Recent Technology and Engineering (IJRTE)	2019	39
6	Fashion-MNIST Classification Based on HOG Feature Descriptor Using SVM	Greeshma K V	International Journal of Innovative Technology and Exploring Engineering (IJITEE)	2019	46
7	The T-X Family of Distriburions: A Retrospect	Meenu Jose	THINK INDIA JOURNAL	2019	49
8	Quantum Finite Automata using Quantum Logic	Dr.Jismy Joseph	Malaya Journal of Matematik	2019	63
9	Culture and lifestyle of KAVARA community-A descriptive study	Dr.Merin Francis	IJRAR(International journal of research and analytical reviews	2019	67
10	Selective photocatalytic dye degradation by surface charged TiO2	Tessy Jose	Materials today: Proceedings (Elsevier)	2019	72

11	A New Section (Begonia Sect. Flocciferae Sect. Nov.) and Two New Species In Begoniaceae from The Western Ghats of India	Sinjumol Thomas	Edinburgh Journal of Botany	2019	78
12	Strobilanthes tricostata a new species of Acanthaceae from the Western Ghats, India	Sinjumol Thomas	Phytotaxa	2019	96
13	Strobilanthes carmelensis (Acanthaceae), a new species from the Western Ghats of India	Sinjumol Thomas	WEBBIA (Journal of Plant Taxonomy and Geography)	2019	103
14	Strobilanthes mullayanagiriensis and S. bislei (Acanthaceae) – two new species from the Western Ghats,India	Sinjumol Thomas	Plant Science Today	2019	109
15	Root and Tuber Vegetables – A Nutrient Study and Vitamin C Estimation	Dr. Vidya Francis	Carmel Blaze	2019	117
16	Exploration of Heathcliffe's Transition from Slave to Master in Emily Bronte's Dystopia Wuthering Heights	Ema Maria Mannaly	Carmel Blaze	2019	131
17	India's Beefed –Up Nationalism	Mary Philip	Carmel Blaze	2019	141
18	A Preliminary Study on the Medicinal Plants of Jewish Cemerty, Mala, Thrissur During the Post Monsoon Season and their Traditional Use	Dr. Bindhu K B	Carmel Blaze	2019	150
19	Nutritive Analysis of Selected Leafy Vegetables	Dr. Roshini K Thumpakara	Carmel Blaze	2019	163
20	Anti Helminthis Activity of Alangium salviifolium against Pheretima posthumous	Dr.Sr.Kochuthressia, K.P.	International Journal of Current Microbiology and Applied Sciences.	2018	175
21	Power Domination in Knodel graphs and Hanoi graphs	Dr.Seethu Varghese	Discussiones Mathematicae Graph Theory	2018	180

22	Strobilanthes orbiculata (Acanthaceae) a new species and notes on S. matthewiana from the southern Western Ghats, India	Sinjumol Thomas Bince Mani S John Britto	Phytotaxa	2018	192
23	Two new species of Impatiens (Balsaminaceae) from the Western Ghats, India	Bince Mani, Sinjumol Thomas & S. John Britto	Phytotaxa	2018	201
24	Impact of Conolly Canal in Market Reorientation and Configuring Regional Networks of Malabar	Brighty Robert	IJRAR International Journal of Research and Analytical Review	2018	209
25	Comparative study of Soil Quality in the indusrtrial area of Angamaly, Kerala, India	Dr. Princy K.G. and Neethu Sunny	EPRA International Journal of Multidisciplinary Reasearch(IJMR)	2018	215
26	Preliminary Approach to Cladogram Preparation using Sele cted Taxa of Bicarpellate	Dr. Bindhu K B	Carmel Blaze	2018	222
27	Determination of Reducing Suger in Natural and Synthetic Fruit Juices	Dr. Vidya Francis	Carmel Blaze	2018	247
28	Global Trends in Educational Technology Adoption	Smitty V Isidhore	Carmel Blaze	2018	261
29	Assessment of Drinking Water Quality:A Case Study of the Industrial Area in Angamaly	Neethu Sunny	Carmel Blaze	2018	270
30	Effect of Carbon Black Types on the Rheological and Mechanical Properties of Natural Rubber Compound	Tessy Jose	Carmel Blaze	2018	277
31	Comparative study of Various Brands of Tea Powder Marketed in Kerala	Dr. Princy K.G.	Carmel Blaze	2018	284
32	Composition, antibacterial and anti-oxidant potentials of the essential oil of Hedychium matthewii	Sinjumol Thomas	Bangladesh Jounal of Pharmacology	2017	293

33	A new subspecies of Celastrus (Celastraceae) from the Palni hills of South India	Sinjumol Thomas and S. Prabhu	Taiwania	2017	302
34	First records of two Ginger LilysHedychium(Zingiberaceae) species from the Western Ghats, India	Sinjumol Thomas	Journal of Threatened Taxa	2017	307
35	Social Exclusion Faced by Elderly Women	Dr. Licy A D	Scholars Journal of Arts, Humanities and Social Sciences	2017	314
36	Preliminary Study on Antimicrobial Activities of Selected Medicinal Plants	Dr. Bindhu K B	Carmel Blaze	2017	322
37	Macrofloral and Microalgal Diversity in the Mangrove Areas of Mala, Thrissur	Sunitha Subramanian	Carmel Blaze	2017	338
38	A Comparative Study on the Physicochemical Parameters of Soil in Mala Block Panchayat	Dr. Princy K G	Carmel Blaze	2017	345
39	Herbal Plants in Cooking- An Analysis and Nutrient Study	Dr. Vidya Francis	Carmel Blaze	2017	351
40	Women Writing on Writing Women: A Study	PRETTY John P	Carmel Blaze	2017	366
41	Hindi aur Vinjapan Ki Duniya	Dr. Shibi C	Carmel Blaze	2017	375
42	Silvia Plath - Sahithyathile Vellivelicham	Dr. Bincy Dominic	Carmel Blaze	2017	382
43	Singleton	Dr. Licy A D	PESQUISA-International Journal Of Research	2016	389
44	Importance of life skills in elderly women's life with special reference to elderly women residing in Thrissur	Dr. Licy A D	PESQUISA-International Journal Of Research	2016	395
45	Efficient Protocol For Direct Somatic Embryogenesis And Plant Regeneration In Kaempferia galaga L from Leaf sheath Explants	Dr.Sr.Kochuthressia K.P.,S John Britto	Life Sciences International Research Journal : Volume 3 Spl Issue (2016) ISSN 2347-8691	2016	407
46	Socio- Cultural Status of the	Dr. Licy A D	Carmel Blaze	2016	413

	Elderly Women				
47	The Binding Vine of Creativity in Shashi Deshpande's The Binding Vine	Pretty John P	Carmel Blaze	2016	434
48	Cheel Kahani mem sthree purush manasikatha ka chithrahn	Dr. Shibi C	Carmel Blaze	2016	443
49	The Politics of Environment in Kerala	Mary Philip	Carmel Blaze	2016	447
50	Algal Diversity of Stagnant Water Bodies of Carmel College Campus, Mala	Dr. Bindhu K. B	Carmel Blaze	2016	461
51	Study on Water Quality Parameters and Algal Diversity of Nadavaramba Chira	Tinu Raphy	Carmel Blaze	2016	484
52	Comparative Study of the Physicochemical Properties od Some Edible Oils	Dr. Princy K G	Carmel Blaze	2016	500
53	Effect of Casein on the Mechanical Properties of Low Density Polyethylene	Dr. Vidya Francis	Carmel Blaze	2016	509
54	3,3,5- Triaryl-3H-Furan-2-Ones: Photochemical Transformations	Dr. Roshini K Thumpakara	Carmel Blaze	2016	516
55	Android OS	Greeshma K V	Carmel Blaze	2016	525
56	Secure Distributed Deduplication Systems with Improved Reliability	Jasmine Jose	Carmel Blaze	2016	535
57	Musical Instruments of Kerala Temples	Bigil Kochappan	Carmel Blaze	2016	542
58	Relevance of Data Visualization in Data Mining	Blessy Paul P	Carmel Blaze	2016	549
59	Screenless Display: An Emerging Trend in The Near Future	Chinju Poulose	Carmel Blaze	2016	561
60	Wireless AD HOC	Loshima Lohi	Carmel Blaze	2016	571
61	Drive Share	Smitty V Isidhore	Carmel Blaze	2016	581
62	The support system of single women	Dr. Licy A D	International journal of applied research	2015	593
63	A comparative study on the life satisfaction level of Single women	Dr. Licy A D	The International Journal of Humanities & Social Studies	2015	602

64	An Ab-Initio Study on Conformers of Cyclohexane An Ab-Initio Study on Conformers of Cyclohexane	Dr. Princy K.G. ,Dr.Roshini K Thumpakara,Dr.Vidya Francis & Jyothy P.J	*International Journal of Engineering Research & Technology (IJERT)*	2015	614
65	Mass Multiplication of Morinda citrifolia (Noni): A Highly Potential Medicinal Plant	Dr. Kochuthressia K.P and Dr. Jaseentha M.O.	International Journal of Advanced Research in Biological Sciences	2015	617
66	Invitro propagation of Kaemferia galanga using rhizhome	Dr.Bindhu.K.B.	International Journal of Current Research	2015	623
67	In vitro Propagation of Aegle marmelos through Nodal Explants	Dr.Bindhu.K.B.	International Journal of Science and Research (IJSR)	2015	627
68	GC-MS Analysis of the Leaves of Pueraria Phaseoloides (ROXB.) Benth	Jaseentha M.O & Kochuthressia K P	Carmel Blaze	2015	631
69	Preparation and CONDUCTIVITY Studies of Poly (P-Phenylenediazomethine)/Poly (Vinylchloride)Blends	Dr. Princy K G	Carmel Blaze	2015	638
70	Major Factors Lead Elderly to Old Age Home	Dr. Licy A D	Carmel Blaze	2015	648
71	The Edible Art in Salt N' Pepper	Lakshmi Salim	Carmel Blaze	2015	672
72	Comparative Study of Two Selected Pteridophyes of Carmel College Campus	Dr. Bindhu K B	Carmel Blaze	2015	677
73	Nyayamoorthy V R Krishnasyaar	Dr. Shibi C	Carmel Blaze	2015	696
74	Nature, Nurture and Nation in Maggi Advertisements	Pretty John P	Carmel Blaze	2015	699
75	Online Retail Management Based on Autonomic Principles	Smitty V Isidhore	Carmel Blaze	2015	713
76	Malayalee Beggars- A Dilemma for Kerala Society	Jisha Chakkunny M	Carmel Blaze	2015	720
77	Pro- Oxidant Activity of TiO2 ON Weathering and Biodegradation of Lldpe-PVA Blends	Dr. Vidya Francis	Carmel Blaze	2015	729

78	Study of Angiosperm Vegetation During Summer Season in a Selected Wetland at Mala	Nithya Madhanan	Carmel Blaze	2015	743
79	Study of Angiosperm Vegetation During Summer Season in a Selected Wetland at Mala	Sunitha Subramanian	Carmel Blaze	2015	750
80	Emerging Trend of E-Commerce in India	Remya M B	Carmel Blaze	2015	757
81	The Fool's Wisdom: A RE-Visioning of Classic Novels threosSufi Perspective	Nasin Yoosef	Carmel Blaze	2015	765
82	Colonial Reflections and Modern Women : Introspecting ' Meenakshi'	Reena K T	Carmel Blaze	2015	775
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85	Cloud Computing	Greeshma K V	Carmel Blaze	2015	798
86	Estimation Procedures for Current Status Competing Risks Data in Presence of Covariates	Dr. Sreedevi E P	Carmel Blaze	2015	816
87	Seed Viability and Germination Studies Inmorinda Citrifolia:A Potential Medicinal Plant	Dr. Kochuthressia K.P	Carmel Blaze	2015	827
88	Seed Viability and Germination Studies Inmorinda Citrifolia:A Potential Medicinal Plant	Dr. Jaseentha M.O.	Carmel Blaze	2015	837

Year of Publication

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Transgender: A Marginalized and Alienated Community

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Introduction

Gender is a multifaceted, construct, a complex phenomenon viewed differently in different societies. The most important impact that gender created in the society is the assigning or segregating the work load among the two dominant group the male and female. The relatively smaller group in population, the transgender is facing inequality and condemnation by this patriarchal society. Living as a transgender someone who identifies with a gender different than one assigned at birth is an experience filled with stress, strain and tensions. Transgender persons who are largely marginalized from the mainstream society because of the social stigma related to the gender identity. It is negatively affects their mental wellbeing. The social exclusion results the different types of discriminations towards this minority group.

The God's own country, Kerala is the first state to introduce a transgender policy in 2015. The State has passed the Transgender Bill in an attempt to bring them to the mainstream of social life. However, discrimination, exclusion, suppression and oppression against transgender persons still continue from all walks of life. Transgender suffer from the lack of continuity in their identity, lack of self esteem, over emphasized and unwanted distinctiveness and injustice at every turn. This study intended to expose sufferings, discrimination and marginalization of transgender and try to explain every day issues of transgender through the sociology of third gender.

Gender equality refers to people receiving equal opportunities to realize their full human potential according to their wish, irrespective of gender. This includes equality in opportunities to take part in social, economic, cultural and political developments and benefiting equally from the results. It can also refer to the equality in protection of human rights. People are not aware about the gender issues especially transgender problems in the present society. Our constitution is guaranteeing fundamental rights for all human beings. But we are creating variety of boundaries for the transgender.

Methodology

The objective of the study is to identify the major problems confronted by the transgender. Research design of the study is descriptive in nature. Transgender people who are living in Kerala formed the Universe of the study. Fifty Samples are taken from the Thrissur district in Kerala. Snowball sampling method was used to collect the data. For this study, both primary and secondary sources of data are used. Primary data collected through interview schedule. Secondary data were collected from books, journals and internet.

Discussion and Results

In the modern complex society transgender confronted a lot of problems. Discrimination, disrespect, inequality, rejection, unwanted attention are the major difficulties of their life. They have restricted access to education, health services, and public spaces. They are denied from the political, religious and recreational involvements with the public. The Constitution provides for the fundamental right to equality, and not allowed any discrimination on the grounds of sex, caste, creed or religion. The Constitution also guarantees political rights and other benefits to every citizen. But the third community continues to be oppressed. The analysis reveals the present conditions of the transgender in our society.

The study shows that 94% of the respondents are not satisfied with their present condition. Transgender faces avoidance in all spheres of life. People living together in a community make up a society, and anything connected to that group can be described as societal. Societal pressures are expectations that influence the entire community, especially the existing social stigmas effect negatively to the transgender. So they are not gratifying by the present condition. The analysis indicates nobody is happy with the attitude of society towards them. All of them are opined that the societal attitude is not favorable to them. It means society is not giving any consideration to the transgender. The study shows in Kerala people are more conservative in nature. Society have very negative attitude to these persons. It creates the adjustment problems in the life of transgender The study clearly revels that a great majority of the respondents openly said that people are more conservative and they have a negative attitude towards them. This situation creates discrimination and a lot of adjustment problems in the everyday life of Transgender.

In Kerala the transgender faces extreme type of avoidance from their fellow beings. This is mainly due to the conventional culture of gender binaries. A well proportion (90%) of the

respondents in this study feel that the society is not considering them and always avoiding them.. This avoidance and negligence always pull them back from public spaces. Actually transgender are very talkative, enthusiastic and friendly in nature. But the people are not ready to communicate with them. The exclusion from the social interactions leads transgender people into several distresses, tribulation, deprivation which further limits their opportunities. It also denies their visibility in all major domains of society.

The study reveals that a little more than half (54%) of the respondents often face negative experiences from the society. The society considered the transgender as a social deviant who have certain psychological problems. There no acceptance from the family and their community. At present our society is not successful in providing the facilities for the transgender to get their livelihood requirements. Not only providing the opportunities but also blaming for their mistakes.

Equality is a fundamental human right. It guarantees in our constitution. The right of equality before law and equal protection of law **is** guaranteed under Article 14 and 21 of the Constitution. The right to chose one's gender identity is an essential part to lead a life with dignity which again falls under the ambit of Article 21.The Court has given the people of India the right to gender identity. Further, they cannot be discriminated against on the ground of gender as it is violation of Articles 14, 15, 16 and 21. But transgender people are discriminated in our society in all walks of life. In public places like bus stands, railway stations, theatres, temples, educational institutions, offices, malls, beaches, playgrounds, even within the public toilets they are offended and insulted. The society considers transgender are not normal as the other members of the society. One of the largest reasons that transgender face inequality and feel inferior is due to the lack of public understanding of transgender people. This cause low self respect, self esteem self confidence and self acceptance within them.

Table-1: Feelings of Respondents

Feelings of respondents	Number of respondents		Total
	Yes	No	
Self respect	12(24%)	38(76%)	50(100%)
Self esteem	10(20%)	40(80%)	50(100%)
Self confidence	18(36%)	32(64%)	50(100%)
Self acceptance	13(26%)	37(74 %)	50(100%)

On respondents feelings about themselves shows that only one fourth (24%) have self respect, while about three fourths do not have any self respect. About one fifth only have self esteem, while a great majority does not have any self esteem. A little more than one third feels self confidence. While others (64%) do not have self confidence. A little more than one fifth only accepted themselves. Self respect helps to fulfill our potential, develop healthy relationships. If we truly respect ourselves, then we can accept ourselves as well as others. The present study shows they have low level of self respect, self confidence and self esteem. Healthy self esteem originates in the environment found in the family, school, peer group, work place, and community. For healthy self esteem individuals need to receive nurturing from the people in their environment. Self control is the ability to regulate one's emotions, thoughts, and behavior. The ability to control ourselves helps to boost our feeling of self esteem. Here the transgender persons are very poor in the self respect, self esteem, self confidence, self acceptance, and self control. Our society has a vital role in these personality traits. They feels the society is under valuating and under estimated them. This attitude of transgender itself acts as a barrier to uplift their life.

Table-2: Types of Difficulties

Types of difficulties	Number of respondents		Total
	Yes	No	
Economic difficulties	46(92%)	4(8%)	50 (100%)
Lack of family support	39(78%)	11(22%)	50 (100%)
Difficulty with identity	38(76%)	12(24%)	50 (100%)
Avoidance based on transgender	45(90%)	5(10 %)	50 (100%)
Difficulties in social participation	48(96%)	2(4%)	50 (100%)
Difficulties in political participation	49(98%)	1(2%)	50 (100%)
Difficulties in religious functions	46(92%)	4(8%)	50 (100%)
Difficulties while using public facilities	48(96%)	2(4%)	50 (100%)
Difficulties in Education	47(94%)	3(6%)	50 (100%)

The table 2 on distribution of Respondents by their difficulties in various life situations shows that Except a few almost all suffer from various difficulties such as economic difficulties (92%), participation in social activities (96%),political participation (98%), religious participation

(92%) and feel avoidance (90%). A more than three fourths (78%) are not getting any support from family and feel homelessness. Another three fourths (76%) feel identity crisis

We have to experience all kinds of difficulties throughout our lives. Everyone has problems in life. For the most part, we are able to quickly solve them without much trouble. Problems become more difficult it is impossible to lead a happy life. Here the table shows different types of difficulties faced by the transgender. The major difficulties faced by the transgender are the economic problems, absence of family support, identity crisis, different types of avoidance, and difficulties in social, political and religious participation. The mentality of the society is not strong enough to support the transgender as to accept them in the mainstream of the society.

Transgender experience discrimination in their everyday life. The major one is they have very limited employment opportunities. This study shows that 96 % respondents are say that government is not giving opportunities to them.4 percentage of the minority respondents are says that the government giving opportunities to them. In real life situations in any of the areas government is not taking any actions to support them. But The Transgender Persons (Protection of Rights) Bill 2016 was introduced in Lok Sabah on August2,2016 highlights a transgender person must obtain a certificate of identity as proof of recognition of identity as a transgender person and to invoke rights under the bill. The bill prohibits discrimination against a transgender person in areas such as education, employment, and healthcare. It directs the central and state governments to provide welfare schemes in these areas.

The study shows that 92%of respondents are believe that the new generation accepts the third identity. Teens are more broadminded persons and they accepting all changes in the society. They oppose the entire conservative and traditional outlook and believe. The study also reveals the other problems that are being faced by the transgender community are unemployment, lack of educational facilities, homelessness, and lack of medical facilities, depression, social exclusion and problems related to marriage.

The rule of law is supreme and everyone is equal in the eyes of law in India. Yet, the transgender community is in a constant battle as they have to fight oppression, abuse and discrimination from every part of the society, whether it's their own family and friends or society at large. The life of transgender people is a daily battle as there is no acceptance anywhere and they are ostracized from the society and also ridiculed.

Implications of the study

Transgender are constantly targeted for abuse. They suffer cruel, inhuman and degrading treatment, including a constant threat of violence that amounts to torture, forced disappearances and sexual violence. The International Protection for the Human Rights of Transgender guarantees all people are entitled to enjoy the protection afforded by international human rights law. Transgender are no exception. The non-discrimination principle, recognized in the UN Charter, the Universal Declaration of Human Rights, and other basic human rights treaties, including the International Covenant on Civil and Political Rights, mandates that the rights recognized in these treaties are ensured to all individuals, without any distinctions based on race, color, sex, national origin, religion or political opinion or other status. The "other status" clause invites the recognition of new grounds upon which discrimination is prohibited, such as sexual orientation and gender identity. It is now well-recognized that discrimination based on sexual orientation and gender identity violates the non-discrimination principle. The obligation to "respect" the right to equality prohibits any discrimination to "ensure" that right requires states parties to protect individuals from discrimination. This study recognized, affecting basic aspects of ordinary life such as work or housing, individuals are to be protected from discrimination within the article of right to equality. The right to personal security also obliges States parties to take appropriate measures in response to death threats against persons in the public sphere, and more generally to protect individuals from foreseeable threats to life. Unfortunately, Kerala has failed in this obligation. The high number of murders and other violent attacks against transgender individuals is stark evidence of the very hostile and violent environment for the transgender population that persists in Kerala. By failing to take adequate measures to protect transgender individuals from such attacks, Kerala is violating its positive obligations with respect to the rights to life and personal security under different Articles.

Conclusion

In Kerala Transgender face discrimination within their own family units and schools, in employment and housing, within government settings, and under the justice and legal systems. The main problem in the society is that there is no proper awareness and understanding of the transgender community and many of them are not accepting even they are human beings. Support from family and society is very essential for their upliftment. The transgender are averse against the society when the basic respect is refused by the society and when they receive ill-treatment

from the society they expose their arrogant activities to safeguard themselves. Marginalization deprives the transgender from their maximum potential for prosperity and denies even in gender related opportunities. It is wrong to judge and discriminate the persons who are different from the stereotype, which is created by human beings. A radical change in the life of transgender people is possible only through powerful legislation. The transgender policy bill introduced by Kerala government shows light on transgender issues and further steps for the upliftment of transgender people. The urgency of the era is the inclusion strategies for overcoming discrimination, inequality and stigmatization.

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A PRELIMINARY STUDY ON THE MEDICINAL PLANTS OF ANNALLUR KOLE LANDS, CHALAKUDY, THRISSUR, KERALA

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Abstract:

A work was carried out to study the diversity of medicinal plant at Annallur Kole lands of Chalakudy, Thrissur. The main aim of the study was to identify the medicinal plants of the kole land , their uses , wetland plant diversity, importance of wetlands and to create awareness about it. Work was done from the period of September to December 2019. Frequent field visit were made, plants were collected and identified with the help of standard flora and with the help of experts from the field of taxonomy. It was observed that the area is rich in plant diversity . We observed 53 plants belonging to 25 families. The medicinal use of each plant were also examined and tabulated. In the present analysis of kole land flora, members of the family Asteraceae were predominant with Eight genus then Convolvulaceae followed by Fabaceae with five and four members respectively.. Then by Cyperaceae,Amaranthaceae, Onagraceae ,Acanthaceae,Euphorbiaceae and Malvaceae members were also there. The data compiled in this study highlights the diversity and abundance of plants with medicinal properties in this wetland system. This necessarily leads to create a better understanding of medicinal plants of kole lands to the present community.

Index Terms – Wetland, medicinal plants, diversity, koleland, taxonomy.

I. INTRODUCTION

Kole wetlands are a type of wetland which support varied spectrum of biodiversity. They form vital ecosystems providing response for the livelihood concerns of thousands of inhabitants in and around this area . Several species of aquatic and semi aquatic medicinal flora make use of the outstanding habitat Kole wetland ecosystem. The plants of this area are being used by local community for healing purposes. More than that the varying conditions due to anthropogenic activities these flora are very subtle to fluctuations in the normal physiochemical parameters of the wetland, results in the extirpation of these plants. This may lead to the ultimate end of the medicinal products. Considerable attempts have to be made to record the availability of medicinal plants and to spotlight the known therapeutic properties of the wetland plants of this important zone. It was reported that the local inhabitants have been using wetland plants against many diseases traditionally. We have to realize the importance of traditional medicine which provides about 80% of health service to world population to an extent that deserves (Marini, 1980). India, has greater potentials to increase its share in the world market, as having excellent traditional knowledge in the herbal medicine,. In the form of food, fodder and medicine, plants of kole wetland ecosystem played engrossing role in the life of humankind in earlier days. But the changed life style, reduced the worth of these wetland plants, and they are treated as weeds. Protection and conservation of wetland is a important matter

Inspite of forming the rich repositories of various plant species, attempts has not been undertaken to itemize the food values and medicinal uses of them. It is a matter of urgent need to record the present status of medicinal plants in this unique ecosystem for their conservation and utilization for sustainable development. In this context a preliminary study has been carried out for the documentation of availability and medicinal potential of plants that grow as weeds in Annallur Kole lands.

II.LITERATURE REVIEW

Many works were carried out by scientists from different part of the world on various aspects of wetland plant which clearly indicates the importance of wetland plant. In India, Kerala is having the largest area under wetlands (Nayar and Nayar, 1997). Using IRS satellite data Nair and Sankar (2002) recently mapped the wetland systems of Kerala and reported that the state has a total of 217 wetland units out of which only 157 units are having an area greater than 56.25ha.

In the Kole land area moderate climatic conditions prevailed. A minimum temperature of 21º C and a maximum of 38º C has a recorded in this area. Air is humid (85-95% during June -September and 70% during January). The southwest and North-west Monsoons are the rainy seasons in Kole lands.

Kole lands are having rich in floristic and faunal diversity than any other fresh water ecosystems. All taxonomic groups including algae, mosses, ferns and flowering plants including many medicinal plants are represented in such areas.. Ecological status of an ecosystem can be evaluated with a knowledge of the major plant communities and their relative importance. depending on the availability of water many aquatic macrophytes grows either submerged or floating on the surface, continuously or periodically. They provides habitat and refuge of the aquatic communities and contribute biomass and nutrients to various trophic levels in the ecosystem, there by helping to maintain the structure and function of aquatic ecosystem. Changes in the community composition or alteration in the abundance of individual species provide valuable information on how and why an ecosystem might be changing (Scott et al., 2002). According to Kelly and Whitton, 1998 a progressive change in species composition can result in the eventual loss of species diversity due to eutrophication. Beside this they also favour periphytic growth, enrich various aquatic fauna and serve as a breeding ground for associated fauna (Mitra, 1997).

Jayson and Sivaperuman (2005), stated that the Kole wetlands act as feeding, roosting and breeding ground for many species of migratory and resident birds and they reported 182 species of birds, 13 species of fishes from the Thrissur Kole wetlands.

III.RESEARCH METHODOLOGY

Study area

The present study is based on the wetland plants collected from Annallur Kole land. Collection was done during the period of September-December 2019.Annalur is a village of Thrissur District near Kottat, Chalakkudy. And this place is 6 km away from Chalakkudy National Highway. The factory Thomson Tiles is running near to this paddy field. The main cultivation of this area is paddy. And the non cultivated area is rich with plant diversity including both aquatic and terrestrial. In this study an attempt was carried out to explore wetland diversity of Annallur paddy field during post monsoon season.

Collection of specimen

The plants were collected from the Annallur Koleland and observed as well as the colour photographs were taken with the help of digital camera in their material habitat. The specific plants in that area were collected along with their flowers taken for further analysis and herbarium preparation. The specimens collected from the wetland were brought in to the laboratory for further analysis. The plants were examined starting from stalk through the calyx corolla, androecium up to the tips of stigma using hand lens. Then record the observed characters in a note book. Flowers were sectioned with help of razor or sharp blade, one horizontally and the other down the middle, for know about placentation and to complete floral diagram and for understanding the status.

Preparation of field book

During the collection, the specimens were collected and tagged within the field number. Filed observation such as habitat, flower colour etc. were entered in the field book. The specimens of appropriate size with relevant parts were collected from the field for herbarium preparation.

Identification of family

On the basis of examined characters, the families of the specimens were identified .As well as the software "flowering plants of Kerala ver.2.0 (Dr.sasidharan , KFRI. Peechi), under biodiversity portal (India biodiversity.org.) and experts in the field of taxonomy were also helped in the identification of plant specimens.

Preparation of herbarium

The collected specimens, were cut or dug, and pressed as soon as possible. After that specimens placed carefully on a pressing sheet. (Newsprint sheet or a blotter) without no folding or overlapping of parts .After drying and pressing specimens were affixed on the herbarium sheet. Then the binomial, family, habitat etc. were recorded on the sheet.

IV. RESULTS AND DISCUSSION

Kole lands in Annallur serve as an excellent habitat for numerous medicinal herbs which can be harvested for economic benefits. This investigation on the availability and abundance of medicinal herbs in the Annallur kole revealed the presence of 44 species under 40 genera and 22 families (Table 1). In the present analysis of kole land flora, members of the family Asteraceae were predominant with Eight genus and Convolvulaceae followed by Fabaceae and convolvulaceae with five and four members respectively.. Then by Cyperaceae,Amaranthaceae, onagraceae ,Acanthaceae,Euphorbiaceae Malvaceae members are also there. Among this three ferns were also noticed during the study time. *Ludwigia octovalvis Ludwigia adscendens ,Merrimia hederacea ,M. tridentata ,Ipomea aquatic, Hygrophylla schulli ,Kyllinga squamulata* Monochoria vaginalis, and *Schoenoplectus articulatus* are frequent in all seasons in the study area. The study area contains saline tolerant species like *Acanthus ilicifolius* with different medicinal values were also come across. The observed species were found to be used in in curation of gastrointestinal disorders, respiratory ailments, dermatological snags, urinogenital illnesses, cardiovascular problems and neuro disorders (Table 1). They were also used for different applications including decoction, extraction, infusion and paste preparation. It was also observed that methods of application of medicine like oral administration, local application, inhalation or smoking and massaging is in practice.

The data compiled in this study highlights the diversity and abundance of plants with medicinal properties in this wetland system. So it is necessary to create a better understanding of medicinal plants of kole lands to the present community. We can change the status of the plants from worst weed to useful medicines for mankind by providing basic information to the local community on the medicinal attributes of these plants. The economic importance of river vegetation of Kerala including both wetland species and bank species was analyzed Maya *et al*., (2003). A review on the utility of Indian wetland plant species as food and medicine by incorporating the traditional knowledge of local communities was made by Swapna *et al.,* (2011).

People have open access to collect and utilize the aquatic medicinal plants in kolelands as most of them are grown in wild and them. Beside this the koleland plants of the region can provide high income generating opportunities to local communities.

Almost all the medicinal plants found in Annallur kolelands are commonly seen in rivers, ponds and paddy fields all over Kerala, however, kolelands offer plenty of space for its feasible agriculture and sustainable exploitation. Some of the therapeutic usages of such species are very unique to the traditional medicinal knowledge system of the locality.

According to Kairo *et al*., 2000, major impediments in the protection of wetland resources are the lack of community participations in management efforts, source of revenue, and dearth of awareness amongst decision makers on the exact values of

wetland. Therefore in this kole wetland region for sustainable management a complete and comprehensive management strategy, based on ethnic, ecological and financial principles, is need to be planned by the whole participation of local stakeholders

Table 1-Table showing the name family and uses of plants reported from the Koleland area

NO	NAME	FAMILY	MEDICINAL USE
1	*Ludwigia octovalvis*	Onagraceae	Used in the treatment of diarrhoea, dysentery, nervous diseases
2	*Ludwigia adscendens*	Onagraceae	A decoction of the aerial parts is used as a treatment for dysentery, fever, cough and ophthalmia.
3	*Ipomea alba*	Convolvulaceae	The whole herb is used in treating snakebite
4	*Merrimia hederacea*	Convolvulaceae	Juice of the leaves, used to heal cracks in the hands and feet
5	*Merrimia tridentata*	Convolvulaceae	A decoction of the whole plant -various ophthalmias.
6	*Ipomea aquatica*	Convolvulaceae	The young shoots used by diabetic patients
7	*Cuscuta chinensis*	Convolvulaceae	A lotion from the stems for sore heads and inflamed eyes.
8	*Ziziphus jujuba*	Rhamnaceae	Used for improving muscular strength and weight, for preventing liver and bladder diseases and stress ulcers.
9	*Physalis minima*	Solanaceae	Appetizing, tonic, diuretic, laxative, useful in inflammations, enlargement of the spleen and abdominal troubles.
10	*Polygonum pencilvanicum*	Polygonaceae	For hair-blacking, liver and kidney-tonifying and anti-aging effects as well as low toxicity.
11	*Eicchhornia crassipes*	Pontederiaceae	The weed biomass can be used for antimicrobial, antifungal activities
12	*Monochoria vaginalis*	Pontederiaceae	Plant is considered alterative, tonic and cooling. Juice of leaves is applied to boils.
13	*Gomphrena decumbens*	Amaranthaceae	Antiasthmatic, abti oxidant properties
14	*Alternanthera philoxeroides*	Amaranthaceae	n extract of the plant is used medicinally in India to treat 'female diseases
15	*Lindernia diffusa*	Scropulariaceae	Leaf paste with lemon juice is given orally to cure excess bile secretion; also applied externally on ringworm and boils.
16	*Urena lobata*	Malvaceae	The leaves are diuretic, emollient, refrigerant, styptic, vulnerary
17	*Sida accuta*	Malvaceae	decoction of the whole plant is used as a treatment for feversThe juice of the plant is used to treat indigestion
18	*Commelina diffusa*	Commelinaceae	The leaves are diuretic and febrifuge The crushed leaves and stems are used as a remedy for irregular menstruation
19	*Cleome viscosa*	Capparadaceae	Anthelmintic, antimicrobial, analgesic, antiinflammatory, immunomodulatory, antipyretic and psychopharmacological, antidiarrheal
20	*Emelia sonchifolia*	Asteraceae	A tea made from the leaves is used in the treatment of dysentery.
21	*Vernonia cinerea*	Asteraceae	Seeds Cures diseases caused by roundworms and threadworms, coughs, flatulence, intestinal colic, and other chronic skin-diseases.
22	*Sphagneticola trilobata*	Asteraceae	A strong decoction of the whole plant is used to treat chest colds. Combined with Lantana camara, as a tea or syrup, as a remedy for colds
23	*Tridax procumbens*	Asteraceae	The leaves are antiseptic, haemostatic and parasiticide.
24	*Mikania michrantha*	Asteraceae	Juice of leaves is applied to boils.
25	*Sphaeranthus indicus*	Asteraceae	widely used in Ayurvedic system of medicine to treat vitiated conditions of epilepsy, mental illness, hemicrania, jaundice, hepatopathy, diabetes, and skin diseases
26	*Phyllanthus amarus*	Euphorbiaceae	Phyllanthus amarus is widely used as a medicinal plant and is considered to be a good tonic, diuretic and febrifuge
27	*Bridelia ovata*	Euphorbiaceae	The leaves are purgative,Another report says that they are a mild laxative.
28	*Alysicarpus vaginalis*	Fabaceae	decoction of the roots is used as a treatment against coughs
29	*Senna tora*	Fabaceae	The seeds are diuretic and purgative.The leaves are purgative
30	*Mimosa pudica*	Fabaceae	The leaves are bitter, mildly sudorific, tonic.A leaf tincture is given by teetotallers to drunkards to remedy drunkenness
31	*Centrosema molle*	Fabaceae	medicine as a toxic, alternative, diaphoretic, blood purifier, in rheumatism
32	*Setaria lucopila*	Poaceae	The germinated seed of yellow-seeded cultivars is astringent, digestive, emollient and stomachic
33	*Eragrostis tenella*	Poaceae	This **Plant** has an extensive property of acting as anticancerous, antimicrobial and antioxidant agents
34	*Ficus sps*	Moraceae	**Ficus** species is used medicinally, mainly to cover and cure

			wounds, boils and sores, but also as an antirheumatic
35	*Acanthus ilicifolius*	Acanthaceae	Diuretic and is used as a cure for dropsy and bilious swellings.
36	*Hygrophylla schulli*	Acantahceae	The plant is often used in traditional medicine, being valued especially as a diuretic.
37	*Kyllinga squamulata*	Cyperaceae	The leaves, stems and rhizomes are analgesic, antiinflammatory, antimalarial, decongestant, diuretic, febrifuge and sudorific.
38	*Cyperus rotundus*	Cyperaceae	Traditional herbal medicine used widely as analgesic, sedative, antispasmodic, antimalarial, stomach disorders and to relieve diarrhoea
39	*Schoenoplectus articulatus*	Cyperaceae	Excellengt souirce of phenolic compounds and anti oxidants.
40	*Ichnocarpus frutescens*	Apocyanaceae	Whole plant is used as tribal medicine in atrophy, bleeding gums, convulsions, cough, delirium, heamaturia etc.,
41	*Corchorus olitorius*	Tiliaceae	Folk remedy for aches and pains, dysentery, enteritis, fever, pectoral pains, and tumors.
42	*Hydrolea zeylanicus*	Hydrophyllaceae	The leaves, beaten into pulp and applied as a poultice, are considered to have a cleansing and healing effect on neglected and callous ulcers.
43	*Ceratopteris thalictroides*	Pteridaceae	In traditional **medicine**, the plant is used as a poultice for skin problems, as a styptic to stop bleeding.
44	*Pteris vittata*	Pteridaceae	The leaves possess astringent **properties**, and a decoction of the fresh leaves is given in dysentery
45	*Salvinia molesta*	Salviniaceae	Known for antioxidant properties, flavonoids, free radicals and phenolic compounds,
46	*Poa bulbosa*	Poaceae	Good fodder for animals
47	*Leucas aspera*	Lamiaceae	Antifungal, prostaglandin inhibitory, antioxidant, antimicrobial, antinociceptive and cytotoxic activities
48	*Hyptis suaveolens*	Lamiaceae	Possess antifertility, antiinflammatory, and antiplasmodial properties.
49	*Ageratum conyzoides*	Asteraceae	Utilized for the treatment of various ailments, such as burns and wounds, headaches
50	*Synedrella nodiflora*	Asteraceae	*Synedrella nodiflora* leaves can be used as Pregnant Mare Serum Gonadotrophin supplier in animal husbandry to improve reproductive parameters in females.
51	*Desmodium triflorum*	Fabaceae	Analgesic and anti-inflammatory activities
52	*Nymphaea nouchali*	Nymphaceae	Used for the treatment of diabetes, liver disorders, urinary disorders, menorrhagia, blenorrhagia, menstruation problem
53	*Cyperus polystachyos*	Cyperaceae	Rhizomes are considered astringent, diaphoretic, diuretic, sedative, stimulant, stomachic, vermifuge, tonic and antibacterial. T

Photographs of plants reported from the study area

Ludwigia octovalvis   *Ludwigia adsc*   *Ipomea alba*   *Merrimia hederacea*   *Pteris vittata*

Ziziphus jujuba   *Polygonum pencilvanicum*   *Physalis minima*   *Mikania michrantha*   *Eicchhornia crassipes*

Gomphrena decumbens   Merrimia tridentata   A. philoxeroides   Lindernia diffusa   Sida accuta

Commelina diffusa   Cleome viscosa   Urena lobata   Emelia sonchifolia   Vernonia cinerea

Phyllanthus amarus   Ficus sps   Senna tora   Sphagneticola Trilobata   Tridax procumbens

Salvinia molesta   Schoenoplectus articulatus Kyllinga squamulata Cyperus rotundus   Eragrostis tenella

Ipomea aquatica   Sphaeranthus indicus   Alysicarpus vaginalis Ichnocarpus frutescens Corchorus olitorius

Mimosa pudica	*Centrosema molle*	*Bridelia ovata*	*Hygrophylla schulli*	*Hydrolea zeylanicus*
Monochoria vaginalis	*Cuscuta chinensis*	*Setaria lucopila*	*Acanthus ilicifolius*	*Ceratopteris thalictroide*
Poabulbosa	*Hyptis suaveolens*	*Leucas aspera*	*Ageratum conyzoides*	
Synedrella nodiflora	*Desmodium triflorum*	*Nymphaea noucha*	*Cyperus polystachyos*	

V.CONCLUSION

As a conclusion we can say that this study is a preliminary step for the identification of valuable medicinal plants in the wetlands of Annallur area. Along with the understanding of the traditional medicines and beliefs we have to develop scientific awareness for protection and conservation of our wetlands, so this study was conducted. High value medicinal plants are in pressur and their biodiversity is in high risk due to huge demand for plant derived drugs. From this minor study 50 genus of wetland plants belonging to 25 families were recorded to be used by the traditional medicine practitioners. In developing countries increasing populations, urbanization and deforestation are contributing to species endangerment. Over exploitation and unsustainable development leads to the decrease or elimination of medicinal plants. These medicinal plants are easily accessible and affordable to rural community and such remedies have certain advantages also. The wetlands have a vast wealth of, of medicinal plants which are sources useful compounds. On the other hand loss of important floral diversity also leads to declining of it. Hence conservation of floral diversity will be important tool to sustain and carry such important knowledge to the future generation. The flora is the most important factor to maintain the biodiversity of an area.

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A new species of *Strobilanthes* (Acanthaceae) from the Western Ghats, India

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ABSTRACT: *Strobilanthes scopulicola*, a new species from the collections of the high altitude montane grasslands of Nilgiri Biosphere Reserve in Western Ghats of India is described and illustrated. Photographs, details of phenology, distribution, pollen morphology and similarity with related species were also provided.

KEY WORDS: Acanthaceae, India, pollen, *Strobilanthes lanata, S. lawsonii*, taxonomy, Wayanad, Western Ghats.

INTRODUCTION

The genus *Strobilanthes* Blume consists of ca. 450 species (Mabberley, 2017) confined to the south and southeast of Asia and Melanesia (Carine and Scotland, 1998; Carine and Scotland, 2002). In India, the genus includes ca. 150 species (Karthikeyan *et al.*, 2009), of which more than 60 occur in south India alone (Carine and Scotland, 2002; Venu, 2006), however, recent findings suggest the unexplored diversity of *Strobilanthes* in south India (Scotland, 1998; Santhosh Kumar *et al.*, 2002; Carine *et al.*, 2004; Gopalan and Chithra, 2008; Mascarenhas and Janarthanam, 2013; Sasidharan *et al.*, 2016; Josekutty *et al.*, 2016, 2018; Augustine *et al.*, 2017; Biju *et al.*, 2017; Thomas *et al.*, 2018, 2019a, 2019b, 2019c, 2020). During the systematic study of *Strobilanthes* from south India for the past twelve years, the authors collected specimen of *Strobilanthes* which grew along the open rocky cliffs in the high altitude montane grasslands of Nilgiri Biosphere Reserve. The plant possessed features such as ovate to lanceolate-ovate leaves, much elongated and uninterrupted to interrupted spikes with tawny indumentum, large, campanulate and deep blue corollas and apically pubescent ovaries. Closer examination of the specimen revealed similarity to *S. lawsonii* Gamble and *S. lanata* Nees. Furthermore, comparison of the specimens with herbarium specimens in India and abroad and critical study of relevant literature revealed that it did not match with any of the known species of *Strobilanthes* including *S. lawsonii* and *S. lanata* (Carine *et al.*, 2004; Venu 2006). Therefore, we describe it as a new species.

TAXONOMIC TREATMENT

Strobilanthes scopulicola A.K. Pradeep, Sinj. Thomas, B. Mani & Britto, *sp. nov*.   **Fig. 1**

Type: INDIA. Nilgiri Biosphere Reserve, Kerala, Wayanad, Meppadi, 1750 m a.s.l., 11°29′17″ N, 76°06′49″, 15 December 2014, *Pradeep A. K. & Bince Mani 68241* (holotype, RHT!).

Diagnosis: *Strobilanthes scopulicola* is allied to *S. lawsonii* and *S. lanata*, but differs by ovate to lanceolate-ovate leaves (not ovate or elliptic), pubescence on adaxial leaf surface (not glabrous), bracts with acute apex (not acuminate) and adaxial pubescence (not glabrous), widely elliptic corolla lobes (neither ovate nor triangular or orbicular), stamina with villous filaments (not sparse hairy), glabrous stigma (not pubescent) and subprolate pollen grains with two ribs completely encircling the grain (neither prolate nor all the ribs fused at poles).

Description: Erect, isophyllous, semelparous shrubs, up to 2.5 m high; stem terete, lenticellate, profusely branched, covered with dense tawny hairs. Leaves opposite, slightly asymmetrical; petiole 10–35 mm long, slightly canaliculate, brown tomentose; lamina ovate to lance-ovate, 70–155 × 22–63 mm, coriaceous, base shortly decurrent, apex long acuminate, up to 50 mm long, margin entire, dense tawny woolly beneath, pubescent on veins above; lateral veins 8–13 pairs, impressed above, raised beneath. Inflorescences axillary or terminal, 65–110 × 4–5 mm, narrow uninterrupted to interrupted compound spikes; peduncle terete, branched, covered with dense tawny indumentum; bracts ovate, ca. 7 × 4 mm, shorter than calyx at anthesis, base rounded, apex acute, margin entire, abaxial surface and margin with tawny woolly indumentum, adaxial surface pubescent; bracteoles ca. 6 × 1 mm, linear, brown woolly outside. Calyx 6–9 mm long, 5-lobed, tube 3–5 mm long, lobes ca. 3 × 1 mm, narrowly acute, unequal with two lobes shorter than the rest, woolly outside and pubescent inside, glandular pubescent in infructescence. Corolla blue, 27–32 mm long, slightly curved and widening from
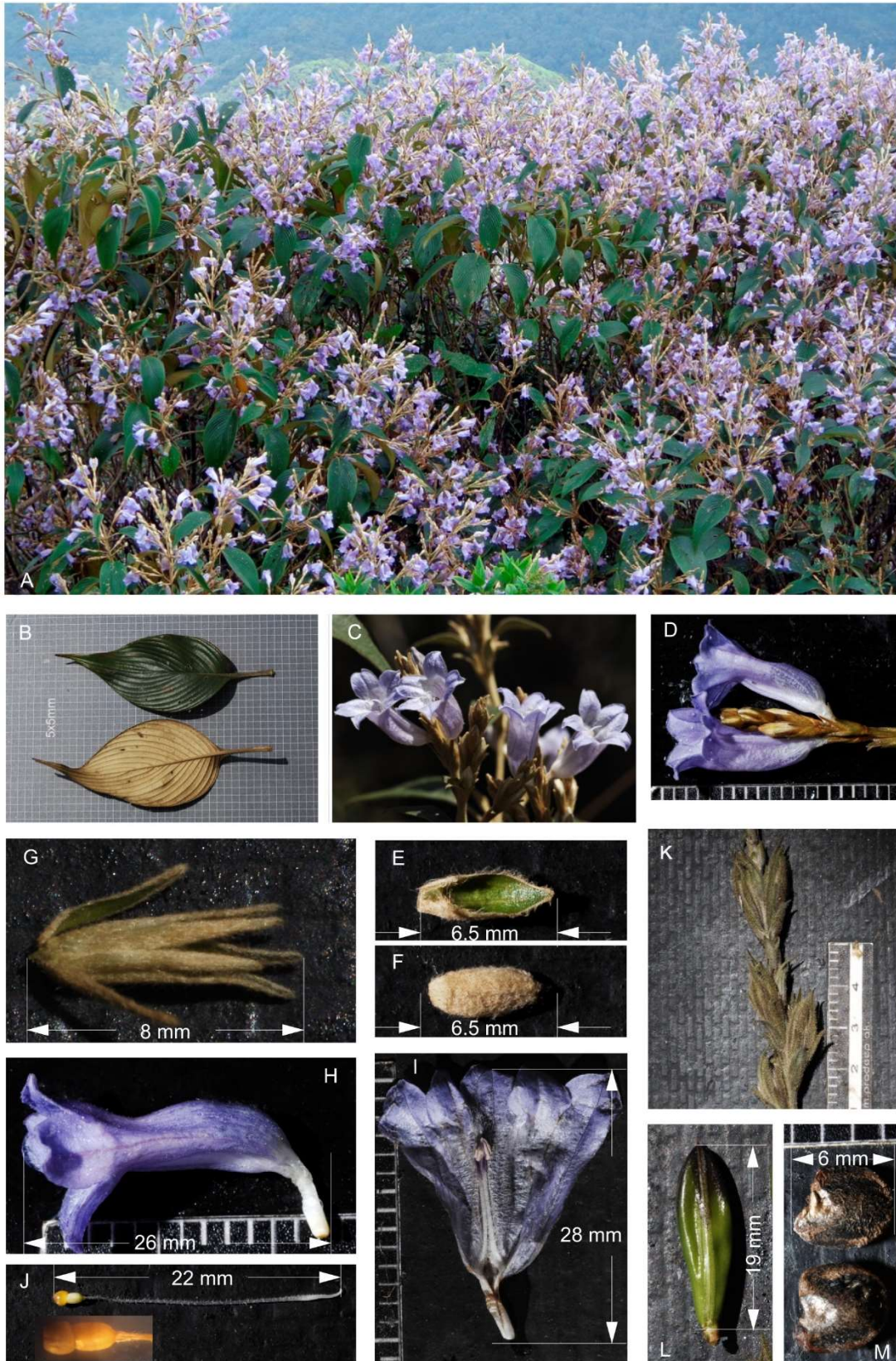
Fig. 1: *Strobilanthes scopulicola.* **A**. Habit; **B**. Leaves: adaxial and abaxial view; **C–D**. Inflorescence; **E**. Bract: adaxial surface; **F**. Bract: abaxial surface; **G**. Bracteole and calyx; **H**. Corolla; **I**. Corolla split open showing the included stamens; **J**. Pistil (inset: ovary with apical pubescence); **K**. Infructescence; **L**. Young fruit; **M**. Seeds.

**Table 1**. Comparison of pollen characteristics of *Strobilanthes scopulicola*, *S. lawsonii* and *S. lanata*.

Species	Pollen type†	Equatorial view	P (μm)	E (μm)	P:E ratio	Ribs (nos.)
S. scopulicola	2	subprolate	43–45	34–36	1.25	21–23
S. lawsonii†	1	prolate	54–61	40–47	1.30	21–27
S. lanata†	1	prolate	72–76	43–50	1.70	24–28

†Type 1: all ribs fuse at the poles; type 2: two or three ribs completely encircle the poles (Carine and Scotland, 1998).

Table 2. Diagnostic characters of *Strobilanthes scopulicola* and allied taxa.

Characters	*S. scopulicola*	*S. lawsonii*†	*S. lanata*†
Adaxial leaf indumentum	pubescent	glabrous	glabrous
Spikes at anthesis	uninterrupted to interrupted	interrupted	uninterrupted
Bract apex	acute	acuminate	acuminate
Calyx	6.0–8.5 mm long	5.6–6.5 mm long	7.1–13.0 mm long
Corolla lobes shape	widely elliptic	ovate to broadly triangular	ovate to sub-orbicular
Filament pubescence	dense villous throughout	sparse white hairs for 0.7–0.8 of length	pubescent below for more than half the length
Pubescence on ovary apex	long hairy pubescent	glabrous	sparsely pubescent
Pubescence of style	pubescent throughout	sparsely pubescent	sparsely pubescent
Pubescence of stigma	glabrous	pubescent	pubescent

†Carine *et al*. (2004).
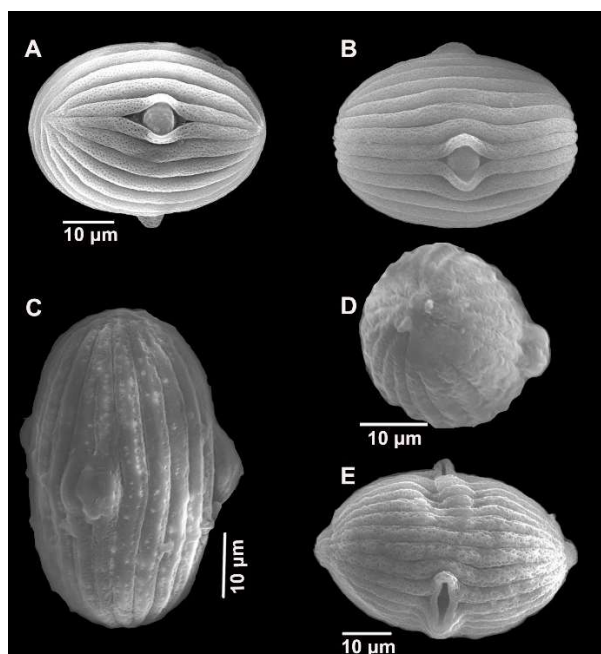
Fig. 2: SEM micrographs of pollen grain of *Strobilanthes scopulicola* (**A–B**), *S. lawsonii* (**C–D**) and *S. lanata* (**E**).

basal tube, 5-lobed; tube 6–7 mm long, glabrous, white; throat campanulate, 16–18 mm long, deep blue, with dense short pubescence on outer surface and long white hairs on inner surface; lobes equal, 5–7 × 6–7 mm, widely elliptic, deep blue, apex rounded to obtuse, with dense pubescence on outer surface. Stamens 2, included, basally attached to corolla; filaments 10–11 mm long, villous throughout; anthers ca. 2 × 1 mm, bithecate. Ovary ca. 2 × 1 mm, apex pubescent, 2-locular with two ovules per locule; style 18–20 mm long, filiform, pubescent throughout; stigma linear, ca. 2 mm long, simple, glabrous. Infructescence 100–200 × 10–20 mm, densely glandular hairy; capsule 20–23 × 7–8 mm, elliptic, glabrous. Seeds 2, 5.0–6.5 × 5.0 mm, tawny lanate.

Etymology: The specific epithet "scopulicola" refers to the habitat rock cliffs of high altitude montane grasslands where the new species is exclusively found.

Phenology: Flowering November–January; seed dispersal from mid-April onwards.

Habitat and distribution: Strobilanthes scopulicola grows along rocky cliffs in grasslands at an elevation of 1600–2050 m a.s.l. in the northern part of the Nilgiri Biosphere Reserve.

Pollen Morphology: Pollen grains are ellipsoid (Fig. 2A–B), tricolporate and contain pseudocolpi. The pollen is subprolate in outline and exine divided into longitudinal ribs which are close, straight, tectate and two of them completely encircle the pollen. Other pollen features are also given for descriptive purposes (Table 1).

Notes: The new species is closely related to *S. lawsonii* by similarities such as tawny indumentum on leaf, stem and inflorescence, leaves with acuminate apex, narrow uninterrupted or interrupted spikes, bracts being shorter than calyx, campanulate corolla and included stamens. The new taxon also shows relationships with *S. lanata* in characters such as entire leaves with dense tawny woolly abaxial indumentum, campanulate corolla and included stamens. However, the new species could easily be set apart from both taxa by several vegetative and floral features (Fig. 3; Table 2).

The variability of pollen morphology in *Strobilanthes* is a potentially useful character to delimit taxa in this group (Carine and Scotland 1998, Deng *et al*. 2006). The close allies of the new taxon, such as *S. lawsonii* and *S. lanata* belong to pollen type 1 (Carine and Scotland 1998) in which the ribs fuse at the poles and none of them completely encircle the pollen. The pollen of *S. scopulicola* belongs to type 2 in which some of the ribs completely encircle the poles. A comparison of pollen characteristics with the related taxa, *S. lawsonii* and *S. lanata*, is presented (Fig. 2 C–E, Table 1).

Fig. 3. Flowering branch of *Strobilanthes scopulicola* (**A**) and *S. lanata* (**C**) and image of the type specimen of *S. lawsonii* (© the Board of Trustees of the Royal Botanic Gardens, Kew) (**B**)

Specimens examined: ***Strobilanthes scopulicola***: INDIA. Nilgiri Biosphere Reserve, Kerala, Wayanad, Meppadi, 20 February 2015, *Pradeep A. K. 68242* (RHT! TAI!); 25 April 2015, *Pradeep A. K. 68414* (RHT!). ***Strobilanthes lawsonii***: INDIA. Tamilnadu, Nilgiri Distr., Sispara Ghat, November 1883, *Gamble 13387* (K! lectotype); Sispara, June 1884, *Gamble 14252* (K!); 19 November 1890, *Anonymous* s. n. (MH!); Coonoor, Sims Park, 16 April 1900, *Bourne* s. n. (K!). ***Strobilanthes lanata****:* India. Tamilnadu, Nilgiri Distr., Sispara, 25 April 1870, *Beddome 119* (K!); Sispara Ghat, *Anonymous* s. n. (MH!); Botanic Garden Ooty, 15 April 1950, *Curator* s. n. (MH!).

ACKNOWLEDGMENTS

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Research Article

Notes on *Strobilanthes cuspidata* with reinstatement of *Endopogon versicolor* (Acanthaceae)

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Abstract
Endopogon versicolor Wight, previously treated as a synonym of *Strobilanthes cuspidata* (Benth.) T. Anderson, is reinstated as a distinct species and a new name *S. benthamii* B. Mani, Sinj. Thomas, Britto, A.K. Pradeep, Y.F. Deng & E.S.S. Kumar is necessarily proposed here. It differs from *S. cuspidata* by the stem and leaf indumentum, bract/calyx length ratio, corolla shape, pollen morphology, etc. Detailed descriptions, illustrations, pollen morphology and comparison with similar species are provided.

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Introduction

Strobilanthes Blume (1) is the second largest genus in the family Acanthaceae. It consists of approximately 450 species widely distributed in tropical and subtropical regions of Asia (2). In the past, there were disagreement on whether a broad or narrow circumscription of the genus might be adopted. Nees (3) was the first to recognize several genera to accommodate the species of *Strobilanthinae*. Bremekamp (4) divided *Strobilanthinae* into 54 genera, but the recent molecular phylogenetic studies rejected the division

proposed by Bremekamp and a single broad circumscription for *Strobilanthes* has been accepted (5-7).

The genus *Endopogon* was established by Nees (3) as "*Corolla bilabiata inflate, labio superiore bifido latiore, intus in canali pilis cincto stylum recondente.....stamina duo..spicae bracteatae floribus oppositis solitaris*" with three species, *viz. Endopogon amomum* Nees, *Endopogon hypoleucus* Nees including two unnamed varieties α and β, and *Endopogon consanguineus* Nees. This genus is characterized by its bilabiate corolla, two stamens

and four-seeded capsules. *Endopogon hypoleucus* Nees var. β differs from var. α by its campanulate corolla and it was later described as a new species by Carine *et al.* (8) as *Strobilanthes carnatica* Carine, J.M.Alexander & Scotland. Several years later Nees described six additional taxa of *Endopogon* including *E. viscosus* Arn. ex Nees from Ceylon (Sri Lanka) with a variety *viz.* var. *humilis* Wight from Courtallum, Tamil Nadu based on Wight's collections.

In his *Icones Plantarum Indiae Orientalis*, Wight (9) described *Endopogon* to possess those species having campanulate-infundibuliform corolla, two stamens and capsules with four seeds. Later, the diagnostic features of bilabiate vs. campanulate corolla caused taxonomic confusion. Simultaneously, Wight (9) described and illustrated (t. 1497) a new species, *E. versicolor* from the Nilgiris, which has campanulate corolla. In the protologue, Wight compared *Endopogon versicolor* with *E. hypoleucus* which has bilabiate and ventricose corolla. Therefore, it is now presumed that both Nees and Wight did not give due weightage on the shape of the corolla while preparing the description of these species. Furthermore, the material (Wight n. 1497, Neilgherries) used by him has campanulate corolla. It could be presumed that Wight may erroneously labelled the material when he described and illustrated the species *E. versicolor* using *Wight 1498* and hence annotated "*Endopogon versicolor*, Icones 1498, Neilgherries" on that specimen. Later, Clarke (10) corrected it as "Wight Ic. t. 1497". It is now evident that the Icones 1498 is *E. viscosus* Nees var. *humilis* and was labelled as "*Endopogon viscosus* var. *humilis*, Ic. 1498, Courtallum". The latter is totally different from the former and the illustration and description of Icones No. 1498 matches with the latter only. Wight (11) again published the same illustration of *E. versicolor* in Illustrations of Indian Botany.

Anderson (12–13) merged *Endopogon* with *Strobilanthes* and treated it as a subgenus, *Strobilanthes* subgen. *Endopogon* (Nees) Anderson, and listed *E. versicolor* under synonymy of both *Strobilanthes cuspidatus* (Bentham) Anderson and *S. viscosus* (Arnott ex Nees) T. Anderson. He considered that Wight's description in the text of t. 1497 is referred only to *S. cuspidatus* while the illustration of t. 1497 is identical with *S. viscosus* (13). Accordingly, *E. versicolor* was subsequently reduced to *S. cuspidatus* by Clarke (10) or *S. viscosus* by Beddome (14). Clarke's treatment was followed by several authors (15–18).

Strobilanthes cuspidatus was originally described as *E. cuspidatus* Bentham (19) based on Hohenacker's meterial (Hohenacker 1169, K) collected from Neilgherries (Nilgiris). It is similar to *E. hypoleucus* in having spicate inflorescence, bilabiate corolla and four seeded capsules. Since then, it has been collected from different regions

of the Neilgherries evidently by the specimens housed at K, E, OXF, BM, CAL, MH, and TBGT. After perusal of specimens and digital images, it is confirmed that there are two different morphotypes of plants involved in these collections. One with campanulate corolla and the others with bilabiate corolla. It is interesting to note that the *E. cuspidatus* is quite distinct by its bilabiate and ventricose corolla, whereas *E. versicolor* is having subequal corolla lobes.

In his *Icones Plantarum Indiae Orientalis*, Beddome (14) provided the description and illustration for *S. cuspidatus* and synonymized *E. versicolor* under *S. viscosus*. However, the illustration he provided for the species has a perfect match with *E. versicolor*.

When Carine *et al.* (8) presented a detailed account on *S. kunthiana* (Nees) T. Anderson ex Benth. group (*Phlebophyllum* sensu Bremekamp), they adopted the treatment of Clarke to treat *E. versicolor* as the synonym of *S. cuspidata*. They also stated that corolla of *S. cuspidata* is campanulate to subventricose and illustrated as such. It is apparent that they examined materials of both *E. versicolor* and *E. cuspidatus* for the description provided. They also pointed out that Anderson (12) erroneously treated illustration of *E. versicolor* (Wight t. 1497) as *E. viscosus* and they considered *S. cuspidata* to be endemic to the Nilgiris.

In the present paper, we revised the taxonomic problems on *S. cuspidata* and *E. versicolor* on the basis of the analysis of gross vegetative morphology and palynological characters using fresh specimens, herbarium materials and literature. Pollen grains were collected from fresh specimens of all the taxa. The grains were washed in water by sonication. The air dried pollens were fixed to aluminium stubs and sputter-coated with gold. Morphological observations were made and micrographs were then taken with JEOL (JSM-6390LV/JED-2300) SEM-EDS. The variability of pollen morphology in *Strobilanthes* is potentially a useful character to delimit taxa in this group (3, 6, 20–21). *Endopogon versicolor* differs from *S. cuspidata* by its campanulate corolla and apiculate pollen grains with straight ribs. Therefore, *E. versicolor* is absolutely different from *S. cuspidata* and allied to *S. carnatica* whereas *E. cuspidatus* is allied to *S. consanguinea* as Bentham stated.

Accordingly, *E. versicolor* is reinstated here as an independent species in *Strobilanthes*. Since the name *S. versicolor* Diels (22) antedated for a Chinese species, a new name *S. benthamii* is proposed here to accommodate *E. versicolor*.

Taxonomy

Strobilanthes benthamii B. Mani, Sinj. Thomas, Britto, A.K. Pradeep, Y.F. Deng & E.S.S. Kumar, **nom. nov.** (Fig. 1 & 2)
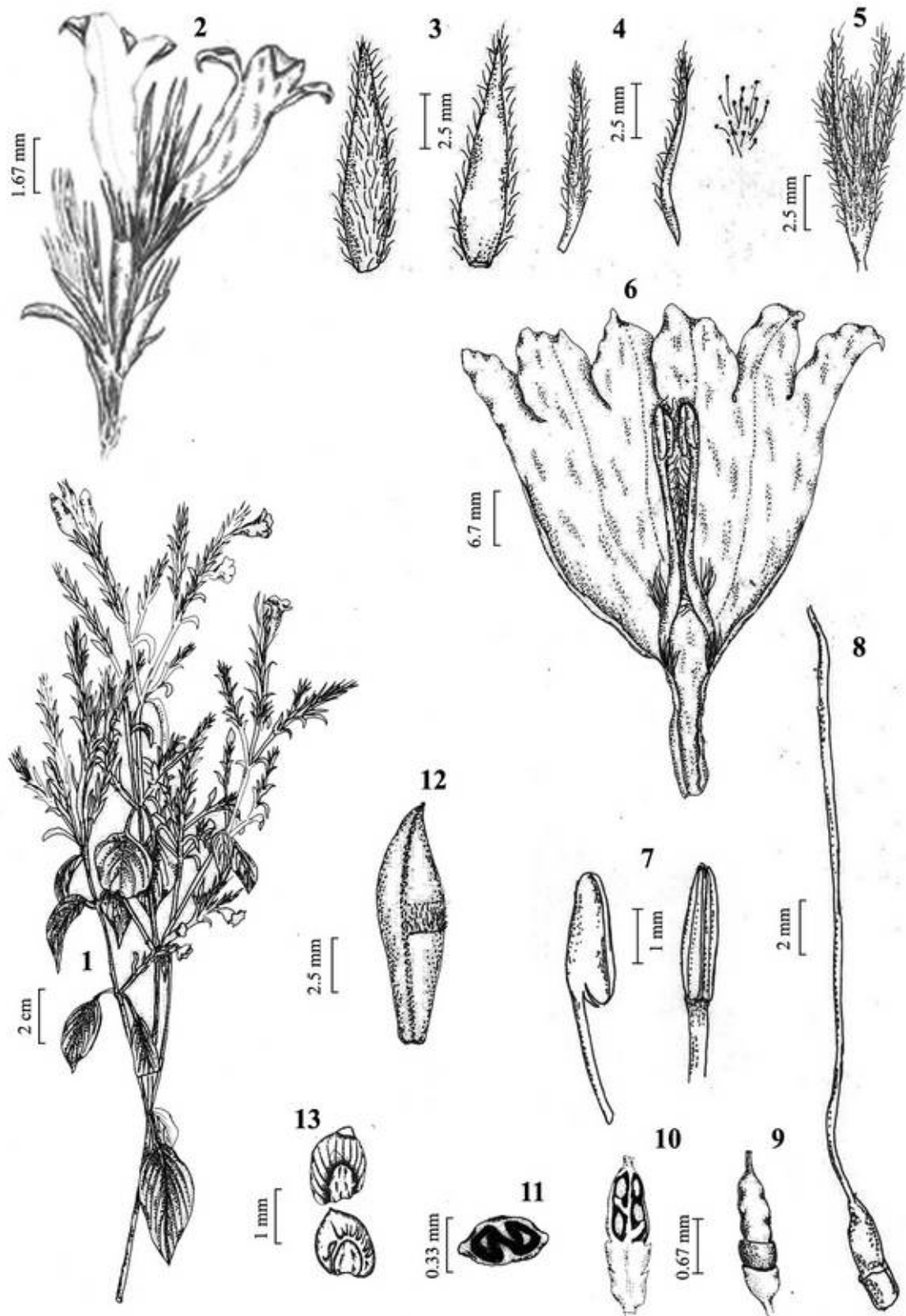
Fig. 1. *Strobilanthes benthamii.* 1. Habit; 2. Inflorescence; 3. Bract; 4. Bracteole; 5. Calyx; 6. Corolla split opened; 7. Anther; 8. Pistil; 9. Ovary; 10. Ovary L.S.; 11. Ovary T.S.; 12. Fruit; 13. Seeds (RHT68803). Illustrated by Philominal Selvi.

Replaced name: *Endopogon versicolor* Wight, Icon. P1. Ind. Orient. 4(3): 19, t. 1497 (1849).

– *Phlebophyllum versicolor* (Wight) Bremek. in Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2, 41(1): 169 (1944), non *Strobilanthes versicolor* Diels (1912: 163).

Type: INDIA. Tamil Nadu: Neilgherries, *Wight s.n.* [1498] (lectotype designated here, K000882933, image!). **Syntypes:** INDIA. Peninsula Indiae, *Wight 2206* (K000882934: image!); Tamil Nadu: Neilgherries, *Wight s.n.* (K000882935: image!); *Wight s.n.* (K000882936: image!).

Fig. 2. Field images of *Strobilanthes benthamii.* 1. Habit; 2. Inflorescence; 3. Bract; 4. Bracteole; 5. Calyx; 6. Corolla split opened; 7. Stamen; 8. Pistil; 9. Infructescence; 10. Seeds.

Shrubs, up to 2.5 m high. Stem quadrangular (young) to terete (mature), young stem covered with dense sericeous indumentum, glandular hairy on uppermost sections at anthesis. Leaves opposite, slightly asymmetrical; petioles to 7.0 cm long, tomentellous; lamina ovate–elliptic,

3.0–13.2 × 1.8–8.6 cm, shortly decurrent at base, slightly crenate along margins, acuminate–acute at apex, abaxilly dense white sericeous, adaxially glabrous; lateral veins 7–12 pairs, prominent abaxially, less so adaxially. Inflorescence of an uninterrupted to interrupted spikes, 1.7–11.5 cm long, 4–7 mm broad, glandular hairy (viscous); axis glandular pubescent; flowers in opposite pairs. Bracts lanceolate, 11.0–12.5 × 2–3 mm, longer than calyx at anthesis, acuminate at apex, often recurved, glandular hairy along margins, abaxially glandular hairy, adaxially glandular-hairy at apex. Bracteoles linear, 8–9 mm long, abaxially glandular hairy, adaxially pubescent; secondary flower buds present. Calyx 5-lobed; two lobes shorter than other three, fused from base for ⅓–½ of length at anthesis; lobes lanceolate, 9–11 mm long, acute at apex, abaxially glandular-hairy, adaxially pubescent. Corolla bluish, 2.6–2.9 cm long; basal tube cylindrical; tube 6–7 mm long, glabrous; throat campanulate, 14–16 mm long, densely fine pubescent outside, inside long hairy along adaxial side; lobes equal, widely elliptic, 5–7.5 × ca. 6 mm, overlapping, fine pubescent outside, glabrous inside. Stamens 2, included, basally attached with corolla; anthers 1.8–2.5 mm long, thecae 2, violet, held parallel with filament; filaments 8–10 mm long, long white hairs for proximal ¾ length; Ovary 1.5–2 mm long, sparsely pubescent at apex, 2-locular; 2 ovules per locule; style 18–19 mm long, filiform, fine pubescent throughout; stigma 2.5–3.0 mm long, sparsely pubescent. Infructescence 7.5–11.4 × 0.8–1.0 cm, glandular hairy (viscous); calyx covering the capsule. Capsule oblanceolate, 11.0–12.0 × 3.0–3.5 mm, apically pubescent. Seeds 4 (rarely 2), 2–3 × 2–2.5 mm, ovate–wide elliptic, truncate at base, cuspidate at apex, densely pubescent.

Habitat and distribution: *Strobilanthes benthamii* grows as patches under moist deciduous forest and also on exposed slopes on hillsides at elevations ranging from 1100–1400 m a.s.l. in the eastern slopes of the Western Ghats.

Notes: *Strobilanthes benthamii,* a Nilgiri endemic, was wrongly treated by various authors (8, 13–14, 16–20) since 1864. It was suggested to be similar to *S. cuspidata* in the characters of white sericeous indumentum on abaxial surface of the leaves, often uninterrupted glandular-viscous spikes, recurved bracts, unequal calyx lobes, included stamens, viscous infructescence and four seeded capsules. However, *Strobilanthes benthamii* can be easily distinguished from the latter in having white sericeous indumentum on young stem, glabrous adaxial leaf surface, bracts exceeding the calyx, campanulate corolla with equal lobes, elliptic anthers and prolate-apiculate pollen grain with straight ribs (Fig. 5.1 & Table 1). *Strobilanthes benthamii* occurs in different parts of the Nilgiris even though each population has limited number of individuals.

Carine *et al.* 2004: 20 (8) indicated the type to be "Neilgherries, Wight s.n. (lectotype: K!)." However, this was not an effective lectotypification because they failed to use the phrase "designated here" (hic designatus) or an equivalent that required by Art. 7.11 of the ICN (23). Here, we formally designated the same specimen as the lectotype using the phrase "designated here".

Strobilanthes benthamii is also allied to *S. carnatica* Carine *et al.* (8), but differs by robust habit, glandular hairy stem at anthesis, ovate-elliptic leaves with acuminate-acute apex, 7–12 pairs of lateral veins, white sericeous abaxial

Table 1. Comparison of pollen features of *S. benthamii*, *S. carnatica*, *S. cuspidata* and *S. consanguinea*.

Species	Pollen class	Shape	Pseudocolpi	P (µm)	E (µm)	P:E ratio	Ribs
S. benthamii	Prolate	Apiculate	Moderately wide	70–81	51–55	1.40	32–36, straight
S. carnatica	Subprolate	Widely ovate	Narrow	37–39	29–31	1.26	27, straight
S. cuspidata	Prolate	Terete	Wide	47–52	31–34	1.50	16–18, spiral
S. consanguinea	Perprolate	Barrel	Narrow	48–53	24–26	2.02	18–21, spiral

Pollen morphology: Pollen grains are ellipsoid, tricolporate and contain pseudocolpi (Fig. 5.1). The grains are prolate in outline and fusiform. The exine divided into longitudinal ribs which are close, straight and tectate. Tectum perforates. A comparison of pollen features with allied species (Fig. 5.2) is given in Table 1.

Etymology: The species is named after George Bentham for his contributions to the field of Botany.

Phenology: Flowering January–March; seed dispersal starts in April.

indumentum on leaves, often uninterrupted broad spikes which are viscous, bracts exceeding the calyx, larger corolla, widely elliptic corolla lobes, prolate-apiculate pollen grains with moderately wide pseudocolpi (Fig. 5.1 & Table 1 & 2), pubescent style and stigma and oblanceolate and puberulent capsules. Moreover, *S. carnatica* is distributed in the Eastern Ghats only (8).

Specimens examined: INDIA. Tamil Nadu: Nilgiri district, Sigur, 1800 m a.s.l., Nov 1884, *Gamble 15670* (MH); Nilgiris, 1500 m a.s.l., 18 Feb 1972, *Sharma 39843* (MH); Nilgiris, 1800 m a.s.l., 29 Jan. 1972, *Vajravelu 39696* (MH); Nilgiris, 1650 m a.s.l., 5 Jan 2017, *Pradeep et al. 68493* (RHT); 1 Apr 2017,

Pradeep et al. 68596 (RHT); 16 Jan 2018, *Pradeep et al. 68803* (RHT); 12 Feb 2018, *Pradeep et al. 68804* (RHT); 11 Mar. 2018, *Pradeep et al. 68805* (RHT).

Strobilanthes cuspidata (Benth.) T. Anderson, J. Linn. Soc., Bot. 9: 465 (1867). (Fig. 3 & 4)

Basionym: *Endopogon cuspidatus* Benth., Linnaea 24: 646 (1851).

long, fine pubescence outside, inner side with two lines of long white hairs on the adaxial side; lobes unequal, folded back, two adaxial lobes partly fused and hooded, widely elliptic, 1.1–1.3 × 1.0–1.2 cm, fine pubescent outside, glabrous inside. Stamens 2, included; filaments 1.1–1.15 cm long, glabrous except at point of fusion with corolla; anthers sagittate, 3.5–4.0 × ca. 1 mm, thecae 2, held parallel to filament. Ovary 2.5–3 mm long, apex

Table 2. Comparison of morphological characters of *S. benthamii* and *S. cuspidata.*

Characters	S. benthamii	S. cuspidata
Stem (young)		
Indumentum	Sericeous	Tawny tomentose
Leaf blade		
Shape	Ovate to elliptic	Ovate
Apex	Acuminate to acute	Acuminate to cuspidate
Margin	Slightly crenate	Entire or slightly crenate
Adaxial indumentum	Glabrous	Pubescent
Bract		
Adaxial indumentum	Glandular hairy at apex	Glandular hairy at upper ½ part
Bract:calyx ratio	Longer	Shorter
Corolla		
Shape	Campanulate	Ventricose
Stamens		
Filaments	Long white hairs for proximal ¾ length	Glabrous
Anthers	Elliptic	Sagittate

Type: INDIA. Tamil Nadu: Nilgiris, *Hohenacker 1169* (lectotype designated by Carine *et al.*, K000882938; E00160838, MPU018233, images!, U0000079 image!), LECB0001800 image!, JE 00002184 image!, JE 00002185 image!, JE 00002186 image!, HAL 0113941 image!).

      Shrubs, up to 1.5 m high. Stem quadrangular to terete; young stem tawny tomentose; mature stem lenticellate. Leaves opposite, symmetric; petioles 3.5–7.0 cm long, tomentose; blade ovate, 4.8–12.5 × 2.5–7.6 cm, shortly decurrent onto the petiole at base, entire or slightly crenate along margins, acuminate–cuspidate at apex, densely tawny hairy on both surfaces when young, becoming white sericeous abaxially and pubescent adaxially; lateral veins 6–12 pairs, prominent on both surfaces, raised beneath. Inflorescence of often uninterrupetd spikes, 3.2–9.0 × 0.7–0.8 mm at anthesis, glandular hairy (viscous); peduncle covered with glandular hairs; flowers in opposite pairs. Bracts lanceolate, 10–11 × 2.5–3.0 mm, shorter than calyx at anthesis except for lowermost ones, acuminate at apex, recurved, abaxially glandular hairy, adaxially glandular hairy on upper ½ portion. Bracteoles linear, 9–10 mm long, abaxially glandular hairy, adaxially pubescent; secondary flower buds present. Calyx 5-lobed; two lobes shorter than other three, fused from base for ⅓–⅔ of length at anthesis; lobes lanceolate, 1.1–1.2 cm long, acuminate at apex, abaxially densely glandular hairy, adaxially fine pubescent. Corolla bluish, 2.7–2.9 cm long, inflated, basal tube cylindrical, 6.5–8.0 mm long, glabrous; throat ventricose, 1.4–1.5 cm

glandular pubescent; style ca. 1.7 cm long, filiform, fine hairs present on lower ¾ portion; stigma linear, ca. 2.5 mm long, fine pubescent. Infructescence 4.0–14.0 × 0.8–1.0 cm, densely glandular hairy (viscous). Capsule oblanceolate, 0.9–1.2 × 0.3–0.4 cm, hairy at apex. Seeds 4, 1.5–2.5 × 1.5–2 mm, widely elliptic–orbicular, truncated–semi-rounded at base, rounded at apex, densely pubescent.

Pollen morphology: Pollen grains are ellipsoid, tricolporate and have pseudocolpi (Fig. 5.3). The outline of the pollen is prolate (cylindrical) and exine is divided into longitudinal ribs which are thick, punctate, distant, spiral and tectate. Tectum perforates. Pollen features of allied species (Fig. 5.4) are given in Table 1.

Phenology: Flowering January–March and it follows a semelparous life history pattern; fruiting April –May.

Habitat and Distribution: It grows as shola forest undergrowth at elevations ranging from 1750–2000 m a.s.l. in Nilgiris, Tamil Nadu.

Notes: Strobilanthes cuspidata, a species endemic to Nilgiris with narrow distribution, has often been confused with *E. versicolor* by many authors. Bentham (19) described the species based on Hohenacker's collection without providing an illustration. Anderson, Beddome and Clarke wrongly synonymised *E. versicolor* under *S. cuspidata* and followed by others (8, 15–17). This species is definitely distinguished from *E. versicolor* (*S. benthamii*) by the characters of tawny tomentum on young stems, leaves with adaxial
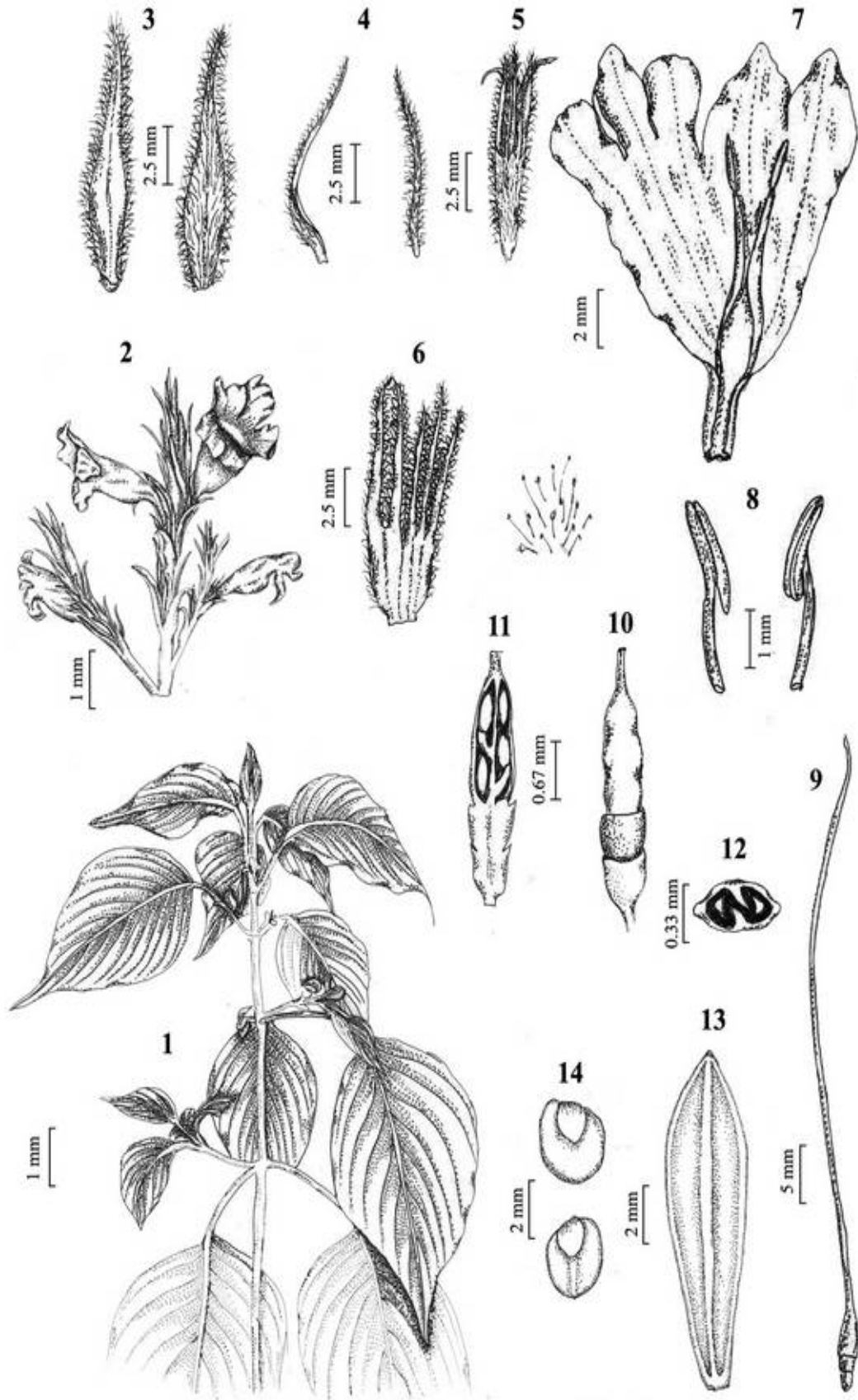
Fig. 3. *Strobilanthes cuspidata*. 1. Habit; 2. Inflorescence; 3. Bract; 4. Bracteole; 5. Calyx; 6. Calyx split opened; 7. Corolla split opened; 8. Anther; 9. Pistil; 10. Ovary; 11. Ovary L.S.; 12. Ovary T.S.;13. Fruit; 14. Seed (RHT68806). Illustrated by Philominal Selvi.
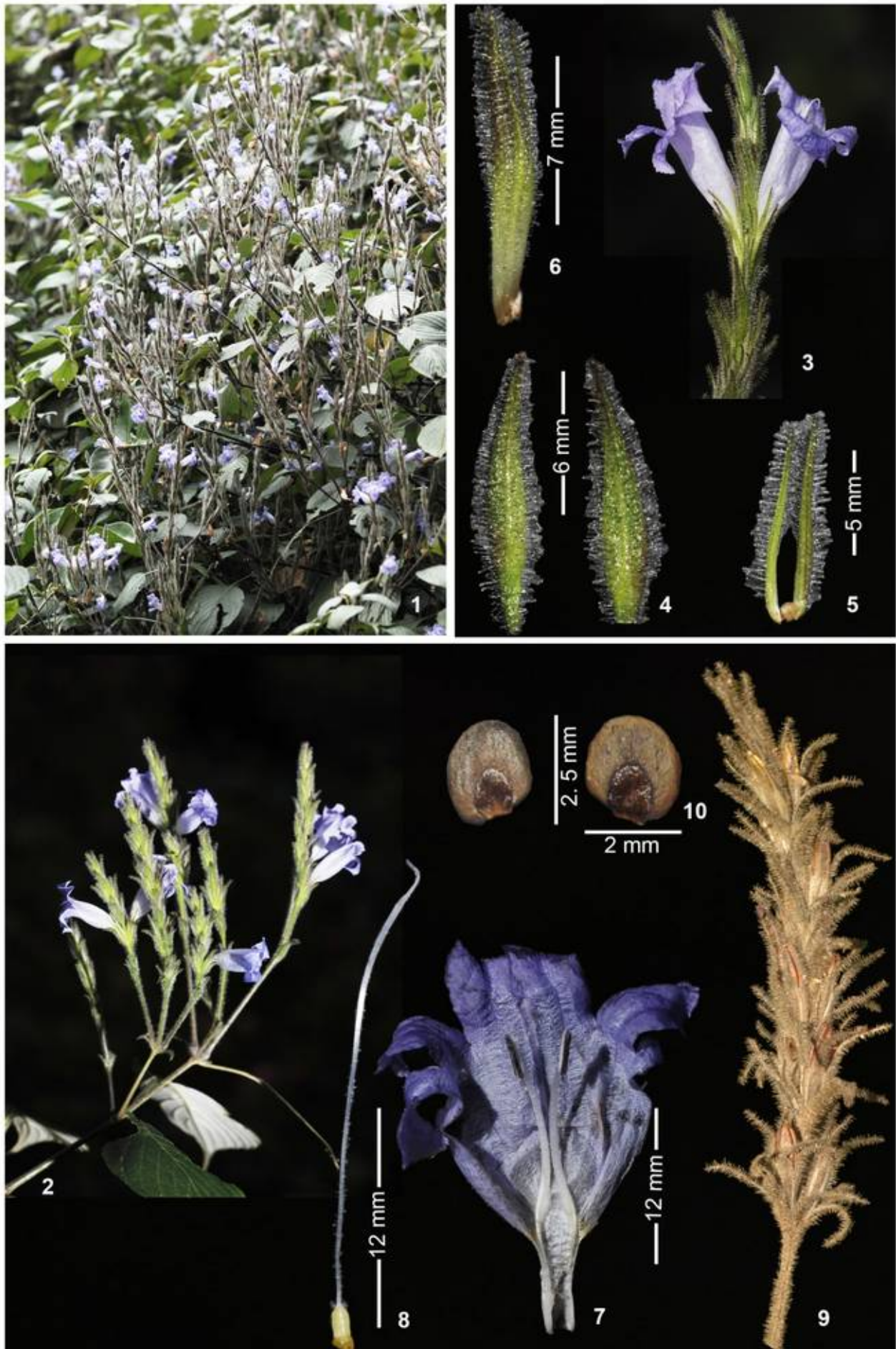
Fig. 4. Field images of *Strobilanthes cuspidata*. 1. Habit; 2. Inflorescence; 3. Pair of flowers; 4. Bract; 5. Bracteole; 6. Calyx; 7. Corolla split opened; 8. Pistil; 9. Infructescence; 10. Seeds.
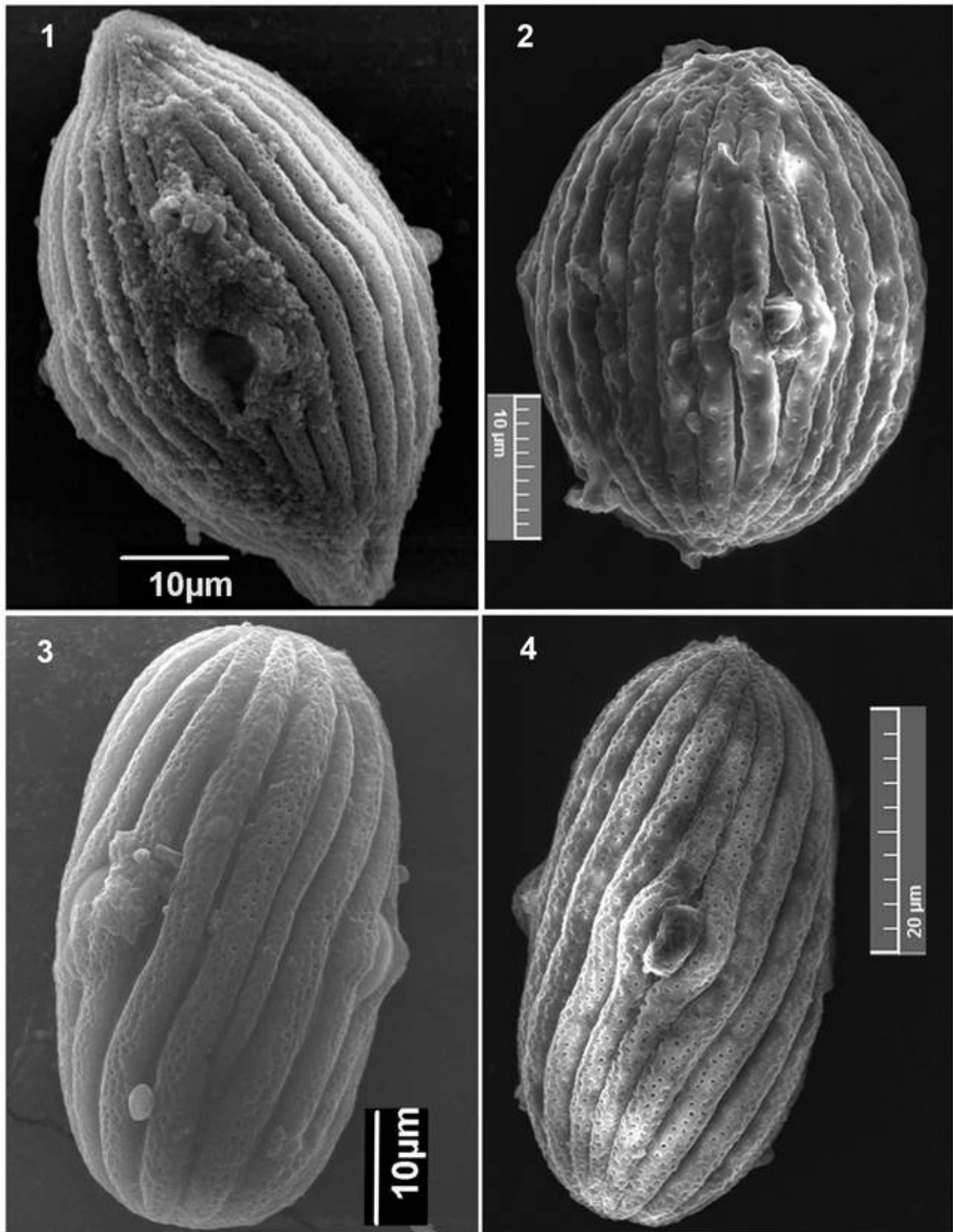
Fig. 5. Scanning electron micrographs (SEM) of pollen grains of *S. benthamii* (1), *S. carnatica* (2), *S. cuspidata* (3) and *S. consanguinea*.

pubescence, bracts being shorter than calyx, ventricose corolla with unequal lobes in which adaxial lobes are hooded, with sagittate anthers, prolate-barrel shaped pollen grains with spiral ribs (Fig. 5.3 & Table 1 & 2).

It is allied to *S. consanguinea* (Nees) T. Anderson, which is widely distributed in the Western Ghats. However, it can be easily distinguished from the latter by having tawny young stem (vs. glabrous or rarely pubescent young stem), strictly white sericeous abaxial leaf indumentum (vs. glabrous or rarely white

indumentum on abaxial leaf surface), broad spikes (vs. narrow spikes) strictly glandular hairy (viscous) floral parts such as peduncle, bracts, bracteoles and calyx (vs. glabrous or rarely sparsely pubescent or glandular floral parts at the time of anthesis), bracts shorter than calyx (vs. bracts equal to the calyx), presence of secondary flower buds in the axis of bracteole (vs. absence of secondary flower buds), unequal calyx lobes (vs. equal), long corolla (vs. short corolla), widely elliptic corolla lobes (vs. narrowly traingular), included stamens (vs. exserted), sagittate anther (vs. elliptic) and pubescent style (vs. glabrous style).

The pollen morphology of *S. cuspidata* (Fig. 5.3) differs from that of *S. consanguinea* (Fig. 5.4) in having cylindrical pollen grains with only 16–18 ribs which are wide and prominent and wide pseudocolpi. Therefore, *S. cuspidata* is totally different from *S. consanguinea*. Moreover, it also ascertains that this enigmatic taxon has a very narrow distribution and it might be rarely found the specimens in herbaria.

Specimens examined: INDIA. Tamil Nadu: Nilgiri District, Nilgiri, 10 Dec 1957, *Sebastine 4886* (MH); 15 Jan. 2018, *Pradeep et al. 68806* (RHT); 30 Jan. 2018, *Pradeep et al. 68818* (RHT); 12 Feb. 2018, *Pradeep et al. 68807* (RHT); 11 Mar 2018, *Pradeep et al. 68808* (RHT).

Competing interest

Authors declare that they have no competing interest.

Authors' contributions

All authors contributed equally to the present work.

Acknowledgements

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Hyperparameter Optimization and Regularization on Fashion-MNIST Classification

Greeshma K V, Sreekumar K

Abstract—Nowadays the most exciting technology breakthrough has been the rise of the deep learning. In computer vision Convolutional Neural Networks (CNN or ConvNet) are the default deep learning model used for image classification problems. In these deep network models, feature extraction is figure out by itself and these models tend to perform well with huge amount of samples. Herein we explore the impact of various Hyper-Parameter Optimization (HPO) methods and regularization techniques with deep neural networks on Fashion-MNIST (F-MNIST) dataset which is proposed by Zalando Research. We have proposed deep ConvNet architectures with Data Augmentation and explore the impact of this by configuring the hyperparameters and regularization methods. As deep learning requires a lots of data, the insufficiency of image samples can be expand through various data augmentation methods like Cropping, Rotation, Flipping, and Shifting. The experimental results show impressive results on this new benchmarking dataset F-MNIST.

Keywords—Data Augmentation, Convolutional Neural Network (CNN), Hyperparameter Optimization, Deep Learning, Fashion-MNIST

I. INTRODUCTION

Deep learning models have made a great breakthrough for the image classification tasks in computer vision. Deep learning often refers to some hidden elements as hyperparameters as they are one of the most crucial components of any deep learning applications. Hyperparameters are the fine tuning elements that live outside the model but that can heavily influence its behavior and the performance of the model immensely dependent on the selection of right hyperparameter. Within this paper a ConvNet model has built with various regularization methods and hyperparameter optimization techniques for recognizing images of fashion objects using the Fashion-MNIST (F-MNIST) dataset. F-MNIST is a fashion products image dataset be made up of 60,000 training set and 10,000 test set samples including 10 categories of 28x28 grayscale images. Figure 1 shows all the class labels, names and some images in F-MNIST.
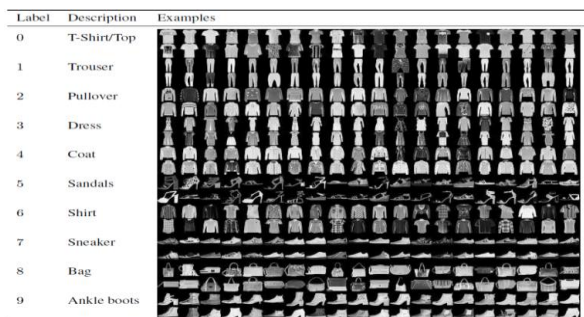

Fig. 1. **Fashion-MNIST Dataset Images**

The regularization technologies like Batch normalization (BN) [8] and Dropout [18] are commonly used to ward off overfitting as regards insufficient training images. Data augmentation is a technique of producing new identical sample images to the training data, which can be considered as one sort of regularization method [14]. For the image classification problems, data augmentations are frequently used in the pioneer research works [17]. For preventing overfitting we have used many effective techniques such as data augmentation and dropout. Most common and the easiest technique to avoid overfitting on the image data is to artificially expand the training image samples. The recently-introduced technique "dropout" [18] is regularization method for neural networks suggested by Srivastava, et al., (2014) where randomly selected neurons ignored or "dropped out" during training.

II. BACKGROUND AND RELATED WORK

In image classification different methods are used such as methods based on low-level image feature representation which consider image as a collection of low-level characteristics like texture, shape, size, color, etc. and methods based on mid-level visual feature constructions for image classification tasks. Nowadays, usage of deep neural networks and neural-networks to obtain image representation is trending. Such architectures allows us to extract features from a specified layer of trained neural network and then use extracted feature maps as a numeric image representation. There are a large number of publications related to the image processing with neural networks. Our work is related to this type of research, where CNN are used for classifying images. Image classification in the fashion domain has numerous benefits and applications and has various research works have been presented about it.

One among the previous studies has reviewed deep neural networks is able to attain record breaking outputs on very challenging dataset using supervised learning (Krizhevsky et al., (2012) [11]). Their network contains 5 CNN layers and 3 fully-connected layers. They worked one among the largest ConvNets on the ImageNet dataset subsets and achieved best ever results reported on this. This neural network includes a number of novel and unusual features that increase the performance such as relu nonlinearity, overlapping pooling etc. and decrease the time for training. They have used various effective methods for reducing overfitting, which are data augmentation and dropout. Fashion-MNIST dataset has been presented by Zalando Research (Xiao et al., 2017 [19]). F-MNIST is proposed to intend for a direct drop-in substitute for the classical MNIST handwritten digits dataset which has been considered as the benchmark for machine learning techniques, as it contains the same structure, image format and size of train and test set splits. They have

provided some results of classification in this paper to form a benchmark on this dataset. All algorithms presented on that were repeated five times by shuffling the training data and the mean of the accuracy on the test data were reported on it. Dufourq et al., 2017 [4] suggest EDEN (Evolutionary DEep Networks), an effective neuro-evolutionary algorithm which includes the strengths of deep networks and genetic algorithms. The search area of the neural network model is explored by them by adding supplementary features like optimization of the embedding layers in their study.

In latest research studies, ConvNets has been used for classifying images. In the work of S. Bhatnagar, D. Ghosal, and Kolekar M. H. (2017) [1], F-MNIST categorization is conducted to categorize groups of fashion article images. They have demonstrated 3 different ConvNet models and applied residual skip connections and batch normalization (BN) for ease and speed of the learning process.

F-MNIST is a kind of more challenging task than classical MNIST dataset. Original MNIST dataset—commonly used as the "Hello World" of machine learning applications in computer vision, is overused, too easy and cannot represent modern computer vision tasks. Researchers at Zalando company have developed a new image classification dataset called F-MNIST in hopes that it should be a substitute for original MNIST [13] dataset. This newly introduced dataset contains images of various products of clothing and accessories—such as t-shirts, coats, shoes, and other fashion items. Each image is a 28x28 grayscale fashion article image, related with a label from ten categories (t-shirt/top to ankle boots). F-MNIST is the most challenging dataset and gives us a lot more room for improving the model. Hence it could be a potential substitute for classical MNIST.

III. PROPOSED METHODOLOGY

Classification of images is used in various applications, ranging from facial recognition to self-driving cars. ConvNets are current state-of-the-art models for object classification. ConvNets are being used everywhere. For getting started with image classification the handwritten digits MNIST dataset is easier and mostly overused.

We propose to classify fashion products images using hyperparameters optimization methods and regularization techniques implementing with CNN. Almost in all computer vision tasks ConvNets are being used. ConvNets mainly consists of three phases. In the first phase a convolution operation occurs in between filters or kernels and input image of very small size and a feature map is produced. Each kernel in a ConvNet learns different features of the image. The convolution operation in ConvNet is simply a mathematical operation i.e. multiplication of the filter and image matrix. The convolution function between a 2D filter Q and 2D image P is,

$$C(m,n) = (P * Q)(m,n)$$
$$= \sum_i \sum_j P(i,j)Q(m-i,n-j) \qquad (1)$$

It can also be expressed as,

$$C(m,n) = (Q * P)(m,n)$$
$$= \sum_i \sum_j P(m-i,n-j)Q(i,j) \qquad (2)$$

For a 3x3 filter size the equation becomes,

$$C(m,n) = (Q * P)(m,n)$$
$$= \sum_{i=1}^{3} \sum_{j=1}^{3} P(m-i,n-j)Q(i,j) \qquad (3)$$

The second phase of ConvNet model is Activation layer. Activation function introduces non-linearity to the model. Most prominent activation functions are ReLU (Rectified Linear Unit) [15], Tanh and Sigmoid. ReLU activation function is implemented in the proposed models. Usually, ReLU function is most popularly used in almost all the ConvNets.
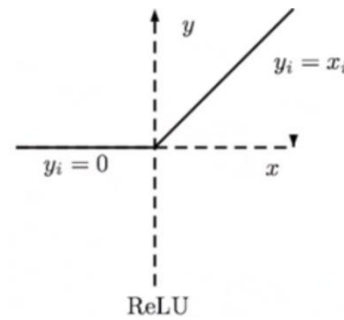
ReLU

$$R(z) = \max(0, z)$$

$$R(z) = \begin{cases} 0 & for \ z < 0 \\ z & for \ z \geq 0 \end{cases}$$

ReLU is best for hidden layers. $R(z)$ is zero when z is less than zero and $R(z)$ is equal to z when z is above or equal to zero. Other alternatives are sigmoid, tanh and other activation functions depending on the task. They are a crucial part of neural networks. The third phase is pooling function which is applied to resize the dimension of the input image to avoid overfitting. ConvNets often use pooling layers to decrease the size of the representation. Suppose we have a 4 x 4 input, and you want to apply a type of pooling called max pooling. And the output of this particular implementation of max pooling will be a 2 x 2 output. To demonstrate, if

$$A = \begin{bmatrix} 1 & 3 & 2 & 1 \\ 2 & 9 & 1 & 1 \\ 1 & 3 & 2 & 3 \\ 5 & 6 & 1 & 2 \end{bmatrix}$$

then the result of this 2 x 2 max pooling operation will be

$$MaxP(A) = \begin{bmatrix} 9 & 2 \\ 6 & 3 \end{bmatrix}$$

In this work two different neural network architectures are proposed: 2 ConvNets and 4 ConvNets. The first one includes two convolutional layers. The last one is composed of 4 convolutional layers. These models with hyperparameters like epochs and batch size, optimizers and activation functions and regularization ways such as data augmentation and dropout usage allows us to achieve good results with this model

architecture compared with others.

Current work the main focus is to classify fashion images in F-MNIST dataset which is a new challenging alternative to MNIST dataset. We show limitations and shortcomings of complex and simple methods. Therefore, we show necessity of hyperparameters and regularization techniques usage in this problem. Usage of a benchmarking dataset is the well-known and promising approach for classifying images. Herewith HPO and regularization approach are used and showing how we can utilize available knowledge from initial dataset to achieve significantly better performance. We show how to overcome the complexities we faced. In fully-supervised deep neural network architectures with limited training data will dramatically overfit the training data. Final classification model is built on joined methods that allow us to benefit both from using the HPO and regularization methods.

A. Image Preprocessing

The F-MNIST database contains 70000 images of dimension 28x28. These images and their corresponding labels are separated as training data and test data. To prepare the data for training, some processing have applied on the images like resizing images, normalizing the pixel values etc. After doing the necessary processing on the image information's, the label data, we have converted it into categorical formats like label '5' should be represented as a vector format of [0, 0, 0, 0, 0, 1, 0, 0, 0, 0] to build the model.

Fig. 2. Some sample Images in Fashion-MNIST Dataset with their labels

Each image has 28 x 28 resolutions. The CNN accepts image input shape in a specific format. So we have reshaped our input. All the images in our dataset are in grayscale. Normalization is applied on the input images for getting the dimensions in same scale. For that images are rescaled so that each pixel in image data lies in [0, 1] interval format instead of [0, 255]. Then we have applied the one-hot encoding technique for the labels. In this process the label which is an integer here is transformed into a vector which includes only one '1' for corresponding label position and the rest of the elements will be '0'.

B. Convolutional Neural Network (CNN or ConvNets)

Among various deep learning architectures, ConvNets stands out for its unprecedented performance on computer vision. ConvNet is an Artificial Neural Network inspired by biological visual cortex and been successfully applied to image processing tasks. A special kind of artificial neural network is ConvNet which contains at least one convolutional layer. A typical ConvNet takes an input image, pass it through a set of layers convolution, non-linear activation, pooling (downsampling) and fully connected, and retrieve an output of classification labels. This output of this CNN layer is an activation map.

The first ConvNets architecture of the model defined in this paper consists of 2 convolution layers succeeded by activation, pooling, fully connected and softmax layers respectively. Multiple filters are used at each ConvNet layer, for various types of feature extraction. In our first ConvNet layer 32 numbers of filters of the dimension (3, 3) is given and in the second layer 64 filters of (3, 3) is applied. In the second ConvNet model 4 convolution layers followed by Batch Normalization, relu, maxpooling and dropout. First two convolution layers contain 32 numbers of filters and next two with 64 filters. Each filter has the dimension of (3, 3).

C. Regularization Techniques

1) Dropout

In neural networks the regularization technique used to reduce overfitting by preventing co-adaptations on training data is dropout. While training neural network the technique dropout is used which randomly dropping out the neurons in the learning stage. After pooling layer and fully connected layer, dropout is introduced in this architecture to reduce over-fitting problem. In our model after pooling layer dropout ignored 25% of the neurons and disabled 50% of the neurons after fully connected layer.

2) Data Augmentation

When working with deep neural network models data preparation is required. Object recognition tasks are more complex and increasingly it requires data augmentation. The deep networks require very huge amount of sample data to attain the best performance. One technique to get more data for training is image augmentation; it artificially creates new training images by applying transformations on the data. To improve the performance of deep neural networks which is used for building a classifier of images using very little data, data augmentation technique can be applied. The method of artificially creating new images for training by applying transformations such as random rotations, shifts, shear, flips etc. is known as data augmentation.

D. Hyperparameter Tuning

1) Optimizers

Optimization algorithms help us to minimize or maximize the objective function. Minimizing the loss by the training process is very important and has a main role in the operation of training of the neural network model. The two optimizers used in these architectures are Adam [9] and Adadelta [20] for optimization of the loss function. Adam work well across a wide range of deep learning architectures. Adam usually outperforms the rest followed very closely by the other adaptive learning rate methods, Adagrad and Adadelta. Adam optimizer can be calculated as

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$$\Delta\theta_t = -\frac{\eta}{\sqrt{\hat{v}_t} + \epsilon}\hat{m}_t \qquad (4)$$

Adadelta is another popular gradient descent technique for optimization of loss function which is also used for the model parameters in our model. Adadelta prevents learning rate decay and it is an extension of Adagrad. The Adadelta rule is represented as

$$\Delta\theta_t = -\frac{\eta}{E[g^2]_t + \epsilon}g_t \qquad (5)$$

$$\Delta\theta_{t+1} = \theta_t + \Delta\theta_t$$

2) Batch size and Number of Epochs

Mini-batch is usually preferable in the learning process of ConvNets. A range of 16 to 128 batch size is a good choice to test with. ConvNet is sensitive to batch size. In this model we have used 64 and 128 as batch size for training images. Number of epochs is the number of complete pass through the entire training set. The number of epochs has increased until the difference of training and the test error is very small. Here, we have checked with 40 and 60 epochs.

3) Activation Function

Activation function is just a thing that should be added to the output at the end of any neural network. This is used to obtain the output of the neural network like yes or no. Depending upon the function it maps the resulting values in between -1 to 1 or 0 to 1 etc. ReLU is really popular in the last few years and it is used in this models.

E. Other parameters

To increase the training speed of the model Batch Normalization was done. To keep the dimensions to be same in the layers after convolution layer the batch normalization applied and it decrease the time for training obviously. The categorical cross entropy is used as loss function because the current problem is the classification of multi-class. This helps for calculating the fault rate value between the actual and predicted.
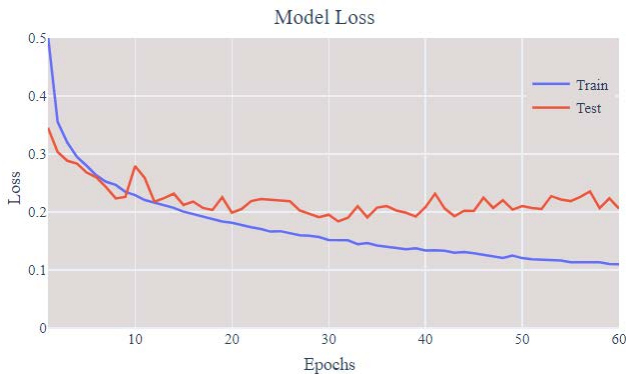

Fig. 3.Model Loss per Epochs in CNN + HPO +Reg Method

Fig. 4. Accuracy per Epochs in CNN + HPO +Reg Method

Overall comparing with base models, the CNN + HPO + Reg model has high accuracy and low loss in both test and training set as shown in Fig. 3 and Fig. 4. The 32 filters generated in first convolution layer is shown in Fig. 5.
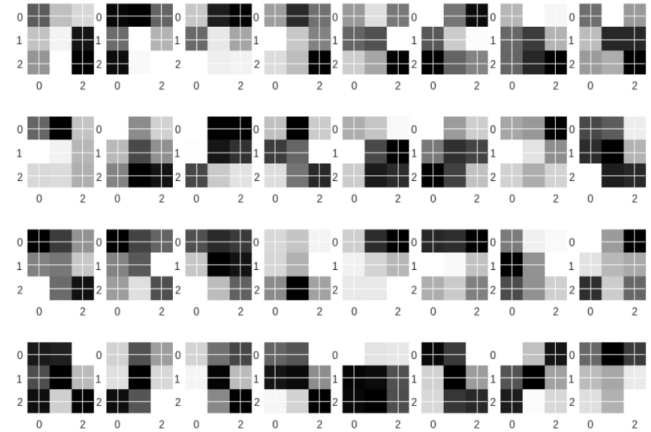

Fig. 5.32 learnable filters with 3x3 kernel size in first layer

IV. EXPERIMENTAL RESULTS AND DISCUSSIONS

A. Fashion-MNIST Dataset

In this work, we use F-MNIST dataset, which contains of 60,000 images of training and 10,000 images of test. Each gray scale image has a dimension of 28-by-28 pixels and grouped into ten categories from T-shirt/top to Ankle boots as displayed in Fig. 1. Figure 6 shows that two sample images in F-MNIST dataset, pictures of T-Shirt and Sandal.
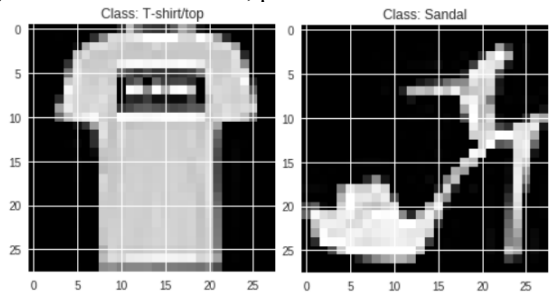

Fig. 6.Two images from two classes of Fashion-MNIST Dataset

We present some state-of-the-arts results to form a benchmark for F-MNIST. All neural network architecture results with several ConvNets models configuring hyperparameters and applying regularization are shown in below Table I. By comparing the results of best models published in the literatures [19], [4] and [1]. In literature [19], SVC (Support Vector Classifier) is applied. Table II Shows that these literature results with our best ConvNet performance.

TABLE I. ACCURACY AND LOSS OF F-MNIST WITH OUR MODELS

Model	Parameter	Accuracy		Loss	
		Train	Test	Train	Test
	Adadelta, BS-128, Epochs – 40	0.9945	**0.9352**	0.0238	**0.2469**
CNN2	Epochs – 60	0.9978	**0.9367**	0.0114	0.2876
	Adam, BS-128, Epochs – 40	0.9982	0.9319	0.0092	0.3098
CNN2	Epochs – 60	**0.9993**	0.9302	**0.0045**	0.3372
	Adadelta, BS-64, Epochs – 40	0.9890	0.9324	0.0379	**0.2617**
CNN2	Epochs – 60	0.9931	0.9317	0.0227	0.3109
	Adam, BS-64, Epochs – 40	0.9961	0.9275	0.0157	0.3147
CNN2	Epochs – 60	**0.9990**	0.9334	**0.0047**	0.3670
CNN4 + HPO + Reg	Adam, BS-64, Epochs – 60	0.9594	**0.9399**	0.1100	**0.2037**

CNN2 – 2 Convolutional Layers; CNN4 – 4 Convolutional Layers; HPO – Hyper Parameter Optimization;
Reg – Regularization; BS – Batch Size; DA – Data Augmentation

In the above table we can see that the accuracy and loss of testing and training set. We have achieved 99.90% training accuracy and 0.47% training loss when we have used Adam optimizer and 64 mini-batch size in 60epochs with 2 ConvNet layers. We got the maximum testing accuracy of 93.99% and minimum testing loss 20.37% with hyperparameter optimization and regularization techniques used with 4 ConvNet layers. In this model we have implemented Adam optimizer with batch size 64 and iterated the model till 60 epochs.

TABLE II. ACCURACY RESULTS ON F-MNIST TEST DATA WITH LITERATURES

Model	Test Accuracy
SVC [19]	0.8970
EDEN [4]	0.9060
CNN2 [1]	0.9117
CNN2 + BN + Skip [1]	0.9254
CNN4 + HPO + Reg	**0.9399**

SVC – Support Vector Classifier; EDEN – Evolutionary DEep Networks;
CNN2 – 2 Convolutional Layers;
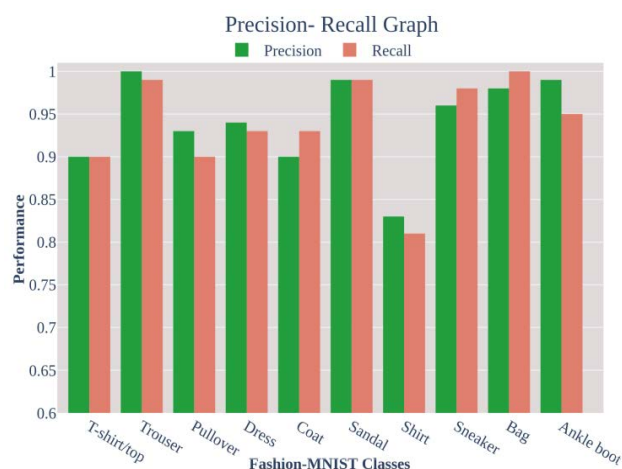BN- Batch Normalization; Skip – Residual Skip Connections; CNN4 – 4 Convolutional Layers

Fig. 7.Precision-Recall Graph of 10 classes

Comparing with the accuracy results on F-MNIST dataset test data results with various models in literature, the CNN4 + HPO + Reg model shows better accuracy results of 93.99% with minimum loss. Figure 8 displays some of the accuracy and loss graphs when using various hyperparameter optimization and regularization techniques. These HPO techniques are varying with their batch size, epochs, optimizers, convolution layers etc.
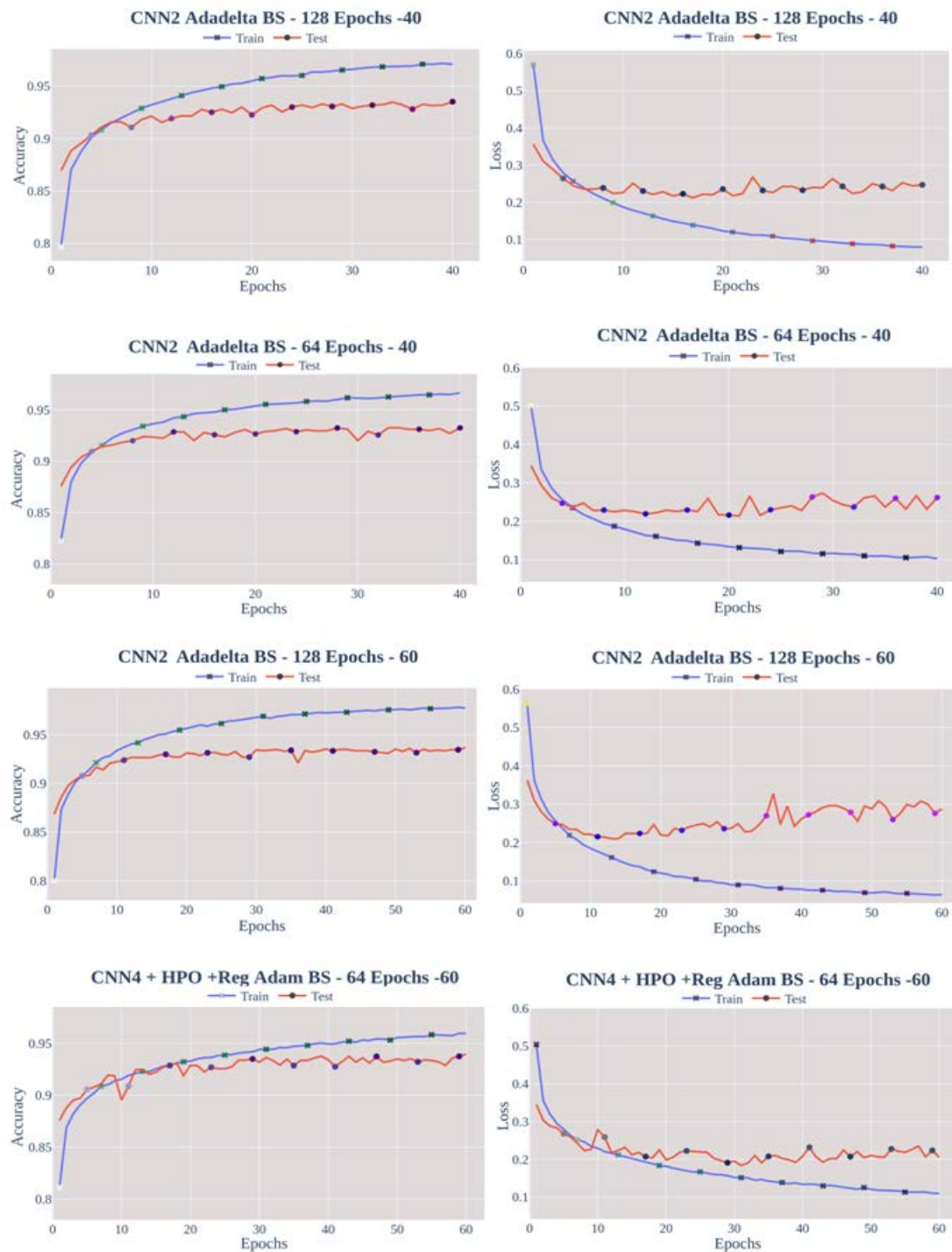
Fig. 8. Accuracy and Loss Graphs using various HPO

TABLE III. CLASSIFICATION REPORT

Class	Recall	Precision	F1 Score
T-shirt/top	0.90	0.90	0.90
Trouser	0.99	1.00	0.99
Pullover	0.90	0.93	0.92
Dress	0.93	0.94	0.94
Coat	0.93	0.90	0.92
Sandal	0.99	0.99	0.99
Shirt	0.81	0.83	0.82

Class	Recall	Precision	F1 Score
Sneaker	0.98	0.96	0.97
Bag	1.00	0.98	0.99
Ankle boot	0.95	0.99	0.97
Overall	**0.94**	**0.94**	**0.94**

Generally used measures for tasks like image classification are Recall, Precision and F1 Score. These results for 10 different categories are shown in Table III. When compared with other categories the scores of recall, precision and f1-score are very less for Shirt and T-Shirt/top. Shirts, Pullover, T-Shirt/top and Coats also show low scores. Among other categories of images, these 4 categories are frequently misclassified. The reason for this low metrics score is its similarity in such small images of 28-by-28 pixels. In the below Table IV we can clearly see the different categories which are the major causes of error in predicting the correct image. The main sources of error in the proposed model are from Shirt and T-Shirt/Top class.

TABLE IV. CONFUSION MATRIX : CNN4 + HPO + REG MODEL

Class	Label	0	1	2	3	4	5	6	7	8	9
T-shirt/top	0	898	0	13	7	2	1	72	0	7	0
Trouser	1	0	988	0	7	1	0	2	0	2	0
Pullover	2	14	0	902	6	36	0	41	0	1	0
Dress	3	15	1	10	932	12	0	29	0	1	0
Coat	4	0	0	17	20	932	0	27	0	4	0
Sandal	5	0	0	0	0	0	995	0	3	0	2
Shirt	6	75	0	29	19	54	0	815	0	8	0
Sneaker	7	0	0	0	0	0	6	0	984	1	9
Bag	8	0	0	0	1	0	0	0	0	999	0
Ankle boot	9	0	0	0	0	0	8	0	37	1	954

V. CONCLUSION

With hyperparameter optimization and regularization techniques used with four layer ConvNets we were capable of attain an accuracy of 93.99%. We can clearly see how by tuning various hyperparameters like optimizers, batch size, number of epochs and regularization methods such as image augmentation and dropout increase the overall performance and significantly decrease the training time. F-MNIST can be a best drop-in substitution for MNIST although it is more difficult than MNIST dataset. We can implement or serve these models with hyperparameter tuning and regularization techniques for various types of image classification tasks and this dataset should be very much challenging when doing machine learning tasks. Configuring hyperparameters needs years of experience and it is a black art, but tuning these parameters we can achieve magical results solving various computer vision tasks.

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Fashion-MNIST Classification Based on HOG Feature Descriptor Using SVM

Greeshma K V, Sreekumar K

Abstract: *Image recognition and classification plays an important role in many applications, like driverless cars and online shopping. We present the classification of Fashion-MNIST (F-MNIST) dataset using HOG (Histogram of Oriented Gradient) feature descriptor and multiclass SVM (Support Vector Machine). In this paper we explore the impact of one of the successful feature descriptor on Fashion products classification tasks. We have used one of the most simple and effective single feature descriptor HOG. The multiclass SVM which is one of the best machine learning classifier algorithms is used in this method to train the images. Selecting appropriate technique for feature extraction and choosing a best classifier algorithm remains a big challenging task for attaining good classification accuracy. However, the experimental results show that impressive results on this new benchmarking dataset F-MNIST.*

Index Terms: *Fashion-MNIST, HOG features, Image Classification, SVM Classifier.*

I. INTRODUCTION

In computer vision one of the most popular applications are Object Recognition or Object Classification. In object classification the main aim is to extract features from the images and classify it into right classes using any one of the classifiers or classification methods. Object classification is an important problem in various computer vision applications, such as image retrieval, driverless car, and surveillance. For example, in a driverless car, we have to classify nearby objects as vehicles or pedestrians. For classifications of images or patterns one of the best classification methods is multiclass SVM (Support Vector Machine). HOG (Histogram of Oriented Gradient) is an efficient gradient based feature descriptor for data discrimination and its performance is excellent comparing with other feature sets. This work classified the fashion products in Fashion-MNIST dataset using HOG features with multiclass SVM classifier. Fashion-MNIST (F-MNIST) is a dataset of 70000 fashion articles developed by Zalando Research Company. Figure 1 shows some images in F-MNIST.

II. BACKGROUND AND RELATED WORK

In this work we propose to classify fashion products using HOG feature descriptors [5] and a multiclass SVM [6] classifier. In OCR (Optical Character Recognition) this type of classifications are used. HOG was first introduced by Dalal
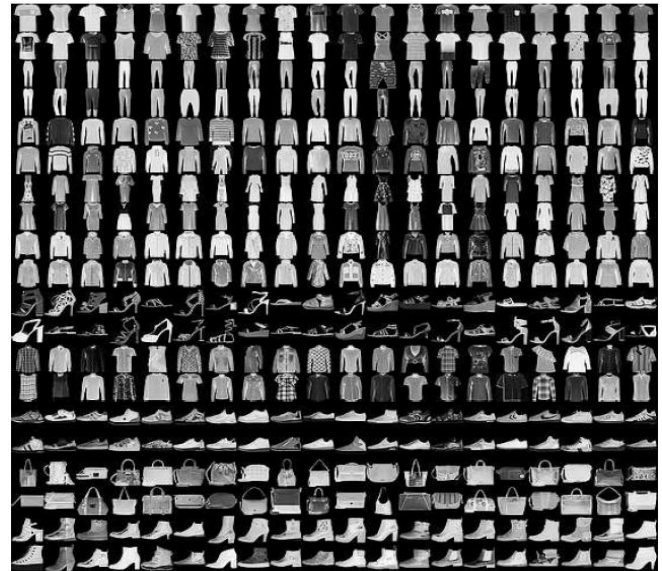

Fig. 1. **Fashion-MNIST Dataset Images**

and Triggs (2005) [5] for the human detection and it is one of the most popular and successful feature descriptors in pattern recognition and computer vision. In one of the research paper presented by Ebrahimzadeh and Jampour [2] shows that they have achieved very high accuracy on HDR (Automatic Handwritten Digits Recognition) using this efficient HOG descriptor with multiclass SVM.

One of the previous works suggested by Khan, H. A. (2017) [4], a new MCS (Multiple-Cell Size) method is being introduced for make use of HOG features and multiclass SVM for performing Handwritten Digits classification efficiently. By performing HOG analysis and computing the HOG features with MCS approach, it has achieved best classification accuracy. Improvements based on Chain Code Histogram (CCH) for recognition of handwritten digits was proposed by Qian, Y. and Xichang (2013) [7] improves the speed of training and recognition and this reduces the feature dimension.

III. PROPOSED METHODOLOGY

A. Preprocessing and Feature Extraction

The various features of the images are extracted in this phase and then they have used with SVM for classifiation of fashion objects in F-MNIST dataset. In advance of training a classifier and evaluating the test, a preprocessing task is

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introduced to decrease noise artifacts produced while collecting samples of images. For training the classifiers by applying pre-processing, it provides better feature vectors. Preprocessing is very much important task because its efficient functioning reduces the misclassification and improves the recognition rate [8]. Herein HOG based feature extraction scheme for recognizing fashion products is used for the proposed work. Every fashion article image of dimension 28x28 is used to extract HOG feature.

B. Histogram of Oriented Gradients (HOG)

One of the simple and effective feature extraction methods is HOG feature descriptor. It is a fast and efficient feature descriptor in compare to the SIFT and LBP due to the simple computations, it has been also shown that HOG features are successful descriptor for detection. Mainly it is used for object detection in image processing and computer vision. Using HOG the shape and appearance of the image can be described. It divides the image into small cells like 4-by-4 which is used in this work and computes the edge directions. For improving the accuracy the histograms can be normalized.
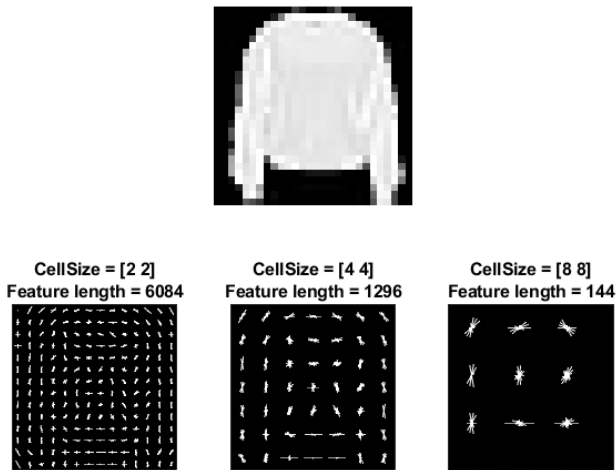

Fig. 2. *Extracted features of an image in Fashion-MNIST Dataset*

In Figure 2 extracted HOG features of one image using three different cell sizes are shown. In this figure the visualization of cell size [2 2], [4 4] and [8 8] are shown. From that it is clearly understood that the cell size [2 2] contains more shape information than the cell size of [8 8] in their visualization. But in the latter case the dimensionality of feature vector using HOG increases comparing with the former. A good choice is the [4 4] cell size. By using this size the numbers of dimensions are limited and this helps to speed up the training process. Also it contains enough information to visualize the fashion image shape. For identifying the suitable parameter setting configuration of HOG parameters more training and testing processes using the classifier has to be performed.

C. Support Vector Machine (SVM)

In machine learning one of the most common and successful classifier in supervised learning is SVM which can be used for classification and regression tasks [6]. Supporting Vector Machine has been successfully applied in the field of pattern recognitions, like face recognition, text recognition and so on.

It shows good performance in applications [8]. So this part we utilize SVM to train and test. This paper employed a multiclass SVM classifier as a classification tool of HOG feature space developed for a complete dataset of fashion images from F-MNIST database. The HOG feature of dimension 1x1296 for each individual fashion object have been arranged in the row wise to prepare complete feature space.

IV. EXPERIMENTAL RESULTS

A. Fashion-MNIST Dataset

F-MNIST dataset is a collection of fashion objects in grayscale. It contains 4 files including the labels and images which are again subdivided into sets of training and test. The labels and images in training set consists of 60000 numbers and in the test set, it is 10000. F-MNIST contains 10 classes of images and the labels and description of each class is given in Table I.

TABLE I. CLASS NAMES AND LABELS OF F-MNIST DATASET

Labels	Description
0	T-shirt/top
1	Trouser
2	Pullover
3	Dress
4	Coat
5	Sandal
6	Shirt
7	Sneaker
8	Bag
9	Ankle boot

B. Experiment Results and Analysis

The presented work is implemented in MATLAB. HOG features of images are extracted from the 28 x 28 pixel training images of F-MNIST using the function in MATLAB. First of all in the training phase, extracting the features using HOG from the training images and then it will be used for making predictions using the classifier. These extracted HOG features are used to train the classifier. The results are evaluated using the test set images, and for measuring the accuracy of the classifier a confusion matrix is produced. Cell size used here for hog feature is [4 4]. And then these features of 60000 images are given into multiclass SVM for training. Finally testing is conducted on 10000 images in test set. It achieves 86.53% accuracy on test images. Table II displays the confusion matrix of the classes in fashion image dataset where it is very clearly understood that the uncertainty took place in between the categories of '0', '6' and '4', '2' and '4',

'6' and '2', '6' which are make sense because t-shirts and shirts, coat and pullover and coat and shirts are looking same and little bit confusing.

TABLE II. CONFUSION MATRIX OF HOG FEATURE 4 X 4

Class	Label	0	1	2	3	4	5	6	7	8	9
T-shirt/top	0	**835**	2	14	26	4	1	109	0	9	0
Trouser	1	2	**963**	2	27	1	0	5	0	0	0
Pullover	2	15	1	**765**	9	113	0	92	0	5	0
Dress	3	26	9	13	**871**	35	0	43	0	3	0
Coat	4	2	1	95	37	**796**	0	68	0	1	0
Sandal	5	0	1	0	0	0	**950**	0	38	1	10
Shirt	6	148	0	84	35	110	0	**612**	0	11	0
Sneaker	7	0	0	0	0	0	31	0	**952**	0	17
Bag	8	2	1	5	7	6	3	10	1	**965**	0
Ankle boot	9	0	0	0	0	0	13	1	42	0	**944**

TABLE III. ACCURACY RESULTS ON F-MNIST IN LITERATURES

Method	Accuracy
SGD Classifier [1]	81.9
Linear SVC [1]	83.6
HOG + SVM	**86.53**

SGD - Stochastic Gradient Descent; SVC – Support Vector Classifier; HOG - Histogram of Oriented Gradient; SVM – Support Vector Machine

Comparing with the accuracy results on F-MNIST dataset test data results with various models in literature as shown in Table III, the HOG + SVM model shows better accuracy results of 86.53%. In Figure 3 it shows that the category-wise accuracy of images in F-MNIST dataset. From this figure it is very clear that the accuracy of class 'shirts', 'pullover' and 'coat' are very low compared with other classes.

V. CONCLUSION

In general, proposed work presents an efficient system for the effective and accurate classification and recognition of the fashion products images. After successful implementation of t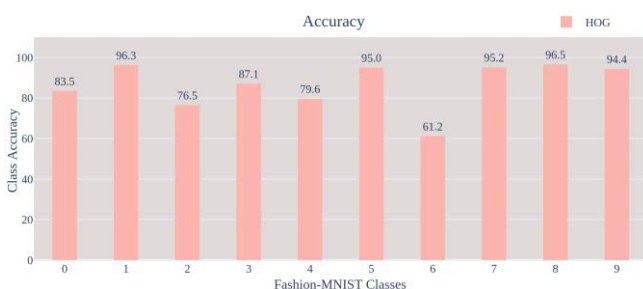he proposed fashion articles classification system using HOG feature space and multiclass SVM classifier, it has shown that the proposed system provides relatively good fashion object classification efficiency as compared to available literature works. In future, many modifications and improvements can be proposed on the preprocessing part and feature extraction and more combinations of features can be explored. We may modify the feature extraction and classification using many other techniques and can produce outstanding performance on fashion image classification. We can explore the other feature types for training the classifiers and analyze the effects of other machine learning algorithms for classifying fashion images.

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Fig. 3. *Class-wise Accuracy of Fashion-MNIST Dataset*

The T-X Family of Distributions: A Retrospect

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Abstract-The T-X method for generating new distributions is an emerging area in recent statistical literature. As a result, new distributions have been developed and studied. This article is a continuation of the paper "A Review Study on T-X Family of Distributions" by Tomy and Jose (2018). It reviews some special members of T-X family of distributions such as, Kumaraswamy-Geometric distribution, T-Normal Family, Poisson-X family, T-Transmuted family and Kumaraswamy-Marshall Olkin family of distributions.

Keywords: Transmuted family, Marshall-Olkin distribution, T-X family, Truncated Poisson distribution, Method of Maximum Likelihood

1. INTRODUCTION

In the present scenario of big data analytics, statistical modeling has got paramount importance. Researchers have started exploring innovative paths by introducing new distributions so as to fit the data in hand.

Alzaatreh et al.[1] proposed a general method to generate new family of distributions called "Transformed-Transformer" method and the family is called T-X family of distributions. The generator T can be any continuous distribution. During the milestones, the Beta generated method laid the first stone. In similar vein Kumaraswamy generated, Gamma generated, Kummer beta generalized and Generalized beta generated distributions paved the further path. The support of the generator in Beta-X and Kumaraswamy generated(Kw-G) family is 0 to 1, the transformed-transformer method overcomes this limitation and use any continuous distribution as a generator to generate distributions by using the function $W[F(x)]$. Many subfamilies of T-X family have been studied in the literature, some of them are Burr X family, T-Geometric family, T-Normal family, Half-Logistic generated, Poisson-X family, T-Transmuted family, Beta Marshall-Olkin and Kumaraswamy Marshall-Olkin family of Distributions. This article is a continuation of the paper entitled "A Review Study on T-X Family of Distributions" by Tomy and Jose[2] discusses the distributions which paved the way for T-X family of distributions and some members of T-X family of distribution.

The main aim of this review is to study and discriminate different subfamilies of T-X family of distributions and provide available literature on continuous and discrete families.

The paper unfolds as follows: In section 2, we consider T-X Family of distributions. Section 3 discusses some special members of T-X family of distributions. Finally in Section 4 we conclude paper.

2. THE T-X FAMILY OF DISTRIBUTIONS

A large number of distributions can be generated by applying any two existing univariate distributions based on T-X method. Several known continuous and discrete distributions are found to be special cases of the first generated distributions. Let r(t) be the Probability Density Function(PDF) and R(t) be the Cumulative Density Function(CDF) of a random variable T $\epsilon[a,b]$ for $-\infty < a < b < \infty$ and let $W[F(x)]$ be a function of the CDF

F(*x*) of some baseline continuous random variable X so that W[F(*x*)] satisfies the following conditions:

W[F(x)] ϵ [a, b]

W[F(x)] is differentiable and monotonically non decreasing

$W[F(x)] \rightarrow$ a as $x \rightarrow -\infty$ and $W[F(x)] \rightarrow$ b as $x \rightarrow \infty$

The CDF of a new family of distributions is defined as

$$G(x) = \int_a^{W[F(x)]} r(t)dt \qquad (2.1)$$

where W[F(*x*)] satisfies the above conditions. The CDF G(*x*) in equation(2.1) can be written as

G(*x*) = R{W[F(*x*)]},   where R(t) is the CDF of the random variable T. If X is a continuous random variable the corresponding PDF is given by

$$g(x) = \{\frac{d}{dx}W[F(x)]\}r\{W[F(x)]\} \qquad (2.2)$$

If X is a discrete random variable, the T-X family, is a family of discrete distributions. The probability mass function (PMF) of the T-X family of discrete distributions may now be written as

$$g(x) = G(x) - G(x-1) = R\{W[F(x)]\} - R\{W[F(x-1)]\}. \qquad (2.3)$$

The term "Transformed-Transformer" was used since the PDF r(t) in equation(2.1) is "Transformed" into a new PDF g(*x*) through the function W[F(*x*)], which act as a "transformer", that is, the random variable X is used to transform another random variable T. Different W(F(*x*)) will define based on the support of the random variable T.

Table 1 lists the T-X families for different W[F(x)] function.

Table 1: T-X families based on different W[F(*x*)]

W[F(*x*)]	Range of T	Members of T-X family
F(*x*)	[0, 1]	Beta Generated (Eugene et al.[3])
		Kw-G (Cordeiro and de-Castro.[4])
		Kummer Beta Generated(KBG) (Pescim et al.[5])
		McDonald Generated (Alexander et al.[6])
		Poisson-X (Tahir et al.[7])
		Kumaraswamy-geometric (Akinsete et al.[8])
$\frac{F(x)}{c + (1-c)F(x)}$	[0,1]	Beta Marshall Olkin (Alizadeh et al.[9])
		Kumaraswamy Marshall Olkin (Alizadeh et al.[10])
- log [F(*x*)]	(0, ∞)	Gamma generated (Ristic and Balakrishnan[11])
- log [1 - F(*x*)]	(0, ∞)	Gamma Generated(Zografos and Balakrishnan[12])
		Weibull-X (Alzaatreh et al[1])
		Weibull-Pareto(Alzaatreh et al.[13])
		Lomax-G (Cordeiro et al.[14])
		Exponentiated Half-Logistic Generated (EHL-G) (Cordeiro et al.[15]
		Generalized Burr X family of distributions (Jamal and Nasir[16])
		Weibull-Lomax (Alzaghal et al.[17])
		ExponentiatedGompertz Generated (Cordeiro et al.[18])
		Gamma-Pareto(Alzaatreh et al.[19])
		Exponentiated Exponential-Geometric (Alzaatreh et al.[20])

		Weibull-Power Cauchy(Tahir et al.[21])
$-\log\left[1-F^{\alpha}(x)\right]$	$(0,\infty)$	Exponentiated T-X (Alzaghal et al.[22])
$\dfrac{F(x)}{1-F(x)}$	$(0,\infty)$	Gamma Generated (Torabi and Hedesh[23])
		A New Weibull-Pareto (Tahir et al.[24])
$-log\left[1-\dfrac{F(x)}{c+(1-c)F(x)}\right]$	$(0,\infty)$	T-Transmuted X Family (Jayakumar and Girish[25])
$\dfrac{F(x)}{1-F(x)}$	$(0,\infty)$	Weibull Rayleigh(Merovci and Elbatal[26])
$\dfrac{F(x)}{1-F(x)}$	$(0,\infty)$	Burr X-G (BX-G) family of distributions (Yousof et al.[27])
		Weibull-G (Bourguignon et al.[28])
		Odd Log-Logistic-G(Cordeiro et al.[29])
		Weibull-Exponential (Oguntunde et al.[30])
		Weibull-Inverse Exponential (Chandrakant et al.[31])
$\dfrac{F^{\beta}(x)}{1-F^{\beta}(x)}$	$(0,\infty)$	Generalized Odd Gamma-G Family (Hosseini et al.[32])
$log\{\dfrac{F(x)}{1-F(x)}\}$	$(-\infty,\infty)$	Logistic-G (Torabi and Montazeri,[33])
		Gumbel-Weibull(Al-Aqtash et al.[34])
$log\{-log[1-F(x)]\}$	$(-\infty,\infty)$	Logistic-X (Tahir et al.[35])

3. SPECIAL SUBFAMILIES OF T-X FAMILY

In this section, we discuss some special cases of T-X family of distributions and their literatures are provided, such as T-Normal Family of distributions, Poisson-X family of distributions, Kumaraswamy-Geometric distribution, T-Transmuted family and Kumaraswamy-Marshall Olkin family of distributions.

3.1 T-NORMAL FAMILY OF DISTRIBUTIONS

Aljarrah et al.[36] used W[F(x)] to be the quantile function of a random variable Y in T-X family and defined the T-X{Y} family for generating families of continuous probability distributions, the corresponding CDF is

$$G(x) = \int_a^{Q_Y[F(x)]} r(t)dt = R\left[Q_Y\big(F(x)\big)\right] \qquad (3.1)$$

where $Q_Y(p)$ is the quantile function of the random variable Y, $0 < p < 1$.

$$Q_Y(p) = inf\{Y\epsilon R:F(y) \geq p\}, \quad p\epsilon(0,1) \qquad (3.2)$$

If the function F is continuous and strictly monotonically increasing then $Q_Y = F^{-1}$. The above family is a family of continuous probability distributions then the PDF associated with equation(3.1) is

$$g(x) = \frac{f(x)}{f_Y\{Q_Y[F(x)]\}}r\{Q_Y[F(x)]\} \qquad (3.3)$$

The quantile function of the random variable X with PDF g(x) is

$$Q_X(p) = Q_X\big(F_Y(Q_T(p))\big) \qquad (3.4)$$

Where $Q_X\big(F_Y(Q_T(p))\big)$ is quantile function of the random variable X with PDF f(x) with

$p = F_Y\big(Q_T(p)\big).$

Some remarks are

(a) If the random variables X and Y with PDF f(x) and f(y) are identically distributed then

G = R.

(b) If the random variables T and Y are identically distributed then G = F.

(c) Beta-X, Kw-G and Generalized Beta Generated Distributions are belong to T-X{uniform} family.

One of the main advantage of using the T-X{Y} framework is that one can keep one or more parameters from the distribution of Y. If the parameter is shape parameter which increase the flexibility of new distribution.

Alzaatreh et al.[37] define the families of Generalized Normal(GN) distributions called T-Normal family which is a subfamily of T-X{Y} family of distribution. That is, X is a normal random variable with PDF $f(x) = \phi(x)$ and CDF $F(x) = \Phi(x)$, then the CDF of T-normal{Y} family of distributions as

$$G(x) = \int_a^{Q_Y[\Phi(x)]} r(t)dt = R\big[Q_Y(\Phi(x))\big] \tag{3.5}$$

The corresponding PDF is

$$g(x) = \frac{\phi(x)}{f_Y\{Q_Y[\Phi(x)]\}} r\{Q_Y[\Phi(x)]\} \tag{3.6}$$

Some special cases are

(a) The beta normal, Kumaraswamy normal and generalized beta-generated normal are belong to the T-normal{standard uniform} family.

(b) The gamma-normal distribution studied by Alzaatreh et al.[37] is a member of T- normal{standard exponential} family.

The Hazard Rate Function (HRF) of the T-normal{Y} family is given by

$$_X(x) = \quad _\phi(x) \frac{T(Q_Y(\Phi(x))}{Y(Q_Y(\Phi(x))} \quad \text{where} \quad _\phi(x) = \frac{\phi(x)}{1-\Phi(x)}$$

Some examples of GN families of distributions with different choices for the random variables Y and T are Weibull-N{exponential}, logistic-N{log-logistic}, exponential-N{log-logistic}, exponentiated-exponential-N{uniform} and logistic-N{extreme value}.

3.1.1 WEIBULL-N{EXPONENTIAL} DISTRIBUTION

In this section, we define and study some properties of a member of the T-Normal family, the Weibull-N{Exponential} distribution introduced by Alzaatreh et al.[37]

If a random variable T follows the Weibull distribution with parameters c and β with PDF

$$r(t; c, \beta) = (c/\beta)(t/\beta)^{(c-1)}e^{-(t/\beta)^c}, t \geq 0 \; c > 0, \beta > 0$$

From equation(3.5), the CDF of Weibull-N{exponential} is defined as

$$G(x) = 1 - e^{\{-[-(1/\beta)log(1-\Phi(x))]^c\}} \tag{3.7}$$

By using equation(3.6), the PDF of the Weibull-N{exponential} is given by

$$g(x; c, \beta) = \frac{c}{\beta}\frac{\phi(x)}{1-\Phi(x)}\{\frac{-log(1-\Phi(x))}{\beta}\}^{c-1}e^{-\{[\frac{-log(1-\Phi(x))}{\beta}]^c\}}, x\epsilon R, c > 0, \beta > 0 \tag{3.8}$$

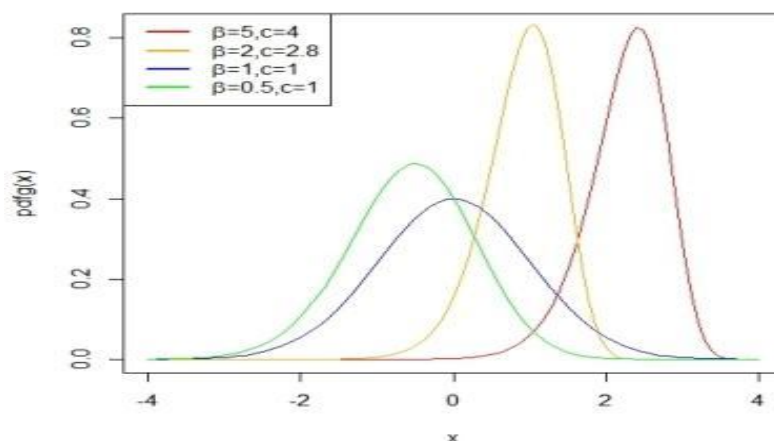Figure 1 gives the graph of PDF of Weibull-N{Exponential} distribution for various values of β and c.

Figure 1: PDF of Weibull-N{exponential} for Various Values of β and c.

Some properties are

(a)When c = 1, the Weibull-N{Exponential} reduces to the Exponential-Normal distribution with $\theta = \frac{1}{\beta}$.

(b) When c = β = 1, the Weibull-N{Exponential} reduces to the Normal distribution.

(c) It is left skewed whenever $\beta > 1$ and right skewed whenever $\beta < 1$. For fixed β, the peak increases as c increases.

The quantile function of the Weibull-N{exponential} distribution is given by

$$Q_X(p) = \Phi^{-1}\{1 - e^{\{-\beta(-log(1-p))^{1/c}\}}\}$$

The shapes of GN distributions can be symmetric, skewed to the right, skewed to the left. This gives the families some flexibility in fitting real world data.

In literature, Nasir et al.[38] introduced and studied the properties of the T-Burr family of distribution as a special case of the T-X{Y} family of distribution. Alzaatreh et al.[39] introduced T-Gamma family has been proposed using the T -X{Y} framework. Similarly Almeida et al.[40] and Alzaatreh.[41] proposed T-Weibull{Y} family and T-Cauchy{Y} family.

3.2 THE POISSON-X FAMILY OF DISTRIBUTIONS

Tahir et al.[7] suggested the Poisson-X family of distributions which is a subfamily of T-X family of distribution but here T is not a Poisson random variable. The procedures used for obtaining the distribution of T are, Consider a company with N independent working systems and that each system consist of c parallel units. The random variables $Z_{i1}, Z_{i2}, \ldots, Z_{ic}$, i= 1,2, . . . ,N are the failure times of the parallel components of the i^t system, are independent and identically distributed standard uniform random variables and Y_i denote the failure time of the i^t system. Also N is a random variable having a zero truncated Poisson distribution with PMF

$$P(N = n) = \frac{\lambda^n}{n!(e^\lambda - 1)}, n = 1,2,3,\ldots, \lambda > 0 \qquad (3.9)$$

The random variable T represents the time to failure of the first out of the N functioning systems ie, $T = min(Y_1, \ldots, Y_N)$. Based on the these situations the obtained conditional CDF of T is

$$R(t|N) = 1 - (1 - t^c)^n \qquad (3.10)$$

Then the CDF of T is,

$$R(t) = \sum_{n=1}^{\infty} P(N = n)R(t|N)$$

$$= \sum_{n=1}^{\infty}\frac{\lambda^n}{n!(e^{\lambda}-1)}1 - (1 - t^c)^n = \frac{1-e^{-\lambda t^c}}{1-e^{-\lambda}} \qquad (3.11)$$

The corresponding PDF is given by

$$r(t;\lambda,c) = \frac{\lambda c}{1-e^{-\lambda}}t^{c-1}e^{-\lambda t^c}; 0 \le t \le 1, \lambda > 0, c > 0 \qquad (3.12)$$

if $\lambda = 1$ then the $r(t;\lambda,c)$ becomes

$$r(t;c) = \frac{c}{1-e^{-1}}t^{c-1}e^{-t^c}; 0 \le t \le 1, c > 0 \qquad (3.13)$$

The CDF of the Poisson-X family is

$$G(x) = \int_0^{F(x)} r(t;c)dt = (1-e^{-1})^{-1}(1 - e^{[-F(x)]^c}) \qquad (3.14)$$

The corresponding PDF is

$$g(x;c) = \frac{c}{1-e^{-1}}f(x)F(x)^{c-1}e^{-[F(x)]^c}; c > 0 \qquad (3.15)$$

3.2.1 THE POISSON POWER CAUCHY DISTRIBUTION

In this section, a member of the Poisson-X family namely the Poisson Power Cauchy Distribution(PPC) is considered and some of its structural properties are investigated.

Rooks et al.[42] proposed a two-parameter Power-Cauchy (PC) distribution, a submodel of the transformed beta distribution. The CDF and PDF of the PC distribution with shape parameter α and scale parameter σ is given by

$$F(x) = 2\pi^{-1}tan^{-1}(x/\sigma)^{\alpha} \qquad (3.16)$$

$$f(x;\alpha,\sigma) = 2\pi^{-1}(\alpha/\sigma)(x/\sigma)^{\alpha-1}[1 + (x/\sigma)^{2\alpha}]^{-1}; x > 0, \alpha > 0, \sigma > 0 \qquad (3.17)$$

from equation(3.14) the CDF of PPC is defined as

$$G(x) = \frac{1}{(1-e^{-1})}(1 - e^{[-2\pi^{-1}tan^{-1}(x/\sigma)^{\alpha}]^c}) \qquad (3.18)$$

By using equation(3.15), the PDF of the PPC is given by

$$g(x;c,\alpha,\sigma) = \frac{2c\alpha(x/\sigma)^{\alpha-1}[2\pi^{-1}tan^{-1}(x/\sigma)^{\alpha}]^{c-1}}{\sigma\pi(1-e^{-1})[1+(x/\sigma)^{2\alpha}]}\{e^{-[2\pi^{-1}tan^{-1}(x/\sigma)^{\alpha}]^c}\}; x > 0, \alpha, \sigma, c >$$

0 (3.19)

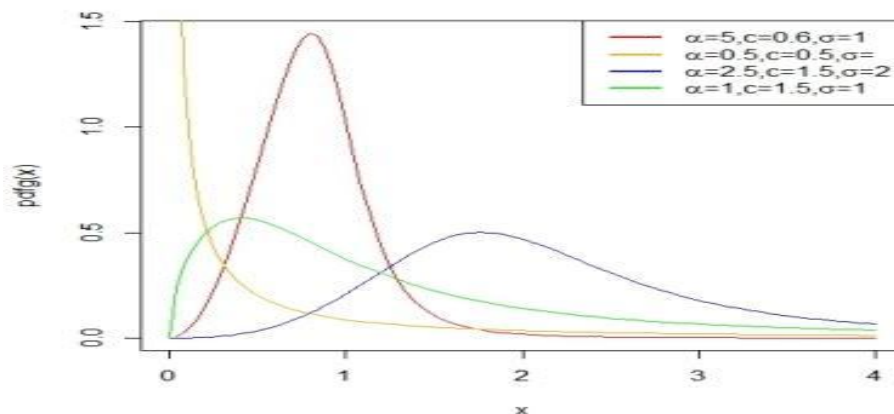Figure 2 gives the graph of PDF of PPC distribution for various values of α, σ and c.

Figure 2: PDF of PPC Distribution for Various Values of α, σ and c.

The PPC distribution is unimodal and its density function can be expressed as a linear representation of Exponentiated Power Cauchy (EPC) densities. The PPC density can produce various shapes such as left-skewed, right-skewed and reversed-J.

The HRF h(x) is

$$(x) = \frac{2c\pi^{-1}(\alpha/\sigma)(x/\sigma)^{\alpha-1}[1+(x/\sigma)^{2\alpha}]^{-1}[2\pi^{-1}tan^{-1}(x/\sigma)^{\alpha}]^c}{1-e^{-\{1-[2\pi^{-1}tan^{-1}(x/\sigma)^{\alpha}]^c\}}} \qquad (3.20)$$

It has increasing failure rate (IFR), decreasing failure rate (DFR), UBT (upside-down-bathtub) and BT (bathtub) shapes.

Tahir et al.[7] discovered the mathematical properties of this family such as ordinary and incomplete moments, quantile and generating functions, modes, Bonferroni and Lorenz curves of Poisson-X family. Also discussed the estimation of the parameters using maximum likelihood method. The distribution is applied to three real data sets were fitted for the PPC and compared with four known distributions. The results showed that the PPC is a relatively better model to fit data than the other distributions.

3.3 THE KUMARASWAMY-GEOMETRIC DISTRIBUTION

Akinsete et al.[8] proposed the Kumaraswamy-Geometric Distribution(KGD). It is obtained by taking T to be Kumaraswamy Distribution with CDF

$$R(t) = 1 - (1 - t^{\alpha})^{\beta} \quad 0 < t < 1, \alpha, \beta > 0$$

The transformer random variable X to have the geometric distribution and W[F(x)] = F(x).

The CDF of KGD is

$$G(x) = \int_0^{F(x)} r(t)dt = 1 - [1 - (1 - p^{x+1})^{\alpha}]^{\beta} \qquad (3.21)$$

The corresponding PMF for the KGD

$$g(x; p, \alpha, \beta) = [1 - (1 - p^x)^{\alpha}]^{\beta} - [1 - (1 - p^{x+1})^{\alpha}]^{\beta}; x = 0,1,2,\ldots,0 < p < 1, \alpha, \beta > 0 \quad (3.22)$$
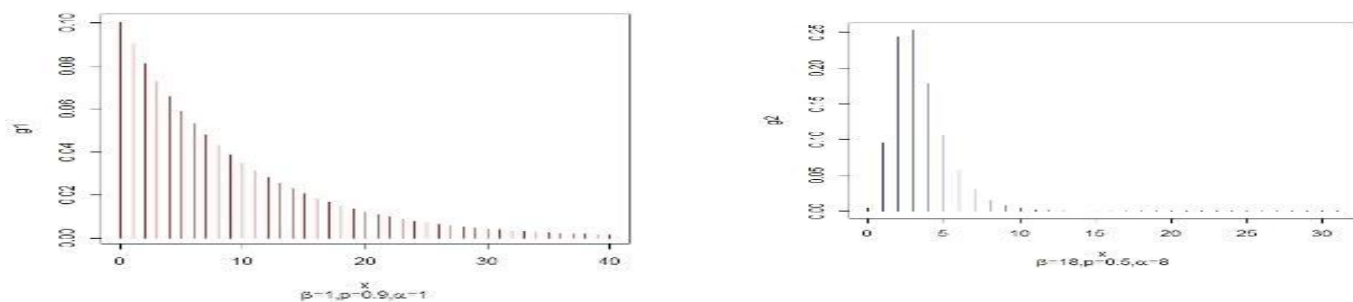

Figure 3 gives the graph of PMF of KGD distribution for various values of α ,β and p.
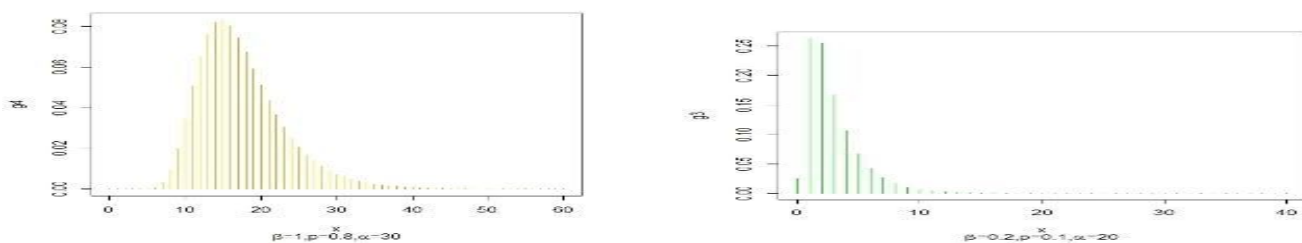

Figure 3: PMF of KGD for Various Values of α ,β and p.

When $\alpha = \beta = 1$, it gives the geometric distribution, when $\alpha = 1$, it gives the

geometric distribution with parameter $1 - p^\beta$ and when $\beta = 1$, it gives EEGD. Also KGD has a reversed J-shape with a unique mode. The KGD can also be derived by considering log-Kumaraswamy distribution instead of Kumaraswamy distribution and taking W[F(x)]= -log(1 - F(x)).

The associated HRF is

$$(x) = \{\frac{1-(1-p^x)^\alpha}{1-(1-p^{x+1})^\alpha}\}^\beta - 1 \tag{3.23}$$

The HRF of KGD, is increasing for $\alpha > 1$, decreasing for $\alpha < 1$ and at $\alpha = 1$ the HRF of KGD is constant.

Akinsete et al.[8] studied the properties of this family such as moments, quantile and generating functions and Shannon entropy are obtained. Also discussed the estimation of the parameters using maximum likelihood method. The distribution is applied to model two real life data sets were fitted for the KGD and compared with generalized negative binomial distribution (GNBD) defined by Jain and Consul [43]and Exponentiated Exponential-Geometric Distribution(EEGD). The results showed that the KGD is a relatively better model to fit data than the other distributions. Hamedani[44] studied the characterizations of KGD such as conditional expectation of certain function of the random variable and the reverse hazard rate function.

3.4 THE T-TRANSMUTED X FAMILY OF DISTRIBUTIONS

The Quadratic Transmuted Family of Distributions was proposed by Shaw and Buckley[45] with CDF

$$F(x) = (1 + \lambda)(J(x) - \lambda J^2(x))$$

for $\lambda\epsilon[-1,1]$, where J(x) is the CDF of the baseline distribution.

Jayakumar and Girish[25] used W[F(x)] to be the $-log(1 - F(x))$ where F (x) is the CDF of Quadratic Transmuted Family of Distributions, in T-X family of Distributions and declined the T-Transmuted X Family of Distributions for generating families of continuous probability distributions,

The corresponding CDF is

$$G(x) = \int_0^{-ln(1-F(x))} r(t)dt = \int_0^{-ln\left(1-J(x)\left(1+\lambda J(x)\right)\right)} r(t)dt$$
$$= R\{-ln\left(1 - J(x)\left(1 + \lambda J(x)\right)\right)\} \tag{3.24}$$

where R(t) is the CDF of the random variable T with pdf r(t).

The PDF corresponding to the T-Transmuted X Family of Distributions in equation(3.24) is given by

$$g(x;\lambda) = G'(x) = \frac{j(x)[1+\lambda-2\lambda J(x)]}{1-J(x)\left(1+\lambda J(x)\right)} r\{-ln\left(1 - J(x)\left(1 + \lambda J(x)\right)\right)\} \tag{3.25}$$

Some properties on the T-Transmuted X Family of Distributions:

(a) When $\lambda = 0$ the T-Transmuted X Family of Distributions reduces to T-X Family of Distributions with $W[F(x)] = -log(1 - J(x))$.

(b) The HRF of the T-Transmuted X family is given by,

$$(x) = \frac{j(x)[1+\lambda-2\lambda J(x)]}{1-J(x)(1+\lambda J(x))} \frac{r\{-ln(1-J(x)(1+\lambda J(x)))\}}{1-R\{-ln(1-J(x)(1+\lambda J(x)))\}}$$

Some examples of T-Transmuted X Family of distributions with different choices for the random variables T and X are Exponential-Transmuted Weibull (ETW), Exponential-Transmuted Rayleigh (ETR) distribution, Exponential-Transmuted Frechet (ETF) distribution and Lomax-Transmuted X Family of distributions.

3.4.1 EXPONENTIAL-TRANSMUTED EXPONENTIAL(ETE) DISTRIBUTION

In this section, we define and study some properties of a member of the T-Transmuted X family, the Exponential-Transmuted Exponential distribution. Jayakumar and Girish[25] applied T-X method and introduced (ETE)distribution.

Then $g(x; \lambda)$ in equation(3.25) reduces to

$$g(x; \theta, \beta, \lambda) = \theta\beta e^{-\theta\beta x} \frac{(1-\lambda+2\lambda e^{-\beta x})}{(1-\lambda+\lambda e^{-\beta x})^{1-\theta}} ; x > 0, \theta, \beta > 0, \lambda\epsilon[-1,1]$$

(3.26)

When $\lambda = 0$, ETE distribution becomes exponential distribution.

Figure 4 gives the graph of PDF of ETE distribution for various values of λ, β and θ
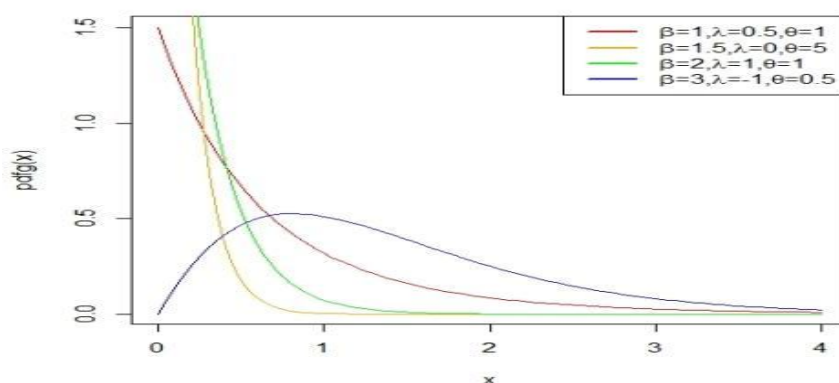

Figure 4: PDF of ETE for Various Values of λ, β and θ

The CDF of the ETE distribution is

$$G(x) = 1 - e^{-\theta\beta x}(1 - \lambda + \lambda e^{-\beta x})^\theta \quad (3.27)$$

The HRF of ETE distribution is

$$(x) = \theta\beta \frac{(1-\lambda+2\lambda e^{-\beta x})}{(1-\lambda+\lambda e^{-\beta x})}$$

The HRF is increasing if $-1 < \lambda < 0$ and decreasing if $0 < \lambda < 1$. When $\lambda = 0$ and $\lambda = 1$ the ETE distribution has a constant hazard rate.

Jayakumar and Girish[25]discovered the mathematical properties of this family such as ordinary moments, quantile and generating functions, modes and entropy. Also discussed the estimation of the parameters using maximum likelihood method and used simulation study to check the performance of the maximum likelihood estimate. The distribution is applied to two real data sets were fitted for the ETE and compared with four known distributions. The results showed that the ETE is a relatively better model to fit data than the other distributions.

In literature Clement and Girish[46] studied the further developments of T-Transmuted X family of distribution. Chhetri et al.[47] proposed and studied the Kumaraswamy Transmuted Pareto distribution. Also Afify et al.[48] studied the Beta Transmuted-H distribution. Similarly Chhetri et al.[49] introduced the Beta Transmuted Pareto distribution.

3.5 THE KUMARASWAMY MARSHALL-OLKIN FAMILY OF DISTRIBUTIONS

The Marshall-Olkin family of distributions was proposed by Marshall and Olkin[50] with CDF

$$F(x) = \frac{J(x)}{1 - cJ(x)}$$

for $c > 0$, where J(x) is the CDF of the baseline distribution.

Alizadeh et al.[10] used W[F(x)] to be the CDF Marshall-Olkin family of distributions and T to be the Kumaraswamy distribution in T-X family and declined the Kumaraswamy Marshall-Olkin family of distributions for generating distributions, the corresponding CDF is

$$G(x) = \int_0^{\frac{J(x)}{1-cJ(x)}} r(t)dt = 1 - \{1 - \{\frac{J(x)}{1-cJ(x)}\}^\alpha\}^\beta \tag{3.28}$$

where r(t) is the PDF of the Kumaraswamy distribution.

The PDF corresponding to the Kumaraswamy Marshall-Olkin family of distributions in equation(3.28) is given by

$$g(x; \alpha, \beta, c) = G'(x) = \frac{\alpha\beta\, c j(x) J^{\alpha-1}(x)}{[1-cJ(x)]^{\alpha+1}}\{1 - \{\frac{J(x)}{1-cJ(x)}\}^\alpha\}^{\beta-1}; \alpha, \beta, c > 0 \tag{3.29}$$

Some properties on the Kumaraswamy Marshall-Olkin family of distributions:

(a) When $c = 1$the Kumaraswamy Marshall-Olkin family of distributions reduces to T-X

   Family of Distributions with $W[F(x)] = J(x)$.

(b) The HRF of the Kumaraswamy Marshall-Olkin family of distributions is given by

$$x(x) = \frac{\alpha\beta\, c j(x) J^{\alpha-1}(x)}{[1-cJ(x)]}\{[1 - cJ(x)]^\alpha - J^\alpha(x)\}$$

Some examples of Kumaraswamy Marshall-Olkin family of distributions with different choices for the random variable X are Kumaraswamy Marshall-Olkin Exponential (KwMO-E), Kumaraswamy Marshall-Olkin Lomax (KwMO-L), Kumaraswamy Marshall-OlkinFrechet (KwMO-Fr) and Kumaraswamy Marshall-OlkinWeibull(KwMO-W) Distribution.

3.5.1   THE KUMARASWAMY MARSHALL-OLKIN LOG-LOGISTIC DISTRIBUTION

In this section, we define and study some properties of a member of the Kumaraswamy Generalized Marshall family, the Kumaraswamy Marshall-Olkin Log-Logistic Distribution. Cakmakyapan et al.[51] applied T-X method and introduced Kumaraswamy Marshall-Olkin Log-Logistic Distribution.

Then $g(x; \alpha, \beta, c)$ in equation(3.29) reduces to

$$g(x; \alpha, \beta, c, \theta, \gamma) = \frac{\alpha\beta c\theta^\gamma x^{\gamma\alpha-1}}{[x^\gamma + c\theta^\gamma]}[1 - (\frac{x^\gamma}{x^\gamma+c\theta^\gamma})^\alpha]^{\beta-1}; x > 0, \theta, \beta > 0, \alpha, \gamma, c > 0 \tag{3.30}$$

When $c = 1$, The Kumaraswamy Marshall-Olkin Log-Logistic Distribution becomes the Kumaraswamy Log-Logistic Distribution.

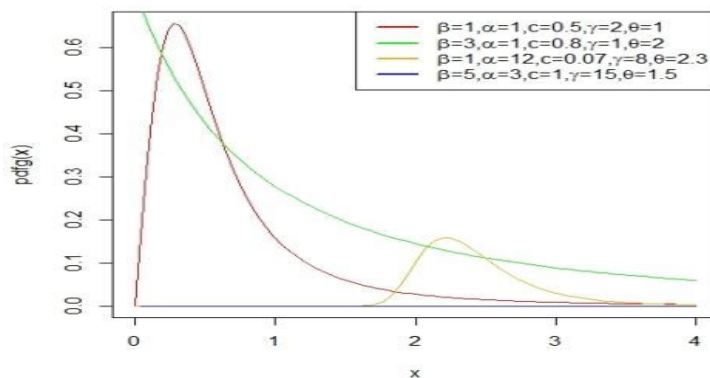Figure 5 gives the graph of PDF of The Kumaraswamy Marshall-Olkin Log-Logistic Distribution for various values of α, γ, β, c and θ

Figure 5: PDF of the Kumaraswamy Marshall-Olkin Log-Logistic Distribution For Various Values of α, γ, β, c and θ.

The CDF of the Kumaraswamy Marshall-Olkin Log-Logistic Distribution is

$$G(x) = 1 - [1 - (\frac{x^\gamma}{x^\gamma + c\theta^\gamma})^\alpha]^\beta \tag{3.31}$$

The HRF of Kumaraswamy Marshall-Olkin Log-Logistic distribution is

$$(x) = \frac{\alpha\beta c(\theta)^\gamma x^{\gamma\alpha-1}}{[x^\gamma + c(\theta)^\gamma]} (\frac{x^\gamma}{x^\gamma + c(\theta)^\gamma})^{\alpha-1} [1 - (\frac{x^\gamma}{x^\gamma + c\theta^\gamma})^\alpha]^{-1}$$

The HRF has increasing, upside-down bathtub and bathtub shaped hazard rate function if $-1 < \lambda < 0$ and decreasing if $0 < \lambda < 1$.

Cakmakyapan et al.[51] discovered the mathematical properties of this family such as ordinary moments, quantile, generating functions, order statistics modes and Reliability. Also discussed the estimation of the parameters using maximum likelihood method. The distribution is applied to a real data sets were fitted for the Kumaraswamy Marshall-Olkin Log-Logistic distribution and compared with three known distributions. The results showed that the Kumaraswamy Marshall-Olkin Log-Logistic distribution is a relatively better model to fit data than the other distributions.

In literature Handique and Chakraborty[52] introduced Beta generated Kumaraswamy Marshall-olkin-G family of distributions, Alizadeh et al.[9]proposed the Beta Marshall-Olkin family of distributions. Similarly Abid and Hassan[53] introduced the Beta Marshall-Olkin Extended Uniform distribution.

4. CONCLUSION

This paper provides an overview of T-X family of distributions, except those discussed in Tomy and Jose[2]. These distributions provide flexible family in which new distributions can be defined and various existing distributions are special cases. Future research in this area is to generate more family of distributions, both continuous and discrete, and to develop their inferential procedures. For researchers and practitioners, we aspire, this review will give a summary of T-X method and associated references for further study in the theory and applications of statistical distributions.

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Quantum finite automata using quantum logic

Jismy Joseph[1]* and K.S. Dersanambika[2]

Abstract
Two types of Quantum Finite Automata are, the Measure once quantum finite automata (MO-QFA) proposed by Moore and Crutchfield [5] and the Many measure one-way quantum finite automata(MM-QFA) proposed by Kondacs and Waltrous [2]. In both cases it is proved that the language accepted is a subset of regular language. In this paper we define a Quantum Finite Automata using quantum logic. The logic underlying Quantum mechanics is not a Boolean algebra. It is an orthomodular lattice. This logic is called quantum logic By using this logic we study about various properties of QFA's.

Keywords
Quantum Logic, Orthomodular lattice, Quantum Finite Automata, Quantum Regular Language.

AMS Subject Classification
68QXX, 68Q05, 03B70, 81P68.

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Contents

1. Introduction

The quantum logic was first introduced by Birkhoff and von Neumann [1] in connection with Quantum Mechanics. In Von Neumann's Hilbert space formalism of quantum mechanics the behavior of a quantum mechanical system is described by a closed subspace of a Hilbert space. Since the set of closed subspaces of a Hilbert space is an orthomodular lattice, Birkhoff and Von Neumann suggested to use orthomodular lattice as the logic of quantum mechanics.

The quantum computational model of Finite Automata has been introduced by multiple authors with two different definitions. The Measure once one way quantum finite automata (MO-1QFA) proposed by Moore and Crutchfield [5] and the Many measure one-way quantum finite automata(MM-1QFA) proposed by Kondacs and Waltrous [2]. A lot of works were done to study about the power of *QFA*. In this paper we define a QFA with the help of quantum logic. This logical approach helps to study about the properties of QFA in a different way. The automata theory based on quantum logic was proposed by Ying in [3]. In his work he introduced an orthomodular lattice valued classical Automata and he discussed about its properties. Many works were done on this line after his work, like [4] In our QFA model using quantum logic, we used the concept probability measurement in quantum logic. Detailed study about probability measurement in orthomodular lattice were done in [7] and [6].

The rest of the paper is organized as follows. In section 2 we recall some definitions that we used in this paper. In section 3 we gave the definition of Quantum Finite Automata using Quantum Logic. Then we give an example of a QFA using Quantum logic. In section 5 we studied about the closure properties of Quantum Regular Languages.

2. Preliminaries

In this section, we recall the definitions of two types of Quantum Finite Automata. Then we discussed about the complete orthomodular lattice which is called the quantum logic.

Definition 2.1. *A Measure Once Quantum Finite Automata is defined as a 5-tuple*

$$M = (Q, \Sigma, \delta, q_0, Q_{acc})$$

where,
Q is the finite set of quantum states
Σ is the set of input symbols
q_0 is the initial quantum state
Q_{acc} is the set of accepting states
For each $\sigma \in \Sigma$, δ_σ is the unitary transformation defined on the Hilbert space spanned by the states in Q
For a given input $w = \sigma_1 \sigma_2 \cdots \sigma_n$ automata starts from the initial state q_0. After reading the input σ_1 unitary transformation δ_{σ_1} is applied to the state q_0. This process continues until it reads the last input symbol and ends in the state $q = \delta_{\sigma_n} \delta_{\sigma_{n-1}} \cdots \delta_{\sigma_1} q_0$. At the end a measurement is performed on q and the accepting probability of the input w is $P(w) = ||P_a q||^2$ where P_a is the projection on to the subspace spanned by $\{q : q \in Q_{acc}\}$

Definition 2.2. *A Measure Many Quantum Finite Automata is defined as a 6-tuple*

$$M = (Q, \Sigma, \delta, q_0, Q_{acc}, Q_{rej})$$

where $Q, \sigma, \delta, q_0, Q_{acc}$ are same as those defined in the previous definition. $Q_{rej} \subset Q$ is the set of rejecting states.
For any input string $w = \sigma_1 \sigma_2 \cdots \sigma_n$ the procedure similar to that of Measure Once Quantum Finite automata except that after every transformation measurement is performed on the resulting states. Here the projective measurement consists of $\{P_a, P_r, P_n\}$ where P_a, P_r and P_n are the projections on to the sub spaces spanned by Q_{acc}, Q_{rej} and Q_{non} respectively ($Q_{non} = Q - (Q_{acc} \cup Q_{rej})$). The accepting and rejecting probabilities are given by
$p(M \text{ accepts } w) = \sum_{k=0}^{l+1} ||P_a \delta_{\sigma_n} \prod_{i=0}^{k-1} (P_n \delta_{\sigma_i}) q_0||^2$
$p(M \text{ rejects } w) = \sum_{k=0}^{l+1} ||P_r \delta_{\sigma_n} \prod_{i=0}^{k-1} (P_n \delta_{\sigma_i}) q_0||^2$

In this paper we will define a quantum finite automata using quantum logic. So now we will give a brief introduction of quantum logic.

2.1 Quantum Logic

The set of all closed subspace of a Hilbert space $L(H)$ is a lattice under $\subset$. It is also an orthomodular lattice. The fundamental assumption in quantum physics is that the experimental propositions form a logic which is isomorphic with $L(H)$ for some Hilbert space H. So the orthomodular lattice is sometimes called quantum logic.

Definition 2.3. *A 7-tuple $(L, \leq, \wedge, \vee, \perp, 0, 1)$ is called a complete orthomodular lattice if it satisfies the following conditions:*

1. *$(L, \leq, \wedge, \vee, \perp, 0, 1)$ is a complete lattice, 0 and 1 are the least and the greatest elements of L. $\leq$ is the partial*

ordering in L and for any $M \subseteq L$, $\wedge M$ and $\vee M$ stands for the greatest lower bound and least upper bound of M respectively.

2. *$\perp$ is a unitary operation on L called orthocomplement and it is required to satisfy the following conditions: for any $a, b \in L$*

   (a) *$a \wedge a^\perp = 0$, $a \vee a^\perp = 1$*

   (b) *$a^{\perp\perp} = a$*

   (c) *$a \leq b$ implies $b^\perp \leq a^\perp$*

   (d) *$a \geq b$ implies $a \wedge (a^\perp \vee b) = b$*

Definition 2.4. *A mapping $p : L \to [0,1]$ is called a probability measure if*

1. *$p(1) = 1$*

2. *$p(\bigvee_{i=1}^{\infty} a_i) = \sum_{i=1}^{\infty} p(a_i)$ whenever $a_i \leq a_j^\perp$ for any distinct indexes $i, j \in \mathscr{N}$*

3. Quantum Finite Automata using quantum logic

Let $(L, \leq, \wedge, \vee, \perp, 0, 1)$ be a complete orthomodular lattice. Then a quntum finite automata is defined using L as follows.

Definition 3.1. *A qantum finite automata using quantum logic is defined as*

$$M = (Q, \Sigma, \delta, q_0, Q_{acc})$$

where,
Q is finite set of states
Σ finite set of input alphabets
q_0 initial state
$Q_{acc} \subset Q$ is the set of accepting states
δ transition function,

$$\delta : Q \times \Sigma \times Q \to l$$

If $w = \sigma_1 \sigma_2 \cdots \sigma_n$ then the lattice value of the word w is defined as

$$l_M(w) \overset{def}{=} \vee \{\delta(q_0, \sigma_1, q_1) \wedge \cdots \delta(q_{n-1}, \sigma_n, q_n) :$$
$$q_0, q_1, \cdots q_{n-1} \in Q, q_n \in Q_{acc}\}$$

Then we measure this $l_M(w)$ using a probability measure defined on L and denote it as $p(w)$. Quantum finite automata accepted a language L with probability λ if $p(w) \geq \lambda$ for all w in L. A language accepted by a QFA is called Quantum Regular Language(QRL).

4. Example

Let $\otimes^2 \mathbb{C}^2$ be the 2 qubit space , where $\mathbb{C}$ denote set of complex numbers. The set of all closed subspaces of the Hilbert space $\otimes^2 \mathbb{C}^2, l$ form an orthomodular lattice $(l, \leq, \wedge, \vee, \perp, 0, 1)$. $q_0 = |0> |0>, q_1 = |0> |1>, q_2 = |1> |0>$ and $q_3 = |1> |1>$ are the basis states in the 2- qubit state space. The automata is defined as $M = (Q, \Sigma, \delta, q_0, Q_{acc})$ where $Q = \{q_0, q_1, q_2\}$, $\Sigma = \{a, b\}$, $Q_{acc} = \{q_2\}$. $a_{ij} = span\{|i> |j>\}$ denote the closed subspace spanned by $|i> |j>, i, j = 0, 1$. $\delta(q_0, a, q_0) = a_{00}, \delta(q_0, b, q_2) = a_{11}, \delta(q_0, a, q_1) = a_{00},$ $\delta(q_1, b, q_2) = a_{00}$

Now $l_M(w) = \begin{cases} a_{00}, & \text{if } w = a^n b, n > 0 \\ a_{11}, & \text{if } w = b \\ 0, & \text{otherwise} \end{cases}$

In this example we use the probability measure $p_\phi : L \to [0, 1]$ where

$p_\phi(S) = ||P^S \phi||^2$ where P^S is the projection operator corresponding to the closed space S and ϕ is the initial state of the QFA.

Now the language accepted by the QFA is

$L(M) = \{a^n b : n > 0\}$ with probability 1.

5. Closure properties of quantum regular language

Theorem 5.1. *If A and B are quantum regular languages with probability λ and μ respectively then $A \cap B$ is also a quantum regular language with probability less than or equal to $min\{\lambda, \mu\}$.*

Proof. Let A be a QRL with accepting probability λ and B be a QRL with accepting probability μ. That is there exist two Quantum finite automata M_A and M_B such that $L(M_A) = A$ and $L(M_B) = B$. Now we construct a QFA, M_C that accepts $A \cap B$. $M_C = (Q_C, \Sigma, \delta_C, r_0, F_C)$ where

$Q_C = Q_A \times Q_B$
$F_C = F_A \times F_B$
$r_0 = (q_0, s_0)$
$\delta_C((p, q), a, (r, s)) = \delta_A(p, a, r) \wedge \delta_B(q, a, s)$

Let $x = a_1 a_2 \cdots a_n \in A \cap B$. Then there exist a path $q_0 q_1 \cdots q_n$ in M_A and a path $s_0 s_1 \cdots s_n$ in M_B labeled by x and whose lattice value is greater than zero. Therefore there exist atleast one path $(q_0, s_0)(q_1, s_1) \cdots (q_n, s_n)$ which is labeled by x in M_C whose lattice value is greater than zero.

Since $x \in A \cap B$ $p_A(x) \geq \lambda$ and $p_B(x) \geq \mu$.

Now

$$
\begin{aligned}
p_C(x) &= p(l_C(x)) \\
l_C(x) &= \vee \{\delta_C((q_0, s_0), a_1, (q_1, s_1)) \\
&\quad \wedge \delta_C((q_1, s_1), a_2, (q_2, s_2)) \wedge \cdots \\
&\quad \wedge \delta_C((q_{n-1}, s_{n-1}), a_n, (q_n, s_n))\} \\
&= \vee \{\delta_A(q_0, a_1, q_1) \wedge \delta_B(s_0, a_1, s_1) \wedge \cdots \\
&\quad \wedge \delta_A(q_{n-1}, a_n, q_n) \wedge \delta_B(s_{n-1}, a_n, s_n)\} \\
&\leq l_A(x) \wedge l_B(x)
\end{aligned}
$$

Therefore

$$p_C(x) \leq p(l_A(x) \wedge l_B(x))$$

Since

$$
\begin{aligned}
l_A(x) \wedge l_B(x) &\leq l_A(x) \text{and} \\
l_A(x) \wedge l_B(x) &\leq l_A(x), \\
p(l_A(x) \wedge l_B(x)) &\leq min\{p_A(x), p_B(x)\}
\end{aligned}
$$

$\Rightarrow p_C(x) \leq min\{\lambda, \mu\}$. Therefore $A \cap B$ is accepted by the QFA M_C with a probability less than or equal to $min\{\lambda, \mu\}$ □

Theorem 5.2. *If A and B are Quantum Regular Languages with accepting probability λ and μ respectively then their union, $A \cup B$ is a QRL with probability greater than or equal to $max\{\lambda, \mu\}$.*

Proof. Let $M_A = (Q_A, \Sigma, \delta_A, q_0, F_A)$ and $M_B = (Q_B, \Sigma, \delta_B, s_0, F_B)$ be the QFA's accepting A and B. To prove the theorem we will construct an automata M_C which will accept the language $A \cup B$. $M_C = (Q_C, \Sigma, \delta_C, r_0, F_C)$ where,
$Q_C = Q_A \cup Q_B \cup \{r_0\}$, we takes the assumption that $Q_A \cap Q_B = \emptyset$

$$\delta_C(p, a, q) = \begin{cases} \delta_A(p, a, q) & \text{if } p, q \in Q_A \\ \delta_B(p, a, q) & \text{if } p, q \in Q_B \\ 0 & \text{otherwise} \end{cases} \quad \delta_C(r_0, \varepsilon, q_0) = 1$$

and $\delta_C(r_0, \varepsilon, s_0) = 1$
$F_C = F_A \cup F_B$

Let $x \in A \cup B$. Then there exist a path in M_A or M_B labeled by x and whose lattice value is greater than zero. Therefore the accepting probability of x in M_C is greater than zero.

We know that

$$
\begin{aligned}
p_C(x) &= p(l_C(x)) \\
l_C(x) &= \vee \{\delta_C(r_0, \varepsilon, r_1) \wedge \delta_C(r_1, a_1, r_2) \cdots \wedge \delta_C(r_{n-1}, a_n, r_n)\}
\end{aligned}
$$

Since $\delta_C(p, a, q) = 0$ if $p \in Q_A$ and $q \in Q_B$,

$$
\begin{aligned}
l_C(x) &= \vee \{\delta_A(q_0, a_1, q_1) \wedge \delta_A(q_1, a_1, q_2) \wedge \cdots \\
&\quad \wedge \delta_A(q_{n-1}, a_1, q_n)\} \\
&\quad \bigvee \{\vee \{\delta_B(s_0, a_1, s_1) \wedge \delta_B(s_1, a_1, s_2) \wedge \cdots \\
&\quad \wedge \delta_B(s_{n-1}, a_1, s_n)\}\} \\
&= l_A(x) \vee l_B(x)
\end{aligned}
$$

$p_C(x) = p(l_A(x) \vee l_B(x)) \geq max\{\lambda, \mu\}$ Therefore $A \cup B$ is a QRL with accepting probability greater than or equal to $max\{\lambda, \mu\}$. □

Theorem 5.3. *If A and B are Quantum Regular languages with accepting probability λ and μ respectively then their concatenation, AB is also a QRL with probability less than or equal to $min\{\lambda,\mu\}$.*

Proof. Let $M_A = (Q_A, \Sigma, \delta_A, q_0, F_A)$ and $M_B = (Q_B, \Sigma, \delta_B, s_0, F_B)$ be the QFA's accepting the languages A and B. Now we will construct a QFA, M_C which accepts the language AB.
$M_C = (Q_C, \Sigma, \delta_C, r_0, F_C)$ where,
$Q_C = Q_A \cup Q_B$
$r_0 = q_0$
$F_C = F_B$
$\delta_C(p,a,q) = \begin{cases} \delta_A(p,a,q) & if\, p,q \in Q_A \\ \delta_B(p,a,q) & if\, p,q \in Q_B \end{cases}$
$\delta_C(p,\varepsilon,s_0) = 1$ for every $p \in F_A$
Let $x \in AB$. Then $x = \sigma_1\sigma_2$ where, $\sigma_1 \in A$ and $\sigma_2 \in B$. There is a path $q_0q_1\cdots q_m$ in M_A labeled by σ_1 and a path $s_0s_1\cdots s_n$ in M_B labeled by σ_2 whose lattice values are greater than zero. So $q_0q_1\cdots q_m s_0s_1\cdots s_n$ is a path in M_C labeled by x whose lattice value is greater than zero since $\delta_C(q_m,\varepsilon,s_0) = 1$ $(q_m \in F_A)$.
Let $\sigma_1 = a_1\cdots a_m$ and $\sigma_2 = b_1\cdots b_n$

$$\begin{aligned} p_C(x) &= p(l_C(x)) \\ l_C(x) &= \vee\{\delta_A(q_0,a_1,q_1)\wedge\cdots\wedge\delta_A(q_{m-1},a_m,q_m) \\ &\quad \wedge\delta_C(q_m,\varepsilon,s_0)\wedge\delta_B(s_0,b_1,s_1)\wedge\cdots \\ &\quad \wedge\delta_B(s_{n-1},b_n,s_n)\} \end{aligned}$$

Suppose that the supremum over all paths labeled by x occur along the path $q_{0k}q_{1k}\cdots q_{mk}s_{0k}s_{1k}\cdots s_{nk}$.
Then

$$\begin{aligned} l_c(x) &= \delta_A(q_0,a_1,q_1)\wedge\cdots\delta_A(q_{m-1},a_m,q_m)\wedge\delta_C(q_m,\varepsilon,s_0) \\ &\quad \wedge\delta_B(s_0,b_1,s_1)\wedge\cdots \\ &\quad \wedge\delta_B(s_{n-1},b_n,s_n) \\ &\leq \vee\{\delta_A(q_0,a_1,q_1)\wedge\cdots\delta_A(q_{m-1},a_m,q_m)\}\wedge \\ &\quad \vee\{\delta_B(s_0,b_1,s_1)\wedge\cdots\delta_B(s_{n-1},b_n,s_n)\} \\ &\leq l_A(\sigma_1)\wedge l_B(\sigma_2) \\ p_C(x) &= p(l_C(x)) \\ &\leq p(l_A(\sigma_1)\wedge l_B(\sigma_2)) \\ &\leq min\{\lambda,\mu\} \end{aligned}$$

Therefore the concatenation of the QRL's A and B, AB is a QRL with a probability less than or equal to $min\{\lambda,\mu\}$ □

Now we gives a pumping lemma for the Quantum Regular Languages.

6. pumping lemma for Quantum Regular Language

Theorem 6.1. *Let L be an infinite Quantum Regular Language. Then there exist some positive integer m such that for any $w \in L$ with $|w| \geq m$ can be decomposed as $w = xyz$ with $|xy| \leq m$, $|y| \geq 1$ such that $w_i = xy^iz$ is also in L for all $i = 0,1,\cdots$. Also $p(w_i) = p(w)$.*

Proof. The proof is similar to that in classical automata theory.
If L is a *QRL* then there exist a QFA, M recognizing L. Let $\{q_0,q_1,\cdots,q_n\}$ be the set of states of M. Now consider the string $w \in L$ such that $|w| \geq n+1$. Now consider the path through which M processes the string w. Let it be $p_0,p_1,\cdots,p_f$, where $p_f \in Q_{acc}$. Since this sequence has exactly $|w|+1$ states, atleast one state must be repeated. Therefore the sequence is of the form $p_0,p_1,\cdots,p_r,\cdots,p_r,\cdots,p_f$. Let $p_0,p_1,\cdots,p_r$ be labeled by x; $p_r,\cdots,p_r$ be labeled by y and $p_r,\cdots,p_f$ be labeled by z. Then $|xy| \leq n+1$ and $|y| \geq 1$. Let $w = a_1a_2\cdots a_n$. Then $l(w) = \vee\{\delta(p_0,a_1,p_1)\wedge \delta(p_1,a_2,p_2)\wedge\cdots\wedge\delta(p_{n-1},a_n,p_n)\}$
Let $w_i = xy^iz$. Then clearly $l(w_i) = l(w)$ from the above formula. Therefore $p(w) = p(w_i)$ □

7. Conclusion

In this paper we defined Quantum Finite Automata using quantum logic and give an example of a *QFA* using quantum logic. We also studied about some closure properties of QRL's. The quantum logic approach makes it easier to study about the properties of Quantum Finite Automata. Also we introduced a pumping lemma for the Quantum Regular Languages.

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CULTURE AND LIFESTYLE OF KAVARA COMMUNITY; A DESCRIPTIVE STUDY

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 Abstract: Kavara is a scheduled caste and scheduled tribes community found settled in some regions of Palakad district and in the hilly areas of Thrissur district in Kerala. The *Kavara* community is culturally rich and have their own traditions. Today they are economically poor and struggling to earn their livelihood with their traditional jobs. The community is in the path of development and gives important to education. This paper is discussing about the heritage and culture of Kavara community.

Index Terms : Kavara community, Kerala, Palakad.

1.1 INTRODUCTION

Tribes are clans with their own culture norms and practices who live in this huge world by strictly following their customs without any effect or invasion of external changes to them. They maintain their own way of living and livelihood. The need of preserving their culture and this customs had been essential in this era . At the same time the need to make people aware about these clans who are part of our humanity is also quite important. This paper is a study about a community called Kavara found in mid Kerala region that is of Palakad and Thrissur. They have their own traditions in marriage, death, birth, jobs,festivals and celebrations. This paper gives a descriptive study on the culture of this community people.

1.2 KAVARA COMMUNITY

Kavara community is one of the scheduled caste and tribes found in Kerala. They are mainly found settled in Kozhinjampara, Irattakulam, Vadakkumchery region of Palakad district and in the hilly areas of Thrissur district. They like to live together as a community. As per the survey of Kerala government, in 1986 *Kavaras* are considered and included under the scheduled caste and scheduled tribe backward community. Some special information about the community is listed below:

1. They are tribes found in the Palakad district. They are also known as *Malayar*. Making the basket and the bracelet are their main job. Have a dowry system in the institution of marriage and giving back this dowry is divorce in their culture. They build special hut for delivery. Drinking alcohol is a common habit among this community.

Keralasamskaracharithra nigandu'-Dr.S.K vasanthan

2. *Kavara* - a tribe trading with glass bracelets, basket etc (*Gavariga*)- *Gundart Nighandu*

3.   *Kavara – Kavarai* (Tamil), *Gavariga* (Kannada), a community making the basket, bracelets.- *Shabdhatharavali-Sreekandeswaram*

The statement that *Kavara* community is also known as *Malayan* cannot be justified as the *Malayar* are group of tribal community found to be settled in the hilly areas of Kerala who are different from the *Kavara* community. They are various interpretation made on the name *Gavariga* given to the community which is mentioned above. But the name *Kavarai* in Tamil and *Gavariga* in Kannada are exactly the name referring to the *Kavara* community in those languages.

1.3 CULTURE

A clear history of *Kavara* community is not available. However, there is mentioning and representation of *Harijan* people (the people belonging to the *Kavara* community were also represented and enacted by the *Nair* people in the folkdance form) in an art form called *Kanyaarkali* (a kind of folkdance form in which people belonging to the *Nair* community were only participated) which was celebrated about 500 years back in the Palakad district of Kerala.

Making different types of basket using the bamboo is the main work of *Kavara* community. Often they use to sell the forest products.The *Kavarakotta* (basket made by the community) and other items made by the community are the pure signs of the folk handicraft skills. Even though the *Paraya* community also make baskets using bamboo, there are clear difference to the baskets made by the *Kavara* community compared to the *Paraya* community.

1.3.1 MARRIAGE

They have their own identity and uniqueness in conventional rituals and practices. The elderly people claim that the new generation are misusing these pure norms. They have specific customs and practices for the birth, marriage and death ceremonies.

More rituals and customs are in the institution of marriage. Girls are married before and after attaining the puberty. They used to marry the daughter of their maternal uncle. When a young man approaches the marriageable age, his brother or uncle selects a suitable girl for him after the payment of two *Panam* to the parents of girl. By giving panam to the parents of girl, the marriage is fixed. In the past an amount of two *Panam* was given. In the event of willingness of the latter a formal agreement is made in the presence of few of their caste man and an auspicious day for wedding is also fixed. In the olden days a practice of paying the sum of 35 *Panam* to the girl's parents for the expense of wedding was held. On that auspicious day the bride groom goes to bride's house with two pieces of clothes, three measures of rice, a *Tali* and two coconuts. A *Pooja* to *Ganapathi* was performed before the function in the early days. There will be specially created temple in bride's house for performing the marriage functions. The *Tali* is kept in a banana leaf near the lighted lamp. Along with that a bunch of bananas, *Idangazhi* (an vessel used for

measuring the paddy) of paddy, *Nazhi* rice (a measure of rice), *Aval* (pressed rice), *Malar* (popped rice) are arranged. Often the wedding cloth is also kept in the items. The *Tali* is handed to the bridegroom by an elderly person of the community. The bride groom ties it round the neck of girl. After that the brides moves in to wear the wedding cloth given by the bridegroom. The main part of the wedding is over by this. There will be a food fest for those who have accompanied them to wedding

There is a practice called *Enna thodeekal* on the wedding day, this is done to avoid the cast an eye. The relatives praise the couples while they make entry to the house. It's the uncle of who handover the girl to her bridegroom. The wedding night is in the bride's house. The banquet of the married couples will be over within a week. The sweets like *Velichennayappam*(sweet made of rice flour and coconut oil), *Murukku* (a type of sweet food), *Neyyappam* (a sweet made of ghee) a taken along with them on their first visit to the bridegrooms house. All the marriage related functions and customs should over within the same month.

1.3.2 DELIVERY

There are also various customs in the course of delivery too. A specially created hut called *Petupura* is created for the delivery. It will be near the house. One or two ladies will be staying there, who serves as the mid-wives. The delivered woman is taken to bath soon after her delivery. Either rice or the rice soup is given to the delivered women in a cycle. Other than that a medicinal drink made with the mixed powder of boiled pepper, turmeric, garlic and cumin (toddy is also added). The pollution is for 28 days. Some consider only for 15 days. On the 29th day after the delivery ,8 the lady is taken to a special bath, after whi ch the pollution is over. A food fest is done to the relatives on that day. The *Peetupura* is burnt on that day. On the sixth month after the delivery naming ceremony of the baby is held.

1.3.3 PUBERTY

There are also some special ceremonies held when a girl acquires puberty. The 7 days of the puberty is the ceremony held. In the first three days she is not allowed entry outside the room (except for the bathing ceremony). Used to keep an item made of iron metal when enter outside. This is done in the belief to avoid the attack by the ghosts. The most important in this ceremony is *Thirandukalyanam*. On the auspicious day the oiling and bathe of the girl is done by her aunt. Other woman relatives make howls on the occasion. All the relatives gather at the girl's home on that day. After the oil bathe ceremony which is held in the nearby lake or pond, the girl is taken to her house with celebration. Some also mention about a custom of *Veli nadathuka* . In this custom the girl has to flow the *Veli* kept in the bark of banana tree towards the east direction in the river, after that she had to wet herself completely for three times in river, after that she should get out from the river without looking back. It is believed that all her sins will be removed by his custom. All the invitees are treated with food on the day.

1.3.4 DEATH

There are also strict and accurate norms foe death ceremonies in the community. The corpse is buried in the land. 15 days after the death is considered as pollution. After the ceremony held on the 16th day

along with the death fete, the pollution is removed. Special prayers and ceremonies are done on these days for the goodness of the soul of dead one. The sons of dead one perform all this ceremonies. There is also a custom in which the daughters of the dead one used to sit in the *Nizhalpaaya* (death mat) on these days. They are not allowed to get out from the death mat, where a lighted lamp is also kept.

1.3.5 OTHER CELEBRATIONS

The festivals like *Onam* (a festival of flowers along with the concept of Mahabali king), *Vishu* (the festival of prosperity), *Kaarthika* (the festival of lights, especially for women and girls) and *Sankraanthi* (a festival on the last day of the month in the Malayalam calendar) are the time for celebrations and customs to the *Kavara* community. The first *Onam* to the married couples are quite important. The bride's parents should bring the things like paddy, sugar, jagery, oil and clothes to the bridegroom's house. This ceremony is done after the *Atham* (the 10 day before the *Onam* festival) and before the *Onam* festival. There are still some *Kavara* families who used to put the *Pookalam* (a design pattern made in front of the house using different flowers as a part of *Onam* festival) from *Atham* till the 28 days of festival. *Thiruvona Sadya* (the food fest held on behalf of *Onam* festival) is quite important in the community. The practice of *Kanikaanal* (the act of seeing the idol of lord Vishnu as the first sight of that day) and giving *Kaineetam* (the act of giving money to the young ones by the elderly ones) in the *Vishu* festival is also important custom in the community.

On the day of *Karkidaka Sankraanthi* (the last day of last month in the Malayalam calendar) a fete is provided to the souls of forefathers. Food items like Chicken curry (kept in banana leaf), toddy and other several food items are arranged in the worshipping room as a part of this custom. On the previous day before of *Sankraathi* there is a custom of *Pottiyattuka* (the custom of moving the evil out of the house). As a part of this custom they keep a light in the broken piece of a pot and chant the following phrase aloud "*moodevi.. poo…poo..shipoodhi….va…va…va*", along with clapping the hands. On following the custom they take a bath and clean the house and their surroundings. This is done in belief as a part of welcoming the goddesses of fortune to their houses. There was a tradition of building grave to the dead ones and worshipping them. Today they are making a cultural transition from their nature worshipping to the worshipping culture of Aryans

Kavara are patriarchal centred community. They follow the *Makkathayam* system (the system of inherence traced by the males). They maintain monogamy system. They also maintain a unity among their community. In the earlier days they maintained untouchable with other communities. The old people from the community say that they had their own barbers and launderer in their community.

Even though they are economically backward today, they are making necessary development in the field of education. Continuing their traditional job couldn't meet their livelihood today, which make them shift to try and do new jobs.

1.4 CONCLUSION

Kavara are the scheduled caste and tribes who belongs to the backward class community in Kerala. They are struggling to maintain their tradition with the upcoming changes in the culture. Even though they are easily adapted to the changes in the society and mingle with the others there is a serious problem of unemployment to them which make them to skip their community job and move away in search of new one. They give importance to the education system which is making some good changes in their community. Still there should be more plans and schemes from the state to protect their welfare.

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Selective photocatalytic dye degradation by surface charged TiO$_2$

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Abstract

Nanocrystalline TiO$_2$ photocatalysts with negative and near neutral surface charge were synthesised by adopting a low – temperature sol – gel method. These catalysts were characterised by powder X – ray diffraction, FT – IR and UV – Vis absorption analyses. Selective photocatalytic efficiency of the synthesised catalysts was tested for the degradation of methylene blue and methyl orange aqueous dye mixture solution. A composite of negatively surface charged TiO$_2$ and Degussa P25 (10 wt %) was synthesised and was tested for the selective photocatalytic degradation of methylene blue and methyl orange aqueous dye mixture solution.
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*Keywords:*Photocatalysis, selectivity, titanium dioxide, methyleneblue, methylorange, indigo carmine

1. Introduction

Selective photocatalysis employing nanocrystalline TiO$_2$ (NTO) has been reported for the selective degradation of the desired pollutant/s [1]. Selectivity is important when dealing with a mixture which contains compounds that we need to remove and other useful compounds [2,3]. Sometimes selectivity is important in a mixture containing highly toxic pollutants (in low concentrations) and comparatively less toxic substances (in high concentrations), where the latter pollutants can be removed by less expensive biological waste water treatments [3]. One of the key steps through which selectivity is achieved in NTO mediated photocatalytic degradations is by the preferential adsorption of the pollutants [1, 3, 4]. The electrostatic force of attraction, between the surface charged NTO and the oppositely charged ionic pollutants, has successfully demonstrated for the selective removal of dyes in their aqueous mixture [3-9]. Low – temperature synthesised NTO photocatalysts with negative and near neutral surface charge were

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demonstrated for the selective photocatalytic degradation of ionic dyes.   Methylene blue (MB), methyl orange (MO) and indigo carmine (IC) dyes were chosen for the present study.

2.1. Catalyst synthesis

The synthesis of TiO_2 photocatalysts was carried out through an acid-stabilized sol-gel method, followed by base extraction.[10,11] NTO catalysts with negative (T9-60) and near neutral (T6-60) surface charge were precipitated from a TiO_2 sol, containing 5% titanium tetra isopropoxide, 5% acetic acid and 1.4% hydrochloric acid, using Na_2CO_3 solution into a final pH of ~ 9 and 6 respectively. A composite of T9 with Degussa P25 (T9-P25) was also prepared by adding 10 wt % of Degussa P25 at the time of Na_2CO_3 extraction.

2.2. Catalyst characterization

The powder x-ray diffraction (XRD) analysis of catalysts was performed with Cu Kα1 (λ=0.15406nm) radiation on a Bruker AXS D8 Advance X-ray diffractometer. Diffraction patterns were taken over 2θ range of 10° – 70° at the scan speed of 0.1° sec[-1]. The crystallite size of prepared catalysts were determined from the characteristic peak of 2θ = 25.3° (101) for the anatase phase using the Sherrer formula, [12] with a shape factor (K) of 0.9;

$$\text{Crystallite size} = K\,\lambda/W\,Cos\theta$$

where, $W = W_b – W_s$, W_b is the broadened profile width of experimental catalyst, W_s is the standard profile width of reference silicon sample. And λ is the wavelength of X-ray radiation. FT-IR spectroscopic analysis of the synthesized catalysts was carried out on a Perkin Elmer FT-IR spectrophotometer. The spectra were recorded in the range of 500 – 4000 cm^{-1}. Band gap of synthesized TiO_2 catalyst was determined using Shimadzu UV-1800 spectrophotometer. Band gap (Eg) was then calculated from hc/λ.

2.3. Photocatalytic reactor

The custom made photocatalytic reactor used in this study is a UV chamber isolated from the open space by five sided opaque wooden walls, and with an openeable front wooden door. The UV source is a set of six 15W UV lamps located at the inner top of the chamber. The wavelength of irradiation was in the range 200 – 400 nm. Reactor contains a magnetic stirrer for the uniform stirring of the reaction mixture, provided with an ice bath for eliminating the effect of evaporation. The reaction mixture was withdrawn at required time intervals by using a syringe

2.4. Adsorption studies

Adsorption studies were conducted under dark by stirring 100 mL of 5 ppm MO (λ_{max} = 466nm) and MB (λ_{max} = 662nm) dye mixture solution with 25 mg of T9-60, T6-60 and T9-P25 catalysts separately in a 250 mL beaker for 30 minutes. The above adsorption studies were repeated with 100 mL of 5 ppm MO and IC dye mixture solution using T6-60 catalyst. Amount of adsorption of each dye was then determined from the decrease in the UV-Visible absorption of each dye, which was analyzed by a UV-Visible spectrophotometer. The catalyst powder was separated from the reaction mixture by centrifugation, before performing the UV-Visible absorption analysis.

2.5. Photocatalytic experiments

The selective photocatalytic activity of the catalysts was evaluated by measuring the decrease in concentration of dyes in the reaction mixture after UV illumination. All photo catalytic reactions were carried out with 100 mL of 5 ppm MO and MB dye mixture solution and a catalyst concentration of 0.25 g L^{-1}. The reaction mixture was stirred for 30 minute under dark, for the adsorption equilibrium to establish, before exposure to UV light, and stirring was
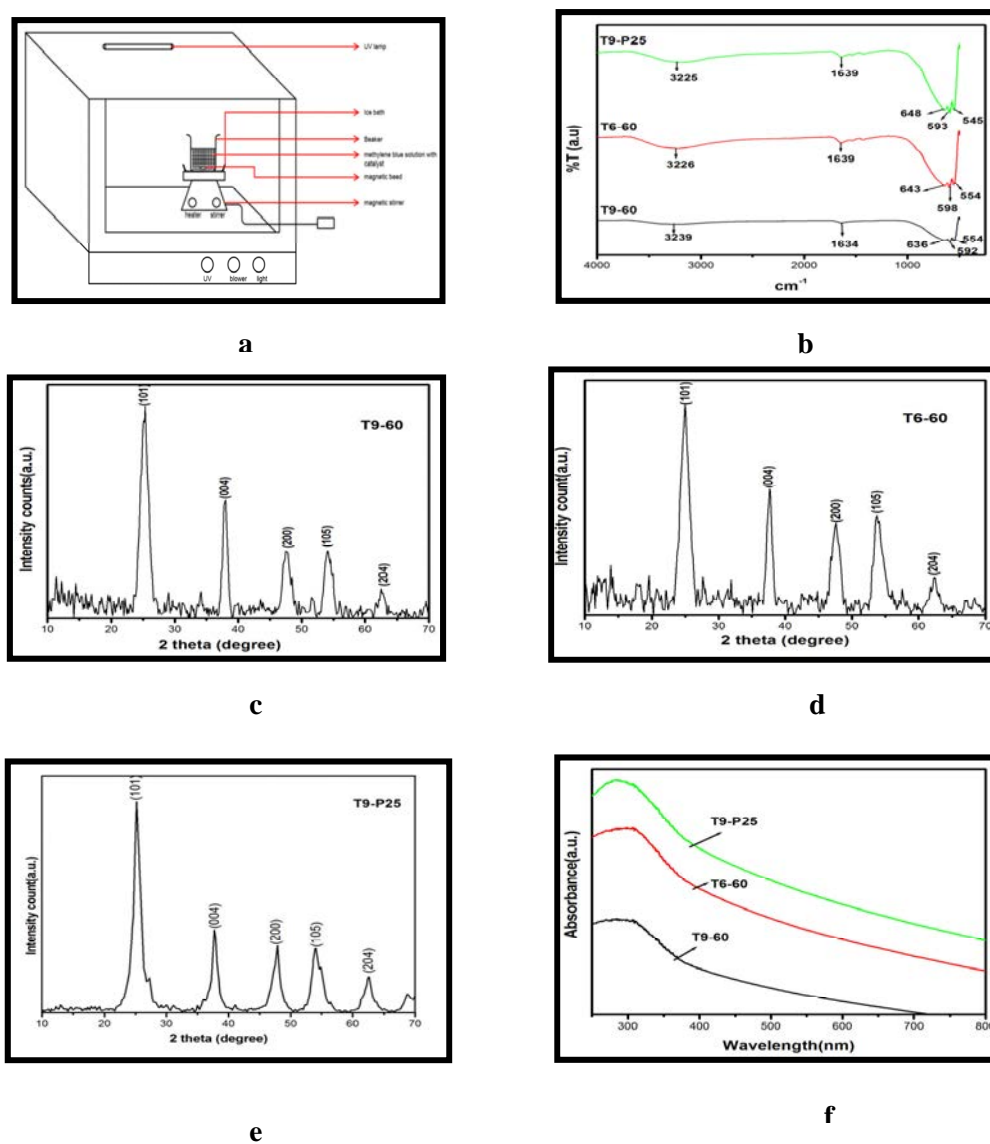
Fig. 1. (a) Diagrammatic sketch of photocatalytic reactor; (b) FT-IR spectra of titania catalysts; (c) - (e) Powder XRD spectra of T9 - 60, T6 - 60 and T9 - P25; (f) UV-Vis absorption spectra of titania catalysts.

throughout the reaction. Amount of degradation of each dye was then determined from the decrease in the UV-Visible absorption of the dye, which was analyzed by a UV-Visible spectrophotometer. The catalyst powder was separated from the reaction mixture by centrifugation, before performing the UV-Visible absorption analysis.

3. Results and Discussion

3.1. Catalyst characterization

The fundamental vibrations of TiO_2 nanocrystals appeared in IR spectra as very intense bands (Figure 1b). The spectra showed the band at 500 - 650 cm^{-1} which corresponds to the including the stretching vibration of Ti - O

bonds. A broad IR band at 3225 – 3239 cm^{-1} range is due to stretching of –OH groups. All catalysts have an IR band at the 1634 - 1639 cm^{-1} range attributed to deformation vibrations of adsorbed water molecules.

X-ray diffraction patterns obtained for all the synthesized NTO catalysts showed the characteristic anatase peak at 2θ = 25.3° (Figure 1 c - e). The P25 incorporated T9-P25 catalyst recorded sharp and intense peaks indicating the composite formation with highly crystalline Degussa P25. The XRD spectrum of T9 - P25 consists of a small peak at 2θ = 27° which further confirms the incorporation of P25 [13]. The calculated average anatase crystallite size for T9-60 and T6-60 was ~ 6 nm, and on incorporation of Degussa P25 enlargement of these crystals (~10.7 nm) took place.

Band gap of all catalysts was determined by measuring their UV - Vis absorbing wavelength in aqueous dispersion (Figure 1f). The band gap was then calculated by using the formula E = hc/λ and was found to be ~3.2 eV.

3.2. Adsorption studies

NTO catalysts exhibited preferential adsorption of MB over MO. The highest adsorption of the cationic MB dye by T9-60 is attributed to the higher negative surface charge on the catalyst resulted during its precipitation from the sol ending in a basic pH. On the other hand, T9 - P25 showed a decrease in the rate of adsorption compared to that of T9 - 60. It was established that the preferential adsorption capacity of T9 - 60 towards MB decreases substantially, after incorporating Degussa P25, and was from 58 % to 13 %. In the case of the adsorption performance of T6 - 60 for MO - IC mixture, it showed preferential adsorption of IC over MO. T6 - 60 adsorbed 22 % IC, where as the MO adsorption was insignificant.

Incompletely saturated co-ordinances on the outermost atoms cause metal oxides to adsorb ions from the surroundings, which contribute to their surface charge. This depends on the pH and ionic composition of the medium. In the synthesis of T9 - 60, extraction of solid product from the acid stabilized sol with Na$_2$CO$_3$ solution (at a final pH of 9) caused the adsorption of OH$^-$ ions on the TiO$_2$ surface and hence the resulting catalyst has a negative surface charge. While in the case of T6-60, isolation with Na$_2$CO$_3$ solution (at a final pH of 6) caused decrease in negative surface charge. MB, being a cationic dye, gets preferentially adsorbed by T9 - 60 and T6 - 60, which has a negative surface charge leaving MO intact in the solution. On the other hand due to decrease in surface negative charge, adsorption rate of T6 - 60 is reduced to half of T9 - 60. Between the anionic dyes IC and MO, T6 – 60 preferentially adsorbed IC (22 %) while leaving MO in the solution. This could be arising from the difference in the structure of IC and MO.

3.3. Selective photocatalaysis

NTO catalysts selectively degraded the cationic MB dye in the mixture of MO & MB, and MO in the solution remained intact under UV exposure (Figure 2). Selective degradation of the cationic MB dye by T9 - 60, T6 - 60 and T9 - P25 is ascribed to their negative surface charge, which resulted in the preferential adsorption of MB and its concomitant degradation. The rate of degradation of MB by T6 - 60 is less compared to that of T9 - 60 in a mixture of MO and MB. Also, complete selectivity in MB degradation is not observed with T6 - 60. This is quite interesting because both T9 - 60 and T6 - 60 showed identical properties in crystalline phase, size, and bandwidth. T6 - 60 has a near neutral negative surface charge while T9 - 60 has higher negative surface charge, which led to the increase in the rate of degradation by T9 - 60.

P25 composite with T9 -60 was expected to increase the rate of MB degradation without losing the selectivity. However, MB degradation by T9 - P25 was slow although the selectivity was maintained (Figure 3). It is obvious from the figure 3b that T6 - 60 preferentially degraded IC over MO, which is in agreement with the adsorption results obtained for these dyes.

4. Conclusion

Low-temperature synthesized anatase nanocrystals, with negative surface charge, exhibited preferential adsorption and selective degradation of the cationic MB dye in an aqueous mixture of MO & MB. Near neutral surface charged catalyst (T6 – 60) also selectively degraded MB, but with lower rate compared to T9 – 60. Incorporation of 10 wt %

Degussa P25 (T9 – P25) resulted in decrease in rate of MB degradation without losing selectivity. Near neutral surface charged catalyst, T6 – 60, selectively degraded one of the anionic dyes IC preferentially over MO in an aqueous mixture.
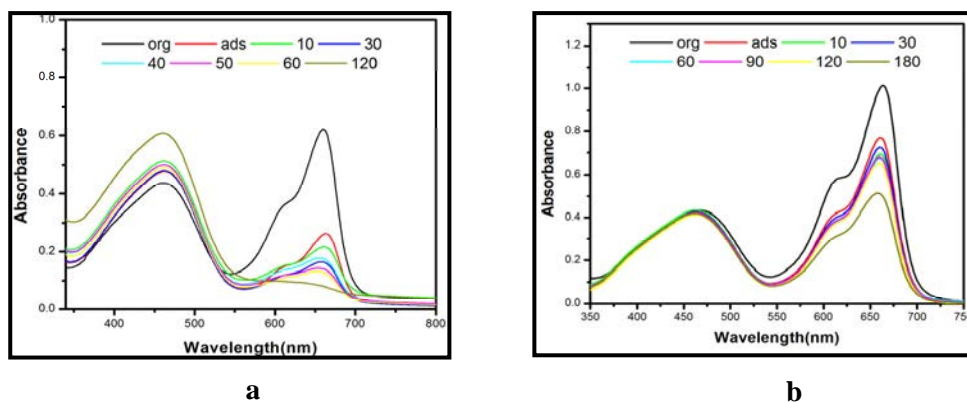

Fig. 2. Activity of (a) T9 - 60 and (b) T6 - 60, on degrading MO - MB dye mixture.
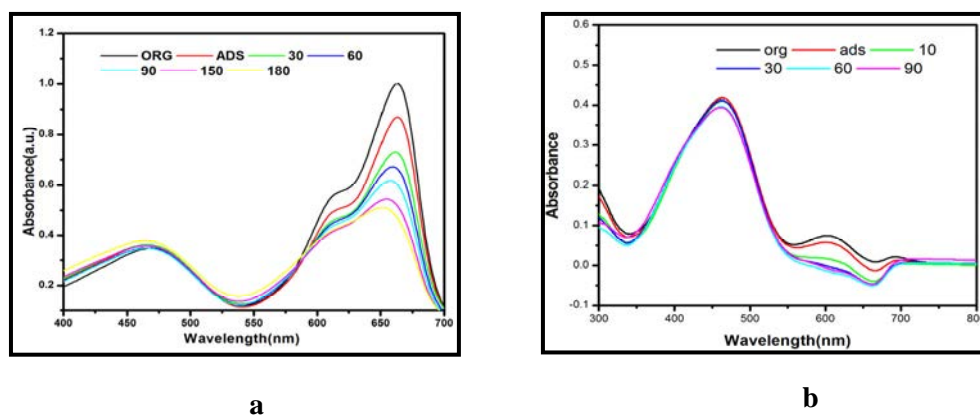

Fig. 3. Activity of (a) T9 - P25 on degrading MO - MB dye mixture and (b) T6 - 60 on degrading MO - IC dye mixture.

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A NEW SECTION (*BEGONIA* SECT. *FLOCCIFERAE* SECT. NOV.) AND TWO NEW SPECIES IN BEGONIACEAE FROM THE WESTERN GHATS OF INDIA

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Two new species, *Begonia bracteolata* and *Begonia keralensis*, are described from the Western Ghats of India. They are placed in the newly created *Begonia* sect. *Flocciferae*, along with *B. albo-coccinea* Hook. and *B. floccifera* Bedd. Lectotypes are designated for three names within this section. Colour photoplates, illustrations and an identification key to *Begonia* sect. *Flocciferae* are also provided.

Keywords. *Begonia albo-coccinea*, *Begonia floccifera*, India, Kerala, lectotype, new section, new species, sect. *Flocciferae*.

INTRODUCTION

Begonia L. is one of the largest pantropical genera in the world, comprising around 1950 species (Hughes *et al.*, 2015–). It has 69 sections worldwide, of which 11 are found in India (Moonlight *et al.*, 2018). During their revisionary studies on the genus *Begonia* in India, the authors came across two interesting rhizomatous begonias from the Western Ghats of Kerala showing similarities to *B. floccifera* Bedd. in having stout, creeping rhizomes, keeled stipules and fleshy leaves. Populations of these two plants were observed in the field over three successive seasons, and specimens were grown at Calicut University Botanical Garden. Based on the observations made, we concluded that both represent new taxa, which are described and illustrated here.

At present, all the rhizomatous begonias of Peninsular India are included in *Begonia* sect. *Reichenheimia* (Klotzsch) A.DC. The rhizomatous species from continental Southeast Asia and China previously assigned to this section have been moved to a newly created section, *Begonia* sect. *Jackia* M.Hughes (Moonlight *et al.*, 2018). After the recent recircumscription by Moonlight *et al.* (2018), sect. *Reichenheimia* contains 20 species, and the seven species from the Indian region (*Begonia albo-coccinea* Hook., *B. floccifera*, *B. phrixophylla* Blatt. & McCann, *B. subpeltata* Wight, *B. tenera* Dryand., *B. thwaitesii* Hook. (Sri Lanka) and

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B. trichocarpa Dalzell) remaining in the section comprise both rhizomatous and tuberous taxa. The two novel species are placed in a new section with the rhizomatous *Begonia albo-coccinea* and *B. floccifera*, which were previously assigned to *Begonia* sect. *Reichenheimia* (e.g. Doorenbos *et al.*, 1998), named here as *Begonia* sect. *Flocciferae* N.Krishna & Pradeep. With the segregation of the two rhizomatous species to this new section, the residual section *Reichenheimia* now includes only tuberous species and is more natural. A key for the identification of the species of sect. *Flocciferae* is provided below.

MATERIALS AND METHODS

The revision and description of the two new taxa are based on living specimens collected by the authors from various parts of India. The living collections maintained at Calicut University Botanical Garden were also used to record phonological data. A comparison was made of specimens at ASSAM, BSI, CALI, MH, SUK and TBGT. The taxonomic keys provided by Uddin (2010), Camfield & Hughes (2018) and other relevant literature dealing with the genus (Clarke, 1879; Gamble, 1919; Balakrishnan, 1981; Chauhan *et al.*, 1996; Hajra *et al.*, 1996; Singh *et al.*, 2000, 2002; Moonlight *et al.*, 2018) were also consulted. Typifications were made according to the provisions of the *International Code of Nomenclature for Algae, Fungi and Plants* (Turland *et al.*, 2018). Floral characters of male and female flowers and fruits were observed using a Leica M80 Stereo Microscope attached to a digital camera (Leica Microsystems, Wetzlar, Germany), and photographs in the field were taken using Nikon D3300 and D750 DSLR cameras (Nikon, Tokyo, Japan). IUCN categories were assigned according to the provisions of IUCN (IUCN Standards and Petitions Subcommittee, 2017).

TAXONOMIC TREATMENT

Begonia sect. **Flocciferae** N.Krishna & Pradeep, **sect. nov.** – Type species: *B. floccifera* Bedd.

Begonia sect. *Flocciferae* differs from the tuberous sect. *Reichenheimia* (Klotzsch) A.DC. in having stout, creeping rhizomes and is distinguished from sect. *Jackia* M.Hughes by its anthers, which are rounded at the apex (not retuse) and dehisce by lateral slits (not unilaterally, i.e. on one side).

Acaulescent, rhizomatous, perennial, glabrous or tomentose herbs. *Stipules* asymmetrical, keeled, apex acuminate, caudate or aristate, persistent. *Leaves* basifixed or peltate, lamina symmetrical, subsymmetrical or asymmetrical, suborbicular, densely tomentose on both surfaces especially when young, glabrescent when mature on adaxial surface, veins 8–10, palmate to pinnate, margins subentire, undulate, distantly denticulate or dentate. *Inflorescence* bisexual, axillary, dichotomously branched at base, male flowers basal, protandrous, female flowers distal; bracts broadly ovate to linear-lanceolate, persistent or caducous, markedly conspicuous often with primary and secondary bracts, margins of primary bracts entire or laciniate. *Male flowers* with 2 or 4 tepals, broadly ovate-orbicular to narrowly
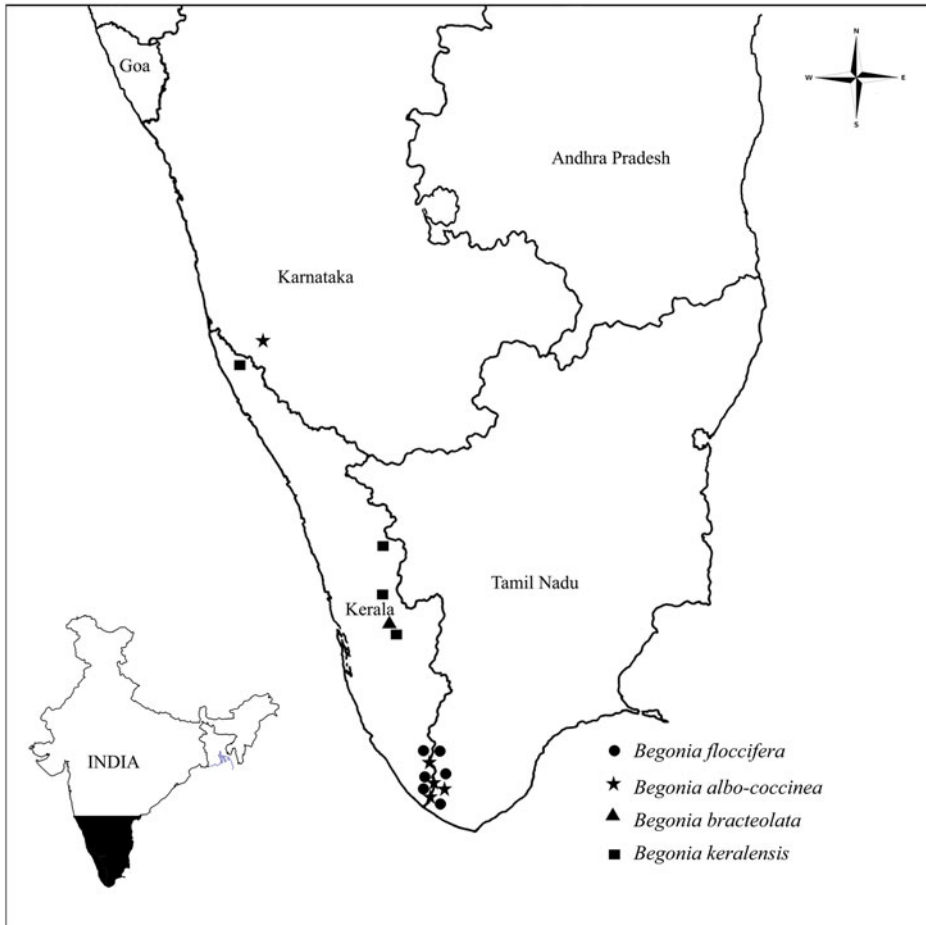
FIG. 1. Distribution of *Begonia* sect. *Flocciferae* N.Krishna & Pradeep in India.

obovate; stamens 20–55; anthers broadly ovate, apex rounded, dehiscing through lateral slits. *Female flowers* with 2–4 tepals, ovary with 3 equal to subequal wings, styles 3, connate at base or fused up to halfway, bifid, stigmatic papillae in a wavy or spirally twisted band. *Fruit* a 3-winged capsule on a slender pedicel, papery, longer than broad, both ends rounded.

Distribution. Asia. Endemic to the Western Ghats of South India (Fig. 1).

Ecology. Occurs from 350 to 1500 m elevation, along wet evergreen forest margins, moist rocks adjacent to streams and waterfalls, occasionally as an epiphyte on tree trunks close to the ground.

Etymology. The sectional name *Flocciferae* is derived from the specific epithet of the type species (*Begonia floccifera*). The term *floccosus* refers to the tufts of soft woolly hairs present on the leaves and petioles of the members of this section.

Species list: Begonia albo-coccinea Hook., *B. bracteolata* N.Krishna, Pradeep et B.Mani, *B. floccifera* Bedd. and *B. keralensis* Pradeep, Sinj. Thomas et Britto.

Key to the species of Begonia *sect.* Flocciferae *in India*

1a. Leaves peltate; style hairy _____ **1. B. albo-coccinea**
1b. Leaves basifixed; style glabrous _____ 2

2a. Female tepals 4, ovate to elliptic, apex acute _____ **3. B. floccifera**
2b. Female tepals 2, reniform, apex rounded _____ 3

3a. Primary bracts laciniate, deeply lobed, lobes 3–6; secondary bracts ovate to elliptic, tepal-like; bracteoles 2 or 3, tepal-like, ovate to elliptic, rarely obovate _____ **2. B. bracteolata**
3b. Primary bracts ovate, entire, unlobed; secondary bracts lanceolate; bracteoles 2, filiform _____ **4. B. keralensis**

Species descriptions

1. Begonia albo-coccinea Hook., Bot. Mag. 71: t. 4172 (1845); A.DC., Prodr. XV, 389 (1864); C.B.Clarke in Hook.f., Fl. Brit. Ind. 2: 654 (1879); Gamble, Fl. Pres. Madras 1: 546 (1919). *Mitscherlichia albo-coccinea* (Hook.) Klotzsch, Abh. Königl. Akad. Wiss. Berlin 1854: 193, t. 6 A (1855) – Type: Hort. Kew 1837, Hooker (lecto K [K000739957], here designated; isolecto G-DC, Hooker, *s.n.*). **Figs 2, 3**.

Begonia grahamiana Wight Ic. t. 1811 (1852); *Mitscherlichia grahamiana* (Wight) Hassk. Hort. Bogor. Descr. 334 (1858). – Type: India. Tamil Nadu, Courtallum, viii 1835, Wight (lecto E [E00179300], here designated).

Monoecious, acaulescent, rhizomatous, perennial herb; up to 40 cm tall including the inflorescence. *Rhizomes* brown, stout, fleshy, 5–15 cm, nodes 5–18 mm apart, brown tomentose on young parts, leaf scars prominent. *Stipules* 2 at each node, persistent, asymmetrical, keeled, 2–4 × 0.7–13 cm, reddish, base truncate, apex acuminate, margins entire, abaxially sparsely tomentose, adaxially glabrous. *Leaves*: petioles 10–18 cm long, reddish, angled, slightly grooved, densely tomentose; lamina peltate, rounded, 11–15 × 13–15 cm, apex rounded, green above, pale green below, margins dentate, densely tomentose above when young, densely tomentose beneath; veins 8–10, palmate to pinnate, greenish as in petioles. *Inflorescence* bisexual, axillary, dichotomous at base, male flowers basal and female flowers distal; peduncles c.20–25 cm long, reddish, densely tomentose when young; bracts persistent, broadly ovate to lanceolate, c.7 × 3–4 mm, brownish, base truncate, apex acute, margins entire, sparsely tomentose. *Male flowers*: pedicels 1.4–2 cm long, reddish, densely tomentose; outer tepals 2, broadly ovate to rotund, 1.3–1.4 × 1.2–1.3 cm, abaxially reddish and adaxially white, base truncate, apex rounded, margins entire, abaxially sparsely tomentose; inner tepals 2, narrowly obovate, 13–14 × 8–9 mm, white, base truncate, apex rounded, margins entire, glabrous; androecium

F I G . 2 . Lectotype of *Begonia albo-coccinea* Hook. (K000739957): the plant on the right side. Copyright of the Board of Trustees of the Royal Botanic Gardens, Kew. © The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.

FIG. 3. *Begonia albo-coccinea* Hook. A, Habit; B, male flower on young inflorescence; C and D, female flower; E, male tepals (abaxial view); F, male tepals (adaxial view); G, female tepals (abaxial view); H, androecium; I, stamens; J, style; K, mature fruit; L, ovary (transverse section).

symmetrical, stamens up to 55, free, arranged on a reduced torus, filaments c.1.3–1.5 mm long, yellow; anthers obovate, c.1 mm long, apex rounded, dehiscing through longitudinal slits. *Female flowers*: pedicels c.1.5 cm long, reddish, tomentose; bracteoles 2, persistent, narrowly ovate, 1.3–1.7 × 0.5–0.7 mm, base truncate, apex acute, margins entire, sparsely tomentose; outer tepals 2, broadly ovate to rounded, 1.4–1.5 × 1.4–1.5 cm, base and apex rounded, margins entire, sparsely tomentose; inner tepals 1 or 2 (rarely 3), narrowly elliptic, 11–12 × 4–5 mm, base truncate, apex obtuse, margins entire, glabrous; ovary 1.4 cm long, 3-winged, sparsely hairy with short yellow tomentum; wings subequal, 13–14 × 3–5 mm; locules 3; placentae undivided, axile, styles 3, straight, 4–5 mm long, yellow, fused up to halfway, pubescent with translucent branched hairs, each stylodium bifurcate at the stigmatic region, stigmatic band not folded, twisted once. *Fruit* a capsule, pendent on slender pedicel, wings 3, subequal, 16–18 × 6–7 mm, longer than broad, papery with persistent bracteoles and style, apex and base rounded, dehiscent on both sides of the wings; seeds numerous, barrel-shaped, c.0.4 × 0.2 mm.

Distribution and ecology. This species is confined to South India, especially towards the southernmost parts of Kerala and Tamil Nadu (see Fig. 1). It is found at forest margins, usually growing as a lithophyte in areas exposed to direct sunlight.

IUCN category. Vulnerable (VU): B1 ab (i and iii). Although this species is within a protected area, these populations are vulnerable and continue to decline in extent owing to habitat destruction.

Phenology. Flowering and fruiting from December to March and up to May in the greenhouse.

Additional specimens examined. India. **Kerala**: Kollam District, Pandimotta, 650 m, 12 i 1994, *E. S. Santhosh Kumar* 18274 (TBGT!); Tiruvananthapuram District, Bonacoud, 750 m, 21 xii 1987, *N. Mohanan* 9038 (TBGT!); Tiruvananthapuram District, Chinichal, 25 ix 2008, *C. G. Vishnu* 64723 (TBGT!); Tiruvananthapuram District, Ponmudi, 5 xii 2013, *G. Rajkumar & M. Alister* 80403 (TBGT!). **Tamil Nadu**: Tirunelveli District, Kokka Aruvi, Courtallam, 400 m, 4 xii 2015, *A. Nasarudheen & M. Alister* 88294 (TBGT!); Tirunelveli District, Mahendragiri, 28 ii 1989, *N. Mohanan* 8018 (TBGT!); Tirunelveli District, Courtallum, 10 ii 2019, *S. Reshmi & Nikhil Krishna* 168417 (CALI!).

Begonia albo-coccinea is clearly distinguished from the other members of this section by its peltate leaves and hairy styles. It has four tepals in male flowers and three or four (rarely five) tepals in female flowers. It has been observed that plants of *Begonia albo-coccinea* grown in greenhouses vary in the position of the petiole and the lamina, with leaves varying from centrally peltate to shortly eccentrically peltate. Hooker (1845), when describing this species, did not give any reference to a specimen in the protologue except for a note that "our plants were raised in the Royal Botanical Gardens of Kew, from seeds sent from India by Strachan, Esq., of Twickenham, Surrey". There are two specimens evidently consulted by Hooker while describing the species at G-DC (Hooker *s.n.*) and K (K000739957). Both specimens apparently came from Kew. The Kew sheet with two specimens mounted is well

preserved, and the specimen on the right side of the sheet bears an annotation in Hooker's own handwriting so was selected as the lectotype.

2. Begonia bracteolata N.Krishna, Pradeep & B.Mani, **sp. nov.**

Begonia bracteolata is closely similar to *B. floccifera* Bedd. but differs in having only two reniform female tepals instead of four ovate to elliptic tepals, primary bracts laciniate (not ovate) and secondary bracts ovate to oblong or elliptic and tepal-like (versus lanceolate), bracteoles ovate to elliptic, rarely obovate (not filiform), tepal-like, and fruits that are longer than broad. – Type: India, Kerala, Idukki District, Karimanal, 10°01′05.3″N, 76°51′00.5″E, 20 i 2018, *Nikhil Krishna* 148495 (holo CALI!; iso MH!, CAL!). **Figs 4, 5**.

Monoecious, acaulescent, rhizomatous, perennial herb, 50–90 cm tall including inflorescence. *Rhizome* brown, stout, woody, 10–30 cm long, nodes 5–15 mm, leaf scars prominent, axillary buds growing after leaf fall. *Stipules* 2 at each node, persistent, asymmetrical, keeled, widely ovate to triangular, rarely obovate, 1.3–4.2 × 2.7–3.4 cm, brownish red, base truncate, apex acute to cuspidate with 5–10 mm long arista, margins entire, abaxially sparsely hairy with brown tomentum, adaxially glabrous. *Leaves*: petiole 7–28 cm long, angular, slightly grooved, pale green with large reddish blotches, densely tomentose; lamina thick, fleshy, 13–28 × 21–35 cm, green above and pale green to pale pink beneath, suborbicular, base asymmetrically cordate, lower lobe overlapping, apex acute, margin distantly denticulate, upper surface tomentose, lower surface densely tomentose when young, sparsely tomentose when mature, leaves, 7- to 9-veined from base. *Inflorescence* axillary, bisexual, dichotomously branched at base, 5–6 times branched, protandrous with male flower basal and female flower distal; peduncle 40–85 cm long, angled, slightly grooved, bulging towards the base, reddish to pale green with reddish blotches, with dense white tomentum; primary bracts 2, caducous, pale green, laciniate, c.3.5 cm long, deeply lobed; lobes 3–6, lanceolate to narrowly ovate with short triangular sublobes, apex acuminate, base truncate, margins sparsely strigose; secondary bracts 3–5, caducous, broadly ovate to oblong or elliptic, rarely with narrow lobes, 7–10 × 3–6 mm, apex obtuse to acuminate, margins entire, glabrous. *Male flowers*: pedicel 1–1.7 cm long, pink with reddish blotches, greenish at the base, sparsely tomentose; tepals 2, orbicular, 1–1.3 × 1.1–1.4 cm, white to pale pink, base and apex rounded, margins entire, abaxial and adaxial surfaces glabrous; androecium symmetrical, stamens 37–49, monadelphous; anthers broadly obovate, 3 mm long, apex rounded, dehiscing through longitudinal slits; filaments c.2 mm long. *Female flowers*: nodding; bracteoles 2 or 3, caducous when mature, tepal-like, ovate to elliptic, rarely obovate, 11–12 × 6–10 mm, white to pale pink, base truncate, apex obtuse or with 3 small triangular lobes, margins entire; pedicel 9–12 mm long, white to pink with reddish blotches, glabrous; tepals 2, persistent, reniform, 0.9–1 × 1–1.2 cm, white to pale pink, base rounded, apex, rounded, glabrous on both surfaces; ovary white to pale pink, wings 3, equal, 11–32 × 3.5–5 mm, glabrous; locules 3, placentae undivided, axile; styles 3, connate at base, bifid from about half of their height, twisted once slightly at apex, stigmatic papillae a wavy band connecting the two stylar
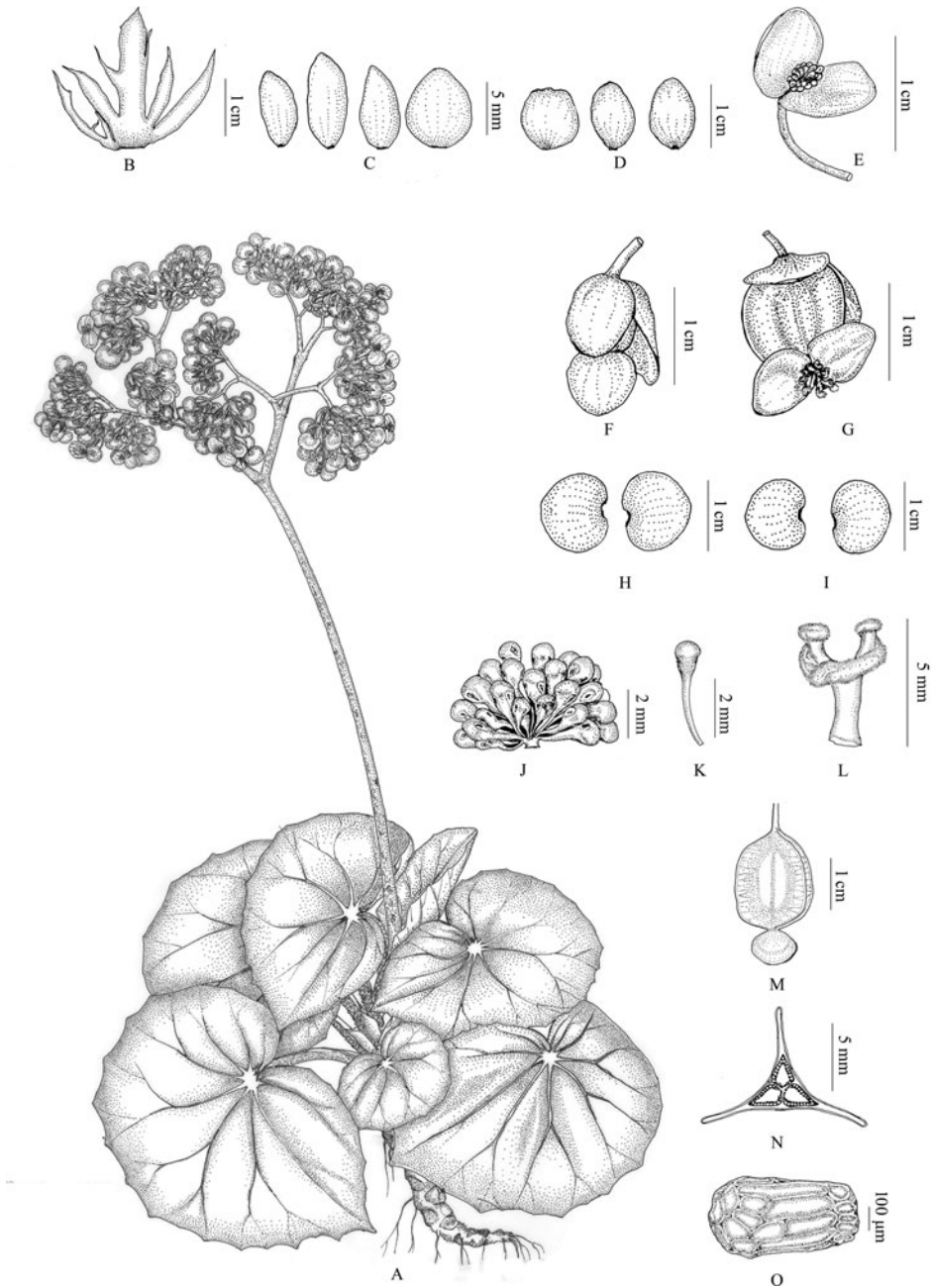
F I G . 4 . *Begonia bracteolata* N.Krishna, Pradeep & B.Mani, sp. nov. A, Habit; B, primary bracts; C, secondary bracts; D, bracteoles; E, male flower; F, female flower bud; G, female flower; H, male tepals; I, female tepals; J, androecium; K, stamen; L, style; M, mature fruit; N, ovary (transverse section); O, seed. Drawn from *Nikhil Krishna* 148495.

F I G . 5 . *Begonia bracteolata* N.Krishna, Pradeep & B.Mani, sp. nov. A and B, Habit; C and D, inflorescence; E, primary bracts; F, secondary bracts; G, bracteoles; H, male flower; I, female flowers; J, male tepals; K, female tepals; L, androecium; M, stamens; N, style; O, stylar branches (detached); P, mature fruit; Q, ovary (transverse section).

lobes. *Fruit* a capsule, pendent on slender pedicel, longer than broad, wings 3, equal, c.1.5 × 0.7 cm, pale green to pale pink, dehiscent on both sides of the wings; seeds numerous, oblong in outline, c.0.5 × 0.25 mm.

Distribution and ecology. Currently known only from Karimanal, Kerala, in South India (see Fig. 1) at an elevation of 500 m. It is found on forest margins, where it usually grows on moist rocks and adjacent wet areas exposed to direct sunlight, in association with *Pouzolzia pentandra* (Roxb.) Benn. and *Apluda mutica* L.

IUCN category. Data Deficient (DD). Known only from the type locality; further distribution information is needed.

Etymology. The specific epithet *bracteolata* refers to its tepal-like bracteoles in female flowers.

Phenology. Flowering and fruiting from December to March and up to May in the greenhouse.

Additional specimens examined. India. **Kerala**: Idukki District, Karimanal, 17 ii 2016, *S. J. Britto, S. Thomas & B. Mani* 67637 (RHT!); 13 i 2019, *S. J. Britto, S. Thomas & B. Mani* 68847 (RHT!).

3. Begonia floccifera Bedd. Icon. Pl. Ind. Or. 23, t. 111 (1874); C.B.Clarke in Hook.f., Fl. Brit. Ind. 2: 654 (1879); Gamble, Fl. Pres. Madras, 1: 546 (1919). – Type: India, Tamil Nadu, Tirunelveli xii 1871, *R. H. Beddome* 217 (lecto K [K000761458], here designated). **Fig. 6**.

Monoecious, acaulescent, rhizomatous, perennial herb; usually growing on rocks directly exposed to sunlight, 50–70 cm tall including inflorescence. *Rhizomes* brown, stout, fleshy, 5–30 cm, nodes 5–20 mm apart, brown tomentose on young parts, leaf scars prominent. *Stipules* persistent, symmetrical, oblong, keeled, c.5 × 2 cm, reddish at keel, base truncate, apex caudate, margins entire, abaxially sparsely tomentose, adaxially glabrous. *Leaves* distichous; petioles 8–22 cm long, pale green to reddish brown, rarely with reddish blotches, upper surface slightly grooved, densely tomentose when young, glabrous at maturity; lamina basifixed, suborbicular, 17–28 × 11–20 cm, broader than long, base asymmetrically cordate, lamina lobes slightly overlapping, apex acute, obtuse when mature, dark green above, pale green below, margins dentate to subentire, densely tomentose above when young, glabrous or glabrescent at maturity, densely tomentose below; veins 8–10, palmate to pinnate. *Inflorescence* bisexual, axillary, dichotomously branched at base, male flowers basal and female flowers distal; peduncle terete, c.60 cm long, brownish red, densely tomentose; primary bracts caducous, ovate, c.6 × 4 mm, pale green, base truncate, apex acute to obtuse, margins entire, sparsely tomentose; secondary bracts persistent, linear to lanceolate, c.2.5–5.5 × 0.4–1.2 mm, pale pink to pale green, base truncate, apex acuminate, margins entire, sparsely tomentose. *Male flowers*: pedicels 8–10 mm long, pale pink, with sparse tomentose hairs; tepals 2, broadly ovate, c.8 × 7 mm, white, base rounded, apex acute, margins entire,

F I G . 6 . *Begonia floccifera* Bedd. A, Habit; B, bracts; C, bracteole; D, inflorescence; E, infructescence; F, male flowers; G, male tepals; H, female flower; I, female tepals; J, androecium; K, stamens; L, mature fruit; M, ovary (transverse section).

glabrous; androecium symmetrical, stamens up to 25, free, arranged on a torus, filaments c.1 mm long, yellow; anthers broadly obovate in outline, c.1 mm long, apex rounded, dehiscing through longitudinal slits. *Female flowers*: pedicels c.5 mm long, white to pale pink, glabrous; bracteoles 2, filiform, c.2.7–3 × 0.4–0.5 mm, pale pink to greenish, base truncate, apex acuminate, margins entire, sparsely tomentose to glabrous; tepals 4, ovate to elliptic, 4–5 × 2–3 mm, base truncate, apex acute, margins entire, glabrous; ovary c.1 cm long, 3-winged; wings subequal, broadest at middle, c.10 × 5 mm; locules 3; placentae undivided, axile; styles 3, straight, c.3 mm long, yellow, one-third fused, each stylodium bifurcate at the stigmatic region, stigmatic band wavy, not twisted. *Fruit* a capsule, pendent on slender pedicel, wings 3, subequal, c.12 × 5 mm, papery with persistent tepals and style, apex and base rounded, dehiscent on both sides of the wings; seeds numerous, obovoid, c.0.37 × 0.21 mm.

Distribution and ecology. This species is endemic to the Western Ghats of Southern Kerala and Tamil Nadu, India (see Fig. 1). It grows lithophytically in exposed areas, occasionally as an epiphyte in primary rain forest between 350 and 1200 m above sea level.

IUCN category. Vulnerable (VU): B1 ab (i and iii). This species is so far reported from protected forests and forest margins in the southernmost parts of the Western Ghats. The populations are severely fragmented and continuing to decline, as observed in the extent of occurrence and the area and quality of the habitat.

Phenology. Flowering and fruiting from December to March in the field and up to May in the greenhouse.

Additional specimens examined. INDIA. **Kerala**: Kollam District, Palaruvi, 19 viii 2016, *Janeesha & Nikhil Krishna* 148436 (CALI!); Tiruvananthapuram District, Meenmutty Waterfalls, 12 ii 2019, *Nikhil Krishna* 168411 (CALI!); Tiruvananthapuram District, Near Bonacaud 13 ii 2019, *Nikhil Krishna* 168412 (CALI!); **Tamil Nadu**: Tirunelveli District, Karayar, 350 m, 30 iii 2017, *G. Rajkumar* 90730 (TBGT!); Tirunelveli District, Kannikatti, 5 vi 1901, *C. A. Barber* 3115 (MH!); ibid., 5 vi 1901, *C. A. Barber* 3116 (MH!); Tirunelveli District, Kappandi, Way to Kannikathy, 350 m, 21 v 1988, *R. Gopalan* 88624 (MH!); Tirunelveli District, Way to Kannikatti, 29 viii 1963, *A. N. Henry* 16363 (MH!); Tirunelveli District, Sengaltheri, 18 ix 1967, *Vajravelu* 29109 (MH!); Kanyakumari District, Lower Kothayar, 340 m, 3 viii 1999, *A. N. Henry* 49587 (MH!).

R. H. Beddome (1874) did not cite any specimens when describing *Begonia floccifera*; there is only an indirect reference in the protologue to two collection localities, Tirunelvelly and Courtallum. There are five specimens available from the Travancore and Tirunelvelly hills: one at K (K000761458); two at BM (BM000944668 and BM000944669), mounted on a single sheet; and two at CAL (CAL0000015336 and CAL0000015337). K000761458 is a well-preserved specimen agreeing perfectly with the original description and evidently consulted by Beddome (it bears labels apparently in Beddome's handwriting). It is therefore designated here as the lectotype.

4. Begonia keralensis Pradeep, Sinj. Thomas & Britto, **sp. nov.**

Begonia keralensis is similar to *B. bracteolata* N.Krishna, Pradeep & B.Mani in habit and leaf shape but differs in having ovate primary bracts (not laciniate), secondary bracts that are lanceolate (not broadly ovate to oblong or elliptic and tepal-like) and filiform bracteoles (not tepal-like, ovate to elliptic or obovate). – Type: India. Kerala, Palakkad District, Nelliyampathy, 10°32′03.8″N, 76°40′51.6″E, 20 xii 2017, *Nikhil Krishna* 168413 (holo CALI!; iso MH!, CALI!). **Figs 7, 8**.

Monoecious, acaulescent, rhizomatous, perennial herb; 30–70 cm tall (including inflorescence), acaulescent. *Rhizomes* brown, stout, fleshy, 7–80 cm, 13–30 mm thick, nodes 5–20 mm apart, brown tomentose on young parts, lenticellate, leaf scars prominent. *Stipules* 2 at each node, persistent, asymmetrical, keeled, oblong to triangular, 0.8–4 × 0.6–2.3 cm, pink to reddish brown, base truncate, apex acuminate to retuse with 6–12 mm long arista, margins entire, abaxially sparsely hairy with brown tomentum, adaxially glabrous. *Leaves*: petiole terete, slightly grooved, 16–50 cm long, pale green to reddish brown with minute white spots and streaks, dense brown tomentum when young, glabrescent at maturity; lamina fleshy, green above and pale green beneath, suborbicular, 18–20 × 21–30 cm, base asymmetrically cordate, lower lobe slightly overlapping, apex acute, margins undulate to subentire, upper surface sparsely tomentose, glabrous when mature, lower surface densely tomentose when young, sparser when mature, 8- to 11-veined, palmate to pinnate. *Inflorescence* axillary, bisexual, dichotomously branched at base, 5–6 times branched, protandrous with male flower basal and female flower distal; peduncle c.27–70 cm long, terete, with dense brown tomentum, reddish to pale green; primary bracts caducous, ovate, apex obtuse to acute, base truncate, margins entire, sparsely tomentose; secondary bracts persistent 2.5–3 × 0.4–0.5 mm, lanceolate, pink to reddish brown, base truncate, apex acute to acuminate, margins entire, abaxially sparsely tomentose. *Male flowers*: pedicel c.1 cm long, pink, sparsely tomentose; tepals 2, orbicular, 0.9–1 × 1–1.3 cm, pink, base rounded, apex rounded to obtuse, margins entire, abaxial and adaxial surfaces glabrous; androecium symmetrical, stamens monadelphous, 25–30; anthers obovate, 2–3 mm long, connective not produced beyond the thecae, apex rounded, dehiscence through longitudinal slits; filaments c.7–1.5 mm long. *Female flowers* suberect; bracteoles 2, persistent, c.2 × 0.5 mm, shorter than ovary, filiform, reddish pink, base truncate, apex acute, margins entire, sparsely tomentose as in pedicels; pedicel c.1–1.2 cm long, pink, sparsely tomentose; tepals 2, reniform, 0.8–1 × 0.9–1.2 cm, pink, base rounded, apex acute to rounded, margins entire, glabrous on both surfaces; ovary pink when young, wings 3, equal, glabrous; locules 3, placenta undivided, ovules arranged on an axile placenta; styles 3, connate at base, bifid from about half their length, stigmatic papillae forming a band connecting the two lobes. *Fruit* a capsule, more or less erect, oblong, pink, wings 3, equal, c.1–1.5 × 0.7 cm, both ends rounded, dehiscent on both sides of the wings; seeds numerous, ellipsoid, 0.36 × 0.18 mm.

Distribution and ecology. This species is distributed in the forests of Kerala, India, ranging from Idukki to Kasaragod (see Fig. 1). It is usually found growing as a lithophyte in areas directly exposed to sunlight at elevations between 400 and 1000 m.
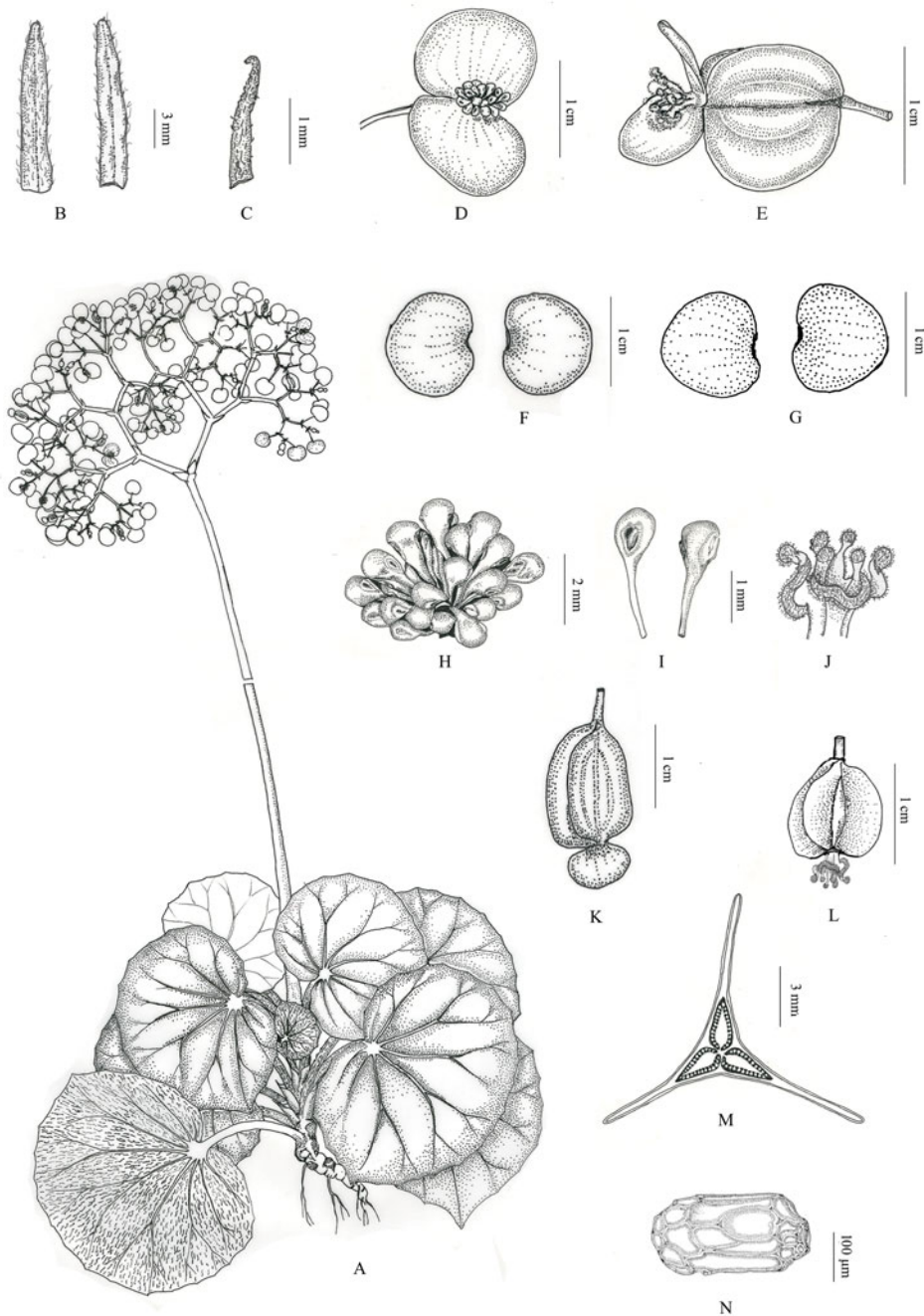
F I G . 7 . *Begonia keralensis* Pradeep, Sinj. Thomas & Britto, sp. nov. A, Habit; B, bracts; C, bracteole; D, male flower; E, female flower; F, male tepals; G, female tepals; H, androecium; I, stamens; J, style; K and L, fruits; M, ovary (transverse section); N, seed. Drawn from *Nikhil Krishna* 168413 (A–I, K, M and N) and *S.J. Britto, S. Thomas & B. Mani* 67657 (J and L).

F I G . 8 . *Begonia keralensis* Pradeep, S. Thomas & Britto, sp. nov. A, Habit; B, inflorescence; C, bract; D, bracteole; E, male flowers; F, female flowers; G, male tepals; H, female tepals; I, androecium; J, stamens; K, style; L, stylar branches (detached); M, dried fruits; N, ovary (transverse section).

IUCN category. Data Deficient (DD). Even though this species is placed under the Data Deficient category, it is reported from five localities in addition to the type locality.

Etymology. The specific epithet *keralensis* is derived from the area of distribution of the species, Kerala in India.

Phenology. Flowering and fruiting from December to March in the field and up to May in the greenhouse.

Additional specimens examined. India. **Kerala**: Thrissur District, Sholayar, 31 xii 2016, *Nikhil Krishna, Manu Philip & S. Reshmi* 148466 (CALI!); Palakkad District, Nelliyambathi, 10 xii 2017, *Shinoj K. & Nikhil Krishna* 14456 (CALI!); Palakkad District, Thippallikkayam, 12 i 2011, *Manudev K.M., A. K. Pradeep & Santhosh Nampy* 4310 (DEV!); Idukki District, Vagamon, 3 xi 2016, *S. J. Britto, S. Thomas & B. Mani* 67657 (RHT!); 15 xii 2018, *S. J. Britto, S. Thomas & B. Mani* 68845 (RHT!); Kottayam District, Mavadi, 13 i 2019, *S.J. Britto, S. Thomas & B. Mani* 68843 (RHT!).

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Article

Strobilanthes tricostata, a new species of Acanthaceae from the Western Ghats, India

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Abstract

Strobilanthes tricostata, a new species with semelparous life history strategy, is described from the Megamalai hills, Tamil Nadu. Pollen morphology, phenology, distribution, conservation status and notes on allied taxa are provided along with illustrations.

Keywords: Acanthaceae, *Strobilanthes*, pollen, taxonomy

Introduction

The genus *Strobilanthes* Blume (1826: 781) consists of approximately 400 species confined to the south and southeast Asia and Melanesia (Mabberley 2017). About 150 species have been reported from India and among them 61 species were reported from south India alone (Carine & Scotland 2002, Venu 2006). The Western Ghats harbours a rich biological diversity and large number of new taxa has recently been reported from this phytogeographic region including species of *Strobilanthes* (Carine *et al.* 2004, Gopalan & Chithra 2008, UNESCO 2012, Sasidharan *et al.* 2016, Thomas *et al.* 2018, 2019). The floristic exploration in the Megamalai hills of Tamil Nadu by the authors led to the collection of an interesting specimen of *Strobilanthes* could easily be distinguished by pubescent narrow spikes with 3-ribbed bracts. After comparing the collections with herbarium specimens in India and abroad and critical study of relevant literature, it was concluded that our collections do not match with any of the hitherto known species of *Strobilanthes* (Carine *et al.* 2004, Venu 2006). Additionally, pollen morphological characters were also studied to distinguish the species from allied species. The variability in pollen morphology is potentially useful in demarcating the species of *Strobilanthes* (Terao 1982, Carine & Scotland 1998, Deng *et al.* 2006).

Taxonomy

Strobilanthes tricostata S. Thomas, B. Mani, Britto & Pradeep, *sp. nov.* (Figs. 1 & 2)

The new species is allied to *Strobilanthes carnatica* Carine *et al.* (2004: 23), but differs in the stem tawny tomentulose (not glabrous), leaves elliptic (not ovate), apex cuspidate (not long acuminate), bracts lanceolate 3-ribbed (not ovate non-ribbed), spikes non-glandular hairy at anthesis (not glabrous or glandular hairy), calyx lobes narrowly triangular (not lanceolate), pollen grains prolate (not subprolate), style pubescent (not glabrous), capsule pubescent apically (not pubescent) and seeds broadly elliptic (not orbicular).

Type:—INDIA.Tamil Nadu:Theni District, Megamalai, 1400 m, 5 December 2016, *Pradeep A. K. et al. 68246* (holotype RHT!, isotype RHT!).
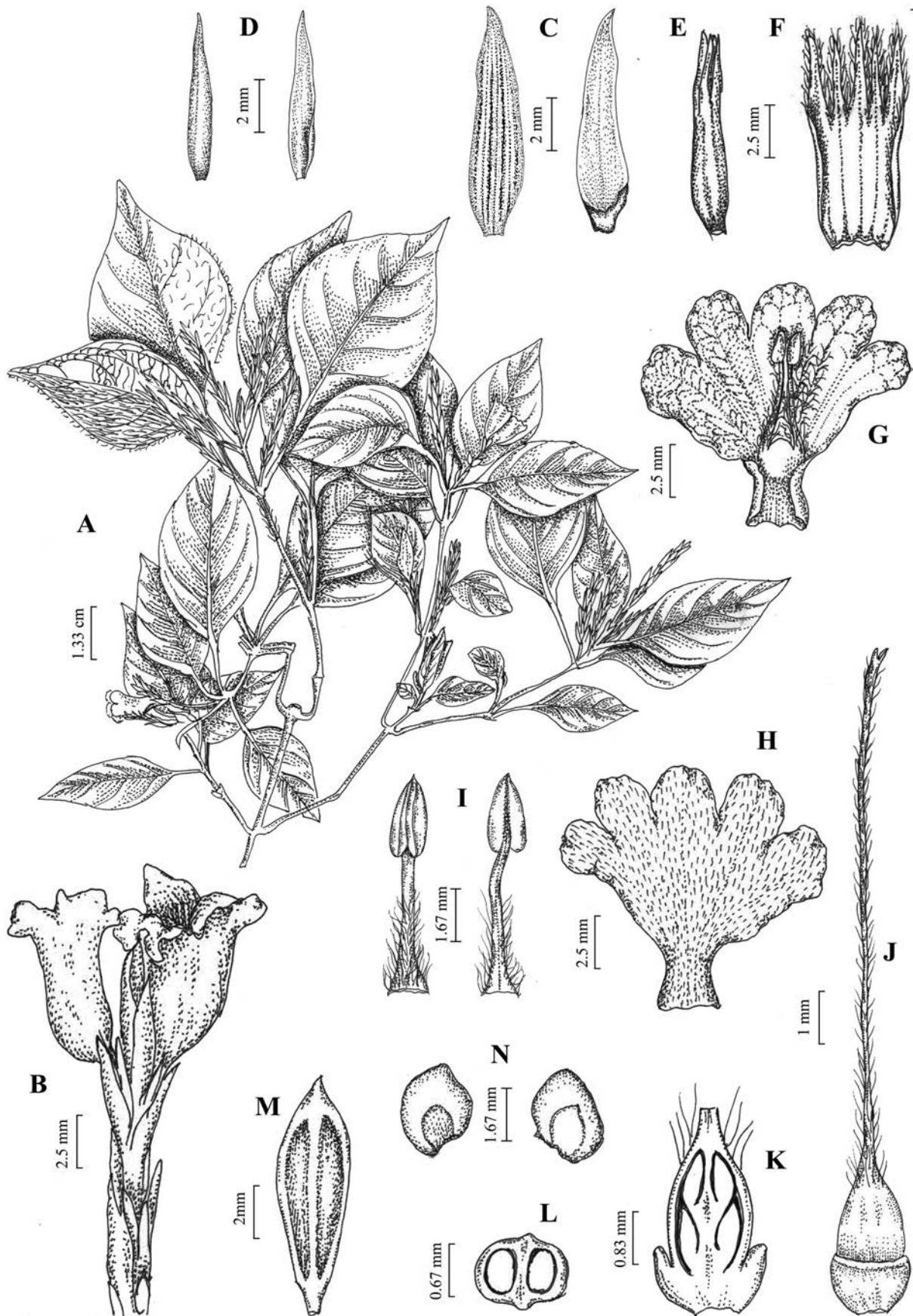
FIGURE 1. *Strobilanthes tricostata sp. nov.* A. Habit; B. Inflorescence; C. Bract; D. Bracteole; E. Calyx; F. Calyx split open; G & H. Corolla split open; I. Stamen; J. Pistil; K. Ovary longitudinal section; L. Ovary transverse section; M. Capsule; N. Seeds (RHT68246). Illustrated by Philominal Selvi.
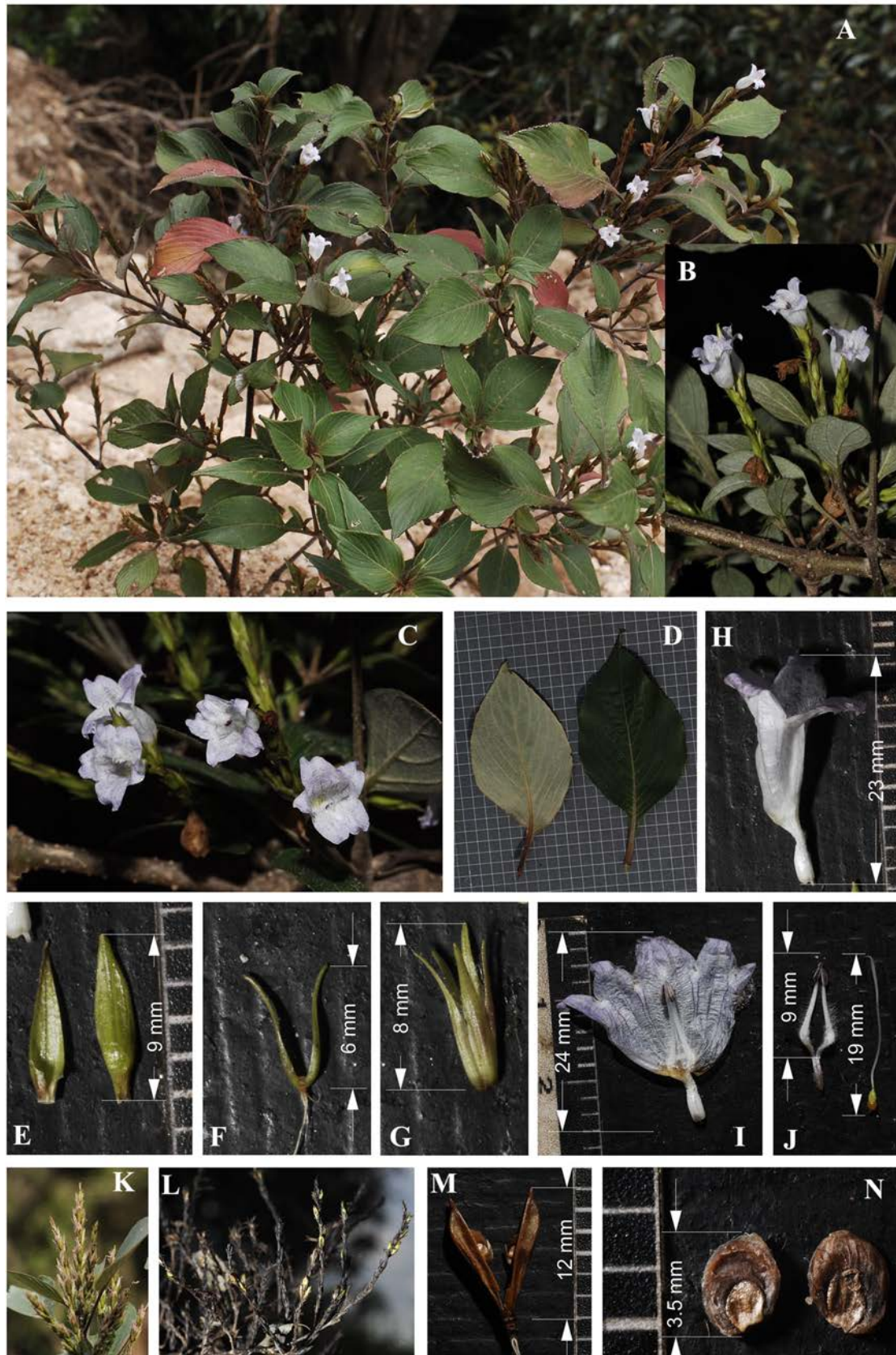
FIGURE 2. *Strobilanthes tricostata sp. nov.* A. Habit; B. Terete stem with tomentum and inflorescences; C. Campanulate corolla showing included stamens; D. Abaxial (left) and adaxial (right) view of leaf blade; E. Adaxial (left) and abaxial (right) surface of bracts; F. Bracteoles; G. Calyx; H. Corolla; I. Corolla split open showing the included stamens; J. Androecium (left) and Pistil (right); K. Young infructescence; L. Mature infructescence; M. Dehisced capsule with seeds; N. Seeds.

Description:—Isophyllous semelparous shrub, 1–2 m high. Stem quadrangular when young, then becoming terete, lenticellate, green–brown, covered with dense short tawny tomentum. Leaves opposite, slightly asymmetrical; petioles 0.8–6.0 cm long, brown tomentulose; lamina elliptic, 4.8–12.5 × 1.9–8.5 cm, chartaceous, base shortly decurrent, margin entire and deflexed, apex cuspidate, abaxially densely covered with tawny indumentum on young leaves, white indumentum on mature leaves, adaxially hirsute, lateral veins 6–13 pairs, prominent on both surfaces, raised beneath. Inflorescences axillary or terminal, 3.5–9.4 × 0.4–0.5 cm, uninterrupted to interrupted narrow spikes; peduncle quadrangular, often unbranched, covered with short tawny tomentum. Bracts lanceolate, 6.0–8.0 × 2.0–2.5 mm, 3-ribbed, entire, ciliate, round at base, narrowly acute at apex, shorter than calyx at anthesis, pubescent on both surfaces; bracteoles linear, 5.0–6.5 × ca. 1.0 mm, pubescent on both surface, margin ciliate, secondary flower buds present. Calyx 6.5–8.5 mm long, pubescent, tubular below, tube 3.0–4.5 mm long, lobes 5, 2.5–4.0 × 0.5–1.0 mm, narrowly triangular, 3 lobes equal, one lobe each longer and shorter than rest, margin ciliate, pubescent without, whitish pubescent within, glandular pubescent in infructescence. Corolla pale purple, 1.7–2.2 cm long, widening from tubular base; tube 4–5 mm long, glabrous, white; throat campanulate, 1.1–1.2 cm long, pale purple, densely fine pubescent on outer surfaces, inside long hairy except the abaxial part; lobes equal, triangular, 4.0–5.0 × ca. 3.5 mm, overlapping, pale purple, apex shortly cuspidate, fine pubescent outside, glabrous inside, margin ciliate. Stamens 2, included; filaments ca. 8 mm long, villous in the proximal ⅔ length; anthers ca. 2 × 1 mm, thecae two, held parallel with the filament. Pistil 2.0–2.1 cm long, ovary ca. 1.5 × 1.0 mm, apex pubescent, 2-locular, 2 ovules per locule; style 1.6–1.7 cm long, filiform, pubescent throughout; stigma lanceolate, ca. 2 mm long, puberulent, curved. Infructescence 7.5–11.4 × 0.8–1.0 cm, glandular hairy, calyx enclosing the capsule; capsule oblance-ovate, 11.0–12.0 × 3.0–3.5 mm, apically pubescent. Seeds 2 (rarely 1), ca. 3.5 × 3.0 mm, widely elliptic, base truncate, densely pubescent.

Pollen morphology:—Pollen grains are ellipsoid (Fig. 3 A), tricolporate and contain pseudocolpi. The grains are prolate in outline. The exine divided into longitudinal ribs which are straight, tectate and aggregate to form a protuberance at poles. A comparison of pollen features of *Strobilanthes tricostata* with allied species are given in Table 1.
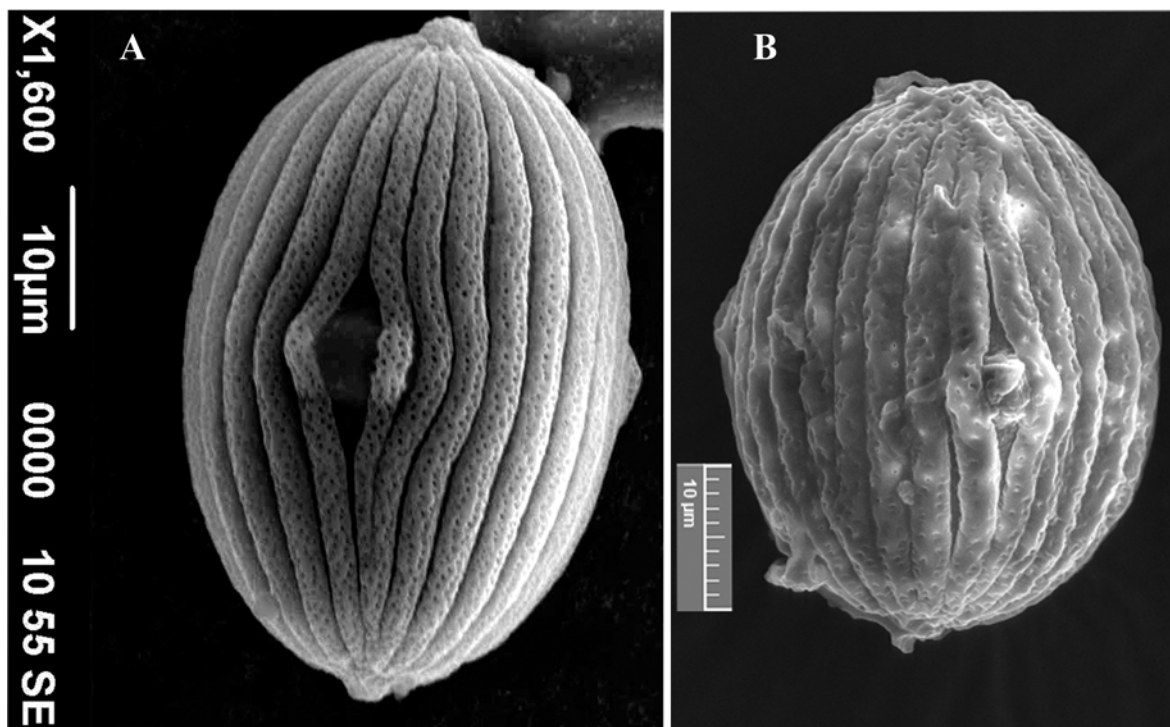
FIGURE 3. SEM micrographs of pollen grains of *S. tricostata sp. nov.* (A) and *S. carnatica* (B).

Etymology:—The specific epithet is referred to the Latin "*tri-*", meaning "three", and "*costa*", meaning "rib", because this species can be easily distinguished from other species by its 3-ribbed bracts.

Phenology:—Flowering December–January; seed dispersal starts on April.

Habitat and distribution:—The new species grows as isolated plants in the banks of streams in the moist evergreen forest and also as undergrowth in the evergreen forest patches. It shows a narrow distribution and found at an elevation of 1400–1600 m towards the eastern slope of the Western Ghats.

Conservation status:—The extent of occurrence (EOO) is estimated to be less than 100 km^2 (B1) and the area of occupancy (AOO) is less than 10 km^2 (B2). It is found in only one location (B2a) and the number of mature individuals is less than 250 (C). The habitat is severely fragmented and decline observed in the area and quality of habitat (B2biii). Based on above criterion it is assessed as critically endangered (CR) (IUCN Standards and Petitions Subcommittee 2016).

Notes:—*Strobilanthes tricostata*, an explicit plant still unknown to science, presently known only from the high altitude evergreen-shola mixed forest in the Megamalai hills. The new species is related to *S. carnatica* by the characteristics such as leaves with decurrent base, spicate inflorescence, presence of secondary flower bud in the axil of bracteoles, campanulate corolla with short tube, broadly triangular corolla lobes, included stamens and apically pubescent ovary (Carine *et al.* 2004). Although, the new species shares features with *S. carnatica*, but differs in the distribution pattern and different vegetative and floral characters. *Strobilanthes carnatica* grow in the dry to slightly moist soil at elevations below 900 m in the Eastern Ghats (Tamil Nadu, Karnataka and Andhra Pradesh), whereas the new species is confined to the evergreen forest at elevations above 1400 m in Megamalai hills which is part of the Western Ghats (Carine *et al.* 2004). The epidermal excrescence on the stem and leaves of the allied species is characterised by either glabrous or having long hairs as indumentum. The stem of the new species however has a tawny tomentulose epidermal excrescence, which is not observed in none of the allies. A detailed comparison between the new species and *S. carnatica* is given in Table 1 & 2.

TABLE 1. Comparison of pollen characteristics of *S. tricostata sp. nov.* with allied taxon.

Species	Outline	Pseudocolpi	P (μm)	E (μm)	P:E ratio	Ribs
S. tricostata	Prolate	Moderately wide	47–49	31–32	1.50	27–30, straight
S. carnatica†	Sub-prolate	Narrow	37–39	29–31	1.26	27, straight

†Carine and Scotland 1998.

TABLE 2. Comparison of diagnostic characteristics among *S. tricostata sp. nov.* and allied species.

Characters	*S. tricostata*	*S. carnatica*†
Stem indumentum	Dense tawny tomentum	Glabrous or with rarely sparse white indumentum on nodes
Lamina shape	Elliptic	Broadly to narrowly ovate
Lamina apex	Cuspidate	Long acuminate
Lamina margin	Entire, deflexed	Entire to slightly dentate/serrate
Lamina veins	6–13 pairs	4–9 pairs
Abaxial leaf indumentum	Tawny indumentum on young leaves; white indumentum on mature leaves	White sericeous indumentum on young leaves; mature leaves glabrous
Adaxial leaf indumentum	Hirsute	Glabrous
Inflorescence	Uninterrupted to interrupted narrow spikes	Interrupted narrow spikes
Axis pubescence at anthesis	Tawny tomentulose	Glabrous or sparsely glandular hairy
Bract	Lanceolate, 3-ribbed	Ovate or rarely obovate
Bract apex	Narrowly acute	Acuminate or rarely obtuse
Abaxial bract indumentum	Pubescent	Glandular-hairy or glabrous
Adaxial bract indumentum	Pubescent	Glabrous or few simple white hairs
Bract:calyx ratio	Shorter	Shorter or rarely equal
Secondary buds in axils of bracteoles	Present	Present
Calyx lobe shape	Narrowly triangular	Lanceolate
Equality of calyx lobes	3 lobes equal, 1 lobe each longer and shorter	2 or 3 shorter
Degree of calyx fusion at anthesis	Ca. 0.5	0.4–0.6
Corolla	Campanulate	Campanulate
Length of corolla tube	4–5 mm	2.1–4.5 mm
Length of corolla throat	11–12 mm	9.2–11.3 mm

TABLE 2. (Continued)

Characters	*S. tricostata*	*S. carnatica*†
Stamina filament pubescence	Villous on proximal ⅔ length	Few white long hairs along most of the length
Pubescence of style	Pubescent	Glabrous
Stigma	Ca. 2 mm long	1.7–2.6 mm long
Pubescence of stigma	Puberulent	Glabrous
Fruit shape	Oblance-ovate	Narrowly ovate
Pubescence of capsule	Hairy at apex	Glabrous
Seed number	2	4

†Carine *et al*. (2004).

Specimens of *Strobilanthes tricostata* examined (Paratypes):—INDIA.**Tamil Nadu:** Theni District, Megamalai, 1400 m, 5 Dec 2016, *Pradeep A. K. et al. 68246* (RHT); 1500 m, 5 Dec 2016, *Pradeep A. K. et al. 68247* (RHT); 1500 m, 5 Dec 2016, *Pradeep A. K. et al. 68416* (RHT); 1400 m, 5 March 2017, *Pradeep A. K. et al. 68415* (RHT); 1400 m, 4 Apr 2017, *Pradeep A. K. et al. 68417* (RHT).

Specimens of *Strobilanthes carnatica* examined:—INDIA. **Tamil Nadu**: Dharmapuri District, Denkanikotta, Javalagiri Reserve Forest, *T. S. Jayaseelan 26509* (isotype RHT); Chitteri Hills, 17 March 1980, *K. M. Matthew 27088* (RHT); Karnataka, Chamarajanagar District, Kollegal, Ponnachi, 880 m, 6 Feb 1930, *V. Narayanaswamy 78746* (MH).

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Strobilanthes carmelensis (Acanthaceae), a new species from the Western Ghats of India

Sinjumol Thomas, Bince Mani, S. John Britto & A. K. Pradeep

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Strobilanthes carmelensis (Acanthaceae), a new species from the Western Ghats of India

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ABSTRACT

Strobilanthes carmelensis, a plietesial new species apparently ascribable to the Strobilanthes kunthiana-group, is described for the flora of Western Ghats (India, Wayanad District, State of Kerala). Pollen morphology, phenology, distribution, notes on allied species and key to the species of the Strobilanthes kunthiana-group are provided along with photographic illustration.

Introduction

The Western Ghats range is known as one of the biodiversity and endemism hotspots in India. Endowed with unique geographical features and biophysical and ecological processes, this range harbours several endemic taxa reflecting its singular habitat. Besides, the Western Ghats are home to large number of threatened taxa including species of Strobilanthes Blume (UNESCO 2012). About 150 species of Strobilanthes have been reported from India and among them 61 species are recorded from Southern Western Ghats exclusively (Carine and Scotland 2002; Venu 2006). Since many species are inadequately known and seldom critically collected – due to their plietesial flowering pattern – species delimitation and nomenclature have remained problematic in Strobilanthes (Wood and Scotland 2009). However, recently researchers from India and abroad have collected and described several new species and also circumscribed the taxonomic status of a few species from the Western Ghats, which projects the latter as a unique centre of Strobilanthes diversity (Carine et al. 2004; Gopalan and Chithra 2008; Mascarenhas and Janarthanam 2013; Josekutty et al. 2016; Sasidharan et al. 2016; Augustine et al. 2017; Thomas et al. 2018, 2019a, 2019b).

While exploring the Wayanad area (district of Kerala), the authors collected an interesting specimen of Strobilanthes. The plants grow as undergrowth in evergreen forests. They belong to the S. kunthiana-group, an informal grouping represented by 14 distinct species (Carine et al. 2004; Augustine et al. 2017; Thomas et al. 2019a, 2019b) and two doubtful taxa (Gopalan and Chithra 2008; Sasidharan et al. 2016) in which our specimen is related to S. gamblei Carine, J. Alexander &

Scotland. The Strobilanthes kunthiana-group corresponds to the genus Phlebophyllum Nees (Nees von Esenbeck 1832) as circumscribed by Bremekamp (1944) and is endemic to peninsular India. The specimen was critically analysed, compared with herbarium specimens in India and abroad, and significant study of relevant literature revealed that our collections do not match any of the recognised species of Strobilanthes (Carine et al. 2004; Venu 2006). Therefore, the authors establish and describe it as a new species.

Taxonomic treatment

Strobilanthes carmelensis Sinj.Thomas, B.Mani, Britto and A.K.Pradeep, **sp. nov.** Figure 1.

Type: INDIA, Kerala, Wayanad District, Vaduvanchal, 850 m asl, 28 November 2014, *Pradeep A.K. et al. 68240* (holotype RHT!; isotype MH!, Acc. 76687).

Diagnosis

The new species is allied to *S. gamblei*, but differs by having distinct ovate leaves with sericeous adaxial indumentum, short and viscous spikes at anthesis, diagnostic ovate bracts, absence of secondary flower buds in the axil of bracteoles, anthers held parallel to the filament, apically pubescent ovary and oval-shaped pollen grains with straight ribs.

Description

Erect isophyllous shrub, up to 1.5 m tall, plietesial; stem angled (young) to terete (mature), lenticellate, young stem canaliculate, densely white-sericeous.
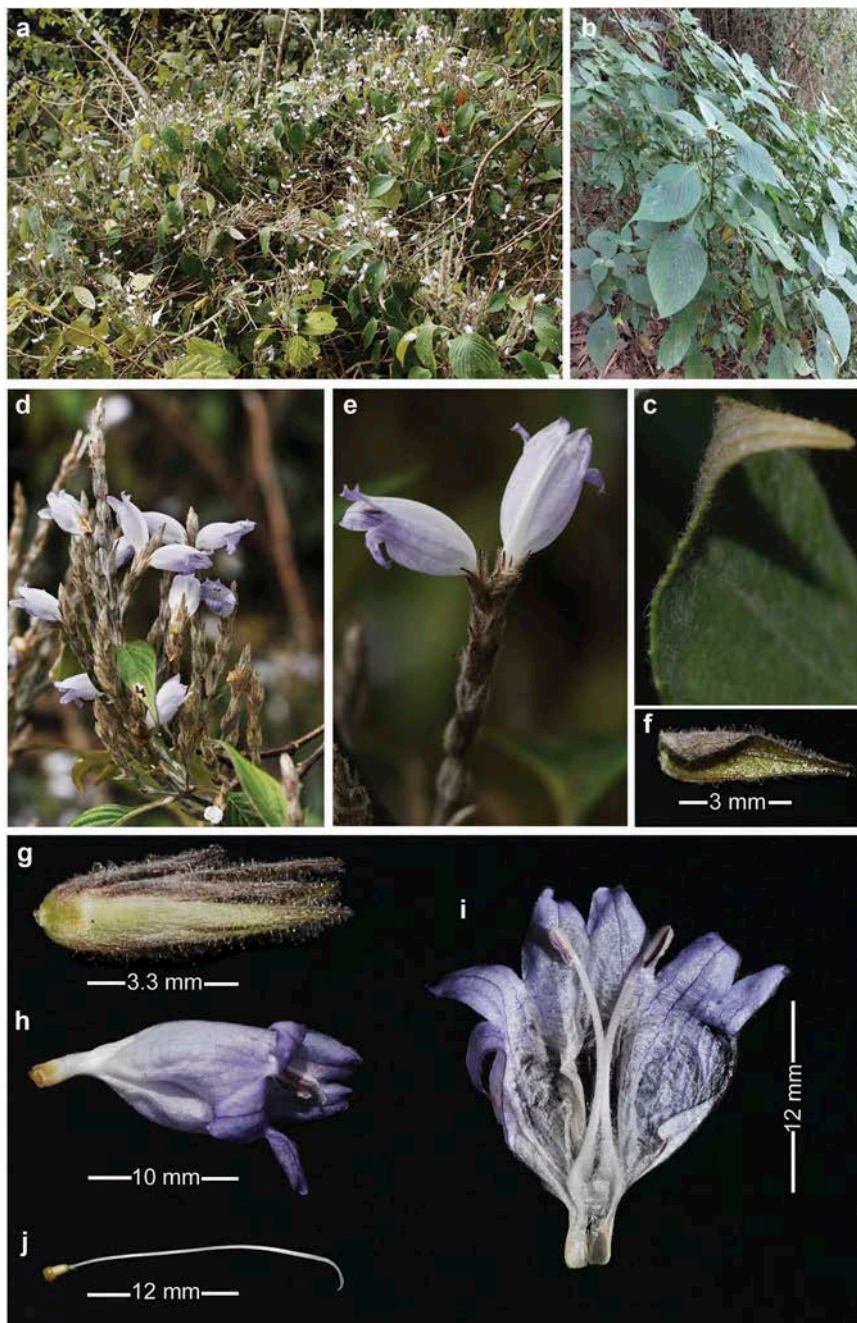
Figure 1. Photographic illustration of *Strobilanthes carmelensis*. (a,b) Habit. (c) Adaxial and abaxial leaf indumentum. (d,e) Inflorescence. (f) Bract. (g) Bracteole and calyx. (h) Flower: abaxial view (without calyx). (i) Corolla split open showing the epipetalous stamens having anthers held parallel to the filament. (j) Pistil.

Leaves opposite, symmetrical; petiole 1.3–6.5 cm long, tomentose; lamina ovate, 5.5–13 × 2.1–7.5 cm, coriaceous, rounded at base, acuminate, entire, dense sericeous indumentum on abaxial surface, appressed white hairs on adaxial surface; lateral nerves 5–11 pairs, prominent on both surfaces, raised beneath. Inflorescences axillary or terminal spikes, also from lower regions of the stem, 25–70 × c. 4 mm, interrupted, glandular hairy at anthesis; peduncle quadrangular, glandular hairy, covered with white indumentum; bracts ovate, 5–5.5 × c. 2 mm, shorter than calyx, acuminate, abaxial surface with glandular hairs and white woolly indumentum, adaxial surface pubescent; bracteoles 4–4.5 × ≤0.5 mm, linear, pubescence same as on bracts, axillary secondary flower buds absent. Calyx 6.5–7 mm long, tubular, 5-lobed, tube c. 2 mm, lobes 4.5–5 × c. 1 mm, linear–lanceolate, unequal with two lobes shorter than the rest, dense white sericeous indumentum mixed with glandular hairs on outer surface at anthesis, pubescent within. Corolla blue, 21–24 mm long, widening from basal tube, 5-lobed; tube 4–5 mm long, glabrous; throat ventricose, 12–14 mm long, fine pubescence on the outer surface, long white hairs present within on adaxial side; lobes unequal, two adaxial lobes partly fused, 4–6 × 2.5–4 mm, widely triangular, shortly cuspidate

at apex, fine pubescent outside, glabrous inside. Stamens 2, exserted, basally attached to corolla tube; filaments 11–12 mm long, villous in the proximal one-quarter; anthers c. 2.5 × 1 mm, oblong, thecae two, held parallel to filament. Pistil 23–24 mm long, ovary c. 1.0 × 0.5 mm, pubescent towards tip, 2-locular, two ovules per locules; style 19–20 mm long, filiform, sparsely pubescent; stigma simple, slightly curved, c. 2 mm long, glabrous.

Etymology

The specific epithet refers to Carmel College in Kerala, a reputed educational institution with active research in the flora of the Western Ghats.

Pollen morphology

Pollen grains are ellipsoid (Figure 2(a)), tricolporate and contain wide pseudocolpi. It is prolate in outline and exine divided into longitudinal ribs, which are straight, tectate and coalesce at poles. Tectum is perforate. Comparison of pollen characteristics (Table 1) with the related taxa, *S. gamblei* (Figure 2(b)), is also provided.

Phenology

Flowering October to December; fruiting January to March.

Habitat and distribution

It grows as understorey in evergreen forest in Meppadi and Vaduvanchal, Wayanad District in Kerala at an elevation of 800–1000 m asl.

Taxonomic notes

Strobilanthes carmelensis and *S. gamblei* have narrow spicate inflorescence with ventricose corolla and exserted stamens. However, the new species could readily be distinguished from the allied species by the characteristics in addition to the diagnostic features such as presence of sericeous indumentum on stem, leaves and inflorescence (vs tawny or cream indumentum in *S. gamblei*), lower bract:calyx ratio (vs ≅1 or ≤1), much shorter floral parts such as bracts, bracteoles, calyx and corolla tube, villous stamina filaments (vs short hairs) and corolla lobes glabrous inside (vs pubescent) Table 2.

The variability of pollen morphology in *Strobilanthes* is potentially a useful character to delimit taxa in this group. The pollen morphology of south Indian and Sri Lankan *Strobilanthes* is well documented and recognised (Carine and Scotland 1998). The new species has characteristic oval-shaped pollen with straight ribs. None of the known species of *Strobilanthes kunthiana*-group having a ventricose corolla possess pollen grains with straight ribs except the proposed new species (Figure 2(a)). However, species of *Strobilanthes* with campanulate corolla predominantly have pollen with straight ribs. *Strobilanthes gamblei*, the allied species, possesses pollen grains with spiral ribs (Figure 2(b)). Therefore, vegetative, floral and micro-morphological features confirm *S. carmelensis* as a distinct species from the Western Ghats of India.

Specimens analysed

Strobilanthes carmelensis: INDIA, Kerala, Wayanad District, 850 m asl, 20 November 2014, *Pradeep A. K. et al. 68238* (RHT!); 880 m asl, 28 January 2015, *Pradeep A.K. et al. 68239* (RHT!).

Strobilanthes gamblei: INDIA, Kerala, Kozhikode District, Tambracheri ghat, Wynaad, 21 January 1903, *Barber 5686* (K!); Kannur District, way to Chandanathode, 27 February 1979, *Ramachandran 133374* (MH!); Idukki District, Kakki dam area, 1000 m asl, 10 October 1983, *Pandurangan 152158* (MH!); Murinjapuzha, 780 m asl, 25 December 2015, *Pradeep A.K. et al. 68243* (RHT!); Vagamon, 1170 m asl, 18 December 2016, *Pradeep A.K. et al. 68248* (RHT!).
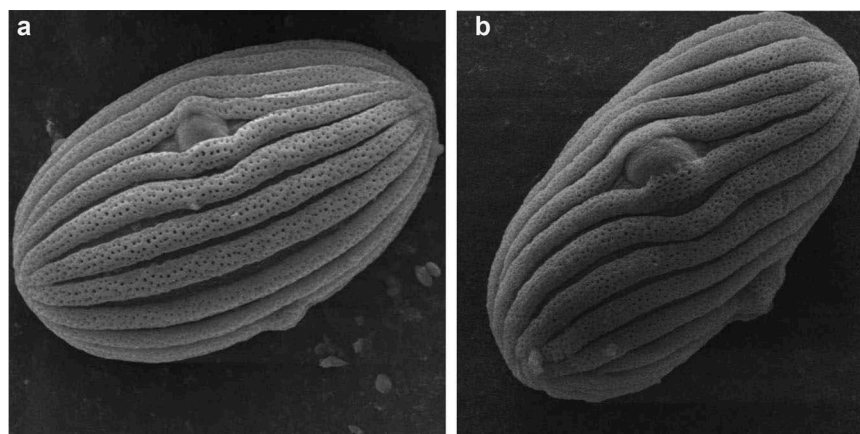

Figure 2. SEM images of pollen grains of *Strobilanthes carmelensis* (a) and *S. gamblei* (b).

Table 1. Comparison of pollen characteristics of *Strobilanthes carmelensis* and *S. gamblei*.

Species	Outline	Shape	P(length of the polar axis) (μm)	E(equatorial diameter) (μm)	P:E ratio	Ribs
S. carmelensis	Prolate	Oval	49.5–51	31.2–33	1.56	17–22, straight
S. gamblei	Perprolate	Terete	49–53	24–28	1.96	16–19, spiral

Table 2. Comparison of diagnostic characters of *Strobilanthes carmelensis* and *S. gamblei*.

Characters	*S. carmelensis*	*S. gamblei*
Leaf shape	Ovate	Ovate to elliptic
Adaxial leaf indumentum	Sericeous	Glabrous or covered with sparse short, stout hairs
Inflorescence	Viscous	Non-viscous
Bract shape	Ovate	Ovate–elliptic
Bract:calyx length	1	≤1
Secondary buds in axils of bracteoles	Absent	Present
Corolla tube	4–5 mm, short	5–8 mm, long
Attachment of anther to filament	Held parallel	Held perpendicular
Pubescence at ovary apex	Pubescent	Glabrous

Key to the species of *Strobilanthes kunthiana-group*

1. Corolla ventricose or subventricose, with two partly fused adaxial lobes 2

    Corolla campanulate, lobes divided equally 9

2. Corolla subventricose to ventricose, stamens included within the throat of corolla 3

    Corolla ventricose, stamens exserted into the upper lip of the corolla 4

3. Bracts lanceolate .... *S. cuspidata*

    Bracts ovate. .... *S. canarica*

4. Abaxial leaf surface glabrous or sparsely pubescent, leaf margins distinctly crenate or serrate. 5

    Abaxial leaf surface densely covered with white or cream or tawny-coloured woolly indumentum, leaf margins entire 6

5. Abaxial leaf surface glabrous or rarely with white sericeous indumentum, leaf margins distinctly serrate. .... *S. consanguinea*

    Abaxial leaf surface sparsely pubescent, leaf margins crenate .... *S. mullayanagiriensis*

6. Anthers held parallel to the filament 7

    Anthers held perpendicular to the filament 8

7. Lamina membranous, spikes uninterrupted, pollen grains with spiral ribs .... *S. bislei*

    Lamina coriaceous, spikes often interrupted, pollen grains with straight ribs .... *S. carmelensis*

8. Leaves long-petiolate, spikes often interrupted, ovary apex pubescent .... *S. gamblei*

    Leaves shortly petiolate, spikes uninterrupted, ovary apex glabrous .... *S. pushpangadanii*

9. Stems, abaxial surface of leaves and inflorescences with dense tawny-coloured woolly indumentum 10

    Stems and abaxial surface of leaves glabrous or if pubescent, the hairs not tawny-coloured 12

10. Inflorescence a narrow, often interrupted spike .. 11

    Inflorescnce a broad, uninterrupted spike.. .... *S. lanata*

11. Lamina with long acuminate apex, ovary apex glabrous .... *S. lawsonii*

    Lamina with cuspidate apex, ovary apex pubescent .... *S. tricostata*

12. Leaves long-petiolate, abaxial surface of leaves glabrous or rarely with sericeous indumentum 13

    Leaves shortly petiolate, abaxial surface of leaves pubescent 14

13. Bracts equal or longer than calyx, 1 calyx lobe shorter than others, lamina pubescent on adaxial surface .... *S. jeyporensis*

    Bracts equal or shorter than calyx, 2–3 calyx lobes shorter than others, lamina glabrous on adaxial surface .... *S. carnatica*

14. Lamina apex shortly acuminate, ovary apex pubescent .... *S. kunthiana*

    Lamina apex acute, ovary apex glabrous .... *S. sainthomiana*

Disclosure statement

No potential conflict of interest was reported by the authors.

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Research Article

Strobilanthes mullayanagiriensis and *S. bislei* (Acanthaceae) - two new species from the Western Ghats, India

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Abstract

Strobilanthes mullayanagiriensis and *S. bislei* are plietesial species described for the flora of Western Ghats of India from Karnataka state. Pollen morphology is used as a key character for establishing these two species. Distribution and notes on its allied species are provided along with photographis for facilitating its identification. The former species readily distinguished from its allied species *S. consanguinea* by coriaceous and scabrous leaves with broadly ovate lamina, crenate margin and cuspidate apex, uninterrupted viscous spikes, longer bract: calyx ratio, much shorter corolla and pollen grains with ribs meet at the poles into two groups and one rib completely encircling the pollen. The latter species definitely distinguished from the allied species by uninterrupted viscous inflorescence with sericeous indumentum, calyx exceeds the bract, anthers are held parallel to the filament and ellipsoid pollen grains with slightly twisted ribs.

Keywords:

New species; *Strobilanthes;* Western Ghats

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Introduction

The Western Ghats is one of the hotspots in India known for high level of biological diversity and endemism. It is a home to a large number of threatened taxa including several species of *Strobilanthes* Blume (1). About 150 species of *Strobilanthes* have been reported from India and among them, 61 species are recorded for the Western Ghats (2–4). During explorations by the authors in Karnataka, interesting specimens of *Strobilanthes* was collected from Chikkamagaluru and Hassan districts (Fig. 1). The specimens were critically analysed, compared with herbarium specimens in India and abroad and significant study of relevant literature has revealed that the collections do not match any of the recognized species of *Strobilanthes* (3,5). Therefore, it is described as new to science.
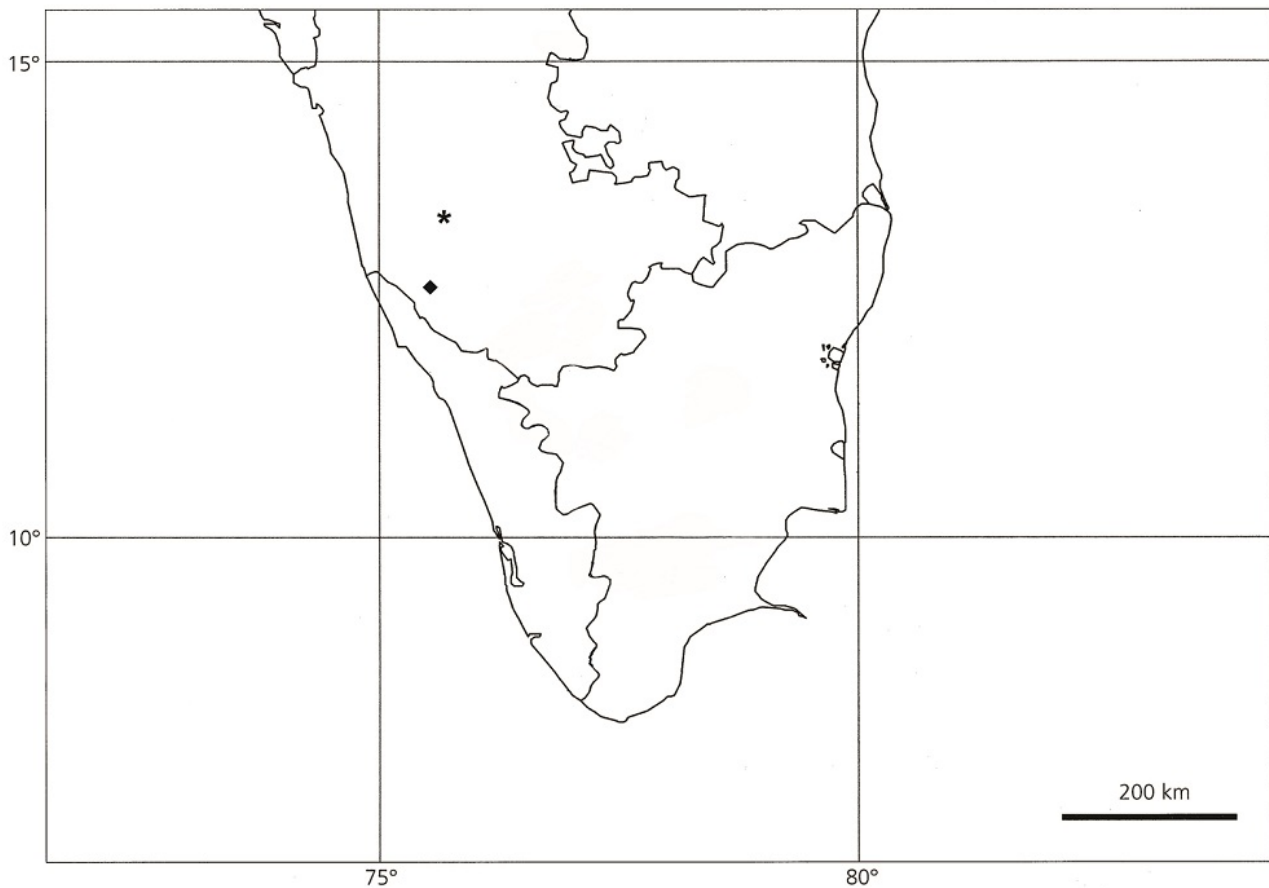
Fig. 1. Distribution of *Strobilanthes mullayanagiriensis* (∗) and *S. bislei* (◆).

Table 1: Comparison of pollen characteristics of new species and the allied taxa.

Species	Pollen class	Shape	Pseudocolpi	P (µm)	E (µm)	P:E ratio	Ribs
S. mullayanagiriensis	Prolate	Ellipsoid	Wide	43–47	26–30	1.60	14–16
S. gamblei	Per-prolate	Terete	Wide	49–53	24–28	1.96	16–19, spiral
S. consanguinea	Prolate	Barrel	Narrow	59–63	37–41	1.60	18–21, spiral
S. bislei	Prolate	Ellipsoid	Wide	46–51	32–34	1.46	20–24, slightly twisted

Taxonomic treatment

Strobilanthes mullayanagiriensis S. Thomas, B. Mani, S.J. Britto & Pradeep A.K., *sp. nov.* (Fig. 2).

The new species is similar to *Strobilanthes consanguinea* (Nees) T. Anderson in floral morphology such as spicate inflorescence with ventricose corolla and exserted stamens. However, it differs from *S. consanguinea* in overall vegetative morphology and having pollen grains with ribs united in to two groups at poles and one rib completely encircling the grain. At the same time, the new species shows similarity in vegetative morphology to *S. canarica* Bedd., but differs by overall floral morphology with regard to viscous uninterrupted spikes, bract ovate with long acuminate apex, bract always much longer than calyx, linear calyx lobes terminate with acuminate apex, bi-lipped corolla glabrous on outer surface, corolla lobes unequal and triangular, stamens exserted, pubescence on ovary apex and pollen grains with ribs united in to two groups at poles and one rib completely encircling the grain.

Type: INDIA. Karnataka: Chikkamagaluru District, Manikyadhare waterfalls, 1750 m MSL., 18 November 2018, *Pradeep A.K. & B. Mani 68840* (holotype RHT!; isotype MH! RHT!).

Erect bushy shrubs, up to 1 m tall; young shoot angled, canaliculated, mature terete, lenticellate, tomentose. Leaves opposite, symmetrical, broadly ovate, 6.5–9 × 3.6–5.6 cm, coriaceous, rounded and decurrent at base, cuspidate at apex, crenate-serrate at margin, short hairs present on abaxial surface, adaxial surface scabrous, tomentulose on mid-vein and lateral veins; lateral nerves 7–9 pairs, prominent on both surfaces, raised beneath; petiole 0.5–5 cm long, brown hairs present on abaxial surface and
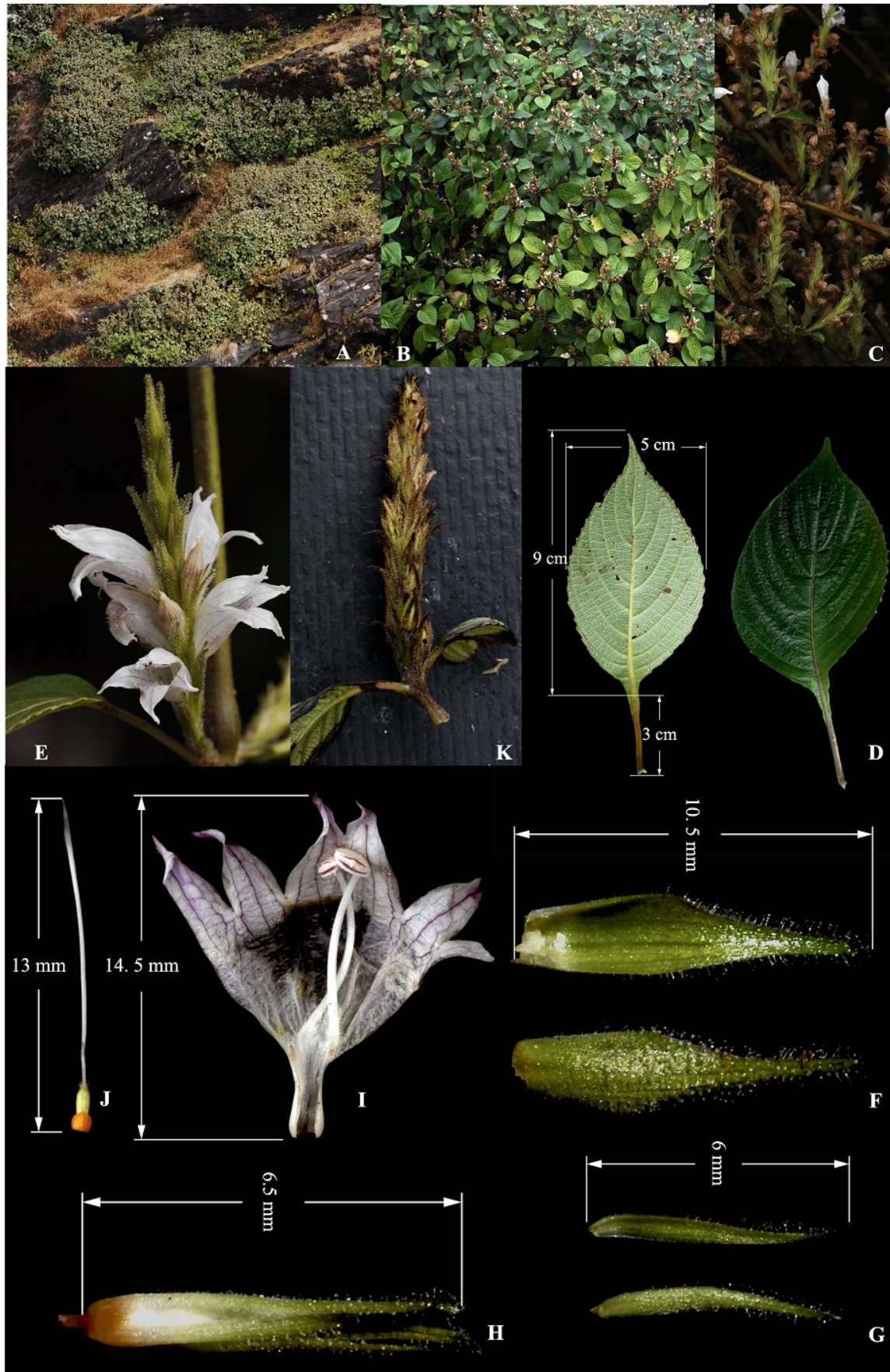
Fig. 2. *Strobilanthes mullayanagiriensis* sp. nov. **A–B**. Habit, **C**. Inflorescence in lower sections, **D**. Leaves, **E**. Inflorescence, **F**. Bracts, **G**. Bracteoles, **H**. Calyx, **I**. Corolla split open showing the epipetalous stamens having anthers held perpendicular to the filament, **J**. Pistil, **K**. Young infructescence.

tomentose on adaxial surface; Inflorescences axillary or terminal or lateral uninterrupted spikes, 30–65 × 6–8 mm, 1–3 forked, glandular hairy at anthesis; peduncle tomentose; bracts ovate, 10–10.5 × ca. 2.5 mm, acuminate at apex, abaxial surface tawny tomentose with glandular
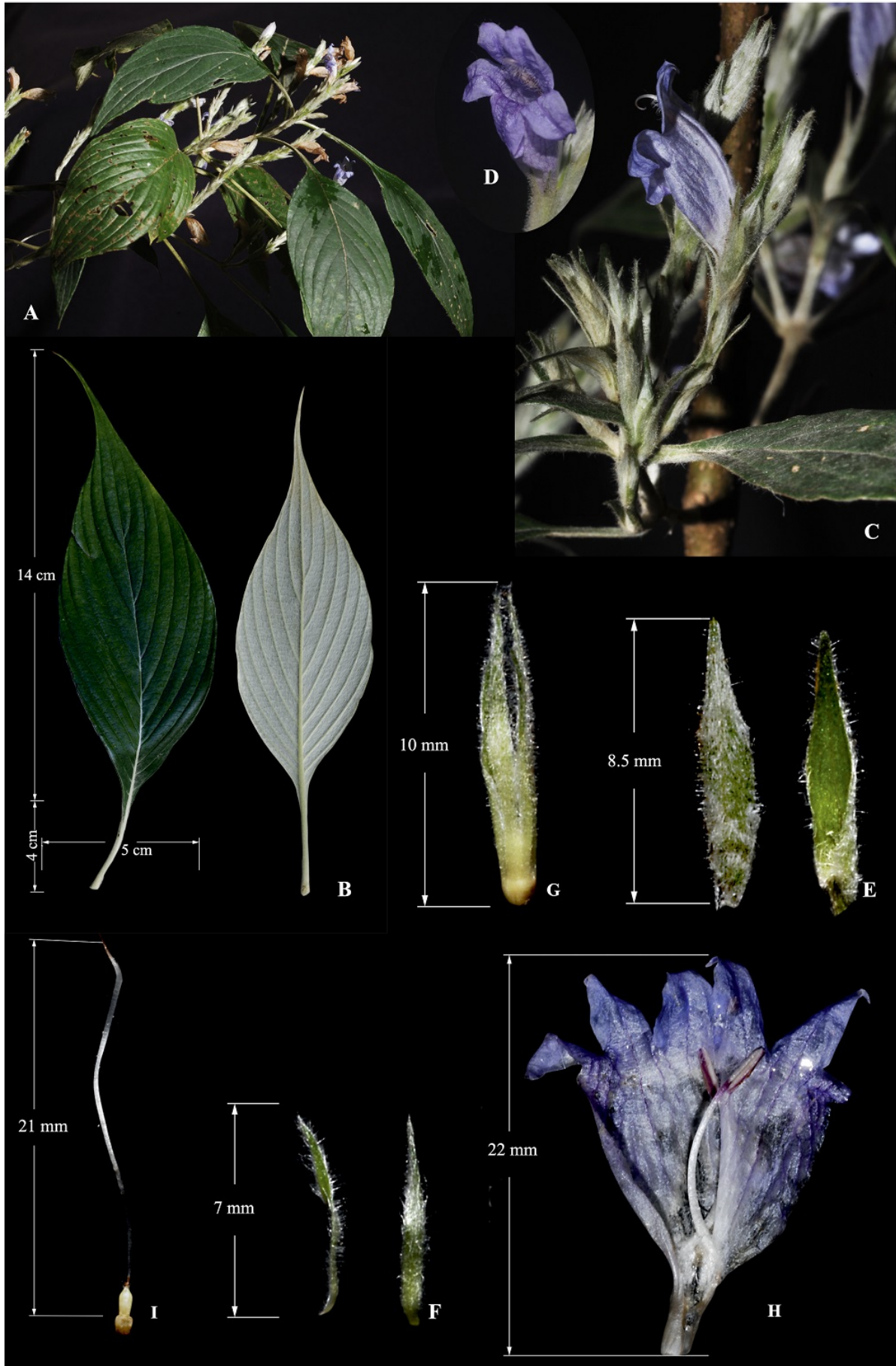
Fig. 3. *Strobilanthes bislei* sp. nov. **A**. Flowering twig, **B**. Leaves, **C**. Inflorescence, **D**. Flower, **E**. Bracts, **F**. Bracteoles, **G**. Calyx, **H**. Corolla split open showing the epipetalous stamens having anthers held parallel to the filament, **I**. Pistil.

hairs and adaxial surface fine hairy throughout, longer than calyx; bracteoles ca. 6 × 0.5 mm, linear, indumentum same as in bracts, axillary secondary flower buds absent. Calyx 6.5–7 mm long, tubular,
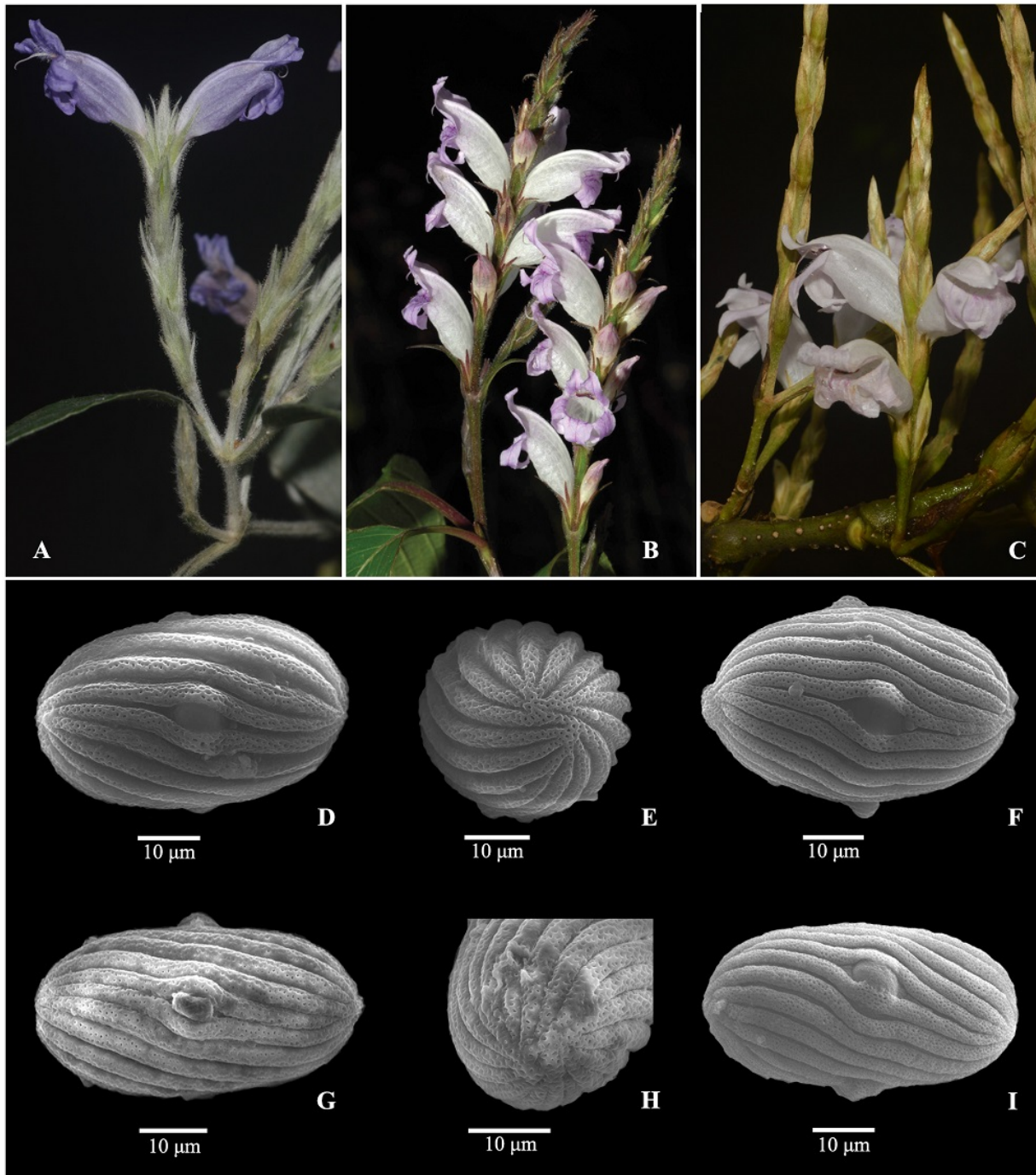
Fig. 4. Inflorescences of *Strobilanthes bislei* sp. nov. (**A**), *S. consanguinea* (**B**) and *S. gamblei* (**C**). SEM images of *Strobilanthes mullayanagiriensis* sp. nov. (**D–E**), *S. bislei* sp. nov. (**F**), *S. consanguinea* (**G–H**) and *S. gamblei* (**I**).

5-lobed, tube ca. 3 mm long, lobes ca. 4mm long, linear, equal, tomentose on the outer surface, pubescent inside. Corolla pale pink, 14–15 mm long, widening from the base, 5-lobed; tube ca. 2 mm long, glabrous outside, pubescent inside; throat ventricose, ca. 6 mm long, glabrous on the outer surface, long white hairy inside; lobes unequal, two adaxial lobes partly fused, ca. 3 × 2 mm, triangular, abaxial lobes recurved, ca. 5 × 2.5–3 mm, broadly triangular. Stamens 2, exserted, attached to the base of corolla tube; filaments ca. 6 mm long, villous on the proximal ¼; anthers ca. 1.5 × 1 mm, elliptic, thecae two, held perpendicular to filament. Pistil 12.5–13 mm long, ovary ca. 1.0 × 0.5 mm, pubescent at apex, 2-locular, 2 ovules per locule; style ca. 10 mm long, filiform, glabrous; stigma simple, ca. 1.5 mm long, glabrous.

Pollen morphology: Pollen grains are ellipsoid (Fig. 4D–E), tricolporate and contain wide pseudocolpi. It is prolate in outline and exine divided into longitudinal ribs, which are spiral, tectate and coalesces at poles in to two groups. One rib is completely encircling the grain. Tectum is perforate. Comparison of pollen characteristics (Table 1) with the related taxa, *S. consanguinea* (Fig. 4G–H) is also provided.

Etymology: The specific epithet refers to the Mullayanagiri peak which is the highest peak in Baba Budan Giri Hill ranges to which the type locality belongs.

Table 2: Comparison of diagnostic characters of new species with allied taxa.

Characters	*S. mullayanagiriensis*	*S. bislei*	*S. gamblei*	*S. consanguinea*
Lamina				
Shape	Broadly ovate	Ovate to elliptic	Ovate to elliptic	Ovate to broadly elliptic
Base	Decurrent	Slightly decurrent	Decurrent	Long decurrent
Apex	Cuspidate	Caudate- acuminate	Long acuminate	Short to long acuminate
Margin	Crenate-serrate	Entire	Entire	Serrate
Texture	Coriaceous, scabrous	Membranous	Coriaceous	Membranous
Veins	7–9 pairs	7–10 pairs	5–11 pairs	3–11 pairs
Abaxial indumentum	Short hairs present	Sericeous	Dense cream or tawny woolly	Often glabrous
Inflorescence	Uninterrupted viscous spikes	Uninterrupted viscous spikes	Interrupted non-viscous spikes	Interrupted spikes, rarely viscous
Bract				
Shape	Ovate	Ovate	Ovate–elliptic	Ovate
Apex	Long acuminate	Long acuminate	Acute to acuminate	Acuminate
Abaxial indumentum	Tawny	Sericeous	Cream or tawny	Often glabrous
Bract: calyx ratio	Longer	Shorter	Equal	Equal
Secondary buds in axils of bracteoles	Absent	Present	Present	Absent
Calyx				
Length	ca. 7 mm	8–11 mm	5–9.5 mm	4.8–8.1 mm
Apex	Acuminate	Acuminate	Acute	Acute
Abaxial indumentum	Tawny	Sericeous	Cream or tawny	Often glabrous
Lobes shape	Linear	Narrowly triangular	Lanceolate	Lanceolate
Corolla				
Colour	Pink	Blue	Pink	Pink
Tube	ca. 2 mm	4–5 mm	5–8 mm	2.1–4.8 mm
Throat	ca. 6 mm	11–12 mm	9.5–18 mm	7.4–14.8 mm
Lobes shape	Triangular	Triangular	Broadly triangular	Narrowly triangular
Attachment of anther to filament	Held perpendicular	Held parallel	Held perpendicular	Held perpendicular

Phenology: Flowers during November–December.

Habitat and distribution: It grows in the open rocky cliffs in the Baba Budan Giri Hills, Chikkamagaluru District in Karnataka at elevation of 1600–1800 m MSL.

Taxonomic notes: *Strobilanthes mullayanagiriensis* and *S. consanguinea* possesses spicate inflorescence with ventricose corolla and exserted stamens. However, the new species could readily be distinguished from the allied species by the characteristics such as bushy habit, coriaceous and scabrous leaves with broadly ovate lamina, crenate margin and cuspidate apex, puberulent abaxial lamina surface, uninterrupted viscous spikes, tawny abaxial bract indumentum and longer bract: calyx ratio, calyx lobes linear with acuminate apex, Etc. A detailed comparison of vegetative and floral characters is given in Table 2.

The variability of pollen morphology in *Strobilanthes* is a useful character to delimit taxa in this group (6–7). The pollen morphology of south Indian and Sri Lankan *Strobilanthes* was well documented and recognised (6). The new species and *S. consanguinea* have prolate pollen with spiral ribs. The pollen of *S. consanguinea* is characterized by having narrow psudocolpi, closely packed ribs, tectum is present on entire surface of the ribs and ribs coalesces at the poles in one group. At the same time, the pollen of *S. mullayanagiriensis* is distinguished by having wide psudocolpi, narrow ribs with tectum on top surface only and the ribs meet at the poles into two groups and one rib completely encircling the pollen. Moreover, the present and previous (6) studies have revealed that the pollen of *S. consanguinea* belongs to type I class and that of *S. mullayanagiriensis* is belongs to type II class (6). Therefore, by the analysis of vegetative, floral and micro morphological features suggested that *S. mullayanagiriensis* as a distinct species from its allied one.

Strobilanthes bislei S. Thomas, B. Mani, S.J. Britto & Pradeep A.K., *sp. nov.* (Fig. 3)

The new species is allied to *S. consanguinea* and *S. gamblei* Carine, J. Alexander & Scotland, however it differs from the allied taxa by possessing sericeous stem, leaves and inflorescence, lamina with 7–10 lateral nerves, uninterrupted viscous spikes, shorter bract: calyx ratio, larger calyx with sericeous indumentum, narrowly triangular calyx lobes with acuminate apex and blue corolla. Moreover, large ellipsoid pollen grains with 20–24 ribs are also the distinguishing feature of the new species.

Type: INDIA. Karnataka: Hassan District, Bisle Ghat, 800 m MSL., 19 November 2018, *Pradeep A.K. & B. Mani 68841* (holotype RHT!; isotype MH!, RHT!).

Erect shrubs, up to 2.5 m tall; young shoots 4-angled, canaliculated, densely sericeous, terete at maturity, tomentose, lenticellate. Leaves opposite, ovate to elliptic, 9.5–21 × 3–9.5 cm, membranous, attenuate at base, caudate-acuminate at apex, margin entire, dense sericeous on abaxial surface, young leaves with sparse sericeous hairs on adaxial surface, mature leaves with short hairs throughout on adaxial surface; lateral nerves 7–10 pairs, prominent on both surfaces, raised beneath; petiole 4–11 cm long, sericeous. Inflorescences axillary, terminal or lateral uninterrupted spikes, 60–85 × 5–7 mm, 1–3 forked, dense sericeous and glandular hairy at anthesis; peduncle quadrangular, sericeous with glandular hairs; bracts ovate, 7.5–8.5 × ca. 2 mm, shorter than calyx, acuminate at apex, abaxial surface glandular hairy and sericeous, adaxial surface glabrous; bracteoles 6–7 × 0.5–0.75 mm, linear, sericeous with glandular hairs. Calyx 10–11 mm long, tubular, tube 3.5–4 mm, 5-lobed, unequal, two lobes shorter than the rest, shorter lobes 4.5–5 mm long, longer lobes 6.5–7 mm long, narrowly triangular, acuminate at apex, dense sericeous with glandular hairs outside, glabrous inside. Corolla blue, 19–23 mm long, widening from the base, 5-lobed; tube 4–5mm long, glabrous; throat ventricose, 11–12 mm long, puberulent on outside, long white hairy inside; lobes unequal, fine pubescent outside, glabrous inside, two adaxial lobes partly fused, ca. 3 × 2–3 mm, triangular, abaxial lobes 4–5 × 3–4 mm. Stamens 2, exserted, basally attached to corolla tube; filaments 9–10 mm long, glabrous; anthers ca. 3 × 1mm, oblong, thecae two, held parallel to the filament. Pistil 21–23 mm long, ovary ca. 2 × 1 mm, pubescent towards apex, 2-locular, 2 ovules per locule; style 16–18 mm long, filiform, glabrous; stigma simple, curved, ca. 3 mm long, glabrous.

Pollen morphology: Pollen grains are ellipsoid (Fig. 4F), tricolporate and contain wide pseudocolpi. It is prolate in outline and exine divided into longitudinal ribs, which are slightly spiral, tectate and coalesce at poles. None of the ribs is completely encircling the grain. Tectum is perforate. Comparison of pollen characteristics (Table 1) with the related taxa, *S. consanguinea* (Fig. 4G–H) and *S. gamblei* (Fig. 4I) is also provided.

Etymology: The specific epithet refers to Bisle Ghat which harbours rich biodiversity and is part of the central Western Ghats. The Bisle Reserve Forest of Gundia river basin, constitutes a vital part of the Mysore Elephant Reserve. It covers an area of 3,339 ha with annual rainfall in the range of 500–600 cm. The reserve mainly consists of species rich evergreen forests have high degree of Western Ghats endemism both among the trees as well as among the ground vegetation. It connects Pushpagiri Wildlife Sanctuary in the south and Kempholé Reserve Forest in north. It is an intrinsic and important part of the Mudumalai - Nagarhollé - Brahmagiri - Muttodi Corridor (8).

Phenology: Flowering on October–November.

Habitat and distribution: It grows on the exposed rocks in the Bisle Ghat forest reserves in Hassan District in Karnataka at an elevation of 700–800 m a.s.l.

Taxonomic notes: *Strobilanthes bislei, S. consanguinea* and *S. gamblei* have spicate inflorescence with ventricose corolla and exserted stamens. However, the new species could readily be distinguished by the uninterrupted viscous inflorescence with sericeous indumentum (Fig. 4A–C). Another striking diagnostic feature of the new species from the allied taxa is the presence of much longer calyx with narrowly triangular lobes which exceeds the bract (Table 2). The corolla of *S. bislei* is blue in colour whereas that of the allied species is pink (Fig. 4A–C). Moreover, anthers are held parallel to the filament in new taxon while it is held perpendicular in *S. consanguinea* and *S. gamblei*. Finally, ellipsoid pollen grains with slightly twisted ribs are characteristic in *S. bislei*. A detailed comparison of *S. bislei* with the allied species is given in Table 1 and Table 2.

Competing interest

Authors' contributions

Acknowledgements

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ROOT AND TUBER VEGETABLES – A NUTRIENT STUDY AND VITAMIN C ESTIMATION

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Introduction and literature review

Vegetables are plants or parts of plants served with the main course of a meal. Apart from their nutritive value, vegetables probably do more than any other groups of foods to add appetizing color, texture and flavor to our daily food. With the wide choice of colour of vegetables, it is possible to select a vegetable with desired colour to heighten the appearance of a meal. Various parts of plants vary in their water, protein, vitamin, mineral and carbohydrate contents [1]. Detection of minerals in vegetables means detection of elements other than carbon, hydrogen and oxygen.

The nutritive value of different vegetables varies sufficiently and it is wise to serve a variety of vegetables to ensure that all the necessary nutrients from the vegetables category are included in the diet. Vegetables, as a group, contribute in digestible fiber, minerals and vitamins to diet. Most vegetables, except those containing starch which provides a useful source of energy, are low in calories. The indigestible fiber content of vegetables contributes to the roughage promoting the mobility of the food through the intestine [2].

OBJECTIVES

The main objective of this project is to the analyze the nutritional information of the selected samples such as Carrot, Chinese Potato, Colocasia, Potato, Tapioca, Yam which are used in our day today life. This study also focuses on the determination of vitamin C content in these samples since adequate consumption of vegetables with high level of vitamin C can help in health improvement and thus reduce diseases such as diabetes, glaucoma,

atherosclerosis, stroke, heart diseases and cancer. Analysis of pH content was also determined.

Materials and Methods

Sample preparation: 5g of sample vegetable is weighed out and squeezed in a mortar. 10ml of distilled water was added and it is squeezed again. Repeat the procedure for 2-3 times and the solution is filtered into 100ml standard flask. The solution was made up into 100ml.

Chemicals used: Picric acid, , Ammonium hydroxide, Ammonium carbonate, Ammonium chloride, Hydrogen sulphide, Disodium hydrogen phosphate, Ammonium molybdate, Concentrated Hcl, Dilute H_2SO_4, Dilute $KMnO_4$, Concentrated H_2SO_4,Copper sulphate, Acetic acid, Sodium hydroxide, Fehling's solution A and B, Tollen's, Benedict's solution, Potassium iodide, Potassium iodate, Ascorbic acid, Starch solution.

Analysis

For the analysis of Root vegetables the following experiments were carried out:

- **Test for Potassium:** To a little of the sample solution in a test tube add 2ml of picric acid solution and shake well. Formation of a yellow precipitate indicates the presence of potassium ions.

- **Test for calcium:** To a little of sample solution, ammonium hydroxide and excess of ammonium carbonate solutions are added. A white precipitate indicates the presence of calcium.
- **Test for Zinc:** To a little of sample solution, ammonium chloride and excess of ammonium hydroxide solutions are added then hydrogen sulphide is passed through it. A white (or dirty white) precipitate indicates the presence of zinc.
- **Test for Magnesium:** To a little of the sample solution in a test tube add NH_4Cl, NH_4OH and excess of disodium hydrogen phosphate solution. The inner sides of the test tube containing the above mixture are scratched using a glass rod. Formation of white precipitate indicates the presence of magnesium ions.
- **Test for Phosphate:** A few drops of sample solution is mixed with1ml concentrated $HNO_{3\ heat\ and\ cool}$. Is then added to about 2ml of ammonium molybdate solution taken in a test tube and shaken well. Canary yellow precipitate confirms the presence of phosphate ions.
- **Test for Manganese:** To a little of sample solution, ammonium chloride and excess of ammonium hydroxide solutions are added and then hydrogen sulphide is passed through it. A flesh colored precipitate.
- **Test for sodium:** A little of sample solution is made a paste with concentrated hydrochloric acid and flame test is conducted with this paste. A golden yellow flame indicates the presence of sodium.
- **Test for Iron:** a little of sample is acidified with dilute sulphuric acid and dilute potassium permanganate is added in drops. Color of potassium permanganate is discharged. This indicates the presence of iron.
- **Test for Carbohydrate (molisch's test):** A little of the sample solution taken in a test tube and add 2 drops of 1%

of alcoholic α- naphthol solution. Add about 1ml of conc.H_2SO_4 carefully along the sides of test tube. A violet ring at the junction of two layers shows the presence of carbohydrate.

- **Test for Glucose:** Its presence is detected by the following tests:
    - **Fehling's solution test:** A little of sample solution taken in a test tube and add few drops of Fehling's solution at equal amount. The test tube is heated on a water bath for 10 minutes. Appearance of brown precipitate confirms the presence of glucose in root vegetables.
    - **Tollen's test:** A little of the sample taken in a test tube and add 2ml of tollen's reagent. The test tube is heated on a water bath for a few minutes. Appearance of silver mirror indicates the presence of glucose.
    - **Benedict's solution test:** A little of sample taken in a test tube and add a few drops of   Benedict's reagent. The test tube was heated for a few seconds. Formation of reddish color confirms the presence of glucose.
- **Test for proteins:** Biuret Test: Take about 1ml of dilute testing solution. Then add 3 drops of copper sulphate solution followed by about 1ml of 10 N ammonium hydroxide solutions. Mix the ingredients thoroughly and note the color. The production of purple to violet color indicates the presence of protein.
- **Test for steroids:** 1g of the test substance (vegetable extracts) was dissolved in a few drops of acetic acid. It was gently warmed and cooled under the tap and a drop of concentrated sulphuricacid was added along the sides

of the test tube. Appearance of green color indicates the presence of steroids.

- **Test for tannins:** The substance (extracts) mixed with basic lead acetate solution. Formation of white precipitate indicates the presence of tannins.
- **Test for flavonoids:** Extract is treated with few drops of NaOH solution. Formation of intense yellow color indicates presence of flavonoids.
- **Test for saponins:** The substance is shaken with water; foamy lather formation indicates the presence of saponins.
- **Test for quinines:** To the test substance, sodium hydroxide was added. Blue green or red color indicates the presence of quinines.

Determination of pH

The pH root vegetable juices were measured with the help of calibrated pH meter (digital readouts). The vegetable juice samples were taken in a 100 ml beaker and the pH meter was immersed in it. The stabilized values are taken to find out the pH of the samples.

Estimation of Vitamin C

- **Preparation of iodine solution:** 5.00g potassium iodide (KI) and 0.268g potassium iodate (KIO_3) where dissolved in to 500ml beaker with 200ml distilled water. 30 ml of 3 M sulphuric acid was added in to the beaker and then diluted with distilled water until 500 ml solution.
- **Preparation of vitamin C standard solution:** 0.250 g ascorbic acid was dissolved in the beaker with 100 ml distilled water. The solution was transferred 250 ml volumetric flask and diluted to the mark with distilled water.
- **Standardization of iodine solution:** 20 ml of vitamin C solution was pipette in to a 125 ml Erlenmeyer flask. 4 drops of 1% starch solution were added and then titrated against

iodine solution until blue black color was observed. The titrations were repeated for concordant values.

- **Titration of vegetable juices:** 20 ml of sample was pipette into a 125 ml Erlenmeyer flask. Followed by 20 drops of 1% starch solution and titrated against iodine solution until blue-black was observed. Titrations were repeated three times and average values are taken.

RESULTS AND DISCUSSIONS:

Mineral Analysis

Potassium-deficient people may also experience high blood pressure, pain in their intestines, swelling in their glands and diabetes as serious side effects of this deficiency. It was observed that all the selected root and tuber vegetables were rich in potassium so it gives yellow precipitate when treated with picric acid. Calcium is a mineral that is an essential part of bones and teeth. Aside from strengthening bones, calcium is also involved in many body functions such as muscle contraction, blood circulation, and nervous system relay activities. A calcium deficiency can lead to problems such as high blood pressure, cardiovascular disease, arthritis and osteoporosis.

Zinc is called an "essential trace element" because very small amounts of zinc are necessary for human health. It is also used for boosting the immune system, treating the common cold and recurrent ear infections, and preventing lower respiratory infections. It was observed that carrot and yam contains zinc as it gives white precipitate for the zinc analysis.

Magnesium deficiency, especially prevalent in older populations, is linked to insulin resistance, metabolic syndrome, coronary heart disease, and osteoporosis. It includes muscle aches or spasms, poor digestion, anxiety, and trouble sleeping. It was observed that all selected root and tuber vegetables except colocasia contains magnesium as it gives white precipitate in the magnesium analysis.

The most significant deficiency symptoms of phosphorus include weak bones and discomfort in various body joints. It was observed that all the selected root and tuber vegetables contains phosphate as it gives canary yellow precipitate in the phosphate analysis.

Manganese is a mineral naturally occurring in our bodies in very small amounts. The symptoms of manganese deficiency include high blood pressure, heart ailments, muscular contraction, bone malformation, high cholesterol, and poor eyesight, hearing trouble, severe memory loss, shivers and tremors. It was observed that carrot, yam and Chinese potato contains manganese as it gives flesh coloured precipitate in the analysis of manganese.

Sodium is an essential element for all animals and some plants. Sodium ions are the major cation in the extracellular fluid (ECF) and as such are the major contributor to the ECF osmotic pressure and ECF compartment volume. Loss of water from the ECF compartment increases the sodium concentration, a condition called hypernatremia.

Iron deficiency may often cause severe fatigue, body weakness, and other related health ailments. People lacking it cannot perform normal functions in an optimal way. Furthermore, women and children need more iron than their male counterparts, and anemia strikes them particularly hard. It was observed that all the selected root and tuber vegetables contains iron as it discharge the colour of $KMnO_4$ in the iron analysis.

Carbohydrates provide energy required for your daily activities. Diets rich in carbohydrates can be helpful in reducing weight and controlling muscle tones in sharp contrast with fad diets would like you to believe. It was observed that all the selected root and tuber vegetables contain carbohydrate as it gives a violet ring in the analysis of the carbohydrate.

Glucose is not only needed to produce energy so you could do all the activity daily without the sign of exhaustion but glucose is also needed as part of the recovery.It was observed that all the

selected root and tuber vegetables contains glucose as it gives brown precipitate in the fehling's test, silver mirror in the tollen's test and reddish colour in the benedict's test for the analysis of glucose.

Consumption of adequate protein ensures strong immune defense, efficient signaling of nerves and impulses, healthy hair and maintenance of fluid balance in the body. It was observed that all selected root and tuber vegetables contains protein as it gives violet to purple colour in the analysis of protein.

	Carrot	Yam	Potato	Colocasia	Tapioca	Chinese
Potassium	✔	✔	✔	✔	✔	✔
Magnesium	✔	✔	✔	✖	✔	✔
Phosphate	✔	✔	✔	✔	✔	✔
Iron	✔	✔	✔	✔	✔	✔
Carbohydrate	✔	✔	✔	✔	✔	✔
Glucose	✔	✔	✔	✔	✔	✔
Protein	✔	✔	✔	✔	✔	✔
Sodium	✔	✖	✖	✖	✔	✖
Zinc	✔	✔	✖	✖	✖	✖
Calcium	✔	✔	✔	✖	✔	✔
Manganese	✔	✔	✖	✖	✖	✔

Test for Steroids, Tannins, Flavonoids, Saponins and Quinines

The steroids can harm your central nervous system and you may be at high risk of psychosis. The body growth can be increased quickly with proper intake of steroids. The physical strength and stamina of person is increased to large extent. A person fells positive and more confident. It was observed that all the root and

tuber vegetables does not contains steroids as it does not give any green colour in the analysis of steroids.

	Carrot	Yam	Potato	Colocasia	Tapioca	Chinese potato
Steroids	✖	✖	✖	✖	✖	✖
Tannins	✔	✔	✔	✔	✔	✔
Flavonoids	✔	✔	✔	✖	✖	✔
Saponins	✔	✔	✔	✔	✔	✔
Quinines	✖	✔	✖	✖	✖	✔

Most of the tannins fight cavities, diarrhea, and some even protect heart diseases and cancer. They disable bacteria in the mouth, which inhibits plaque formation. Tooth decay is also prevented. But they stain teeth. It was observed that all the selected root and tuber vegetables contains tannins as it gives white precipitate when treated with basic lead acetate solution.

Flavonoids are best known for their antioxidant and anti-inflammatory health benefits as well as the support of the cardiovascular and nervous systems. Risk of dietary deficiency for flavonoids is basically synonymous with low dietary intake of whole, natural foods, and in particular, low intake of vegetables and fruits. It was observed that all the root and tuber vegetables except colocasia and tapioca contains flavonoids as it gives intense yellow colour when treated with NaOH.

Saponins-group of chemicals with detergent-like properties that plants produce to help them resist microbial pathogen such as fungi and certain bacteria and viruses. Health benefits of saponins include control of blood cholesterol levels, bone health, cancer, and building up the immune system. It was observed that all the selected root and tuber vegetables contain saponins as it forms foamy lather when it is shaken well with water.

Saponins are thought to bond with cholesterol and other pathogens in your body. This prevents them from being absorbed by your body, carrying them through your body's digestive system instead, where they can be properly eliminated. It was observed that yam and Chinese potato contains quinines as it gives green colour when treated with NaOH solution.

No	Sample	Observation	Inference
1.	Carrot	No precipitate	Absence of quinines
2.	Yam	Green color	Presence of quinines
3.	Potato	No precipitate	Absence of quinines
4.	Colocasia	No precipitate	Absence of quinines
5.	Tapioca	No precipitate	Absence of quinines
6.	Chinese potato	Green color	Presence of quinines

Determination of pH:

The pH of all selected root and tuber vegetables were found to be in the range 5.2-6.5. It clear that colocation is slightly acidic among the selected vegetables and tapioca and the Chinese potato are the least acidic vegetables. Whereas the all the other samples almost neutral.

pH

	pH
Carrot	6.3
Yam	5.5
Potato	5.2
Colacasia	4.3
Tapioca	6.5
Chinese potato	6.5
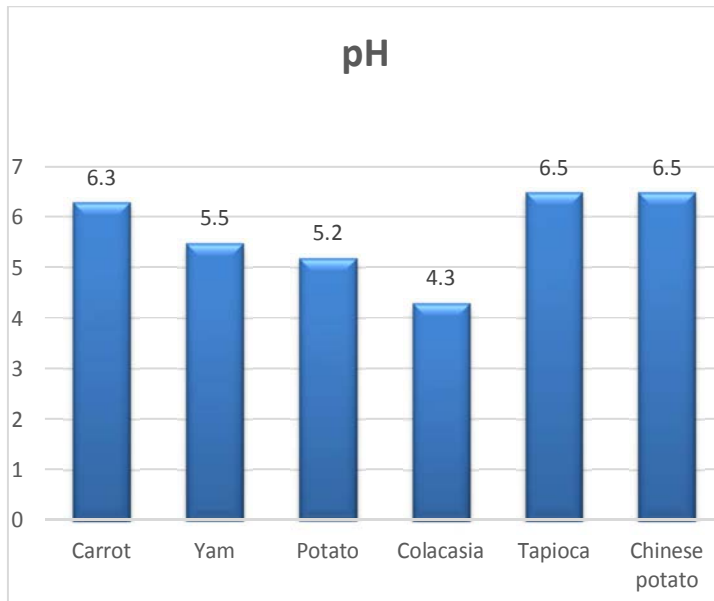
Vitamin C

Vitamin C, also known as ascorbic acid and L-ascorbic acid, is a vitamin found in food and used as a dietary supplement. As a supplement it is used to treat and prevent scurvy [3]. Evidence does not support use in the general population for the prevention of the common cold [4] . It may be taken by mouth or by injection.[3]. It is generally well tolerated [3]. Large doses may cause gastrointestinal upset, headache, trouble sleeping, and flushing of the skin.[5] . Normal doses are safe during pregnancy [6]. Vitamin C is an essential nutrient involved in the repair of tissue [3].From

the above data it is found that highest vitamin C is found in yam having 4.4768mg/100g followed by Tapioca (3.936), Potato (3.165), Colocasia (2.933), Carrot (1.852) and Chinese Potato (0.2933).
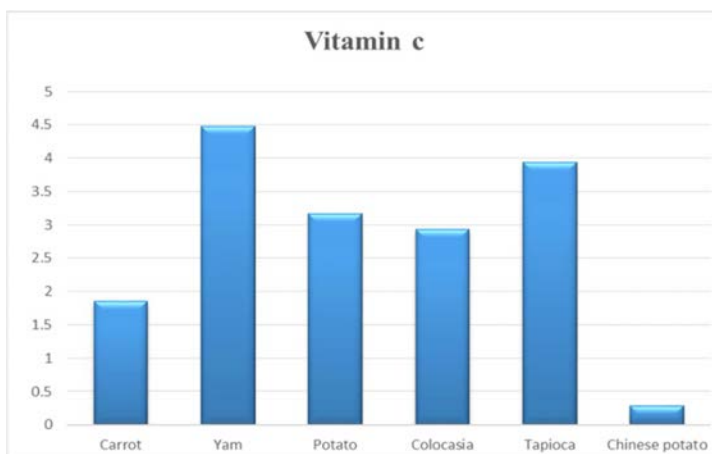
CONCLUSIONS

- Our analysis provides that selected root and tuber vegetables such as carrot, Yam, Potato, Colocasia, Tapioca, And Chinese Potato are rich in potassium, phosphate, iron, carbohydrate, glucose, protein, tannins and saponins.
- Calcium is present in all the selected samples except colocasia.
- Among the samples zinc is present in carrot and yam whereas it is absent in potato, colocasia, tapioca and Chinese potato.
- Magnesium is present among the all the selected samples except colocasia.
- Among the samples manganese is present in carrot, yam and Chinese potato whereas it is absent in potato, colocasia and tapioca.

- Sodium is present in carrot and tapioca while it is absent in all the other selected samples.

- Steroids are absent in all the selected root and tuber vegetables.

- Among the samples flavonoids are present in carrot, yam, potato and Chinese potato whereas it is absent in colocasia and tapioca.

- Quinines are present in yam and Chinese potato while it is absent in all the other samples.

- The Moisture content value was found to be highest in Potato and least in Tapioca.

- The pH of all selected vegetables juices was found to be in the range 5.2-6.5. Our analysis showed that selected vegetables juices are acidic in nature. The pH value was found to be highest in Tapioca (6.5) and Chinese potato (6.5) and least in Colocasia (4.3).

- The ascorbic acid content of selected vegetables juices were determined iodometrically ,and the highest value of vitamin C is found in yam (4.48 mg/100g), followed by tapioca (3.94mg/100g), potato (3.17 mg/100g), colocasia (2.93 mg/100g), carrot (1.85 mg/100g) and Chinese potato (0.29mg/100g).

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EXPLORATION OF HEATHCLIFFE'S TRANSITION FROM SLAVE TO MASTER IN EMILY BRONTE'S DYSTOPIA *WUTHERING HEIGHTS*

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Abstract

From being an outcast, though only to a few, to the master of the manor,Wuthering Heights, the transition of Heathcliffe is tremendous. Heathcliffe, the dark horse, in every literal sense, waited for his day to dawn, to finally be the ruler, master of Wuthering Heights .Heathcliff's zeal for Catherine is so dark and ominous that he becomes hell-bent on destroying the happiness of her daughter and even his own son. Heathcliff's departure after Catherine's marriage shows his overwhelming mental anguish in realizing that Catherine shall never be his. Heathcliff's frustration on never having the love of his life and Hindley torturing him in his young days makes him a discourteous and a scamp.

Introduction

The Earnshaws named the boy, whom Mr. Earnshaw brought from Liverpool, as Heathcliff. This was the name of a son who died in childhood, and it served him ever since, both for Christian and surname. (Bronte 29)

Catherine was the only accomplice Heathcliff had in Wuthering Heights. Hindley ostracized Heathcliff from childhood. Hindley always used to thrash Heathcliff. But Heathcliff never complained and endured Hindley's blows.

He seemed a sullen, patient child, hardened, perhaps, to ill-treatment: he would stand Hindley's blows without winking or shedding a tear, and my [Nelly] pinches moved him only to draw in a breath, and open his eyes as if he had hurt himself by accident, and nobody was to blame. This endurance made old Earnshaw furious

when he discovered his son persecuting the poor, fatherless child, as he called him (Bronte 30).

Mr.Earnshaw heeded Heathcliff more than his own two children, which made Hindley covetousand he saw his father as atyrant.

So, from the very beginning, he bred bad feeling in the house; and at Mrs. Earnshaw's death which happened in less than two years after, the young master had learnt to regard his father as an oppressor rather than a friend, and Heathcliff as a usurper of his parent's affections and his privileges, and he grew bitter with brooding over these injuries. (Bronte 30)

Once Mr. Earnshaw purchased a couple of colts to Wuthering Heights. Heathcliff took the handsomest, but it illand Heathcliff wanted to exchange colts with Hindley. Unsurprisingly Hindley refused. Heathcliff said if Hindley won't give his colt then he will tell Mr. Earnshaw about the thrashings Hindley gave him. But Hindley did not heed his words. Instead Hindley cuffed Heathcliff over his ears and heavedan iron weight at Heathcliff. It hit Heathcliff's breast, and he got knocked down. Nelly was surprised to see Heathcliff getting up coolly like nothing happened.

I was surprised to witness how coolly the child gathered himself up, and went on with his intention, exchanging saddles and all, and then sitting down on a bundle of hay to overcome the qualm which the violent blow occasioned, before he entered the house." (Bronte 31)

When they were children Hindley used to harm Heathcliff a lot because his father had compassion for the "fatherless child". And since his father's love moved to Heathcliff rather than him, Hindley grew into a disobedient and offensive son. His father sent him to college to end his enmity with Heathcliff and to bring about some changes in his conduct.

Soon after Mr.Earnshaw dies, Hindley takes over Wuthering Heights. He allowed Heathcliff to stay, but only as a servant. But

Catherine and Heathcliff were very close friends. And Hindley was always worried about their friendship.

Once Catherine and Heathcliff go off to Thrushcross Grange, where the Lintons lived. As a result ofa dog bite Catherine continues with the Lintons till her wound is nursed back to health. Afterward when she comes back to Wuthering Heights she initiallyasks for Heathcliff. Hindley becomes aggravated and asks Heathcliff to come and see Catherine like the other servants.

Heathcliff, you may come forward. You may come and wish Miss Catherine welcome, like the other servants. (Bronte 41)

Catherine so journ with the Lintons makes her very intimate with Edgar Linton. This hurts Heathcliff. He wishes that he was like Edgar Linton so that Catherine would think highly of him, like she had a high regard for Edgar.

I wish I had light hair and a fair skin, and was dressed and behaved as well, and had a chance of being as rich as he will be!" (Bronte 44)

One day the Lintons visit Wuthering Heights. Heathcliff scrubs himself to look neat and tidy like Edgar. Mrs.Linton asks Hindley to keep that 'naughty and swearing boy' out of her children's sight. When Hindley sees Heathcliff clean and cheerful his anger amplifies.

They met, and the master, irritated at seeing him clean and cheerful, or, perhaps, eager to keep his promise to Mrs.Linton, shoved him back with a sudden thrust, and angrily bade Joseph "keep the fellow out of the room-send him into the garret till diner is over. He'll be cramming his fingers in the tarts, and stealing the fruit, if left alone with them a minute. (Bronte 45)

He shall have his share of my hand, if I catch him downstairs again till dark" cried Hindley. "Be gone, you vagabond! What! You are attempting the coxcomb, are you? Wait till I get hold of those elegant locks-see if I won't pull them a bit longer! (Bronte 45)

When Edgar Linton taunts Heathcliff, about his locks, they get into a fight. Hindley comes and takes Heathcliff away and punches

him. While Heathcliff comes back he is red and breathless. Catherine dismisses her old playmate's quandary and pays attention to her new friends. All this builds revulsion and vengeancein Heathcliff towards Hindley.

'I'm trying to settle how I shall pay Hindley back. I don't care how long I wait, if I can only do it, at last. I hope he will not die before I do!'

'For shame, Heathcliff!' said I [Nelly] 'It is for God to punish wicked people; we should learn to forgive.'

'No, God won't have the satisfaction that I shall,'he returned. 'I only wish I the best way! Let me alone, and I'll plan it out: while I'm thinking of that, I don't feel pain." (Bronte 47)

The hatred and revenge towards his master, Hindley, grows fervent everyday in Heathcliff's mind. Usually in most of the stories about slaves we see that they will be devoted to their masters and will show high respect to their masters. Taking the example of Daniel Defoe's Robinson Crusoe, there is a slave called Friday. He is handsome yet looks savage. His master names him Friday. Friday obeys his master just fine.

Friday believed that it was his duty to remain loyal and stanch to his master. He treasured his master though his master made him work like a dog. Friday neither complained nor wanted deliverance from his master.

However Heathcliff is just the reverse. Unlike Friday, Heathcliff was adopted by Hindley's father to his family. As a result Heathcliff was moreover like a member of the family when Mr.Earnshaw was alive. Subsequently when Hindley took over Wuthering Heights everything changed. Heathcliff became a servant, who loathed his master.

Along with him, grew his abhorrence towards his master. He waited for the day he would be able to take revenge on his master.

If old man Earnshaw's policies seem rather capricious, the next generation is clearly perverse. Hindley Earnshaw exercises power out

of class anger and fraternal rivalry. His aim is to obstruct legitimate desires, those to which one is entitled by nature rather than rank, and he succeeds in twisting Heathcliff's spontaneous desire for Catherine into a lust for vengeance. Hindley is portrayed in this novel as brutal degraded sort, strong in the desire to work all mischief, but impotent in his degradation.

Heathcliff may be considered as the hero of *Wuthering Heights*, if a hero there be. He is an incarnation of evil qualities; implacable hate, ingratitude, cruelty; falsehood, selfishness and revenge.

Catherine Earnshaw decides to marry Edgar Linton although she loves Heathcliff. But Catherine fears that she will be poor if she marries Heathcliff.

"Nelly, I see now, you think me a selfish wretch, but, did it never strike you that if Heathcliff and I are married, we should be beggars? Whereas, if I marry Linton, I can aid Heathcliff to rise, and place him out of my brother's power." (Bronte 63)

After Hindley's wife's death Hindley is caught in a downward spiral of destructive behavior, and ruins the Earnshaw family by drinking and gambling in excess.

Knowing that Catherine was going to marry Edgar, Heathcliff runs away. He later returns with lots of money. His master Hindley was in a state of loss. Hindley does not care about his life. He was always drunk and never cared for his son, Hareton. Hindley loses his mind by drinking. Heathcliff stays at Wuthering Heights and spends his time gambling with Hindley and teaching Hareton bad habits. Hindley dissipated his wealth and mortgaged his house to Heathcliff to pay his debts. Hindley later dies after a fight with Heathcliff. Heathcliff takes over Wuthering Heights and Hareton. He degrades and perverts Hareton. Heathcliff taught him vulgarities as a way of avenging himself on his father, Hindley. Hareton speaks with an accent similar to Joseph and works as a servant at Wuthering Heights, unaware of his true rights.

With no one to care and teach good lessons, Hareton grows up as a rude and rough man. Heathcliff makes Hareton work very hard Hareton toils night and day. Heathcliff thus takes revenge on Hindley, through his son, Hareton. He treats Hareton very badly. But Hareton remains loyal to him.

When Heathcliff suffered from his master from his childhood days, he waited silently to take revenge. He also loathed Edgar Linton for marrying his love, Catherine Earnshaw. Heathcliff behaves bad to the second generation, Catherine [Edgar's daughter], Hareton and his son Linton. He makes Hareton suffer under him. He induces Catherine to marry Linton. Linton was a sick boy. When he became seriously ill, Heathcliff does not even send for the doctor, because he never loved his son, because he loathed his mother Isabella.

The guest was now the master of Wuthering Heights: he held firm possession, and proved to the attorney, who, in his turn, proved it to Mr.Linton, that Earnshaw had mortgaged every yard of land he owned for cash to supply his mania for gaming; and he, Heathcliff, was the mortgagee. In that manner, Hareton who should now be the first gentleman in the neighbourhood, was reduced to a state of complete dependence on his father's inveterate enemy; and lives in his own house as a servant deprived of the advantage of wages, and quite unable to right himself, because of his friendlessness, and his ignorance that has been wronged. (Bronte 144)

His son Linton dies, making young Catherine a widow. His [Heathcliff] cruelty never ends. After Linton's death Catherine goes back to Thrush cross Grange. But he forces her to leave Thrush cross Grange and stay in Wuthering Heights. He hates young Catherine because she is the daughter of Edgar Linton. But seeing her often reminds him of her mother, Catherine Linton. Before his death Heathcliff was able to take revenge on his master, making his master's son, a slave under him, owning Wuthering Heights and Thrush cross Grange. Thus Heathcliff becomes the master and his master's son his slave.

Human Degradation in *Wuthering Heights*

Wuthering Heights is aoutlandish story. There are evidences in each chapter of the natureof rugged power, an unconscious strength, which the possessor seems to never think of turning to the best advantage. The general effect is inexpressibly painful. The novel presents shocking pictures of the worst forms of humanity.

Wuthering Heights casts a gloom over the mind not easily to be dispelled. It is a sprawling story, carrying us, with no mitigation of anguish, through two generations of sufferers, though one presiding evil genius sheds a grim shadow over the whole and imparts a singleness of malignity to the somewhat disjointed tale.

Inconceivable as are the combinations of human degradation which are here to be found moving within the circle of a few miles. The reality of unreality has never been so aptly illustrated as in the scenes of almost savage life which Emily Bronte has brought so vividly before us.There is no single character which is not utterly hateful or thoroughly contemptible. If you do not detest the person, you despise him; and if you do not despise him, you detest him with your whole heart.

Hindley, the brutal, degraded sort, strong in the desire to work all mischief, but impotent in his degradation; Linton Heathcliff, the miserable, driveling coward in whom we see selfishness in its most abject form; and Heathcliff himself, the presiding evil genius of the piece, the tyrant father of an imbecile son, a creature in gigantic excess-form a group of deformities such as we have rarely seen gathered together on the same canvas.

There is selfishness, ferocity in the love of Heathcliff, which scarcely suffer it, in spite of its rugged constancy, to relieve the darker parts of his nature. Even the female characters excite something of loathing and much of contempt.

Catherine the elder - wayward, impatient and impulsive - sacrifices herself and her lover to the pitiful ambition of becoming the wife of a gentleman of her place. Hence her own misery, her early death, and something of a brutal wickedness of Heathcliff's character and conduct; though we cannot persuade ourselves that even a happy love would have tamed down the natural ferocity of a tiger.

Catherine the younger is more sinned against than sinning, and in spite of her moral defects, we have some hope of her at the last.

The main characters have at least one bad behavioural trait in them- self-centeredness or edginess.

Conclusion

The rivalry between Heathcliff and Hindley Earnshaw, as stated earlier, commenced from their childhood days. Hindley's qualms that one day Heathcliff will be the heir of his father's possessions and the way Mr.Earnshaw showed more love and care to Heathcliff are the motives behind Hindley's cruel behaviour towards Heathcliff.

Hindley was also frustrated by the intimacy of Catherine and Heathcliff. His fears came true. Catherine and Heathcliff were inseparable. Though for selfish gains, Catherine marries Edgar Linton.

Thoroughly at a loss, Heathcliff runs away from Wuthering Heights and comes back with lots of money. His return is the turning point in the novel, from where everything starts: Hindley's death, making Hareton his slave, Catherine's death and the taking over of Wuthering Heights. In the end it is seen that Heathcliff also takes over Thrushcross Grange.

Having Wuthering Heights and his master's son as his slave, Heathcliff calms down. He destroys many people's life including his Catherine's. Heathcliff spoils young Cathy's life by making her forcefully marry his son Linton. Linton dies and Cathy becomes a widow at a very young age.

Heathcliff gains everything but there is a loss in his life: an eternal loss. He did not get his Catherine, and she dies very young. His love for her is so extreme that he even digs her grave to see her face again, just to believe that she is merely sleeping.

First Heathcliff is the slave and Hindley his master. Then later on, as time changes, Heathcliff becomes the master and Hindley's son, Hareton, becomes Heathcliff's slave.'Now my bonny lad, you are mine! And we'll see if one tree won't grow as crooked as another, with the same wind to twist it!'(Bronte 144)

His upbringing and his sufferings in his childhood days made Heathcliff's mind full of malicious thoughts and vicious things. Slavery made him hard and he built his mind to take vengeanceon his master. The paper endeavors to throw fresh light on the manner in which the so-called fiendish Heathcliff overcomes the fetters of slavery and takes over his master's chattels.

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INDIA'S BEEFED –UP NATIONALISM

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Abstract

India today has made a mark in almost all spheres of national and international significance. More than the challenges faced by the country on the international front, the struggles within have been far more difficult to handle. With more and more nations gradually accepting a more democratic form of governmental operations, demands for autonomy, regionalism and the like have also become a phenomena frequently observed. Given such a background, diversity in India, is passing through a very turbulent phase. In numerous cases, it is becoming a cause for concern, given the recent conflicting views on the idea of nationalism and even more disturbingly the restrictions that are being imposed on certain sections of the society with regard to their choice of profession, food and the like. The irony is that it is happening in a country that is considered one of the largest democracies in the world. In its march forward as one of the powerful countries on the international front, India and its constitution is faced with an all new role of answering the all new interpretations and misinterpretations with regards to what had been originally conceptualised by the framers of the Indian constitution. Perhaps as a country India is facing a far more challenging situation today than it faced soon after independence. Only time will tell, how we will be able to overcome these problems.

Keywords: - Nationalism, diversity, democracy, constitution, food, indianess

India for ages has maintained its identity as a land of diversities, whether in religion, culture, food, language, festivals and so many other aspects of social, economic and political life. This variety has benefitted not only people within the country but also people from

around the world to come here and get a taste of this uniqueness.Indian dishes like kebabs, chicken tikka masala, biryani, and curries are immensely popular and available in places like UK, Canada, the Middle East, US and even China. The diversity of Indian cuisine makes catering to different palates easy. You could enjoy dishes from Goa, Punjab, South India, Rajasthan, Gujarat and even Parsifood.India is quite famous for its diverse multi cuisine available in a large number of restaurants and hotel resorts, which is reminiscent ofunityin

versity.Bengali,Gujarati,Kashmiri,Mughlai,Punjabi,RajasthaniandSouth Indian cuisines are evolving and gastronomically going places. The mention of varieties in cooking may make this article seem like one about Indian cuisine but what is to be discussed is a more fundamental and serious issue related to food and eating habits and choices. Unlike numerous foreign countries where the difference in cooking and eating is basically understood by the style in which it is cooked or the ingredients used, in India the broad classification is vegetarian and non-vegetarian. Though, in general it is just the difference in the ingredients used, inIndia, it speaks of many more differences such as cultural, regional and religious. On one hand, the unity in diversity gives us a sense of pride when we showcase ourselves in front of other countries of the world, within the country, this variety or difference has been the cause of more serious issues. Just as the spices have found their way to the tables of the most famous foreign eateries and hotels, the political ideologies or more appropriately, politicalagendas have found their way into determining what food one should or shouldn't eat. The irony is that on one hand, the multiplicity of political parties gives the impression that we are accepting diversities of ideas and opinions but at the same time mob lynching of people who either consume meat of animals considered sacred by a particular community or have been doing the work of disposing off the waste or carcass of animals are treated as outcasts or untouchables. Another important aspect of this issue is that, in many a case, eating of the

forbidden meat or disposing of the remains is not by choice but the part of culture, tradition, occupation or merely accessibility. In states like Kerala, consumption of meat, especially red meat has cultural and traditional links while in states like Assam, it is a matter of availability and dietary requirements arising out of difference in climatic conditions. Though Punjab and Gujarat are both north-Indian states, while the former is well-known for both its vegetarian and even more for its non-vegetarian dishes, the latter is famous for its vegetarian dishes, so here it has more to do with cultural practices rather than regional practices. The results of viewing these distinct cultural, regional or communal practices with political propaganda and ideologies have unfortunately and dangerously resulted in the isolation of one of the largest minority community in India. The vested and venomous interests of certain fundamentalist anti-social groups to project India as a nation belonging to the so-called majority community, once in a while raises its head to threaten the very fabric of Indian democracy. Very often such useless debates tried to capture national attention but were pushed to the backseat due to various reasons. However, when the epicentre of debate shifted from nationalism to religious or communal issue, it assumed a more dangerous proportion.This act is being complemented by the silence of the political leadership on these incidences. Fundamentalist ideas are thus thriving under such conditions. While the accused side has taken it upon themselves as their duty to punish or suppress the meat-eating evil-doers, the victims are at the mercy of the governmental and constitutional mechanisms to give them some relief. The worst hit are people belonging to the lower strata of society.The protection of cows, raising the spectre of a "pink revolution", which is said to have originated in the native land of the present prime-minister aimed to protect the so called endangered cows and other cattle used for meat export. Violence connected with consumption or handling of the forbidden meat ranged from the most rural villages to the most advanced IITs too. However, a notable fact that remains is that, of the

victims, almost all of them belonged to the Dalit or the most downtrodden sections of the society.The rage and support over the issue spread like wild fire and in a very short period of time engulfed the entire country. What should have been left to the choice of an individual became a matter of prestige and ego of certain groups and communities. The irony of the situation was that citizens of the country especially those belonging to the minority communities began to wonder whether it was possible to deny rights and privileges, guaranteed by the constitution to one and all, at the whims and fancies of any dominant or majority group or groups of people. Even more disturbing is the fact that this issue is not the first of its kind. Though not based on eating habits or profession, the earlier issue was one affecting the people in general, namely the debate over the issue of showing respect to the National Anthem. Here again, the debate is over personal choices and decisions and whether such decisions can be dictated by a few to the rest or vice-versa. Nationalism is an emotional and psychological sentiment of oneness that every citizen is expected to share with every other citizen, uniting them under one common factor inspite of their inherent differences of religion, caste, class, language and the like. It is a sentiment that should come from within voluntarily and naturally and something that does not need to be imposed and whose non-compliance need not solicit legal action or punishment or any other kind of pressure for that matter. DuringWe witnessed the division of citizens into two groups, one supportive of such a development and another one which considered such a move to be an infringement on their personal freedom and choices and in many cases, an unnecessary doubt on their spirit of nationalism. However, the case of eating the forbidden meat or any kind of dealings connected to the bovine was of a more serious nature. On the one hand it was concerned with cultural and societal practices and freedoms of certain communities and groups; on the other hand, it was the question age-old profession and means of livelihood for many other communities and groups. The challenging part of the problem was that

the sections of society being affected by such a control and restriction were one of the most downtrodden and economically and socially backward people of the country. Initially what started as a restriction very soon turned out to be the reason behind the lynching of innocent people across the country. Anybody suspected of trading, transporting or consuming the forbidden meat, had to face the ire of vigilantes who were on the lookout for people who dared to go against this dictat. Unfortunately, all the violence against the people who were supposedly involved in the so called unholy meat-eating affair, largely belonged to the Muslim. Even more disturbing is the fact that for a huge number of people, it became an issue of livelihood, especially those who earned their daily bread by trading in meat or any remains. It was impossible for them to abandon something that they had been doing for ages and switch over any new trade or business, almost impossible, given their economic and social status. Initially, they underwent all the stigma and isolation but slowly they began to retaliate by refusing to do some of related jobs which had been carried out by certain communities for years together. The irony of the situation is that on one hand, they were ill-treated and victimised for they so called profession or trade, on the other hand, the perpetrators were unable to find a remedy or an alternative to the situation. Somebody had to clear dispose or remove the dead carcass, but who would do it, remained a big question.

While this was the situation in the badly affected parts of India, there were states like Kerala that came down on such dictats in a much lighter yet firm way. Numerous groups and associations and the public in general expressed their opinion by organising beef-fest and distributing delicacies made of beef, freely all over the state and were on few counts faced with opposition too. Fortunately, the issue did not take a very serious turn here. Apart from this, there were states in India, especially in the north-east where the forbidden meat forms a major part of the daily diet of the majority of the people. There also,

perhaps the numbers made all the difference and violence in this matter was not heard of.

Keeping aside, the degree of violence in the different parts of India, the underlying matter is that when a citizen's rights and privileges are brought under the scanner by a group of people, assuming to be the majority, who could they seek help from? Since independence in the year 1947, it goes without saying that as citizens of India, we look up to the constitution of India to uphold and protect our rights. We are well aware of the fact that constitutional remedies act as a strong pillar of strength when citizens are faced with any kind of apprehensions regarding their rights and privileges, however, in this case, as all might have noticed that lynching has not so far been brought under the ambit of a criminal or punishable offense. Perhaps that is why it was able to remain unnoticed or unattended for a while till media took over and brought it to the limelight. Another worry is that we are not sure as to how many incidents have been reported out of the total happenings.

On the global front, as we already discussed, through our variety delicacies and flavours, we are building a connect with all other nations. India is being acknowledged as an emerging super-power and its diversity being viewed as its biggest asset. It is admist such circumstances that the above said internal disturbances have to a very large extent marred the face of India. On the one hand while we are taking pride in the Indianisation of various international cuisines, within our own country, the very fabric of Indianness is at stake. We are now living a digital life and everything is on smart phones and people expect to see and believe rather than study. It also helps them to get a visual of the recipe process and this is very important. Sometimes we do mention things that help visibly more than the text format. That's how the Indian cuisine was able to grab the attention of the international pallet. Over the ages we have survived the test of time by protecting and maintaining our uniqueness and difference but today that same difference is turning into a reason for fear. Quite

unexpectedly, food and eating habits have found an unexpected connection with the expression of nationalism. The very idea of nationalism is undergoing a sea change. The diversity that was once the cornerstone of our strength is now the cause of dissent. The difference in opinion further solidifies with the merging of religious, linguistic and other differences with issues of a much lighter nature. Killings in the name of personal choices are very scary phenomena.Of late, there have been many instances where constitutional provisions, rights and privileges guaranteed by the Indian constitution have been either forced on many citizens or been with-held from many others. The interpretation of the constitution on many instances has left citizens often confused about the actual meaning or substance of the constitution. The political shade or colour given to judicial decisions has often forced the citizens to become doubtful about their very position and presence in the country which they believe to be their homeland that would protect them against any kind of harm. Given the present state of affairs, there is a large section of people in India, who have started to feel unsafe in their own land of birth. India, one of the largest democracy in the world, needs to protect its diversity, since it's this very diversity that makes this democracy very unique. Here, it is to be understood that like democracy, nationalism is also one of the strongest elements that unites the country and helps it to move forward. History tells us that India has come a long way starting from the time of colonial rule, princely states and provinces to states, re-organization of states to the present form of states and union territories. One may argue that increase in the number of states and union territories is an indication of the fact that the very fabric of the nation is falling apart but in reality it is a sign of a more democratic process. However, any harm to the democratic fabric in the name of religion, culture, caste or opinions will cause such serious damage which might become almost impossible to heal. The reasons being that there is an evident absence of leaders who like during the time of freedom struggle were able to rise above all other differences to work

towards one nation. India, falling apart on such petty issues would destroy us forever so it is the duty of each and every citizen of India to ensure that India remains united at any cost.

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A PRELIMINARY STUDY ON THE MEDICINAL PLANTS OF JEWISH CEMERTY, MALA, THRISSUR DURING THE POST MONSOON SEASON AND THEIR TRADITIONAL USES

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Abstract

Medicinal plants have been discovered and used in traditional medicinal practices since pre- historic times. They synthesise countless chemical compounds to fight against insects, fungi, bacteria etc. With an aim to explore the data about medicinal plants of Jewish cemetery Mala, which is a heritage site of Thrissur district , we conducted this study during September to December. This area is rich in floral diversity . Collections were made once in a week along with survey of medicinal plants. We analysed the floral characters and made herbarium. We collected 27 medicinal plants from this area, which are famous for their usage in Ayurveda, Homeopathy and traditional system for curing various diseases. This study reveals that this area is a rich source of plant diversity and has to be protected.

Key words: Medicinal plants, post monsoon, tradition, diversity

Introduction

Plants are inevitable components for the survival of the other life forms. In this world most regions are covered by green plants. All plants have medicinal values. Plants are distributed by their adaptation to environmental changes.

The plant resources not only provide us nourishment, clothing, housing, fuel and medicine but also meet our several other requirements. Therefore the knowledge about plants and

biodiversity is an absolute requirement for the conservation of our natural resources and is impossible to conserve plant diversity without a basic idea of plant distribution.

Medicinal plants have curative properties due to the presence of various complex chemical substances of different composition, which are found as secondary plant metabolites in one or more parts of these plants. These plant metabolites according to their composition, are grouped as alkaloids, glycosides, corticosteroids, essential oils etc.

Medicinal plants have played an important role in development of human culture for example religions and different ceremonies. Many medicines are produced from the medicinal plants indirectly such as aspirin. Medicinal plants are resources of new drugs. Studying on medicinal plants help to understand plant toxicity and protect human and animals from natural poisons. Preservation and identification of medicinal plants protect its biodiversity, for example metabolic engineering of plants. This encyclopedia deliberates for the readers its uses and relevance of plants as sources of medicine. It provides illustration of medicinal plants, as well as an understanding of their anatomy, morphology, physiology and the chemicals present in them which make them valuable. It is designed to be comprehensive reference tool for health authorities, scientists and pharmacists and to the general public.

The first and the most crucial aspect in present scenario of traditional medicine system is to conserve our already depleted resources, conservation in itself i.e; a broad field which include preservation, maintenance of sustainable utilization, restoration and enhancement of the natural environment is essential. Here an attempt has been made to study about the medicinal

plants of the Jewish cemetery during post monsoon season and to know their medicinal values.

Materials And Methods

Study area

The present study is based on the medicinal plants collected from Jewish Cemetery Mala, Thrissur during the period of September-December.2018. In this study an attempt was carried out to explore medicinal plants diversity of Jewish Cemetery, Mala during the post monsoon season. Mala is a multicultural society. Migrants from different parts of the world settled in Mala; especially noteworthy are the Jews from Palestine (Eretzisrael), Brahmins from the Konkan and Kudumbis and Konganis from Goa. Jewish Cemetery is a part of cultural heritage site of Kerala.

Study area

Climate and temperature

The Jewish Cemetery Mala located in Thrissur district is a part of Western Ghats and receives comparatively a normal rate of South East and North East monsoon. The maximum average temperature of the area in the summer season is 35.7^0C , while the minimum temperature recorded is 21^0C.The winter season records a maximum

average of 32.3˚ C and minimum average of 180 ℃ .The mean relative humidity varies from 80. 90% during rain season and lowers to 65-70 % in summer periods

Methods

Collection of specimen

The plants were collected regularly in a week and observed as well as the color photographs were taken with the help of digital camera in their material habitat. The medicinal plants were collected along with their flowers taken for further analysis and herbarium preparation.

Preparation of field book

During the collection, the specimens were collected and tagged within the field number. Field observation such as habitat, flower colour etc. were entered in the field book. The specimens of appropriate size with relevant parts were collected from the field for herbarium preparation.

Examination of plant specimens

Equipments needed for examination of plant specimens:

Hand lens (10x and 15x),a sharp razor, blades, a pair of dissecting needles, a pair of forceps, collection bottles ,polythene and a good plant identification manual.

The collected fresh specimens were brought in to the laboratory for further analysis. The plants were examined starting from flower stalk through the calyx, corolla, androecium up to the tips of stigma using hand lens. The observed characters were recorded in a note book. Flowers were sectioned with the help of razor or sharp blade, one horizontally and the other down the middle, for knowing about placentation and to complete floral diagram and for understanding the ovary status.

Identification of family

On the basis of examined characters, the families of the specimens were identified by preparing suitable keys based on system followed by j.s.gamble, in his flora of presidency madras. As well as the software "flowering plants of kerala ver.2.0 (Dr.Sasidharan, KFRI.Peechi), under biodiversity portal (India biodiversity .org.) and experts in the field of taxonomy were also helped in the identification of plant specimens.

Preparation of herbarium

The collected specimens, after being cut or dug, were pressed as soon as possible. Then the specimens placed carefully on a pressing sheet. (news print sheet or a blotter) without no folding or overlapping of parts. After drying and pressing specimens were affixed on the herbarium sheet. Then the binomial, family, habitat etc. were recorded on the sheet.

Results and discussion

We observed 29 medicinally important plants during the course of our study. The description of each member is given below.

Table 1 : List of medicinal plants and their uses collected from the study area

No.	Plant Name	Family	Habit	Parts used	Medicinal uses
1	*Acalyphaindica*	Euphorbiaceae	H	Whole plant	Worm infestation, burns, cough, constipation, skin eruptions, ulcers, bronchitis, ear and urinary diseases.
2	*Achrassapota*	Sappotaceae	T	Bark, fruits	Rich in dietary fiber, vitamins A and B, and C, the sapota is also packed with anti-oxidants
3	*Aervalanata*	Amaranthaceae	S	Whole plant	Urinary obstructions, bladder stones and haemorrhages associated with pregnancy
4	*Anacardiumoccidentale*	Anacardiaceae	T	Fruits, Seeds, Roots and Bark	Diabetes, poisoning and ulcers.
5	*Biophytum sensitivum*	Oxalidaceae	H	Whole plant	Urinary calculi, hyperdipsia, bilious fevers, wounds, asthma, stomachalgia, snakebite and insomnia.

6	*Briza minor*	Poaceae	H	Whole plant	Antiviral –anti microbial properties. It is used for the treatment of urinary tract infection .,syphilis and dysentery.Used as a good fodder for cattles.
7	*Centrosem amolle*	Fabaceae	C	Seeds	Scorpion and snake bites. Antimicrobial and Wound Healing
8	*Chromolae naodorata*	Asteraceae	H	Leaves	Cuts and wounds to stop bleeding
9	*Cynadond actylon*	Poaceae	C	Whole plant	Used for the treatment of urinary tract infection, syphilis and dysentery.
10	*Emilia sonchifolia*	Asteraceae	H	Whole plant	Diarrhoea, cuts and wounds, intermittent fevers, asthma, eyesores and night blindness.
11	*Euphorbia hirta*	Euphorbia ceae	H	Whole plant	Hypotensive, anticancerous , anxiolytic, analgesic, antimalarial, antiasthmatic, antidiarrheal, antioxidant, antiamoebic, anti-inflammatory, antifungal, antibacterial, antiamoebic, antispasmodic etc
12	*Glycosmis pentaphylla*	Rutaceae	S	Leaves and stem	Used for cough, jaundice, inflammation, rheumatism and anemia.

13	*Hyptissuov eolens*	Lamiaceae	H	Whole plant	Worm infestation, wounds and inflammations of the navel of the newborn and also emetic.
14	*Leucasasp era*	Lamiaceae	H	Whole plant	Worm problems, fever, cough, jaundice, psoriasis, respiratory, intestinal and skin diseases.
15	*Macarandr apeltata*	Euphorbia ceae	T	Root ,leaves and bark	As a decoction, to treat stomach-ache, dysentery, haemoptysis, cough and fever.
16	*Mikaniama crantha*	Asteraceae	C	Leaves	Snake bites, eliminating discomfort of hornet, bee and ant stings antimicrobial activity from the leaves
17	*Mitracarp oushirtus*	Rubiaceae	H	Whole plant	Used to treat ringworm,andeczema,freshc uts,wounds and ulcer
18	*Murreyako enigii*	Rutaceae	S	Leaves	Used in skin diseases,hemopathy,wormtr oubles,neurosis and poisons
19	*Ocimum sanctum*	Lamiaceae	H	Whole plant	Cough, cold, bronchitis, dysentery, improves appetite, skin diseases, itches, ringworm, leprosy, intestinal worms, ulcers, poisonous affections and specific for all kinds of fevers.

20	*Phyllanthu sniruri*	Euphorbia ceae	H	Whole plant	Jaundice, cough, chronic dysentery, dyspepsia, indigestion, diabetes, urinary tract and skin diseases
21	*Ruelliapro stata*	Acanthace ae	H	Whole plant	Used in bladder stones and in bronchitis. Paste of leaves is also used for skin diseases and boils
22	*Setariaviri dis*	Poaceae	H	Whole plant	The seed is diuretic, emollient, febrifuge, refrigerant and tonic. The plant is crushed and mixed with water then used as an external application in the treatment of bruises
23	*Scopariad ulsis*	Scrophular iaceae	H	Leaves , root, stem	Digestive problems, pulmonary condition, fever,skin disorders ,hypertension,hemorrhoids,di-arrhea,dysentery,insectsbites ,anemia,albuminuria,diabetes,herpes
24	*Sidaacuta*	Malvaceae	S	Root, leaves	Dermatopathy, diarrhoea, tuberculosis, leucorrhoea, and burning sensation
25	*Sidacordif olia*	Malvaceae	S	Root, leaves	Dysentery rheumatism, neurological disorders, headache, tuberculosis and ophthalmia.
26	*Synedrella nodiflora*	Asteraceae	H	Leaves	Antidiarrhoel agent along with its hypoglycaemic potentialities. It has antiseptic, antipyretic , antimicrobial, analgesic, and

				antioxidant
27	*Tridaxproc umbens*	Asteraceae	H	Leaves	Dysentery, diarrhoea, haemorrhages from cuts, bruises and wounds
28	*Vernoniaci nera*	Asteraceae	H	Whole plant	Malaria, fever, leucorrhoea, excessive bleeding, chronic skin diseases, dysuria, bladder stones, piles, worms and haematological disorders.
29	*Zizipusoen oplia*	Rhamnace ae	S	Leaves and bark	Effective in stomach ache, wounds, acid refluxe, anemia, bronchitis, ascaris, diarrhea. It have antispasmodic , analgesic, anti microbial,antiseptic activities.

We have found out that during the course of study there were 29 medicinally importnant plant in the study area. The Asteraceae family was represented by 8 genus, then Euphorbiaceae with 4 genus, followed by lamiaceae with 3 genus. Malvaceae, Rutaceae were represented by 2 members. Poaceaewith 3 members.While Fabaceae, Sappotaceae, Scrophulariaceae, Acanthaceae, Amaranthaceae Anacardiaceaoxalidaceae were monospecies. Majority members of medicinal plants were herbs with a percentage of 55 followed by shrub 19%, trees 15% and climbers 11%.

Pie diagram indicating the quantity of shrub, herb, trees and climbers in the study area.
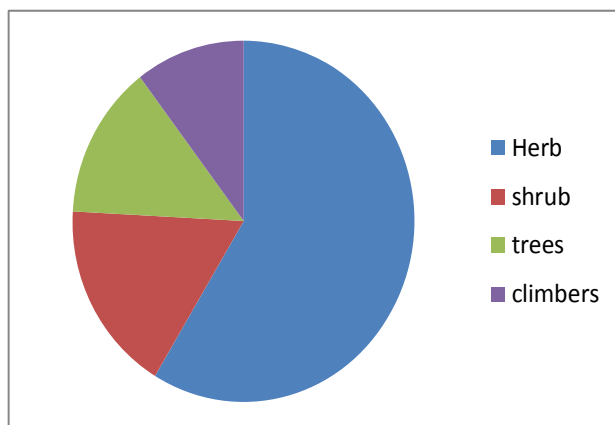
Discussion

Ancient way for insitu conservation of genetic diversity is full filling through such isolated areas. They are also pertaining the role of conserving the depleting resource elements like medicinal plants. Actually they are the treasure house of important plants and dispersal areas of plants. Natural vegetation of a region is present in such areas. Ravi prasad*et al*.,in 2011 reported that over expolitation and unscientific uses of plants from groved will result in their ultimate lose. Similarly in this study area overgrazing is the problem for the existence these plants

Deepa*etal.,*2016 reported the presence of *Mikaniamicrantha* and *Centrosemamolle* which are important climbers and used for snake bites, in the sacred grooves also. Absence of proper compound walls soil errosion severely affected this area especially during the flood time. Induchoodan in 1998 reported that water is playing important role in soil erosion. *Chromolaenaodorata* and *Mikaniamicrantha*are

invasive species. According to Mandal and Joshy 2015 establishment of invasive species causes changes in propagule pressure, availability of nutrients and light and not exclusively on habitat richness.

Summary And Conclusion

An attempt was made to study the medicinal plants and their importance in Jewish Cemetery which is a part of heritage site of Kerala, during the post monsoon season . For this purpose many plants were collected and analyzed.Of these many of them were medicinal. A systematic analysis of morphological characteres were done and preparation of herbarium was also carried out. This study shows that natural vegetation is maintained inside the cemetry and rich diversity of medicinal plants. Here the percentages of herb species are large compared to shrubs, trees and climbers. Local level control is essential for to the protection of such isolated areas. Such areas are the last refuge of many plants. So they should be considered as natural gifts and can be conserved for requirement of society and also help in education and research. From this study it was clear that Jewish Cemetery contains many medicinal plants and proper care should be given to protect this area as a source of biodiversity. A more systematic and continous study of plants in this area will lead to get a clear cut idea about the various plants of this area. In this circumstance suitable management measures and awareness programmes about medicinal plants inside the Jewish cemetry is necessary for sustainable utilization of the valuable bioresources.

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NUTRITIVE ANALYSIS OF SELECTED LEAFY VEGETABLES

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Abstract

Leafy vegetables are generally good sources of nutrients. They are rich in vitamins C and K and the minerals iron and calcium. They are important protective foods and highly beneficial for the maintenance of health and prevention of diseases as they contain valuable food ingredients which can be utilized to build up and repair the body. The main protective action of vegetables has been attributed to the antioxidants present in them. Vitamin C is a water soluble antioxidant which is found in variablequantities in vegetables. An antioxidant vitamin like ascorbic acid is important in human food since they function as an anticancer agent. Vitamin C cannot synthesized through body cells, nor does it store it. It is therefore important to include plenty of vitamin C-containing foods in daily diet. The objective of the study was to determine quantitatively the vitamin C content of selected leafy vegetables of our locality. Since it is a poor man's vegetable, our aim was to compare the vitamin C content of these leafy vegetables and make some recommendations for their intake.

1. Introduction

Nature has provided different life forms on which humans survive on Earth. Primitive humans ate all types of fruits, leaves and roots of plants collecting from wild, before he learnt to grow useful plants. Vegetables are the fresh and edible portions of herbaceous plants, which can be eaten raw or cooked. They are valued mainly for their high carbohydrate, vitamin and mineral contents. Vegetables may be edible roots, stems, leaves, fruits or seeds. Each group contributes to diet in its own way. Vegetables

supply the body with minerals, vitamins, certain hormone precursors as well as proteins and energy. They can provide appreciable amounts of nutritive minerals. Vegetables are valuable in maintaining alkaline reserve of the body. Vegetables also act as buffering agents for acidic substances produced during the digestion process. Consumption of fruits and vegetables in diet has been reported to protect the human body from degenerative diseases.

Many leafy vegetables especially, amaranth and spinach have attained commercial status and its cultivation is wide spread in India. Because of their low production cost and high yield, leafy vegetables are considered to be one of the cheapest vegetables in the market and it could be rightly described as 'poor man's vegetables.

The main protective action of vegetables has been attributed to the antioxidants present in them. The oxidative stress experienced by a tissue, organelle or organ results from the balance between the production and removal of potentially damaging reactive oxygen species. Antioxidants can prevent the chemical damage caused by reactive oxygen species such as free radicals that are generated by a variety of sources including pesticides, tobacco smoke, exhaust fumes, certain pollutants and organic solvents. The potential cancer inducing oxidative damage might be prevented or limited by dietary antioxidants found in fruits and vegetables. An antioxidant vitamin like ascorbic acid is important in human food since they function as an anticancer agent. Vitamin C also known as ascorbic acid is a water soluble antioxidant which is found in variablequantities in fruits and vegetables and has been thus making them more motile found to prevent tissue damage. Several doctors routinely prescribe vitamin C to aid recovery in several ailments and diseases including cold, cough, influenza, sores, wounds, gingivitis, skin diseases, diarrhoea, malaria and bacterial

infections. The increased knowledge of the role of vitamin C has necessitated the development of accurate and specific methods for its determination.

2. Materials And Methods

Leafy vegetables namely Coriandrum Sativum (Coriander leaves), Sauropus (Velicheera), Brassica Oleracea (Cabbage), Spinacia Oleracea NaadanCheera), Talinum Fruticosum (SambarCheera), Amaranthus Dubius (Red Cheera) &Mintha Spicata (Mint Leaves) were collected from home & local market. The leaves were removed from the stem and damaged ones excluded. These were then washed thoroughly with water &dried. Blend a 5 g sample with 50 ml of distilled water. Stain the mixture. Add 10 mL portions of distilled water several times while grinding the sample, each time decanting off the liquid extract into a 100 mL volumetric flask. Finally, strain the ground pulp through cheesecloth, rinsing the pulp with a few 10 mL portions of water and collecting all filtrate and washing in the volumetric flask. Make the extracted solution up to 100 mL with distilled water.

Coriandrum

Sativum Sauropus

Brassica Oleracea

SpinaciaOleracea

TalinumFruticosum

AmaranthusDubius

MinthaSpicata

The amount of ascorbic acid can be determined by acid-base reaction or oxidation-reduction reaction. The redox reaction is better than an acid-base titration since there are additional acids in a juice, but few of them interfere with the oxidation of ascorbic acid by iodine. Vitamin C is a weak acid and a good reducing agent. Iodine is a weak oxidizing agent, so that it will not oxidize substances other than the ascorbic acid in the sample of fruit juice. As a strong reducing agent, vitamin C will reduce I_2 to I^- very easily. The excess of iodine

react the starch as indicator to perform the amount of vitamin C is finishing in redox reaction. In this reaction, the ascorbic acid molecule gains oxygen (in the form of OH groups). Each iodine atom in the I_2 molecule accepts an electron and become a negatively charge o form iodide ion. Thus that, the ascorbic acid molecule was oxidized and the iodine molecule was reduced.

$$C_6H_8O_6 + I_2 + 2H_2O \rightarrow C_6H_{10}O_8 + 2I^- + 2H^+$$
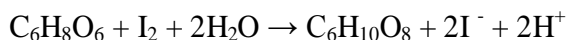
Excess iodine reacts with iodide ions (I^-) to form triiodide ion (I^{3-}) which forms a very intense blue color when it reacts starch. This color is due to incorporation of the ions within the molecular structure of the starch.

$$I_2 + I^- \rightarrow I^{3-}$$
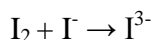
To detect the end point, starch must be added at the beginning of the titration in the conical flask. When all ascorbic acids have finished, the excess of iodine solution will react the starch to form blue-black color in the solution.

$$I^{3-} + starch \rightarrow starch\ (I^{3-})$$
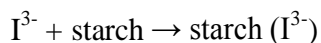
3. Results and Discussion

The result of the average value of vitamin C in each leafy samples selected under the specified condition are tabulated in Table below.

No	Leafy Vegetables	Condition	Temperature	Total Vitamin C(mg/5g)
1	CoriandrumSativum (Coriander leaves)	Fresh	32^0C	28.6
2	Sauropus(VeliCheera)	Fresh	32^0C	64.8
3	Brassica Oleracea (Cabbage)	Fresh	32^0C	11.6
4	SpinaciaOleracea (NaadanCheera)	Fresh	32^0C	35.9
5	TalinumFruticosum (SambarCheera),	Fresh	32^0C	21.8
6	AmaranthusDubius (Red Cheera)	Fresh	32^0C	31.7
7	MinthaSpicata(Mint Leaves)	Fresh	32^0C	43.5

It showed the highest concentration of vitamin C found in Velicheera, hitting 64.8 mg /5g, the lowest level was found in Cabbage, when it reached 11.6mg /5 g of extract. However Coriandrum Sativum (*Coriander leaves*)-(28.6mg/5g),Amaranthus Spinosus (Naadan Cheera)-(35.9mg/5g), Talinum Triangular (SambarCheera) - (21.8mg/5g), Amaranthus Ceuentus (Red Cheera)-(31.7mg/5g) & Mentha (Mint Leaves)-(43.5mg/5g) were also found to be rich in vitamin C.

Total Vitamin C   (mg/5g)
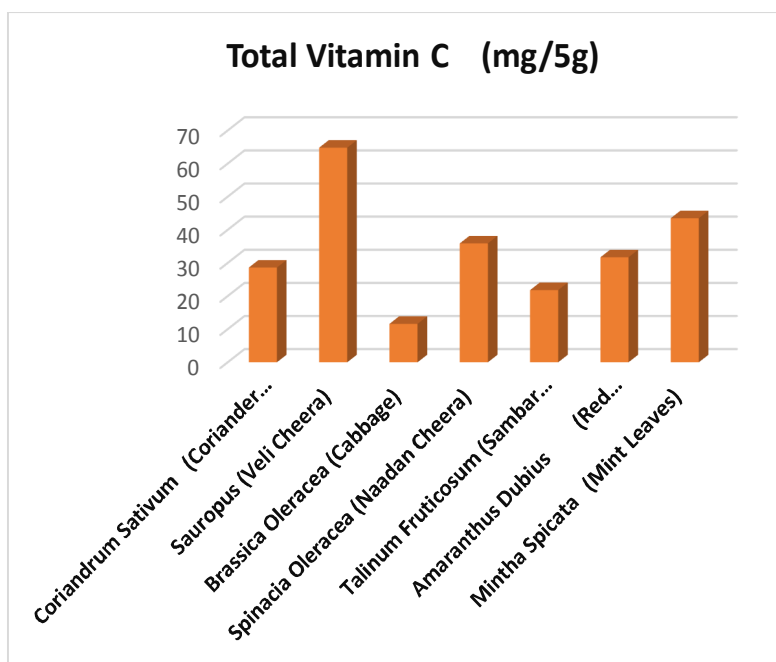
4. Analysis of Nutrients

Our analysis also showed the presence of Iron, Magnesium and Potassium in all of our selected samples. Iron is an essential mineral used to transport oxygen to all parts of our body. Iron is an important

component of hemoglobin, the substance in red blood cells that carries oxygen from our lungs to transport it throughout our body.Iron has other important functions too, "iron is also necessary to maintain healthy cells, skin, hair and nails. A slight deficiency of iron causes anemia and a chronic deficiency can lead to organ failure. Conversely,too much iron leads to production of harmful free radicals and interferes with metabolism causing damage to organs like the heart and liver. Iron which comes from leafy vegetables is well regulated by the body, so over dose is rare &usually only occurs when people take supplements. Potassium is a mineral necessary for the proper function of many of your body systems; it's also often referred to as one of the key electrolytes in your body. A deficiency in potassium causes fatigue, irritability & hypertension. Magnesium is a mineral found in the body & is essential for regulation of muscle function, nerve activity, bone strength, heart rhythm, immune system, blood pressure, blood sugar & metabolism. Eating foods high in magnesium can help to maintain the proper levels of important minerals. Except MinthaSpicata (Mint Leaves)all other samples showed the presence of calcium. Calcium is absolutely essential mineral that helps support development of healthy teeth, bones, muscles, & much more. Calcium plays an integral role in the secretion of a number of hormones & enzymes that are vital for your body function efficiently. However, calcium is needed by the body for much more & calcium deficiency can cause more problems than weak bones and teeth

No	Leafy vegetable	Proteins	Flavonoids	Carbohydrates	Starch	Fe^{2+}	Ca^{2+}	K^+	Mg^{2+}
1	CoriandrumSativum (Coriander leaves)	✓	✓	✓	✗	✓	✓	✓	✓
2	Sauropus (VeliCheera)	✓	✓	✓	✗	✓	✓	✓	✓
3	Brassica Oleracea (Cabbage)	✓	✓	✓	✗	✓	✓	✓	✓
4	SpinaciaOleracea(NaadanCheera)	✓	✓	✗	✗	✓	✓	✓	✓
5	TalinumFruticosum (SambarCheera),	✓	✓	✓	✗	✓	✓	✓	✓
6	AmaranthusDubius (Red Cheera)	✓	✓	✓	✗	✓	✓	✓	✓
7	MinthaSpicata(Mint Leaves)	✓	✓	✓	✗	✓	✗	✓	✓

5. Conclusion

Leafy vegetables are important as food both from economic and nutritional stand point. Their nutritive significance is their richness in minerals and vitamins which is essential in the maintenance of human health. The importance and awareness of nutrition has resulted in the increased demand of knowledge of the biochemical nutrients of foods.

The ascorbic acid content of seven leafy vegetables Coriandrum Sativum (Coriander leaves), Sauropus (Velicheera), Brassica Oleracea (Cabbage), Spinacia Oleracea (Nadan cheera), TalinumFruticosum (Sambarcheera), Amaranthus Dubius (Red cheera), Mintha Spicata (Mint leaves) were determined iodometrically in order to know which leafy vegetable would best supply the ascorbic acid need for the body. It showed the highest concentration of vitamin C found in Velicheera, hitting 64.8 mg /5g, the lowest level was found in Cabbage, when it reached 11.6mg /5 g of extract. However Coriandrum Sativum (*Coriander leaves*)- (28.6mg/5g), Spinacia Oleracea (Naadan Cheera)- (35.9mg/5g), Talinum Fruticosum (Sambar Cheera) - (21.8mg/5g), Amaranthus Dubius (Red Cheera)- (31.7mg/5g) &Mintha Spicata (Mint Leaves)-(43.5mg/5g) were also found to be rich in vitamin C. Vitamin C exist in the form of drugs as swallow tablets, chewing tablets, swallow capsules, solvents and injection. We can had access to the handling of the recommended amount of vitamin C easily through alternative medicine but the damage will be limited in the short term if they are to stop dealing dose, therefore preferred experts dealt vitamins by natural eating and drinking, and not to rely on synthetic substitutes. Through this paper we makes some suggestions for the preferential intake of leafy vegetables.

Our analysis also showed the presence of Proteins, reducing sugar, Flavonoids, Calcium, Magnesium and iron. The result suggest that the vegetables if consume in sufficient amount would contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against diseases arising from malnutrition. Adequate consumption of the

vegetables with high vitamin C content will result in improved health.

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Anti Helminthis Activity of *Alangium salviifolium* against *Pheretima posthumous*

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A B S T R A C T

K e y w o r d s

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The present study was intended to delineate the Anti Helminthis activity of *Ankolam* leaf extract. The crude extract was obtained by the employment of Soxhlet extraction method. The extract was used to screen the antagonistic activity *in vitro* by taking *Pheretima posthumous* as the study subject. B y the employment of molecular sequencing the identity of plant was confirmed as *Alangium salviifolium.* The results obtained proved the capability of extract to down regulate the biological activities of subject. Mortality was induced by varying concentrations (100-1000 ppm/ml). Interestingly the antagonistic activity was in direct proportional with the extract administrated. The analysis of phyto-constituents revealed that the extract is composed of polyphenols, Saponins, Flavonoids etc. Therefore, it is assumed that the biological activities are complimented by the phyto-components. The results obtained from the current studies can be further exploited in the field pharmaceuticals.

Introduction

Despite of some biological advantages in the field of agriculture Helminthis are known for its expanded infection and disease spreading abilities. Therefore, it is crucial to improve efficient control agents against them (Cabardo and Portugaliza, 2017).

Trematodes, the causal agents of schistosomiasis an important parasites of economic and public health implications. Schistosomiasis affects over 240 million people worldwide, with up to 700 million individuals living at risk of infection (Cala *et al.,* 2012). The disease caused up to 250,000 deaths per year in the last decade

(Kumarasingha *et al.,* 2016). Similarly, Helminthis infection causes huge revenue in agro farming. There have been several synthetic chemical compounds and nanoparticles proven their anti helminthis activity. However, it is also observed that these compounds are mostly toxic to the environment. In this juncture it is essential to develop suitable ethnobotanical agents against this threat (Khan *et al.,* 2018).

Alangium salvifolium Wang. belongs to the family *Alangiaceae* and is commonly known as sage leaved Alangium. It is a well-known traditionally used medicinal plant in India and it is also one of the most versatile medicinal plant having a wide spectrum of biological

activities like antidiabetic, antiulcer, analgesic, anti-inflammatory, antimicrobial, antioxidant, anti-arthritic, diuretic, antifertility, anthelmintic, antiepileptic and antifungal (Shravya *et al.,* 2017). *A. salvifolium* is a tall thorny tree and the genus contains 17 species of small trees, shrubs and lianas. Alangium name has been derived from the Malayalam word Alangi. Almost all the parts (root, bark, leaves, seeds and fruits) are known to have important therapeutic uses and are extensively used for different purposes in the indigenous herbal medicines (Saraswathy *et al.,* 2010).

A. salvifolium is widely distributed in South East Asia, from India to China, Thailand, Philippines, Indonesia and Papua New Guinea. It is also found in Africa, Madagascar, Southern and Eastern Asia, tropical Australia, the western Pacific Ocean islands and New Caledonia. In India, it is found throughout the Hyderabad forests and Sitamata wildlife sanctuary, Rajasthan (Singh Tanwer and Vijayvergia, 2014)

Materials and Methods

Plant collection, identification and extract preparation

The leaf of *Ankolam* were collected from Botanical garden of St. Mary's College, Thrissur and the identity of plant was confirmed by molecular sequencing (Zhang *et al.,* 2016). The dried leaves were ground to a course powder and 50g of the powdered plant materials is subjected to extraction by using Soxhlet apparatus using 95% ethanol as the solvent.

The filtrate is collected after 72 hours. It is twice filtered using Whatman no.1 filter paper and extracts were concentrated by evaporation at room temperature. The dried residue is kept in refrigerator for further studies (Vadakkan *et al.,* 2018).

Collection of study subjects

Pheretima posthumous were collected from vermicomposting unit of St. Mary's College, Thrissur, Kerala and washed with normal saline to remove all fecal matter which was brought to Laboratory. The identity of collected organisms was confirmed by the help of Dr. Dalie Domnic, Head of the department, Department of Zoology, St. Mary's College, Thrissur, Kerala. Study subjects were acclimatized in aquaria for a minimum period of four days in holding tanks containing aerated, de-chlorinated tap water and washed sand.

Screening of anthelmintic activity

Test samples of plant extract was prepared at the concentrations 100 - 1000 ppm/ml in 10 ml of distilled water and five worms of approximately equal size (same type), about 3 g weight were placed in each petridish containing 10 ml of above test solution of extracts. All the test solutions were prepared freshly before starting the experiments. Observations were made for the time taken for paralysis was noted when no movement of any sort could be observed except when the worms were shaken vigorously. Time for death of treating worms were recorded after ascertaining that worms neither moved when shaken vigorously nor when dipped in warm water. Standard drug Albendazole is taken as control for comparison (Jacob, 2018).

Phytochemical analysis of plant extract

Phytochemical screening was carried out to assess the qualitative chemical composition of crude ethanolic extracts of *Alangium salviifolium*. Standard screening tests using conventional protocol, procedure, and reagents were conducted using standard procedures to identify the constituents as described previously (Belemlilga *et al.,* 2016).

Results and Discussion

Identification of source plant

By the employment of *rbcL* gene sequencing and phylogenetic tree construction it was evident that the source plant is *Alangium salviifolium* (Figure 1).

The BLAST results suggested that source plant is showing maximum similarity that with *Alangium salviifolium* ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit (rbcL) gene, partial cds; chloroplast which is submitted under the accession number JF308648.1 and *Alangium kurzii*ribulose 1,5-bisphosphate carboxylase large subunit (rbcL) gene, partial cds; chloroplast gene which is submitted under the accession number AF384108.1. Molecular characterization is used as a successful tool for

the identification of plants (Vadlapudi and Kaladhar, 2012).

Effect of plant extract in causing death and paralysis in *Pheretima posthumous*

Ethanolic extract of *Alangium salviifolium possess* dose dependent anthelmintic action. At higher concentrations, it produces paralytic effect much earlier and the time to death at higher doses, the plant extract induces 100% mortality (Figure 2). It was observed that time required for inducing paralysis and causing death is in directly proportional that with the concentration of extract administrated.

Time taken for inducing paralysis was only 19 minutes when the concentration was 1000 ppm/ml whereas the time of survival was prolonged to 67 minutes in lower concentration of antagonist.

Fig.1 Phylogenetic tree of *Alangium salviifolium* source plant
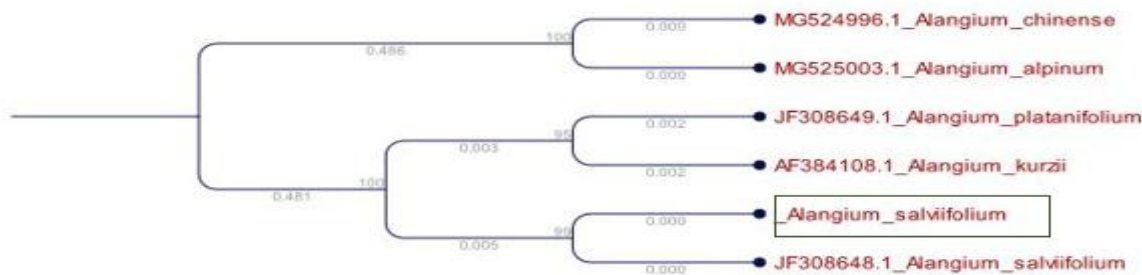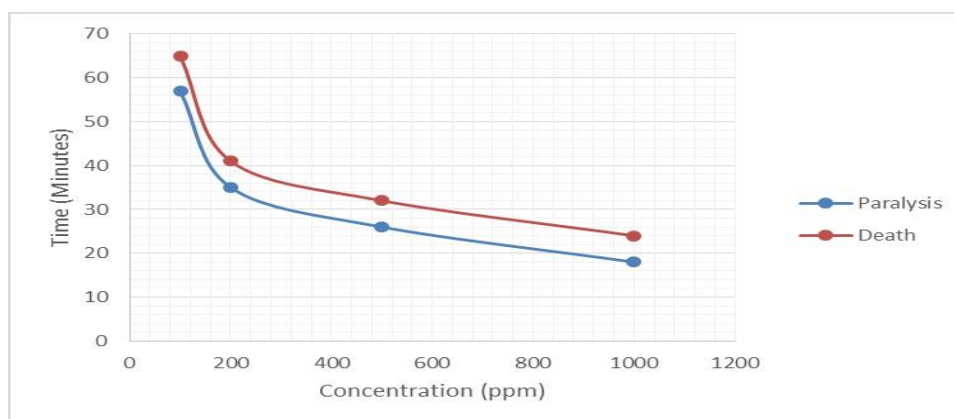

Fig.2 Antihelmintic activity of extract in varying concentration

A similar kind of activity was reported in aqueous leaf extract of *Annonamuricata* L. (Annonaceae) against *Haemonchus contortus* from sheep (Ferreira *et al.,* 2013). Similarly plant extracts from Brazilian savanna also possessed Anthelmintic activity(Oliveira *et al.,* 2017). Generally, Albendazole eliminate worm chiefly by inducing flaccid paralysis interestingly plant extract also showed same clinical symptoms therefore we assume that the mechanism of plant extract is similar to that of Albendazole (Haque *et al.,* 1993).

Phytochemical analysis of plant extract

Phytochemical screening of ethanolic extract of *Alangium salviifolium* showed the presence of alkaloids, coumarins, terpenoids, cardioglycosides, flavonoids, saponins, quinine and phenols as major chemical constituents. Among these, poly phenols, flavonoids are said to have anthelmintic activity (Nayak *et al.,* 2012). Therefore, it is assumed that the activity is contributed by the presence of the polyphenols and flavonoids. From the results, it is evident that ethanolic extract of *Alangium salviifoliumpossess* anthelmintic properties in a dose dependent way. *Alangium salviifolium* extract kills the worm even in low concentrations within short duration of time compared to standard drug Albendazole. It justifies the claims of its potential anthelmintic property.

Acknowledgement

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POWER DOMINATION IN KNÖDEL GRAPHS AND HANOI GRAPHS

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Abstract

In this paper, we study the power domination problem in Knödel graphs $W_{\Delta,2\nu}$ and Hanoi graphs H_p^n. We determine the power domination number of $W_{3,2\nu}$ and provide an upper bound for the power domination number of $W_{r+1,2^{r+1}}$ for $r \geq 3$. We also compute the k-power domination number and the k-propagation radius of H_p^2.

Keywords: domination, power domination, Knödel graph, Hanoi graph.

2010 Mathematics Subject Classification: 05C69.

1. Introduction

Electric power networks must be monitored continuously and this can be accomplished efficiently by placing *phasor measurement units* (PMUs) at selected network locations. The power domination problem, as introduced in [2], is to find the minimum number of PMUs needed to monitor a given electric power system. This problem has been formulated as a graph theoretic problem by Haynes *et al.* [10]. The additional propagational behaviour in power domination is due to the use of Kirchhoff's laws in an electrical network [1].

Let G be a graph and $S \subseteq V(G)$. The *open neighbourhood* of a vertex v of G, denoted by $N_G(v)$, is the set of vertices adjacent to v. The *closed neighbourhood* of v is $N_G[v] = N_G(v) \cup \{v\}$. For a subset S of vertices, the *open* (respectively *closed*) *neighbourhood* $N_G(S)$ (respectively $N_G[S]$) of S is the union of the open (respectively closed) neighbourhoods of its elements. A vertex v in a graph G is said to *dominate* its closed neighbourhood $N_G[v]$. A subset $S \subseteq V(G)$ of vertices is a *dominating set* if $N_G[S] = V(G)$. The minimum cardinality among dominating sets of G is called its *domination number*, denoted by $\gamma(G)$. The propagational behaviour of the set of monitored vertices distinguishes power domination from the standard domination in the following way.

The *set monitored by* S, denoted by $M(S)$, is defined algorithmically as follows:

- (domination) $M(S) \leftarrow S \cup N(S)$,
- (propagation) as long as there exists $v \in M(S)$ such that $N(v) \cap (V(G) \setminus M(S)) = \{w\}$, set $M(S) \leftarrow M(S) \cup \{w\}$.

Equivalently, the set $M(S)$ of vertices monitored by the set S is obtained from S as follows. The set of vertices *monitored* by a set S, denoted by $M(S)$, initially consists of all vertices in $N_G[S]$. This step is called the domination step. Then this set is iteratively extended by including all vertices $w \in V(G)$ that have a neighbour v in $M(S)$ such that all the other neighbours of v, except w, are already in $M(S)$. This second part is called the *propagation step*. This step is continued until no such vertex w exists, at which stage the set monitored by S has been constructed. The set S is called a *power dominating set* (PDS) of G if $M(S) = V(G)$. The *power domination number* of a graph G, denoted by $\gamma_{\mathrm{P}}(G)$, is the minimum cardinality among power dominating sets of G.

Later, the definition of $M(S)$ was formally described with the following sets definition, where $\mathcal{P}_{G,1}^i$ is the set of vertices monitored after i propagation rounds. This definition was first introduced by Aazami in [1] and then Chang *et al.* generalized this definition in [4] to introduce k-power domination for a nonnegative integer k. The corresponding definition for the monitored set, $M(S)$, is obtained by replacing k by 1 in the following.

Definition 1.1 (Monitored vertices)**.** Let $k \in \mathbb{N}_0 \colon = \{0, 1, \ldots\}$. If G is a graph and $S \subseteq V(G)$, then the sets $\left(\mathcal{P}_{G,k}^i(S)\right)_{i \in \mathbb{N}_0}$ of vertices *monitored* by S at step i are as follows:

$\mathcal{P}_{G,k}^0(S) = N_G[S]$, (domination step) and

$\mathcal{P}_{G,k}^{i+1}(S) = \bigcup \left\{ N_G[v] \colon v \in \mathcal{P}_{G,k}^i(S), \left| N_G[v] \setminus \mathcal{P}_{G,k}^i(S) \right| \le k \right\}$ (propagation steps).

We remark that for $i \ge 0$ we have $\mathcal{P}_{G,k}^i(S) \subseteq \mathcal{P}_{G,k}^{i+1}(S)$. Furthermore, every time a vertex of the set $\mathcal{P}_{G,k}^i(S)$ has at most k neighbours outside the set, we add its neighbours to the next generation $\mathcal{P}_{G,k}^{i+1}(S)$. If $\mathcal{P}_{G,k}^{i_0+1}(S) = \mathcal{P}_{G,k}^{i_0}(S)$ for some i_0, then $\mathcal{P}_{G,k}^j(S) = \mathcal{P}_{G,k}^{i_0}(S)$ for every $j \ge i_0$. We thus define $\mathcal{P}_{G,k}^\infty(S) = \mathcal{P}_{G,k}^{i_0}(S)$. When the graph G is clear from the context, we will simplify the notations to $\mathcal{P}_k^i(S)$ and $\mathcal{P}_k^\infty(S)$.

Definition 1.2 [4]**.** A *k-power dominating set* of G (k-PDS) is a set $S \subseteq V(G)$ such that $\mathcal{P}_{G,k}^\infty(S) = V(G)$. The *k-power domination number* of G, denoted by $\gamma_{\mathrm{P},k}(G)$, is the minimum cardinality among k-power dominating sets of G.

Clearly, $\gamma_{\mathrm{P},0}(G) = \gamma(G)$ and $\gamma_{\mathrm{P},1}(G) = \gamma_{\mathrm{P}}(G)$. Upper bounds for the power domination number are studied in [10, 19]. The power domination problem for various products of graphs is studied in [7, 8, 18] and exact values are determined for some product graphs. The generalized power domination is further studied in [5, 6]. In [6], the authors introduced the *k-propagation radius* of a graph G, motivated from the studies in [1], as a way to measure the efficiency of a minimum k-PDS. It gives the minimum number of propagation steps needed to monitor the entire graph G over all minimum k-PDS. The k-power domination number and propagation radius of Sierpiński graphs (cf. [14]) are determined in [6].

Definition 1.3 [6]**.** The radius of a k-PDS is defined by

$$\mathrm{rad}_{\mathrm{P},k}(G, S) = 1 + \min \left\{ i : \mathcal{P}_{G,k}^i(S) = V(G) \right\}.$$

The *k-propagation radius* of the graph can be expressed as

$$\mathrm{rad}_{\mathrm{P},k}(G) = \min \left\{ \mathrm{rad}_{\mathrm{P},k}(G, S) : \ S \text{ is a } k\text{-PDS of } G, \ |S| = \gamma_{\mathrm{P},k}(G) \right\}.$$

Knödel graphs $W_{\Delta, 2\nu}$ $(0 \le \Delta - 1 \le \lfloor \log_2(\nu) \rfloor)$ have been introduced by Knödel in [15] as the network topology underlying an optimal-time algorithm for gossiping among n nodes. They have been widely studied as interconnection networks mainly because of their favourable properties in terms of broadcasting and gossiping [3]. $W_{r,2^r}$ is one of the three nonisomorphic infinite graph families known to be minimum broadcast and gossip graphs. The other two families are the hypercube of dimension r, H_r [16] and the recursive circulant graph

$G(2^r, 4)$ [17]. Vertex transitivity as a Cayley graph [11], high vertex and edge connectivity, dimensionality and embedding properties [9] make the Knödel graph a suitable candidate for a network topology and an appropriate architecture for parallel computing. For a survey about the Knödel graphs, see [9].

We will use the notations $\mathbb{N}_t := \{t, t+1, \ldots\} \subseteq \mathbb{N}_0$, $[t] := \{1, \ldots, t\} \subseteq \mathbb{N}_1$, and $[t]_0 := \{0, \ldots, t-1\} \subseteq \mathbb{N}_0$, $t \in \mathbb{N}_0$, in the sequel; note that $|[t]_0| = t = |[t]|$.

Definition 1.4 [9]**.** The *Knödel graph* on 2ν vertices, where $\nu \in \mathbb{N}_1$, and of maximum degree $\Delta \in [1 + \lfloor \log_2(\nu) \rfloor]]$ is denoted by $W_{\Delta, 2\nu}$. The vertices of $W_{\Delta, 2\nu}$ are the pairs (i, j) with $i \in [2]$ and $j \in [\nu]_0$. For every such j, there is an edge between vertex $(1, j)$ and any vertex $(2, j + 2^\ell - 1 \bmod \nu)$ with $\ell \in [\Delta]_0$.
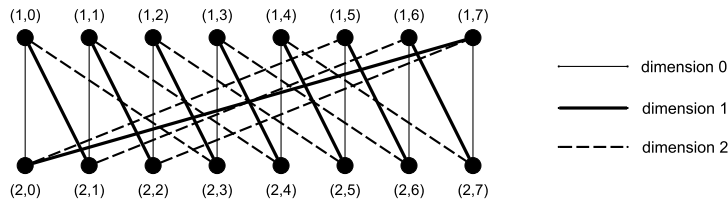

Figure 1. The graph $W_{3,16}$.

An edge of $W_{\Delta, 2\nu}$ which connects a vertex $(1, j)$ with the vertex $(2, j + 2^\ell - 1 \bmod \nu)$ is called an edge *in dimension ℓ*; cf. Figure 1.

The Tower of Hanoi (TH) problem, invented by the French number theorist É. Lucas in 1883, has presented a challenge in mathematics as well as in computer science and psychology. The classical problem consists of three pegs and is thoroughly studied in [12]. On the other hand, as soon as there are at least four pegs, the problem turned into a notorious open question. The general TH problem has $p \in \mathbb{N}_3$ pegs and $n \in \mathbb{N}_0$ discs of mutually different size. A *legal move* is a transfer of the topmost disc from one peg to another peg, no disc being placed onto a smaller one. Initially, all discs lie on one peg in small-on-large ordering, that is, in a *perfect state*. The objective is to transfer all the discs from one perfect state to another in the minimum number of legal moves. A state (= distribution of discs on pegs) is called *regular* if on every peg the discs lie in the small-on-large ordering. The Hanoi graphs H_p^n form a natural mathematical model for the TH problem. Each graph is constructed with all regular states as vertices, and two states are adjacent whenever one is obtained from the other by a legal move. For any $n \in \mathbb{N}_0$, H_1^n is the graph K_1. For two pegs, only the smallest disc can be moved in any regular state. Hence, for $n \in \mathbb{N}_1$, H_2^n is the disjoint union of 2^{n-1} copies of K_2, i.e., $H_2^n \cong W_{1, 2^n}$. Many properties of Hanoi graphs have been studied in [13] and literature therein.

Definition 1.5 [13]**.** The *Hanoi graphs* H_p^n for *base* $p \in \mathbb{N}_3$ and *exponent* $n \in \mathbb{N}_0$ are defined as follows.

$V(H_p^n) = \{s_n \cdots s_1 \colon s_d \in [p]_0 \text{ for } d \in [n]\},$

$E(H_p^n) = \big\{\{\underline{s}i\overline{s}, \underline{s}j\overline{s}\} \colon i, j \in [p]_0,\, i \neq j,\, \underline{s} \in [p]_0^{n-d},\, \overline{s} \in ([p]_0 \backslash \{i,j\})^{d-1},\, d \in [n]\big\}.$

The edge sets of Hanoi graphs can also be expressed in a recursive definition (cf. Figure 2).

$$E(H_p^0) = \emptyset,$$

$$\forall\, n \in \mathbb{N}_0 \colon E(H_p^{1+n}) = \big\{\{ir, is\} \colon i \in [p]_0,\, \{r, s\} \in E(H_p^n)\big\}$$

$$\cup \big\{\{ir, jr\} \colon i, j \in [p]_0,\, i \neq j,\, r \in ([p]_0 \backslash \{i,j\})^n\big\}.$$
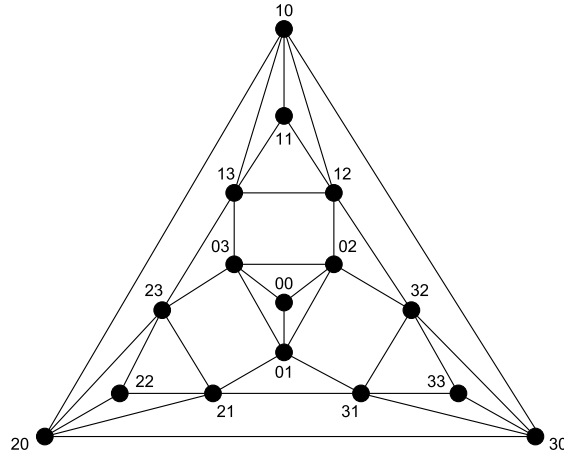
Figure 2. The graph H_4^2.

The vertices of the form $i^n := \overbrace{i \ldots i}^{n \text{ times}}$ are called *extreme vertices* of H_p^n.

In this paper, we study the power domination problem in Knödel graphs and Hanoi graphs. We determine the power domination number of $W_{3,2\nu}$ and provide an upper bound for the power domination number of $W_{r+1,2^{r+1}}$ for $r \in \mathbb{N}_3$. We also compute the k-power domination number and k-propagation radius of H_p^2.

2. Power Domination in Knödel Graphs

In this section, we study the power domination number of Knödel graphs. For $\Delta = 1, W_{1,2\nu}$ consists of ν disjoint copies of K_2 and therefore $\gamma_{\mathrm{P}}(W_{1,2\nu}) = \nu$. For

$\nu \in \mathbb{N}_2$ and $\Delta = 2, W_{2,2\nu}$ is a cycle on 2ν vertices and clearly $\gamma_P(W_{2,2\nu}) = 1$. We have the following theorem for the case $\Delta = 3$, if $\nu \in \mathbb{N}_4$.

Theorem 2.1. *For $\nu \in \mathbb{N}_4$, $\gamma_P(W_{3,2\nu}) = 2$.*

Proof. We prove that the set $S = \{(1,0),(2,2)\}$ is a PDS of $W_{3,2\nu}$. Clearly, $\mathcal{P}_1^0(S) = \{(i,j) \colon i \in [2], j \in [3]_0\} \cup \{(1,\nu-1),(2,3)\}$. For $\nu = 4$, S is a dominating set of $W_{3,8}$ and for $\nu = 5, 6$, we can easily observe that all vertices of $W_{3,2\nu}$ get monitored after stage 1 and therefore S is a PDS. Let $\nu \in \mathbb{N}_7$. Depending on whether ν is odd or even, we write $\nu = 2m - 1$ or $\nu = 2m$, $m \in \mathbb{N}_4$, respectively. Then for $i \in [m-3]$,

$$\mathcal{P}_1^i(S) = \big(\{(1,j) \colon j \in [i+3]_0\} \cup \{(1,\nu-j) \colon j \in [i+2]\}\big)$$
$$\cup \big(\{(2,j) \colon j \in [i+5]_0\} \cup \{(2,\nu-j) \colon j \in [i]\}\big).$$

We get that $\mathcal{P}_1^{m-3}(S) = V(W_{3,2\nu})$, if ν is odd, and $\mathcal{P}_1^{m-2}(S) = \mathcal{P}_1^{m-3}(S) \cup \{(1,m), (2,m+2)\} = V(W_{3,2\nu})$, if ν is even. Hence, in both cases we see that every vertex of $W_{3,2\nu}$ gets monitored after stage $\lfloor \frac{\nu}{2} \rfloor - 2$ and therefore S is a PDS of $W_{3,2\nu}$.

To prove that $\gamma_P(W_{3,2\nu}) \geq 2$, let us assume that $\{v\}$ is a PDS of $W_{3,2\nu}$. Then, since $W_{3,2\nu}$ is bipartite, after the domination step, each of the neighbours of v has exactly two unmonitored neighbours which prevents the further propagation. Hence $\gamma_P(W_{3,2\nu}) = 2$.   ∎

We now focus on the family of Knödel graphs $W_{r+1,2^{r+1}}$. In the next theorem, we prove that the power domination number of $W_{r+1,2^{r+1}}$ is at most 2^{r-2}. For that, we construct a PDS of cardinality 2^{r-2} in $W_{r+1,2^{r+1}}$. One can easily check that $S' = \{(1,1),(2,6)\}$ is a PDS of $W_{4,16}$. It is proved in [9] that $W_{r+1,2^{r+1}}$ can be constructed by taking two copies of $W_{r,2^r}$ and linking the vertices of each copy by a certain perfect matching. Therefore, in order to construct a PDS for $W_{5,32}$, we take two copies of the set S', each from a copy of $W_{4,16}$ that lies in $W_{5,32}$ and then prove that the new set is a PDS of $W_{5,32}$. We now extend the same idea to construct a PDS of $W_{r+1,2^{r+1}}$ for larger values of r. In the proof of the following theorem, we first produce a set S and then give the set of vertices that are dominated by $\mathcal{P}_1^0(S)$. After that we give the elements in $\mathcal{P}_1^1(S)$ and $\mathcal{P}_1^2(S)$, the sets of vertices that get monitored at the first and second propagation step, respectively. We obtain that the entire graph gets monitored in two propagation steps and thus S is a PDS of $W_{r+1,2^{r+1}}$.

Theorem 2.2. *For $r \in \mathbb{N}_3, \gamma_P(W_{r+1,2^{r+1}}) \leq 2^{r-2}$.*

Proof. Let $\nu = 2^r$ and $S = \{(1, 2^{r-3}+j),(2, 7 \cdot 2^{r-3}-1+j) \colon j \in [2^{r-3}]_0\}$. Then

$$\mathcal{P}_1^0(S) = S \cup \{(1, 7 \cdot 2^{r-3}+j-2^\ell \bmod \nu),(2, 2^{r-3}+j+2^\ell-1 \bmod \nu) :$$
$$j \in [2^{r-3}]_0, \ell = r-3, r-2, r-1, r\}.$$

For $r = 3$, the vertex $(1, 2j + 1)$ monitors $(2, 2j + 1)$ for every $j \in [3]$ and the vertex $(2, 2j)$ monitors $(1, 2j)$ for every $j \in [3]_0$. Thus we get $\mathcal{P}_1^1(S) = V(W_{4,16})$. Assume now that $r \in \mathbb{N}_4$. Then, for each j and ℓ, where $j \in [2^{r-4}]_0$, $\ell = r - 2, r - 1, r$, the vertices in the set $\{(1, 7 \cdot 2^{r-3} + j - 2^\ell \bmod \nu)\}$ monitor the vertices in the set $\{(2, 8 \cdot 2^{r-3} + j - 2^\ell - 1 \bmod \nu)\}$ by propagation. Also, for each j and ℓ, where $2^{r-4} \leq j \leq 2^{r-3} - 1$, $\ell = r - 2, r - 1, r$, the vertices in the set $\{(2, 2^{r-3} + j + 2^\ell - 1 \bmod \nu)\}$ monitor the vertices in the set $\{(1, j + 2^\ell \bmod \nu)\}$ by propagation. Hence the set of vertices monitored at stage 1 is given by

$$\mathcal{P}_1^1(S) = \{(1, j + 2^\ell \bmod \nu) \colon 2^{r-4} \leq j \leq 2^{r-3} - 1, \ell = r - 2, r - 1, r\}$$
$$\cup \{(2, 8 \cdot 2^{r-3} + j - 2^\ell - 1 \bmod \nu) \colon j \in [2^{r-4}]_0, \ell = r - 2, r - 1, r\} \cup \mathcal{P}_1^0(S).$$

Again following the propagation rule, for each j and ℓ, where $2^{r-4} \leq j \leq 2^{r-3} - 1$, $\ell = r - 2, r - 1, r$, the vertices in the set $\{(1, 7 \cdot 2^{r-3} + j - 2^\ell \bmod \nu)\}$ monitor the vertices in the set $\{(2, 8 \cdot 2^{r-3} + j - 2^\ell - 1 \bmod \nu)\}$ and for each j and ℓ, where $j \in [2^{r-4}]_0$, $\ell = r - 2, r - 1, r$, the vertices in the set $\{(2, 2^{r-3} + j + 2^\ell - 1 \bmod \nu)\}$ monitor the vertices in the set $\{(1, j + 2^\ell \bmod \nu)\}$. Hence the set of vertices monitored at stage 2 is given by

$$\mathcal{P}_1^2(S) = \{(1, j + 2^\ell \bmod \nu) \colon j \in [2^{r-4}]_0, \ell = r - 2, r - 1, r\}$$
$$\cup \{(2, 8 \cdot 2^{r-3} + j - 2^\ell - 1 \bmod \nu) \colon 2^{r-4} \leq j \leq 2^{r-3} - 1, \ell = r - 2, r - 1, r\}$$
$$\cup \mathcal{P}_1^1(S) = V(W_{r+1, 2^{r+1}}).$$

Therefore every vertex of $W_{r+1, 2^{r+1}}$ gets monitored after stage 2 and hence S is a PDS of $W_{r+1, 2^{r+1}}$ and $\gamma_P(W_{r+1, 2^{r+1}}) \leq |S| = 2^{r-2}$. ∎

For $r = 3$, any singleton set $\{v\}, v \in W_{4,16}$, cannot itself power dominate the entire graph, as each of the neighbours of v will have exactly three unmonitored neighbours after the domination step. Hence the bound in Theorem 2.2 is sharp for $r = 3$. We further illustrate Theorem 2.2 for the graph $W_{5,32}$. The vertices of the set S as defined in the theorem are coloured black in Figure 3.
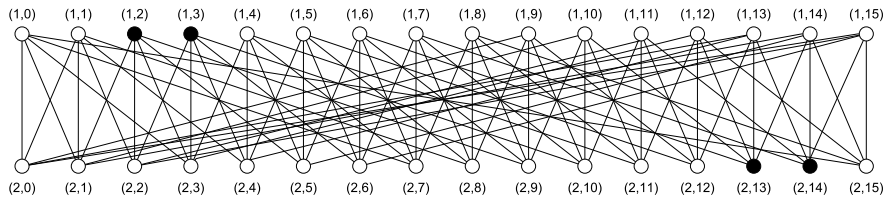
Figure 3. A power dominating set in the graph $W_{5,32}$.

In Figure 4, the set of dominated vertices, $\mathcal{P}_1^0(S)$, is coloured black and the remaining vertices are white.
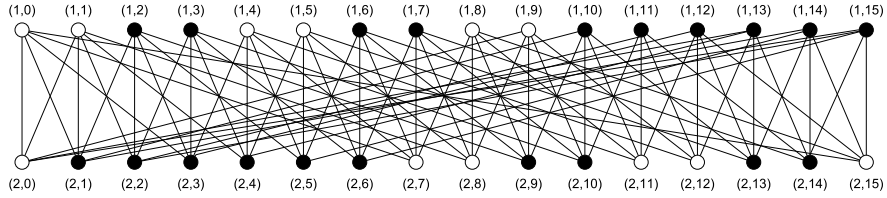
Figure 4. Neighbourhood is monitored.

The black vertices in Figure 5 and Figure 6 represent the sets $\mathcal{P}_1^1(S)$ and $\mathcal{P}_1^2(S)$, respectively.
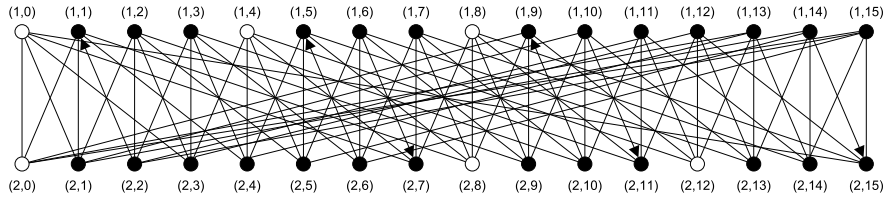
Figure 5. Propagation occurs.
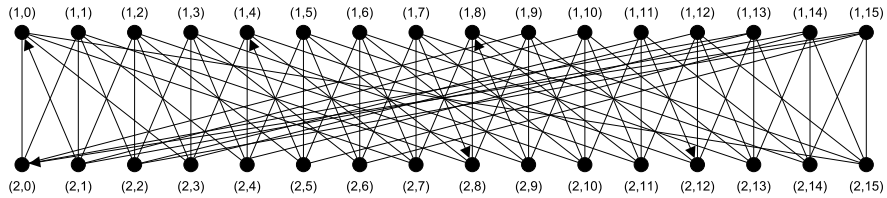
Figure 6. End of propagation.

The directed edges in the figures indicate the direction in which the propagation occurs at each stage. For instance, the directed edge $[(2,2),(1,1)]$ in Figure 5 indicates that $(2,2)$ monitors $(1,1)$ in the first propagation step. We observe that all the vertices get monitored by stage 2 and therefore S is a PDS of $W_{5,32}$.

However, we found that for $r = 5$, $W_{6,64}$ has a power dominating set of cardinality 6, namely $S = \{(1,1),(1,2),(1,11),(2,22),(2,27),(2,31)\}$. Therefore $\gamma_{\mathrm{P}}(W_{6,64}) < 2^3$. Hence the bound in Theorem 2.2 is not sharp for $r = 5$. This has to be compared with a conjecture stated in [5]. This conjecture says that, for $k \in \mathbb{N}_1$ and $r \in \mathbb{N}_2$, if $G \neq K_{r+1,r+1}$ is a connected $r + 1$-regular graph of order n, then $\gamma_{\mathrm{P},k}(G) \leq \frac{n}{r+2}$. In the present example this means, for $k = 1$, $\gamma_{\mathrm{P}}(W_{6,64}) \leq 9$.

3.   GENERALIZED POWER DOMINATION IN H_p^2

In this section, we study the behaviour of power domination in H_p^2. The cases $p \in [2]$ are trivial with $\gamma_{\mathrm{P},k}(H_1^2) = \gamma_{\mathrm{P},k}(K_1) = 1$ and $\gamma_{\mathrm{P},k}(H_2^2) = 2 = \gamma_{\mathrm{P},k}(W_{1,4})$, respectively, for all k.

Recall that for $p \in \mathbb{N}_3$ and $n = 2$, $V(H_p^2) = \{s_2 s_1 \colon s_1, s_2 \in [p]_0\}$ and $E(H_p^2) = \{\{ri, rj\}, \{i\ell, j\ell\} \colon r, i, j \in [p]_0,\ i \neq j,\ \ell \in [p]_0 \backslash \{i, j\}\}$.

Note that the extreme vertices are of degree $p - 1$ and all the other vertices are of degree $2p - 3$ in H_p^2. It is easy to observe that $\gamma(H_p^2) = p$. Indeed, any set containing a vertex from each of the p cliques in H_p^2 forms a dominating set of H_p^2. Since each of the p cliques contains an extreme vertex, any dominating set of H_p^2 must contain at least p vertices and hence $\gamma(H_p^2) = p$.

For $p = 3$, H_3^n is isomorphic to the Sierpiński graph S_3^n; see [13, p. 143 ff]. It is proved in [6] that

$$\gamma_{\mathrm{P},k}(S_3^n) = \begin{cases} 1, & n = 1 \text{ or } k \in \mathbb{N}_2; \\ 2, & n = 2 \text{ and } k = 1; \\ 3^{n-2}, & n \in \mathbb{N}_3 \text{ and } k = 1. \end{cases}$$

Therefore $\gamma_{\mathrm{P},1}(H_3^2) = 2$ and $\gamma_{\mathrm{P},k}(H_3^2) = 1$ for $k \in \mathbb{N}_2$.

For $p \in \mathbb{N}_4$, the Hanoi graphs do not contain perfect codes for $n \in \mathbb{N}_3$ [13, p. 195]. The domination number of these graphs is not known. Therefore we concentrate on $n = 2$. (For $n = 1$, $H_p^1 \cong K_p \cong S_p^1$.)

Theorem 3.1. *Let $k \in \mathbb{N}_1$ and $p \in \mathbb{N}_4$. Then*

$$\gamma_{\mathrm{P},k}(H_p^2) = \begin{cases} 1, & k \in \mathbb{N}_{p-2}; \\ p - k - 1, & k \in [p-3]. \end{cases}$$

Proof. *Case* 1. $k \in \mathbb{N}_{p-2}$. Let v be an arbitrary vertex of H_p^2. Let K_p^i denote the subgraph induced by the vertices $\{ij \colon j \in [p]_0\}$. Assume that $v \in K_p^i$ for some i. Let $S = \{v\}$. Then $V(K_p^i) \subseteq \mathcal{P}_k^0(S)$. Since each vertex in K_p^i other than the vertex ii has $p - 2$ neighbours outside K_p^i, for any $j \neq i$, $V(K_p^i) \backslash \{jj, ji\} \subseteq \mathcal{P}_k^1(S)$. Hence any vertex $j\ell$ in K_p^j, $\ell \neq i, j$, will have two unmonitored neighbours, namely jj and ji. Since $k \geq p - 2 \geq 2$, these vertices will get monitored by propagation, i.e., $V(K_p^j) \subseteq \mathcal{P}_k^2(S)$. Since this is true for any $j \neq i$, S is a k-PDS of H_p^2.

Case 2. $k \in [p-3]$. We first prove that $\gamma_{\mathrm{P},k}(H_p^2) \leq p - k - 1$. Let S be the set of vertices $\{i(i-1) \colon i \in [p-k-2]\} \cup \{0(p-k-2)\}$. Then $\mathcal{P}_k^0(S) = \bigcup \{V(K_p^i) \colon i \in [p-k-1]_0\} \cup \{ij \colon p-k-1 \leq i \leq p-1,\ j \in [p-k-2]_0\} \cup \{i(p-k-2) \colon p-k-1 \leq i \leq p-1\}$. Let Y be the set of vertices $\{ij \colon i \in [p-k-1]_0,\ p-k-1 \leq j \leq p-1\}$. Then any vertex $v = i'j'$ in Y has exactly k unmonitored neighbours given by

$\{\ell j' : p - k - 1 \le \ell \le p - 1, \ell \neq j'\}$ which will get monitored by propagation. Therefore, the remaining set of unmonitored vertices is given by $\{jj : V(K_p^j) \cap S = \emptyset\}$, which will then get monitored by propagation by its neighbours in K_p^j. Thus S is a k-PDS of H_p^2, which implies $\gamma_{P,k}(H_p^2) \le p - k - 1$.

We next prove that $\gamma_{P,k}(H_p^2) \ge p - k - 1$. Let S be a k-PDS of H_p^2. Suppose on the contrary that $\gamma_{P,k}(H_p^2) \le p - k - 2$. Assume first that S has exactly one vertex in p-cliques K_p^i for $i \in \{i_1, \ldots, i_{p-k-2}\}$. Let $\{i_1 j_1, \ldots, i_{p-k-2} j_{p-k-2}\}$ be the set of $p - k - 2$ vertices in S. Then $S \cap V(K_p^{i'}) = \emptyset$ for any $i' \in I' = [p]_0 \backslash \{i_1, \ldots, i_{p-k-2}\}$. Let $X = \{i'j_1, \ldots, i'j_{p-k-2}\}$. Then $\mathcal{P}_k^0(S) \cap V(K_p^{i'}) \subseteq X$. This holds for any $i' \in I'$. Let $J' = [p]_0 \backslash \{j_1, \ldots, j_{p-k-2}\}$. Then the set of vertices $\{i'j' : i' \in I', j' \in J'\}$ has an empty intersection with $\mathcal{P}_k^0(S)$. Since every vertex in H_p^2 has either no or more than k neighbours in this set, no vertex from this set can get monitored later on, a contradiction. Assume next that $|S| < p - k - 2$ or that S intersects some K_p^i in more than one vertex. Then we can conclude analogously that not all vertices of $K_p^{i'}$ will be monitored and hence $\gamma_{P,k}(H_p^2) \ge p - k - 1$. ∎

It is obtained in [6] that $\gamma_{P,k}(S_p^2) = \begin{cases} 1, & k \in \mathbb{N}_{p-1}; \\ p - k, & k \in [p-2]. \end{cases}$

We can observe that for $p \in \mathbb{N}_4$, $\gamma_{P,k}(S_p^2) - \gamma_{P,k}(H_p^2) = 1$ if and only if $k \in [p-2]$ and for $k \in \mathbb{N}_{p-1}$, the two values coincide.

We now compute the propagation radius of H_p^2. For $p = 3$, it is proved in [6] that $\mathrm{rad}_{P,1}(H_3^2) = 2$ and $\mathrm{rad}_{P,k}(H_3^n) = 3$ for $k \in \mathbb{N}_2$.

Theorem 3.2. *Let $k \in \mathbb{N}_1$ and $p \in \mathbb{N}_4$. Then $\mathrm{rad}_{P,k}(H_p^2) = 3$.*

Proof. For $k \in \mathbb{N}_{p-2}$, $\gamma_{P,k}(H_p^2) = 1$ and let $S = \{ij\}$ be a k-PDS of H_p^2. If $i \neq j$, we prove that the vertices ji and jj do not belong to $\mathcal{P}_k^1(S)$. Clearly, $ji, jj \notin \mathcal{P}_k^0(S)$. Also none of the neighbours of ji and jj belongs to $\mathcal{P}_k^0(S)$. Therefore, ji and jj cannot be monitored in stage 1. For $i = j$, we can similarly prove that the vertices ℓi and $\ell\ell$, for $\ell \neq i$, do not belong to $\mathcal{P}_k^1(S)$ and hence $\mathrm{rad}_{P,k}(H_p^2) \ge 3$. To prove the upper bound, consider the set $S = \{ii\}$. Then,

$$
\begin{aligned}
\mathcal{P}_k^0(S) &= V(K_p^i), \\
\mathcal{P}_k^1(S) &= \mathcal{P}_k^0(S) \cup \bigcup \left\{ V(K_p^\ell) \backslash \{\ell i, \ell\ell\} : \ell \in [p]_0 \backslash \{i\} \right\}, \\
\mathcal{P}_k^2(S) &= \mathcal{P}_k^1(S) \cup \{\ell i, \ell\ell : \ell \in [p]_0 \backslash \{i\}\} = V(H_p^2).
\end{aligned}
$$

Hence $\mathrm{rad}_{P,k}(H_p^2) \le \mathrm{rad}_{P,k}(G, S) = 3$.

Suppose that $k \in [p-3]$ and let S be a minimum k-PDS of H_p^2. Then $\gamma_{P,k}(H_p^2) = p - k - 1$ and thus there exist at least $k + 1$ p-cliques K_p^i not containing any vertex of S. Let $K_p^{i'}$ be an arbitrary such clique. We prove that

the vertex $i'i'$ is not in $\mathcal{P}_k^1(S)$. Clearly, the vertex $i'i'$ does not belong to $\mathcal{P}_k^0(S)$. Moreover, $|V(K_p^{i'}) \cap \mathcal{P}_k^0(S)| \leq p - k - 1$ and therefore $|V(K_p^{i'}) \backslash \mathcal{P}_k^0(S)| \geq k + 1$. Hence any neighbour of $i'i'$ has more than k unmonitored vertices preventing any propagation to this vertex on that step. Thus $i'i'$ is not in $\mathcal{P}_k^1(S)$. To prove the upper bound, consider the set $S = \{i(i-1) \colon i \in [p-k-2]\} \cup \{0(p-k-2)\}$. Then,

$$\mathcal{P}_k^0(S) = \{V(K_p^i) \colon i \in [p-k-1]_0\} \cup \{ij \colon p-k-1 \leq i \leq p-1, \, j \in [p-k-1]_0\},$$
$$\mathcal{P}_k^1(S) = \mathcal{P}_k^0(S) \cup \{ij \colon p-k-1 \leq i,j \leq p-1, \, i \neq j\},$$
$$\mathcal{P}_k^2(S) = \mathcal{P}_k^1(S) \cup \{ii \colon p-k-1 \leq i \leq p-1\} = V(H_p^2).$$

This completes the proof.   ■

Acknowledgements

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Strobilanthes orbiculata (Acanthaceae) a new species and notes on *S. matthewiana* from the southern Western Ghats, India

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Abstract

A new species *Strobilanthes orbiculata* is described from the southern parts of the Western Ghats, India. It is a semelparous species found in the shola forests in Vattavada and Kundala in Idukki district of Kerala. Notes on pollen morphology, distribution, phenology, conservation status and photographic illustrations are given. Moreover, a short note on a narrow endemic taxon *Strobilanthes matthewiana* is also provided.

Keywords: Endangered, Palni hills, pollen grain, rhombic, scaberulous, *S. adenophora*

Introduction

Strobilanthes Blume (1826: 781), the diverse and widespread genus in the family Acanthaceae, consists of approximately 450 species confined to the south and Southeast Asia, Melanesia (Carine & Scotland 1998, Carine & Scotland 2002). About 150 species have been reported from India and among them 61 species are reported to be from South India alone (Carine & Scotland 2002, Venu 2006, Karthikeyan *et al*. 2009). Species delimitation and nomenclature have remained problematic in *Strobilanthes*, since many species are poorly known and rarely collected, owing to their plietesial flowering pattern (Wood & Scotland 2009).

During the botanical exploration in Vattavada and Kundala, Kerala which border the southernmost parts of the Palni hills, an exceptionally distinguishing new species of *Strobilanthes* was found in the shola forests. It is very distinct from the related species by large orbicular leaves with cuspidate apex and two seeded capsules. While comparing the collections with herbarium specimens in India and abroad and also after critical study of relevant literature we observed that our collections do not match with any of the known species of *Strobilanthes* (Matthew 1999, Venu 2006). Therefore, it is described below as a new species.

Strobilanthes orbiculata S. Thomas, B. Mani & S. J. Brittto, *sp. nov.* (Fig. 1 & 2)

Diagnosis:—The new species is allied to *Strobilanthes pulneyensis* Clarke (1884: 438), but differs in having large orbicular leaves with cuspidate apices, leaf blade with 8–11 pairs of secondary veins, head inflorescence with only fertile bracts, narrowly triangular to triangular calyx lobes, oblong corolla lobes, 5-cryptoaperturate pollen grains and two seeded rhombic capsules.

Type:—INDIA. Kerala: Idukki district, Vattavada, 1950 m a.s.l., 2 October 2016, *Pradeep A. K. RHT68162* (holotype RHT!; isotypes MH!, RHT!).
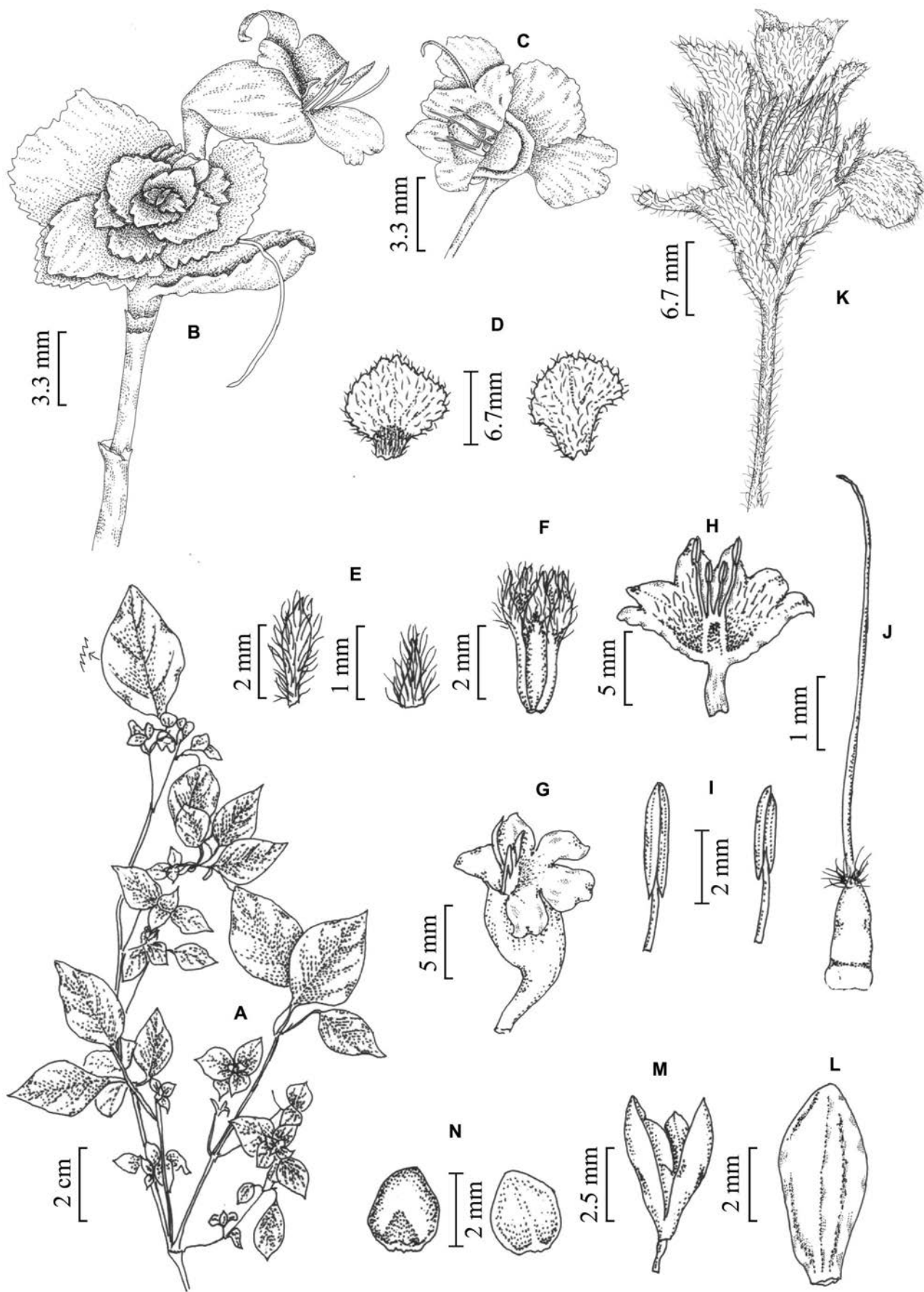
FIGURE 1. *Strobilanthes orbiculata*. A. Flowering branch; B–C. Inflorescences; D. Bract: abaxial (left), adaxial surfaces (right); E. Bracteole; F. Calyx; G. Corolla with stamens and pistil; H. Corolla split open showing the included stamens; I. Stamens; J. Pistil; K. Infructescence; L. Fruit; M. Dehisced fruit; N. Seeds. Illustrated by Philominal Selvi.
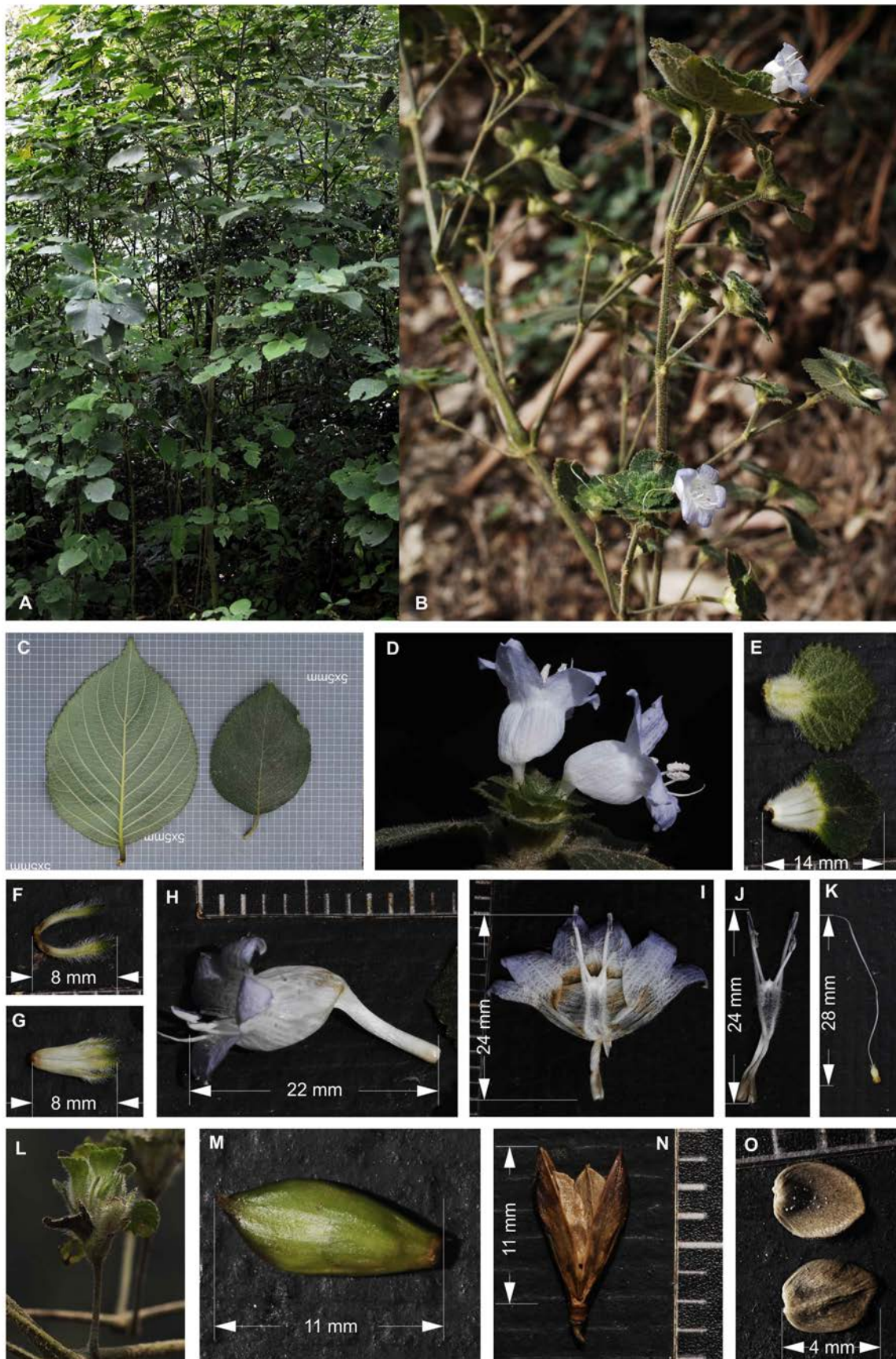
FIGURE 2. *Strobilanthes orbiculata*. A. Habit; B. Flowering branches; C. Leaves adaxial and abaxial view; D. Inflorescence with a pair of flowers; E. Bract: abaxial (upper), adaxial surfaces (lower); F. Bracteole; G. Calyx; H. Corolla with stamens and pistil; I. Corolla split open showing the included stamens; J. Androecium; K. Pistil, L. Infructescence; M. Separated fruit; N. Dehisced fruit with seeds; O. Seeds. Photo credit: Pradeep A. K.

Description

Large semelparous anisophyllous shrub, to 3.5 m tall. Stem terete, scabrous; branchlets long, nodes distant. Leaves symmetric, opposite, decussate; lamina orbicular, 85–220 × 70–150 mm, coriaceous, base rounded, margin crenate, apex cuspidate, lateral nerves 8–11 pairs, abaxial surface hirsute and adaxial surface scaberulous; petioles 25–100 mm long, scaberulous. Inflorescence of small subsessile–pedunculate heads, terminal or axillary, peduncle 3–45 mm long; heads solitary on each peduncle, 7–15 mm long, composed of 8–16 bracts. Bracts overlapping, all possess flower buds, the outermost foliaceous, 9–35 × 5–25 mm, obovate–oblance-ovate, base cuneate, margin crenate, apex obtuse, base sheathing and whitish creamy, upper leafy part green and recurved, hirsute throughout; bracteoles 6–8 × ca. 1 mm, oblanceolate, distal ⅔ hirsute on both surfaces. Calyx 7–9 mm long at anthesis, tubular, tube 3.0–4.0 mm long, glabrous, lobed to about half way down, lobes narrowly triangular–triangular, 2–3 lobes slightly shorter than the rest, hirsute. Corolla 25–29 mm long, white–pale blue, delicate, sparsely fine pubescent outside, tube 8–9 mm long, throat 11–13 mm long, villous inside, the lobes oblong, 7–8 × 4–5 mm, pubescent on outer surface, inside glabrous except abaxial lobes. Stamens 4, didynamous, all fertile, filaments connate and united with ⅔ length of throat, villous, not exceeding corolla, short and long stamens have nearly equal length, filaments sparsely long hairy pubescent, the two longer filaments 8–9 mm long, the two shorter ones 6.5–7.5 mm long; anthers oblong, ca. 2 × 1 mm. Ovary ca. 2 × 1 mm, pubescent on apex, locules two with 2 ovules each; style 22–24 mm long, linear, sparsely hairy; stigma ca. 2 mm long, linear, glabrous. Infructescence 15–20 × 12–14 mm, non-glandular hairy; capsules ca. 10 × 5 mm, rhombic, glabrous, 2-seeded; seeds orbicular, apex shortly cuspidate, glabrous.

Pollen morphology:—Pollen grains are spheroidal and echinulate and base of the spines are slightly thickened. Each pollen has five apertures which are equatorial. The ectoapertures are not apparent (cryptoaperturate) and the endoapertures are circular. Exine composed of small densely packed columellae forming a solid continuous tectum with granular appearance. Small, evenly spaced spines present on slightly raised areas of tectum. The raised area of tectum around each spine is micro-reticulate (Fig. 3 B–C).

Etymology:—The specific epithet 'orbiculata' indicates the "orbicular leaves" which is a diagnostic feature of the new taxon.

Phenology:—The new species is known to flower in October to January and to fruit in February–May. The flowering periodicity is unknown.

Habitat and distribution:—The new species is found to be an undergrowth in the shola forests in and around Vattavada and Kundala. It also shows a narrow distribution and occurs at an elevation of 1775–2000 m a.s.l.

Conservation status:—It is assessed as endangered (EN, B1, B2a, C, C2a, D) according to IUCN guidelines (IUCN Standards and Petitions Subcommittee 2016). The extent of occurrence is estimated to be less than 100 km² and the area of occupancy is less than 10 km². The species is found only in five locations and the number of individuals is less than 2500 with 100% mature individuals in each population. The restricted area of occupancy with a plausible future threat could drive the taxon to CR category (IUCN Standards and Petitions Subcommittee 2016).

Additional specimens examined (paratypes):—INDIA. Kerala: Idukki district, Vattavada, 1950 m a.s.l., 02 October 2016, *Pradeep A. K. RHT68163* (RHT!); 15 October 2016, *Pradeep A. K. RHT68194* (RHT); Kundala, 1775 m a.s.l., 15 October 2016, *Pradeep A. K. RHT68193* (RHT).

Taxonomic notes:—*Strobilanthes orbiculata* is morphologically allied to *S. pulneyensis* in having peduncled head inflorescence, non-glandular bracts in the infructescence, ventricose corolla, four stamens in didynamous condition and glabrous seeds. However, it differs from the latter by the upright habit (not straggling), terete and scabrous stem (not quadrangular and hispid), large and orbicular leaves with crenate margin and cuspidate apex (not ovate-lanceolate or elliptic leaves with serrate margin and acuminate apex), scaberulous adaxial leaf pubescence (not bulbous-based hairy), lamina with 8–11 pairs of secondary veins (not 6–7 pairs of secondary veins), scaberulous petiole (not simple hairs), absence of sterile bracts (not presence of leafy bracts), obovate to oblance-ovate bracts with obtuse apex (not ovate–spatulate bracts with acute apex), oblanceolate bracteoles (not linear–lanceolate), short calyx which is split only up to half way down (not calyx which is split up to ⅔ down), narrowly triangular to triangular calyx lobes which is non-glandular hairy (not narrowly linear calyx lobes which is glandular hairy), oblong corolla lobes (not orbicular), stamina sheath fused with ⅔ length of the corolla throat (not fusion of only ⅓ length), short and long stamens having almost equal length (not up to 5 mm difference in length), stamens not exceeding the corolla (not long stamens exceeding corolla), long hairy stamina filaments (not glabrous), rhombic 2-seeded capsules (not 4-seeded oblong–obovate capsules) and shortly cuspidate seeds (not non-cuspidate). A detailed comparison between the two taxa is enumerated in Table 1. *S. pulneyensis* is a straggling shrub widely distributed in the peninsular India, whereas

the new species is an upright large shrub plausibly restricted to Vattavada and Kundala region. The new taxon is well distinguished from *S. pulneyensis* by the inflorescence without sterile (foliar) bracts, whereas the presence of a pair of foliar bracts is a distinguishing feature of *S. pulneyensis*. In addition the heads are strictly depressed in *S. orbiculata*, but it is depressed to strobilate in *S. pulneyensis* (Matthew 1995) (Fig. 3A). Although, both taxa have four stamens in didynamous condition, stamens are not exceeding the corolla in new species, whereas the long stamens exceed the corolla in *S. pulneyensis*. Furthermore, the difference in length between the long and short stamens are ca 2 mm in new species but it is ca 5 mm in *S. pulneyensis*. A striking difference could also be observed in the fruit morphology and number of seeds between the two taxa. In *S. orbiculata* capsules are rhombic in shape and produce only two viable seeds which are develop from the upper ovules in each locule whereas the capsules are oblong-obovate and possess four seeds in *S. pulneyensis*. Moreover, the vegetative characters especially the leaf morphology of the new taxon is totally different from its close relative *S. pulneyensis* (Table 1).

TABLE 1. Comparison between *Strobilanthes orbiculata* and *S. pulneyensis*.

Characters	*S. orbiculata*	*S. pulneyensis*†
Habit	Large erect shrub	Straggling shrub
Stem	Terete	Quadrangular
Pubescence on stem	Scabrous	Hispid
Lamina dimension	85–220 × 70–150 mm	ca. 120 × 60 mm
Lamina shape	Orbicular	Ovate-lanceolate or elliptic
Lamina base	Rounded	Rounded or broadly ovate
Lamina margin	Crenate	Serrate
Lamina apex	Cuspidate	Acuminate
Lamina pubescence	Scaberulous	Bulbous-based hairy
Secondary veins	8–11 pairs	6–7 pairs
Petiole length	25–100 mm	ca. 50 mm
Pubescence of petiole	Scaberulous	Hairy
Inflorescence	Head	Heads to strobilate
Foliar bract (Sterile)	Absent	Present
Bract shape	Obovate–oblance-ovate	Ovate–spatulate
Bract apex	Obtuse	Acute
Bracteole shape	Oblanceolate	Linear–lanceolate
Calyx tube	½ length from base	⅓ length from base
Calyx lobes	2–3 lobes slightly shorter,	Equal
Calyx lobe shape	Narrowly triangular–triangular	Narrowly linear
Calyx pubescence	Non-glandular pubescent	Glandular pubescent
Corolla tube	Shorter than throat	As long as throat
Corolla lobes shape	Oblong	Orbicular
Stamens	Connate and united with ⅔ length of throat, not exceeding corolla	Connate and united with ⅓ length of throat, long stamens exceeding corolla
Stamina filament length (short)	6.5–7.5 mm	ca. 3 mm
Stamina filament length (long)	8–9 mm	ca. 8 mm
Pubescence of stamina filament	Sparsely long hairy	Glabrous
Pollen grain	5-aperturate	3-aperturate††
Style length	22–24 mm	ca. 15 mm
Capsule	Rhombic	Oblong–obovate
Seeds	2, orbicular, apex shortly cuspidate	4, orbicular, apex rounded

† Venu (2006); †† Carine & Scotland (1998).

The variability in pollen morphology is potentially useful to differentiate the species of *Strobilanthes* (Bremekamp 1944, Terao 1982, Carine & Scotland 1998, Deng *et al*. 2006). Based on shape there are two classes of pollen (spheroidal and ellipsoidal) recognised among the south Indian and Sri Lankan *Strobilanthes*. The spheroidal pollens are distinguished by sexine structure and the number, distribution and type of aperture (Carine & Scotland 1998). Carine & Scotland (1998) recognised 16 pollen types in spheroidal class which again fall into two distinct morphological classes based on structure of sexine (pollen types 7–13 & 14–22). By pollen morphology the new species is allied to *S. adenophora* Nees (1847: 182) in addition to *S. pulneyensis*, all have spherical echinulate (spheroidal) pollen grains

with cryptoapertures. The former belongs to pollen type 10 characterised by 5-cryptoaperturate pollens whereas the latter coming under type 8 characterised by 3-cryptoaperturate pollens. In both of the allied taxa sexine structure is similar in the following features: (i) the sexine of prominently raised areas only being supported by columellae (ii) the tectum around the raised areas is prominently reticulated. Moreover, the spines are placed very close in both species (Carine & Scotland 1998). However, the spine length is 3–3.5 µm in *S. pulneyensis* whereas that of *S. adenophora* is 3–6 µm.

Strobilanthes orbiculata, the new species, has 5-cryptoaperturate pollens as in *S. adenophora*. However, *S. orbiculata* has sexine features distinct from allied species by having columellae forming a solid and continuous tectum with granular appearance and terminating into well spaced short spines. In addition, spines have a length of ≤3 µm and the tectum around the spines are feebly reticulated in *S. orbiculata* (Fig. 3 B–C). Based on pollen morphology, *S. orbiculata* differs from *S. pulneyensis* and related to *S. adenophora* only in the number of apertures in pollen grains. *S. adenophora* is a Sri Lankan endemic sub-shrub species distributed along the banks of streams at an elevation of 50–200 m. There are other vegetative and floral features which distinguish between *S. orbiculata* and *S. adenophora* (Wood 1995, Wood 1998). Finally, the pollen of new species therefore is assigned for placement as a new pollen type distinct from pollen type 8 and 10 because of the differences in sexine structure and spine length.
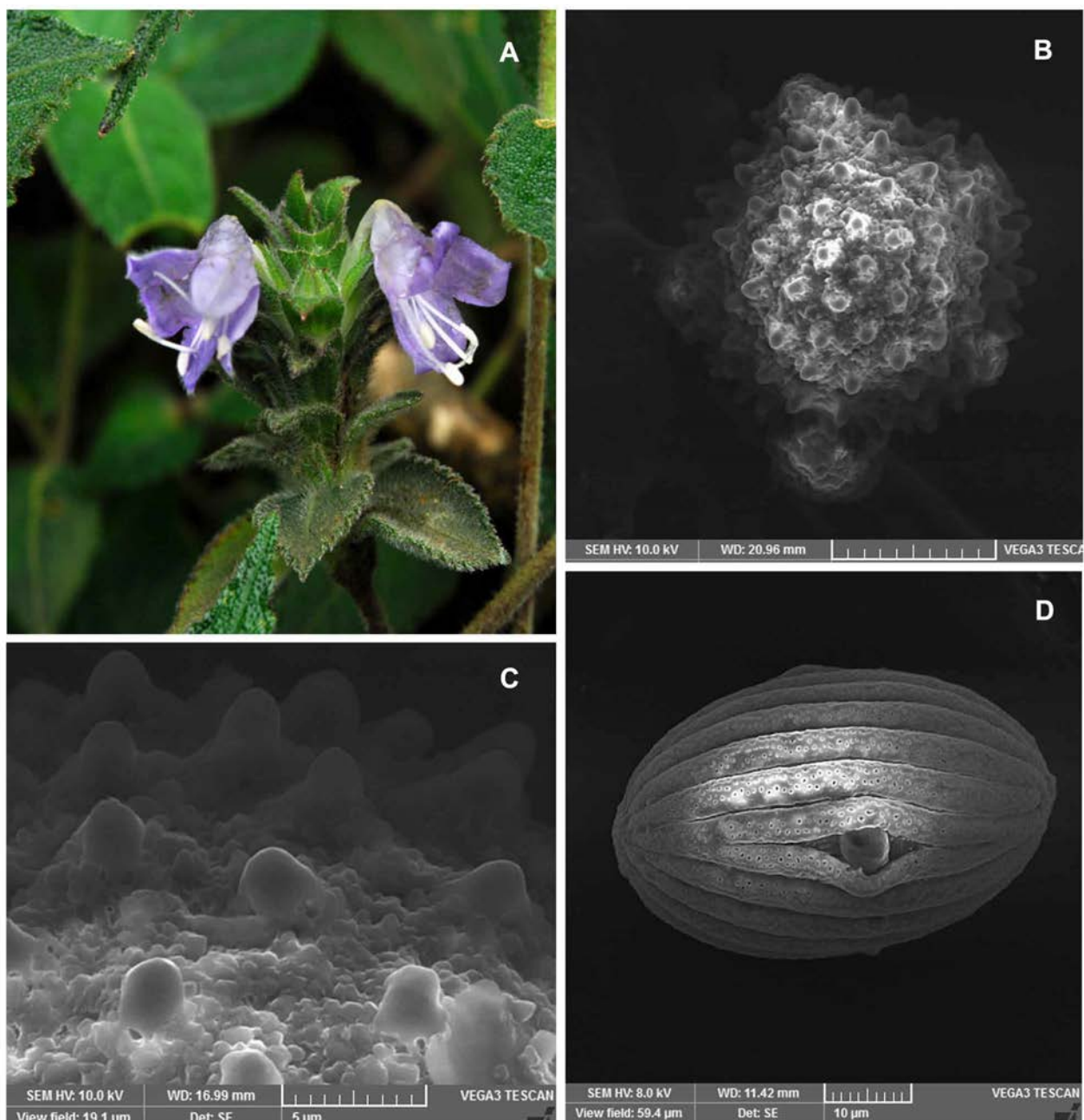
FIGURE 3. Inflorescence of *S. pulneyensis* (A) and SEM images of pollen grains of *S. orbiculata* (B–C) and *S. matthewiana* (D).

Strobilanthes matthewiana R.W. Scotland (1998: 204) (Fig. 4)

Type:—INDIA. Tamilnadu: Dindigul, Kodaikanal, Thoppithookkiparai–Periyur path, 16 Aug 1987, *K.M. Matthew & K.T. Mathew RHT50266* (holotype K; isotypes RHT, SHC, MH).
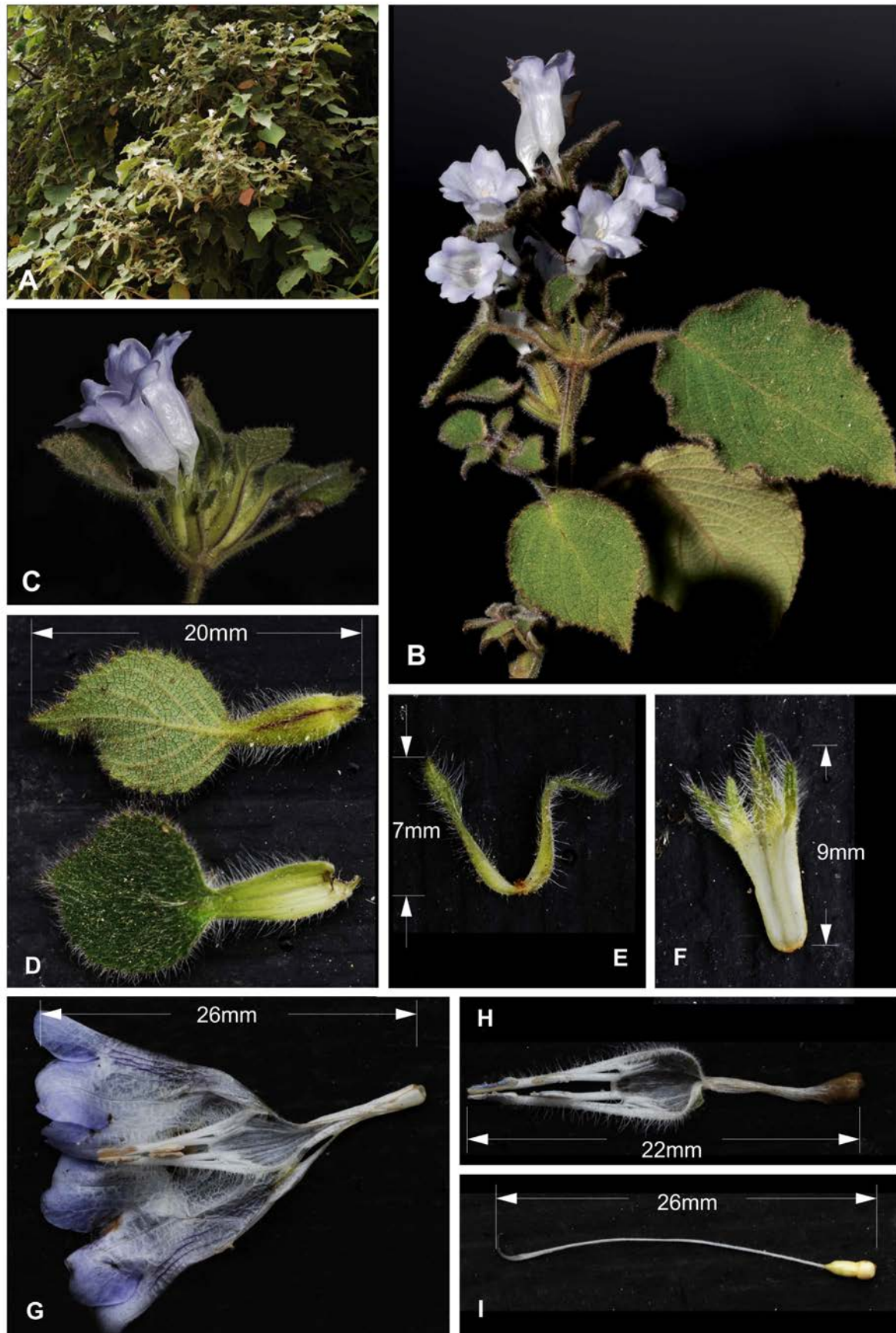
FIGURE 4. *S. matthewiana*. A. Habit; B. Flowering branch; C. Inflorescence; D. Bracts (outermost); E. Bracteoles; F. Calyx; G. Corolla split open; H. Androecium; I. Pistil. Photo credit: Pradeep A. K.

Description

Large semelparous anisophyllous shrub, to 4 m tall. Stem terete, cottony above with pilose glandular and eglandular hairs, lenticellate below. Leaves symmetric, opposite, decussate; lamina ovate, 50–116 × 10–85 mm, coriaceous, base slightly cordate or rounded, margin dentate to crenate, apex acute, lateral nerves 6–11 pairs, adaxial surface hirsute, abaxial surface pubescent with eglandular and glandular hairs throughout; petioles 15–50 mm long, pubescent with glandular and eglandular hairs. Inflorescence subsessile–pedunculate heads, axillary and terminal, 1– 4 heads per node, peduncle 2–18 mm long; heads solitary on each peduncle, 10–25 mm long, composed of 6–12 bracts. Bracts overlapping, 10–25 mm long, all possess flower buds, outermost foliaceous, with more or less parallel sided to urceolate long bases with ovate crenate apices, innermost lanceolate with ovate crenate apices, apex recurved, hirsute except adaxial surface of base; bracteoles 6–9 mm long, linear to lanceolate, pubescent except inside of base, apex often recurved. Calyx 9–13 mm long at anthesis, tubular, tube 6–9 mm long, glabrous, lobed to ⅓, lobes triangular, one lobe each slightly longer and shorter than the rest, long white hairs present throughout. Corolla 18–35 mm long, pale violet, glabrous outside, tube 10–13 mm long, throat 10–15 mm long, campanulate, inside of corolla with small tuft of hairs at same height as longer stamens, lobes round, 5–7 × 5–7 mm, glabrous. Stamens 4, didynamous, included, all fertile, longer stamens 9–11 mm with ciliate filaments, shorter stamens 4–5 mm, filaments glabrous, anthers elliptic, ca. 2 × 1 mm. Ovary ca. 2 × 1.5 mm, glabrous, ovules four; style 16–32 mm long, linear, sparsely hairy for two thirds length; stigma ca. 2.5 mm long, curved, glabrous. Capsule ca. 1.4–1.7 × 5 mm, oblong to elliptic, apiculate, glabrous, 2-seeded; seeds orbicular, ca. 4.5 × 3 mm, areolate with hygroscopic hairs.

Pollen morphology:—The pollen grains are ellipsoidal and 3-colporate. It is prolate in equatorial view and circular in polar view. Ectoapertures fusiform, whereas endoapertures circular. Exine is divided into longitudinal ribs, which are straight and narrow and pseudocolpi present between them. The number of ribs is 18–19 and the tectum is micro-reticulate (Fig. 3D).

Phenology:—It flowers during November 2016 to January 2017 and to fruit in March–May.

Habitat and distribution:—Distributed in the southern part of the Palni hills at an elevation of 2000–2300 m a.s.l. It grows as a gregarious shrub bordering the shola forests.

Conservation status:—It is assessed as endangered (EN, B1, B2a, C, C2ai, D) according to IUCN guidelines. It is estimated that the extent of occurrence is less than 100 km^2 and the area of occupancy is less than 10 km^2. The habitat is severely fragmented and located in few places. The number of individuals is less than 2500 with 100% mature individuals in each population. The restricted area of occupancy with a plausible future threat and pletesial life cycle pattern could drive the taxon to CR category (IUCN Standards and Petitions Subcommittee 2016).

Taxonomic notes:—*S. matthewiana* a narrow restricted endemic species distributed in the high altitude shola margins of the Palni hills. Scotland (1998) established this species based on the collections of Matthew and Mathew (RHT50266) from upper Palni hills in 1987. The flowering periodicity of the plant is so far unknown. The present collections are closer to the Top Station, Tamilnadu. Interestingly, our collection is 30 years after the collections of K. M. Matthew and K. T. Mathew. Therefore, the flowering periodicity of the plant may be either 10 or 15 years. Our study has also revealed the extent of occurrence of this species to the south of the Palni hills bordering the state of Kerala and its distribution is at an elevation of 2000 m a.s.l.

Specimens examined:—INDIA. Tamilnadu: Dindigul, Kodaikanal, Thoppithookkiparai–Periyur path, August 1987, *K.M. Matthew & K.T. Mathew RHT50266* (RHT); Kathirikkai Odei, Marion shola, along the Kodaikanal–Munnar road, 2000 m a.s.l., April 1988, *K.M. Matthew & K.T. Mathew RHT52759* (RHT); Theni,Top Station, 20 December 2016, *Pradeep A. K. RHT68249* (RHT); *Pradeep A. K. RHT68250* (RHT).

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Article

Two new species of *Impatiens* (Balsaminaceae) from the Western Ghats, India

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Abstract

Impatiens saulierea and *I. josephia*, two new species, are described from the Western Ghats, India. The former is collected from Kakkayam, Kozhikode and the latter from Idukki, Kerala. A detailed description of both taxa along with diagnostic characters between allied species, conservation status, pollen morphology and colour photographs are provided.

Keywords: *Impatiens aliciae*, *I. diversifolia*, saccate, SEM, stipule

Introduction

Balsaminaceae comprises over 1,000 species in two genera, the monotypic *Hydrocera* Blume (1825: 241) ex Wight & Arnott (1834: 140) and *Impatiens* Linnaeus (1753: 937), the diverse and large genus (Stevens 2012) mainly distributed in the Old World tropics and subtropics, with only a few species found in northern temperate regions (Grey-Wilson 1980a; Yuan *et al*. 2004; Janssens *et al*. 2009). *Hydrocera* is native to the Indo-Malayan region, where it occurs as a semi-aquatic plant in stagnant water, including India, Thailand, Cambodia, Malaysia, Sri Lanka, Laos, Vietnam, Indonesia and southern China. *Impatiens* occurs chiefly in montane forests of the tropics and subtropics of the Old World with five diversity centres: tropical Africa, Madagascar, South India and Sri Lanka, Sino-Himalaya and Southeast Asia (Grey-Wilson 1980b; Ramadevi & Narayana 1990). Several species of *Impatiens* are popular ornamental plants and are characterized by spurred zygomorphic flowers with fused stamens surrounding the pistil (Bhaskar 2012; Ruchisansakun *et al*. 2015).

Impatiens is represented by more than 210 taxa in India and is mostly distributed in the Eastern Himalayas and the Western Ghats (Bhaskar 2012). Among these, more than 106 species of *Impatiens* are endemic to the Western Ghats, of which more than 80% are endangered (Bhaskar 2012). Moreover, several possibly endemic new taxa have been recently reported from various parts of the Western Ghats (Hareesh *et al*. 2015, Prabhukumar *et al*. 2015, Chhabra *et al*. 2016).

While working on the diversity of *Impatiens* in Kerala, the authors collected two interesting specimens of *Impatiens* from the wet rocky habitats in the evergreen forest in Kakkayam, Kozhikode district and Idukki, Idukki district, which are allied to *Impatiens diversifolia* Wall. ex Wight & Arn. (1834: 139) and *I. aliciae* C.E.C. Fisch. (1934: 389) respectively. The former has diagnostic upright and stiff stems, axillary 2–3-flowered fascicled inflorescences and saccate lips with a straight spur; the latter has a strictly upright habit, 3–5-flowered axillary fascicled inflorescences, pink and long pedicellate flowers, and boat-shaped lips with orange blotches at the centre. Detailed taxonomic studies with a review of the pertinent literature (Bhaskar 2012, Dessai & Janarthanam 2011, Prabhukumar *et al*. 2015; Ramasubbu *et al* 2015) showed these taxa are hitherto undescribed species. Hence, both are described and illustrated here as new species.

Taxonomy

Impatiens saulierea B. Mani, S. Thomas & S. J. Britto *sp. nov*. (Fig. 1)

The proposed new species is morphologically allied to *Impatiens diversifolia*, but differs in having upright and stiff stems, salmon-red and
forked stipules, linear leaves, 2–3-flowered axillary fascicles, pink flowers, 5–6 mm long falcate lateral sepals, saccate lips without a
yellow blotch, a straight spur which is longer than the wing (lateral united) petals, widely elliptic and pubescent standard petals, non-
stipitate and obovate dorsal lobes of wing petals, an obovate basal lobe of the wing petals, a yellow dorsal auricle, terete pollen grains
with more than 4-colpi and with an irregularly baculate pollen reticulum, long and fusiform capsules, and sub-globose seeds.

Type:—INDIA. Kerala: Kozhikode District, Kakkayam, 680–720 m, 11 October 2016, *Mani et al. 68152* (holotype RHT!, isotypes MH!,
RHT!).

Description

Terrestrial, slender, erect annual herb, 40–70 cm tall, branched; stem angled–terete, green, salmon-red tinged, glabrous,
nodes slightly swollen. Leaves opposite, decussate, petiolate, stipulate; stipules persistent, salmon-red, forked; petiole
2–4 mm long; lamina 4.5–8 cm long, 5–9 mm wide, linear, base rounded, margin serrate, narrowly acute at apex, lower
surface whitish-green, glabrous, upper surface green, pubescent, midrib distinct, lateral veins obscure. Inflorescence
2–3 flowered in axillary fascicles. Flowers 1.6–1.8 cm across; bract basal, ca. 2 × 0.5 mm, narrowly triangular,
salmon-red; pedicel 2.3–3.5 cm long, salmon-red, pubescent along one side. Lateral sepals 2, 5–6 × 0.5–1 mm, falcate,
glabrous, pink, apex ca. 1 mm long, mucronate; lower sepal 6–7 × 3–3.5 mm, saccate, glabrous, pale pink, 1 mm
long, mucronate at apex, spur 1.8–2.3 cm long, pale pink, straight, glabrous; dorsal petal 5–5.5 × 6.5–7.5 mm, widely
elliptic, pubescent, pink, mid-vein green-tinged, apex obtuse, 1 mm long, mucronate; lateral united petals 12–16 ×
6.5–9.5 mm, bilobed, pink, basal lobe 2–3 × 1–1.5 mm, obovate, much smaller than distal lobe, distal lobe 10–14 ×
6.5–9.5 mm, obovate, glabrous, auricle short, rotund, yellow. Stamens 5, cohering above pistil, column ca. 3 × 2 mm,
slightly curved; filaments 5, pink, narrow and free at base, broad and connate towards apex, ventral filaments shorter;
anther ca. 0.5 × 0.25 mm, pollen pink, terete. Pistil ca. 2.5 × 1.5 mm, lanceovate, glabrous, carpels 5, ovules 4 in 3–4
locules and 3 in 1–2 locules, on axile placentae; style rudimentary; stigma 5-toothed. Capsule 12–24 × 4–5.5 mm,
fusiform, ridged, glabrous–sparsely pubescent, green–salmon-red, scar present at base of dorsal side; pedicel 3.2–4.0
cm long, horizontal–reclined in fruit, seeds 16–19 in number, ca. 2 × 1.25 mm, sub-globose, caruncle present, glabrous,
black, shining.

Etymology:—*Impatiens saulierea* is named in honour of Fr. Sauliere who botanised in the Anglade Institute of
Natural History (AINH), Shembaganur, Kodaikanal, a hill laboratory of RHT.

Phenology:—Flowering and fruiting just after the southwest monsoon season, September–October.

Habitat and distribution:—Grows along with *Impatiens gardneriana* Wight (1846: 1050) on wet and dripping
open rocky slopes in the ever green forests at elevation of 680–720 m a.s.l. The new species is known only from the
hill ranges of Kakkayam, Kozhikkode district in Kerala.

Preliminary conservation status:—The present study made known that *Impatiens saulierea* shows an extent of
occurrence of less than 100 km², the area of occupancy is less than 10 km², number of mature individuals are less than
250 and the number of mature individuals in each subpopulation is less than 50 (IUCN 2016). By following IUCN
criteria for assessing the conservation status, *I. saulierea* is assessed as belonging to the Endangered (EN) category.

Taxonomic notes:—*Impatiens saulierea* shows similarity to *I. diversifolia*, but differs from the latter by various
morphological characteristics which are depicted in Table 1. *I. diversifolia* prefers to grow in marsh habitats around or
above 1000 m a.s.l. and often grows as a diffuse annual or perennial herb. On the other hand, the new species grows on
wet and dripping rocky slopes and the plants are upright and strict annual herbs. Again, *I. diversifolia* is characterised
by the presence of a yellow eye (blotch) in the lip, with an often curved or S-shaped and forked spur which is equal
to the length of the wing (lateral united) petals and a stipitate dorsal lobe of the wing petals. Conversely, a lip without
eye (blotch), straight and unforked spur which is longer than the wing petals, and a non-stipitate dorsal lobe of the
wing (lateral united) petals are also key diagnostic characteristics of *I. saulierea*. Moreover, petiolate and linear leaves,
round leaf bases, dorsally pubescent laminas, a pedicel being shorter than subtending leaves, and a long, fusiform
capsule with 16–19 seeds are also important morphological characters useful to discriminate it from allied species.
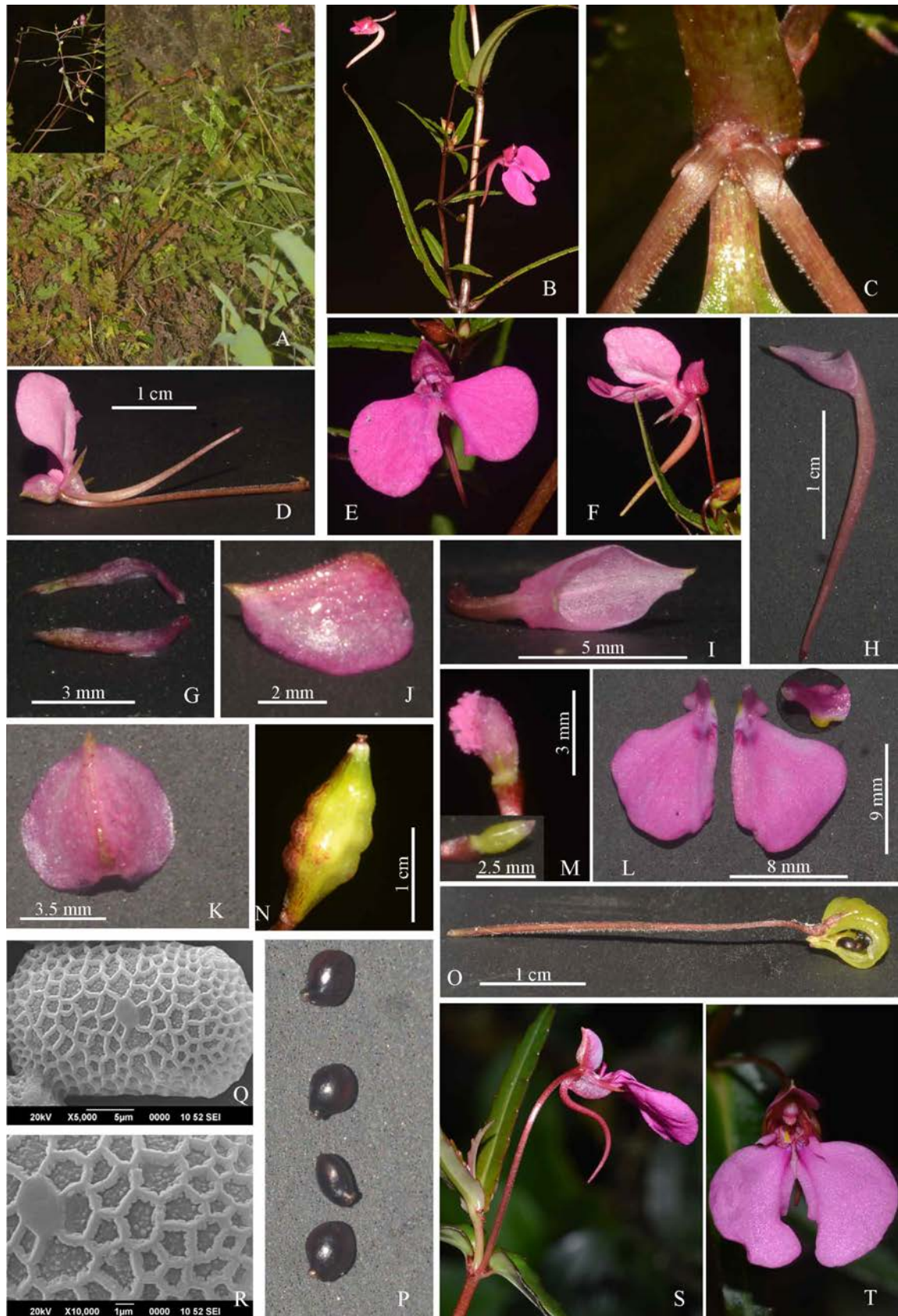
FIGURE 1. *Impatiens saulierea* (A–R) and *I. diversifolia* (S–T). A. Habit; B. Flowering branch; C. Node region shows petiolate leaves, forked stipules & bracts; D. Single flower; E. Flower: front view; F. Flower: ventro-lateral view; G. Lateral sepals; H. Lower sepal with straight spur; I. Saccate lower sepal; J. Dorsal petal: lateral view; K. Standard petal: dorsal view; L. Lateral united petals (inset: yellow dorsal auricle); M. Androecium (inset: pistil); N. Fruit; O. Fruit: dehisced; P. Seeds; Q. Scanning electron micrographs (SEM) of entire terete pollen; R. Reticulate sexine under high magnification; S. Flower with S-shaped spur; T. Flower: front view shows stipitate lateral united petals and yellow eye on lower sepal.

TABLE 1. Comparison of morphological characteristics of *Impatiens saulierea* sp. nov. with *I. diversifolia.*

Characters	*I. saulierea*	*I. diversifolia†*
Habitat	Wet rocky slopes	Marshy area
Habit	Upright annual herbs	Diffuse annual or perennial herbs
Height	40–70 cm	30 cm or more
Stem	Angled–terete, stiff, salmon-red tinged	Quadrangular, succulent or flaccid below, reddish
Stipule	Two-forked	Non-forked
Leaves	2–4 mm long petiolate	Sessile or shortly petiolate
Lamina shape	Linear	Elliptic or oblong, often boat shaped
Lamina apex	Narrowly acute	Obtuse or acute
Lamina base	Rounded	Cordate
Lamina dorsal surface	Pubescent	Glabrous
Inflorescence	Axillary 2–3-flowered fascicle	Solitary
Flowers	1.6–1.8 cm across	1.7 –2.2 cm across
Flower colour	Pink	Pink–reddish
Pedicel	Shorter than leaf	Longer than or same as leaf
Pedicel in fruit	Horizontal–reclined in fruit	Deflexed
Lateral sepals	Falcate, apex 1 mm long mucronate, pink	Linear, acuminate, red
Lower sepal	Saccate, yellow eye absent	Saccate, yellow eye at centre
Spur	1.8–2.3 cm long, straight, longer than wing petals	1.5–1.8 cm, S-shaped, tip often forked, same as the length of wing
Standard petal	Widely elliptic, pink, pubescent	Round, red, glabrous
Lateral united petals	1.2–1.6 cm long, pink	1.5–1.8 cm long, red
Dorsal lobe	Obovate, non-stipitate	Broadly semi-obovate, 5 mm long stipitate
Basal lobe	Obovate	Linear or conical
Dorsal auricle	Short, rotund, yellow	Short, spiniform or rotund, red/pink
Pollen grain	Pink, terete, more than 4 colpate, sexine reticulate, reticulum 0.6–3μ × 0.6–1.2 μ, irregularly baculate, muri 0.5 μ thick, dupli-columellate	Orange, rectangular, 4-colpate, sexine reticulate, reticulum ca 6 × 4 μ, muri 0.9 μ thick, dupli-columellate
Capsule	1.2–2.4 cm long, fusiform	8 mm long, ovate–ellipsoid
Seeds	16–19 in number, sub-globose	Many, globose

†Bhaskar 2012

Impatiens josephia S. Thomas, B. Mani & S. J. Britto *sp. nov.* (Fig. 2)

The proposed new species is morphologically allied to *Impatiens aliciae*, but differs in having erect, quadrangular and stiff stems, salmon-red stipules, linear leaves, 3–5 flowered axillary fascicled inflorescences, falcate and pubescent (mid-vein) lateral sepals, a boat-shaped lip with an orange blotch at the centre, a widely obovate dorsal lobe of the wing petals, a short dorsal auricle which is ¼ the length of the wing (lateral united) petals, rod-shaped pollen grains with polar colpi, fusiform and long pedicellate capsules, and slightly reniform–discoid seeds.

Type:—INDIA. Kerala: Idukki District, Idukki, 940–1000 m, 08 October 2016, *Thomas et al. 68212* (holotype RHT!, isotypes MH!, RHT!).
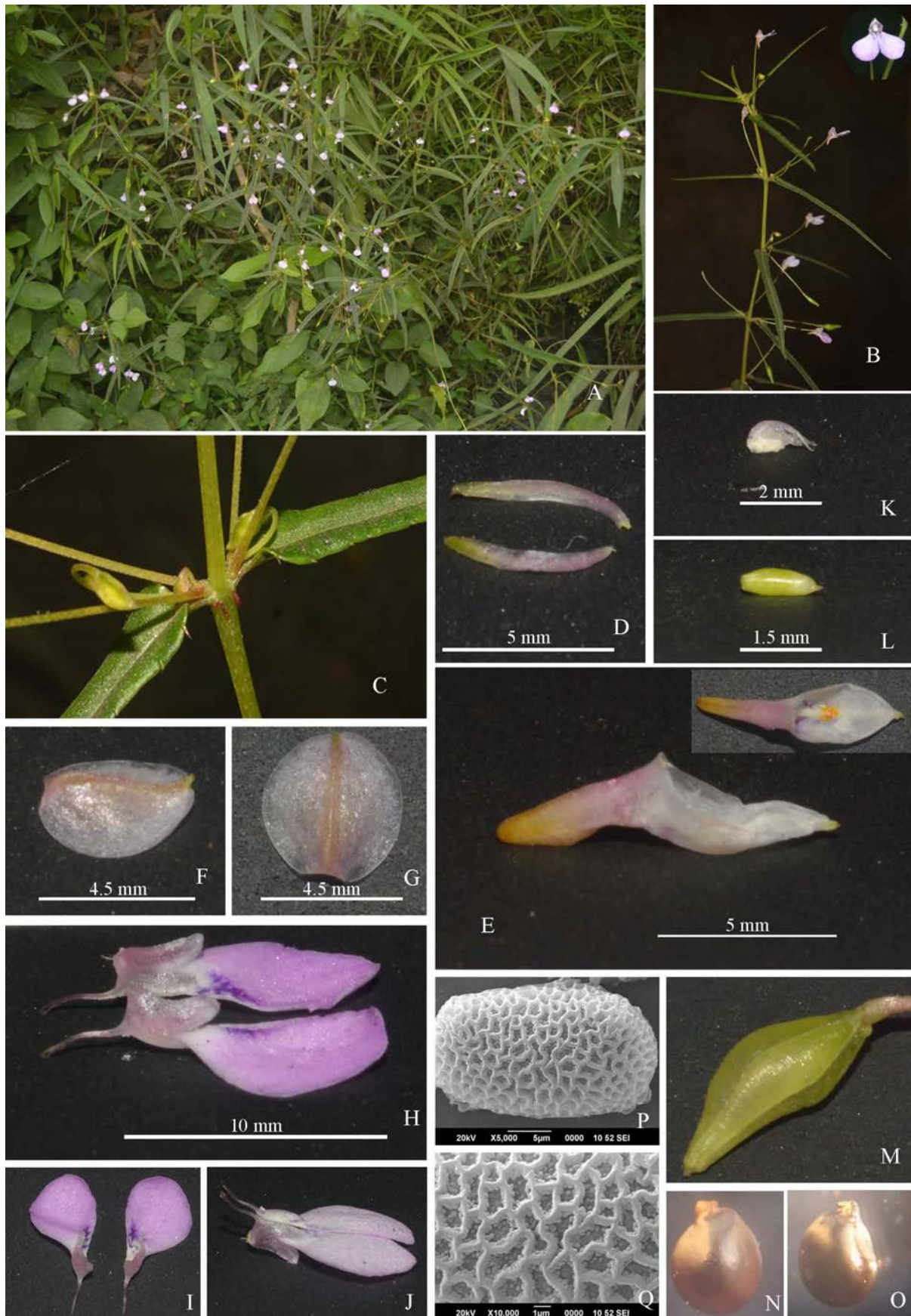
FIGURE 2. *Impatiens josephia*. A. Habit; B. Flowering and fruiting branch; C. Node region shows petiolate leaves, salmon-red stipules & fascicled inflorescence; D. Lateral sepals; E. Lower sepal (inset: orange blotch at centre); F. Standard petal: lateral view; G. Standard petal: dorsal view; H–J. Lateral united petals; K. Androecium; L. Pistil; M. Fruit; N–O. Seeds; P. SEM micrographs of entire pollen grain; Q. Reticulate sexine under high magnification.

TABLE 2. Diagnostic morphological characters of *Impatiens josephia* sp. nov. and *I. aliciae*.

Characters	I. josephia	I. aliciae†
Habit	Annual herbs, upright	Annual herbs, often procumbent
Height	30–55 cm	20–35 cm
Root stock	Absent	Horizontal, short, woody
Stipule	Salmon red	Green
Leaves	Linear	Narrowly elliptic–oblong
Lamina apex	Narrowly acute	Apiculate
Lamina base	Rounded	Acute
Inflorescence	Axillary, 3–5 flowered fascicle	Axillary, 1 or 2-nate
Flower colour	Pink	Deep pink or white with purple streak
Pedicel	2.5–4.0 cm long	To 2.4 cm long
Pedicel in fruit	3.0–4.8 cm long, inclined–descending	To 2.5 cm, deflexed
Lateral sepals	Falcate, 0.25 mm mucronate, puberulent	Linear, acute
Lower sepal	Boat-shaped, apex cuspidate, orange blotch at the centre	Cymbiform, subacute, blotch absent
Spur	ca. 3.5 mm long, tubular, straight, pink, yellow towards apex	2–3 mm, tubular–saccate, straight or slightly curved, pink
Standard petal	Orbicular, apex retuse	Orbicular, cuspidate
Dorsal auricle	ca. 2.5 mm long, ¼ th length of wing, filiform, edge not folded	Half as long as wing (5.5 mm), strap-shaped, edge folded to form a tube
Pollen grains	Rod-shaped, 4-colpate, colpi polar, sexine reticulate, reticulum small, sparsely baculate, dupli-columellate	Bilateral, 4-aperturate, more or less pleura goniotreme (angulaperturate), sexine reticulate, lumina small, baculate, faintly dupli-columellate
Capsule	12–15 mm long, fusiform	10–11 mm long, ellipsoid
Seeds	11–15 in number, slightly reniform–discoid	10–20 in number, sub-globose

†Bhaskar 2012

Description

Terrestrial, upright, annual herb, 30–55 cm tall, branched, branches erect; stem quadrangular, pale green, glabrous. Leaves opposite, decussate, stipulate, stipule salmon-red, ca. 2 mm long, petiolate; lamina 4.8–7.4 cm long, 4.5–5 mm wide, linear, base rounded, margin serrate, narrowly acute at apex, upper surface green, pubescent, lower surface whitish-green, glabrous, midrib distinct, lateral veins obscure. Inflorescence 3–5 flowered in axillary fascicles. Flowers 8–10.5 mm across; bract ca. 1 × 0.5 mm, narrowly triangular, caducous, pale green, situated at base of pedicel; pedicel 2.5–4 cm long, pale green, sparsely red-tinged, pubescent along one side. Lateral sepals 2, 4–5 × ca. 0.5 mm, falcate, mid-vein puberulent, pink, green towards apex, apex ca. 0.25 mm long, mucronate; lower sepal 4.5–5 × ca. 2.5 mm, boat-shaped, glabrous, white–pale pink with a prominent orange blotch at the centre, apex cuspidate, spur ca. 3.5 × 1 mm, tubular, straight, glabrous, pink, yellow towards apex, shorter than the wing (lateral united petals) petals; dorsal petal 4–4.5 × 4–4.5 mm, orbicular, mid-vein pubescent, pink, dorsally keeled, apex retuse, ca. 0.5 mm long mucronate; lateral united petals 9–10 × ca. 5 mm, bilobed, pink, basal lobe ca. 3 × 1.5 mm, falcate, much smaller than distal lobe, distal lobe 7–7.5 × ca. 5 mm, widely obovate, glabrous, auricle prominent, 2.5 mm long, filiform, purple, ¼ the length of the wing. Stamens 5, cohering above pistil, column ca. 2 × 1.25 mm, slightly curved; filaments 5, white, narrow and free up to ⅔ their length, broad and connate at apex, ventral filaments shorter; anther ca. 0.5 × 0.25 mm, pollen white, rod-shaped. Pistil ca. 1.5 × 0.5 mm, narrowly oblong, glabrous, slightly curved, pale green, ovules 3–4 in each locule, on axile placentae; style rudimentary; stigma 5-toothed. Capsule 12–15 × ca. 4 mm, fusiform, asymmetrical, glabrous, green, scar present at base of dorsal side; pedicel 3.0–4.8 cm long, horizontal–reclined in fruit, seeds 11–15 in number, ca. 1.75 × 1 mm, slightly reniform–discoid, glabrous, black, shining, with caruncle present.

Etymology:—The name *I. josephia* has been chosen in accolade of St. Joseph's College, Tiruchirappalli, which is one of the pioneer and foremost educational institutions in India.

Phenology:—Flowering starts from end of August and lasts up to October. Fruits matured during September–November.

Distribution and preliminary conservation status:—The new species is known only from the hill ranges of Idukki, Idukki district in Kerala. It grows on wet and dripping rocky slopes in the evergreen forests at an elevation of 940–1000 m a.s.l. *Impatiens josephia* shows an extent of occurrence that is estimated to be less than 100 km², the area of occupancy is less than 10 km², with a continuing decline observed in the quality of habitat, the number of mature individuals are less than 250 with an observed continuing decline and the number of mature individuals in each subpopulation is less than 50 (IUCN 2016). By following IUCN criteria for assessing the conservation status, *I. josephia* is assessed as belonging to the Endangered (EN) category.

Taxonomic notes:—*Impatiens josephia* resembles *I. aliciae* in its herbaceous habit, shortly petiolate and serrate leaves, lamina with indistinct lateral veins, axillary flowers, pedicel pubescence, small flowers, and orbicular standard petal. However, it differs from the latter by various morphological characteristics (Table 1). *I. aliciae*, an annual herb, often grows as a procumbent plant characterised by having a short root stock, narrowly elliptic-oblong leaves, axillary 1 or 2-nate flowers, cymbiform lower sepal (lip), 2–3 mm long spur, obovate dorsal lobe of wing petals, 5.5 mm long dorsal auricle which is half as long as the wing (lateral united) petal, bilateral pollen grains, ellipsoid capsules and sub-globose seeds. Alternatively, *I. josephia* is an upright plant with stiff and quadrangular stems, salmon-red stipules, linear and dorsally pubescent leaves, 3–5-flowered axillary fascicled inflorescences, long pedicellate flowers, falcate lateral sepals with pubescence on mid-veins, boat-shaped lips with an orange blotch, ca. 3.5 mm long spur, widely obovate dorsal lobe of wing petals, a ca. 2.5 mm long dorsal auricle which is only ¼ as long as the wing (lateral united) petal, rod-shaped pollen grains, fusiform capsules and slightly reniform–discoid seeds.

Acknowledgements

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IMPACT OF CONOLLY CANAL IN MARKET REORIENTATION AND CONFIGURING REGIONAL NETWORKS OF MALABAR

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ABSTRACT *This paper examines about the north and south regions of Malabar through the inland water way and configure the market system of interior parts by interconnecting with major ports near to Malabar. The hydrological elements used as an imperial policy in the west coast of Malabar in Madras presidency of British India. However, as an impact of the integration of the natural inlets like rivers, backwaters and estuaries it brings out an uninterrupted line of inland waterway. This study also analysis the reach ability of the canal to fulfill the imperial purpose and relocation of market system of west coast of south India, leads the market reorientation in early 20th century. The canal policy of British was a prime motive of imperial power that took up the natural water bodies especially rivers, backwaters and estuaries to join with artificial ways.*

In Indian subcontinent, the implementation of colonial dominance was executed through the political as well as economic spheres. The process of colonialism initially referred as a political ascendency then it further rooted in the territory through the economic policies. The economic intervention was considered as the actual arbitration of British.As a part of the political and economic strategic policies British tried to enact Treaty of Seringapatanam in 1792 and Treaty of Powney in 1790with Malabar and Cochin as a part of political ascendancy and it tries to merge the individual principalities with Bombay presidency. So, the English East India Company (EEIC) became an initial form of colonialism maintained their economic policies through acquisition of territories.

Since 19th century the inland navigation system was a part of the imperial policy of British. They were much known to the water resources and its mobilization facilities from the remote areas of the regions. So, British gave emphasis on making water navigational channels throughout the accessible regions, witnessed to spurt irrigational works occurred during the period of 1836 to 1866 in British India.Here, British tried to attempt realigning land and water policies in terms of systematic alteration of British India's great drainage networks. In fact, the period witnessed the systematic proliferation of 'control' of society and nature that combined through hydraulic interventions of colonialism.[i] The construction of canal with the geographical affluence paved the integration of both the colony and colonial power at greater extent. The hydraulic as well as mercantile policies were brought to bear in parallel and created some transitions in the economic as well as political sphere of Malabar. That they primarily engaged with the local marts where the imposition of transit and town duties by EIC led to segmentation and contraction of the ancient markets.

In the case of inland navigation British thoroughly understood about the geographical features of their equipped region, like the possibilities of navigational channels, satellite ports and interlinking with natural harbors etc. however these navigational prospects of Malabar along with natural advancement were first enunciated by H.S. Graeme, who identified the continuity of water channel from *Hodsurg to Chetuvai* around 150 miles distance. It can be better used during monsoons when the sea is impassable.[ii] Further, the interlinking plan of natural water bodies facilitates an unbreaking water navigation system in Malabar. The first connection of this system was the construction of a canal named as *Pyolee canal* to link *Korapuzha*in the north and *Beypoor* in the south which was initiated by Malabar collector H.V.Conolly (1840-1848) and canal became popularly known as *Conolly Canal* in the history of Kerala.

The original anicut of the canal starts from the northern part of Malabar that is, *Pyolee canal* of 3 miles in length that connecting 30 to 40 miles of the natural navigation. The second stretch of the canal was the 6 miles that connects 40 miles of river and natural backwater carriage to the south of Calicut which named as *Calicut canal*. The third stretch of the canal named as *Tanur canal* was occurred in the *Kadalundyriver*, about 8 miles cut through from the high ground of *pooraparamba*which stretch up to *Tiroorangadi*. The final stretch was the interconnection between *Ponnani and Chetuvai backwater* with the artificial channel of *Veliangode - Orumanayur canal*, which finally conjoins with the harbor of Cochin. So,

these artificial channels primarily connecting the waterways like *Beypoor, Kadalundy, Ponnani, Chetuvai backwater, Karuvannur*river with the backwaters of Cochin.[iii]

Here, the canal mainly accessed for the navigation and transportation purpose, which definitely shows the upward and downward commutation of men and material. For instance, the cultivation of grains in the northern part of Calicut was lower than the south Malabar, so they exported the grains from south to north. And the chief articles like sappanwood, arrowroot, pepper, bettlenut etc. for exporting to foreign and asiatic bottoms from the Malabar ports were collected from the interior parts with the accessibility of the artificial channels.The transportation facilities further progressed by the navigation of boats that transported both the commodities and men from one place to another. And here, the canal was only easy and convenient means of communication between the north to southern stretch, which facilitated very large number of travelers through this route.[iv]Gradually, British tried to impose toll levies and taxes to the transportation facilities of the channel. By this the ferries of the Malabar district, were classified to four classes and also categorized the navigable boats into big boats, smaller, passenger and miscellaneous based on the service accessibility of river and canal. The ferry levies were in the amount of 6 pies, exempted in some cases. Whereas, the toll levies were implied on both the rivers and canal channels which become more convenient in the transportation of both commodities and people.[v] In fact, it clearly points that the artificial channel of west coast were imperially taken by British, who directly controlled the entire water bodies.

Although Malabar was an emporium of trade and commerce since 19th century which had a vast market network near to the old port cities of Ponnani, Calicut, Chetuvai and chavakkad.Here the market was mainly existed as in the form of *angadis* and *chanda* which primarily connects with port that gave more accessibility to the transaction of goods through water channels. The port cities were linked with the adjacent market centers had been transported the important commodities from these regions. The *Calicut and Ponnani*ports were connected with the north and south section of Malabar regions, where the major market depots for the timber products. The *Chetuvai and Chavakkad* port, played a pivotal role since ancient period, connected with the interior parts and exported rice and other grains which linked with the small bazaars of the region. The accessibility of canal led to the easy flow of commodities from the remote areas to the port cities. That the pepper, cardamom, dry ginger, bettlenut etc. were grown in the eastern part of Malabar which brought by the rivers like *Kuttiyadi and Korapuzha*, further moved through the canal channels to Calicut port. There is some evident form of inland channel that used for the commercial purpose, like*valiyangadi or bigbazaar*, which was commonly known as *Bazaar canal or Robinson canal,* actually lies between the Calicut railway station and *Kallai*river. These portions were now transformed into the premises of Calicut railway station and used these channels for the drainage and sanitation purposes. Another inland communication was connected to Calicut the areas of *Areekod, Edavanna and Nilambur* where rice, paddy and timber was busy with large paddy boats thatched in with a semi-circular roof of leaves carried 1 to 4 tons of cargo to Calicut port. Most of these paddy boats belonged to the wealthy merchants of the city.[vi]The ports were developed due to the advancement of canal navigation system and it transported the grains, manufactured iron from palakkad, sappan wood, arrowroot, coconut, copra and oil etc. were the exportation articles from north to south were then carried through the canal system.[vii]

In fact, the imperial discussion between the officials evidently shows the integration of inland network for the commercial purposes. The configuration of regional networks of Malabar prominently connected with the navigation system by which, it conjoins the inland parts of Malabar and British Cochin in south wards.The accessibility of the direct navigation through inland waterways strategically paved the way for depreciating the importance of the subordinate ports. For instance, the *Chetuvai port*, a subordinate declined because of the systematic plan of the company was to create a direct navigation via northern to southern end. The records of export and import value indicate steady increase in the exports rather than import.[viii]

TABLE 1: EXPORT AND IMPORT FROM CHETUVAI PORT DURING THE YEAR 1848-1857.

Year	Import	Export
1848	293	91114
1849	5046	13453
1850	7622	92424
1851	-	71443
1852	10787	115505
1853	1798	110757

1854	12316	102755
1855	17926	105057
1856	58047	74949
1857	24322	94432
Total	1,38,157	971,889
Average	13,815	97,189

So, British tried to develop the dam near *Chetuvai* along with the improvement of *Eddathiruthy and Chavakkad*channels which directly brought the commercial goods to *Chavakkad*, then directly exported from chavakkad direct to an exit seaward at Cochin. Here onwards the imperial forecast about the importance of Cochin port which explicitly seen in the official communications. According to H.V.Conolly, Cochin port is rising graduallyan importance and it was much frequented with British and foreign vessels, as well as steamers and country craft looking at the tonnage account, the average number of vessels of the description which are hereafter contribute to the customs, amount to more than 500 and then tonnage to 4500 a year, the traffic with free Indian ports is also considerable.[ix]

Apparently, British brought a new scheme of trading system, the *looping trade system* that is *port to port trade* within the madras presidency through the Act VI of 1848. As per the Act, the trade from port to port should be left free and unrestricted and take this opportunity as a modifying or abolishing the duties on articles used for the purpose of manufacture .[x] In the case of Malabar, the company targeted to the *Cochin port* as a port to port trading system, which was affluent with sea trade activities within the madras presidency.By the survey of the company with the sea ports like *Tanjore, Ganjam, Calicut and Cochin*, the number of foreign vessels and tonnage of goods passed through Cochin was commendable.[xi]

TABLE 2: **FOREIGN VESSELS PASSES THROUGH MAJOR PORTS IN SOUTH INDIA 1845-47.**

Year	Port of Ganjam		Port of Tanjore		Port of Cochin		Port of Quilon		Port of Calicut	
	Vessels	Tonnage	Vessels	Tonnage	Vessels	Tonnage	vessels	Tonnage	Vessels	Tonnage
1845	3	118	3	607	15	2536	-		4	398
1846	11	1068	1	151	12	2296	1	81	2	87
1847	4	422	2	196	6	2294	-		1	33
TOTAL	18	1068	6	954	33	7126	1	81	7	518

The advancements of *Cochin port* paved the way for the diminishing the necessity of other ports in the west coast. So, as a mercantile policy the company planned to maximize the utilization of accessibility of the *Cochin port* by connecting it with the inland areas, linked with the of artificial channel of *Conolly canal*with the natural watercourse of the region brings out the southward relation.

In fact, it washydrological perspective with mercantile policy of British that actually configured hierarchies of ports as well as the market centers. The mercantile policy of Malabar certainly shaped through the treaty of 1865, popularly known as *Inter- Portal Trade Convention*. The treaty signed with Travancore and Cochin princely states, to transport the whole products of these southern states through the port of British Cochin. According to the treaty, these states were liable to pay duty for import and exporting commodities from their ports and taken away the monopoly of pepper, cardamom and tobaccos. Whereas, as per the Act of 1848 port to port treaty, port of British Cochin was exempted from the liable duties and government viewed other ports as like foreign except British ports. By the strong support of both these treaties the mercantile policy of company established in the western coast of Malabar region. So, the market hierarchies now orientated towards British Cochin that trading system moved more to south.The market centers of different regions as from the northern part or southern part, all of them magnetized towards the Cochin harbor, that owned by British. The perceptions of treaty basically a theory to grabbing the major market position with it root, from the interior section, through the inland waterways and channelized the market towards the British commercial port. The provision of the treaty itself clarifies that the improvements made in Malabar would materially increase the trade of British Cochin.[xii] So, the reorientation becomes complete through Inter Portal Convention Treaty in 1865.

The transition in the orientation of market centers and port towns during the period of second half of 19th century, also witnessed the emergence of new locale for the local marts. Earlier times, the centers of market existed along with the passes and major ports which were geographically inclined

areas for the transaction of trading system. The period later half of 19th and first half of 20th century, explicitly shows that the reorientation of the market system that primarily become more interior and remote in its character. The impact of Conolly canal for the emergence of new marts at considerable extent, which the canal stretches more closely related to these regional markets and by the introduction of these navigation facilities the economy underwent great transformation. Due to the emergence of new market centers nearly to the inland areas where the major center of agro products namely coconut oil, oil cake, coprah and coir led to the reorientation of the commodities of the transaction through channel. Since 19th century the coconut commodities became major product for the exportation from the west coast. So, the articles of coconut like coprah, coir goods and oil also considered as the important products of this period before that, these products were shown undistinguished under the 'fruits and vegetables' of other sorts but under the instruction of government orders, the product separately shown in the trade accounts. The total quantity exported was valued at 21lakh of which 15 lakh were from Malabar.[xiii]

The study concludes that the penetration of British to Malabar region mainly through the mercantile and hydrological policies. In the hydrological aspects, British tried to bridging regional networks by connecting natural waterways with the possible artificial channels of canals.   It was mainly 4 parts; Pyolee, Ellathur to Beypoor, Tanur to Calicut, Ponnani to Chetuvai, unconnected parts of west coast division. Above all, the canal construction policies were also played a pivotal role in the transition in the system of market as well as port hierarchy in the region.And this waterway became inevitable and forms practically sole means of communication between the southern parts, especially British Cochin, one of the flourishing port of British Empire.

[1]RohanD'souza, 'Water in British India: Making of a Colonial Hydrology', *History Compass*, Vol.4, No.10, UK: Blackwell, pp.621-628.

[1] Letter from H.V.Conolly to F.C.Cotton, civil engineer of 7th division, Ootacamund, dt.21st July 1845, Calicut.

[1] Map-1.Rivers and backwaters map with conolly canal.

[1] Letter from Thahasildars of Ponnani to Revenue Divisional Officer, Palakkad, 28th August, 1909, Dispatch Abstract Regarding Improvements of West Coast Canal from Ponnani to Chetuvai, Calicut Regional Archives.

[1]Correspondence Relating to Introduction of Canal and Ferry Act in Malabar from 1874 to 1880, Vol.1, Calicut Regional Archives.

[1]*Routes in Madras Presidency*, Madras, October 1879,p.508.

[1]Letter from H.V.Conolly, collector of Malabar to F.C.Cotton civil engineer of 7th division, dt.21st July, 1845, Calicut. Madras record office si.no.7177, correspondence relating west coast canal project, 1856-1859, 3rd volume. Calicut regional archives.

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[1]Administrative report of madras 1845-57.

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[1]Administrative report of madras 1880-81.p.128.

Rivers and Backwaters Map with Conolly Canal

Prepared by the researcher
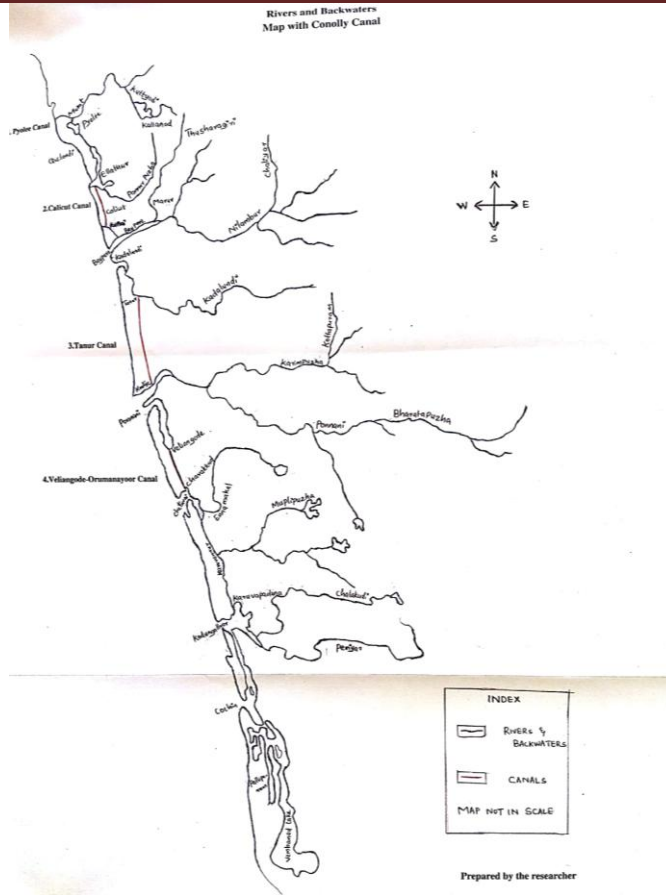
Seeing yourself as you want to be is the key to personal growth.
~ Anonymous

COMPARATIVE STUDY OF SOIL AND WATER QUALITY IN THE INDUSTRIAL AREA OF ANGAMALY, KERALA, INDIA

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ABSTRACT

In the present study, physicochemical and biological quality of soil in industrial area of Angamaly, in Ernakulam District, Kerala, India was carried out. Dumping of industrial wastes and discharge of industrial effluent without proper treatment enhances the infiltration of harmful compounds to the ground water. Physicochemical parameters of soil and water like pH, Total Hardness, Magnesium Hardness, Calcium Hardness, Chloride content, Dissolved Oxygen, Chemical Oxygen Demand (COD) and Total Dissolved solids(TDS) were determined to find the extend of pollution and the reasons for the ground water problems in the selected area. The water quality parameters were found to be within the permissible limits specified by BIS standards.

KEY WORDS: *Soil quality, Ground water , pH, Total Dissolved Solids, Ca Hardness, Mg Hardness, Total Hardness, Chloride Content, Dissolved Oxygen, Chemical Oxygen Demand*

INTRODUCTION

Soil fertility is the inherent capacity of the soil to provide the essential plant nutrients in adequate amounts and in proper proportions for the plant growth (Rajan Kumar Basak., 2012). Soil characterization of a region is an important aspect in relation to sustainable agricultural production. The macronutrients and micronutrients are important soil elements that control its fertility and enhance the yield of crops (R. P. Singh, Mishra. , 2012; R. P. Singh, et al (2012)). Soil quality may include a capacity for water retention, carbon sequestration, plant productivity, waste remediation, and other functions, or it may be defined more narrowly (SS Kekane ETAL 2015; Ku Smita Tale et al, 2015).

But nowadays, groundwater pollution has emerged as one of the most significant environmental problem. In modern economies there are a large number of industries functioning across the world. With the advancement of it's functioning the environment is

getting more vulnerable to pollution. Dumping of industrial wastes containing large amount of various chemicals enhance the infiltration of harmful compounds to the ground water. Landfills, use of fertilizers, discharge of industrial effluent without proper treatment into nearby water bodies etc. are some human activities threatening the ground water.

Rapid determination of pollutants penetrating into the water is necessary for adequate measures to restrict environmental damages. Hence, there is an immediate need to identify potential water quality and devise appropriate methodologies for long term sustainability. Good quality of water resources depend on large number of physicochemical parameters , the magnitude and source of any pollution load ; and to assess that monitoring of these parameters is essential. Parameters for drinking water qualities are chemical, physical and microbiological. Physical parameters include Total Dissolved Solids, Color, Odor etc. ; chemical parameters include p^H, Dissolved Oxygen(DO), Total Hardness, Calcium Hardness, Magnesium Hardness, Chemical Oxygen Demand(COD), Oxalate Content, Chloride Content, Fluoride Content, Phosphate Content, Sulphate Content, Heavy metals etc. and Microbiological parameters include Biological Oxygen Demand(BOD) MPN index etc. (RanjanaAgrawal 2009, Rajan Kumar Basak., (2012), Sadhana Chaurasia etal 2014).

OBJECTIVES
- To become familiar with the texture of soil in industrial areas.
- Comparison of different soil and water quality parameters in industrial areas.
- Determination of physicochemical parameters of soil and water like pH, acidity, alkalinity, Total Hardness, Magnesium Hardness, Calcium Hardness, Chloride content, Dissolved Oxygen, Chemical Oxygen Demand (COD) and Total Dissolved solids(TDS)

MATERIALS AND METHODS
Study area
The selected area for our study is industrial area of Angamaly, in Ernakulam District, which is located in Kerala State, India. Angamaly has many industries like Silver Star Plastic Industry, K K Industries, Kathir Food Products, Alpha Paints, Associated Rubber Chemicals (Kochi) Private Limited, Malabar Anhydrous Ammonia Industry, Surya Metals Industry, Boxer Company, Thettayil Thread Rubber Industry, Luciya Paper Board Industry etc. In the present study, 20 samples were collected from 5 sampling stations. Manual sampling with a plastic container in acquiescence with established standard norms was adopted. Labels were used to prevent sample misidentification. Sample preservation

was done in tune with minimum possible time lapse between collection and analysis.

Methods for the Determination of Quality Parameters
The standard techniques and methods were followed for different chemical analysis of samples (R. Gopalan etal, 2008; Leo M.L. etal, 2013; Sirkar A G etal, 2007). TDS was determined by gravimetric evaporation method. pH of the water samples are determined with the help of pH meter. Electrical conductance was measured using conductivity meter. The chemical parameters such as Chloride content, Dissolved oxygen, Hardness and Chemical oxygen demand were computed by Argentometry, Winkler's titration method, Complexometry and back titration respectively.

pH of the water samples are determined with the help of pH meter. The chemical parameters such as Acidity, Alkalinity, Chloride content, Dissolved oxygen, Hardness and Chemical oxygen demand were computed by acidimetry, alkalimetry, Argentometry, Winkler's titration method, Complexometry and back titration respectively.

RESULTS AND DISCUSSION
The collected samples were analysed for various physico -chemical parameters like total dissolved solids, p^H, acidity , alkalinity , calcium hardness , magnesium hardness , total hardness , dissolved oxygen, chloride and COD .The chemicals and reagents used for analysis were of analar grade. All the measurements were carried out in the temperature of 30^0C and are expressed in the unit of mg/l. The results are given in Table I.

pH value of the samples vary between 6.1 to 7.6 and is shown in the figure 1. From the table and figure, it is clear that the p^H of the water samples were found to be within the permissible limits of 6 to 8.5.

The total dissolved solids of the samples vary between 70.99 – 255.74 mg/l and were also within the permissible limits of less than 500mg/l . TDS value is an indication amount of soluble salts. This data is supported by the electrical conductance measurement whose value lies between 0.11 -0.79 dSm^{-1} and shown in figures 2 and 3 respectively. Sample 5 shows higher conductance value which contains more dissolved ions than the permissible limit.

Hardness of the samples were determined by complexometric titrations which vary between 43.95 – 223.6 mg/l and is shown in figure 4. The maximum permissible limits of Ca and Mg hardness is 100 mg/l and 30mg/l respectively. All the samples except sample 5 showed hardness within the limits set by BIS as well as WHO standards. But hardness of sample 5 exceeds the permissible limit which in turn showed that the water is hard and can't be used for washing purpose. It can be used after softening process.

Chloride content of all samples never found to be exceeding the permissible limit of 250mg/l in the study area and vary between 12.4 – 189.65 mg/l as shown in the figure 5.

Dissolved oxygen levels indicates the ability of water to purify itself through biochemical process. The permissible levels of DO according to BIS as well as WHO standards is 4-6mg/l. DO of the samples are shown in figure 6 and vary from 2.83 – 4.62 mg/l was less than the permissible levels except for sample 1 and sample 5. The low amount of dissolved oxygen in water indicates the presence of high amount of impurities. In the view of DO, sample1 and sample 5 are polluted.

COD determination is reliable and fast for the determination of organic pollutants as well as for the assessment of the quality of water. The COD of good and palatable drinking water should not be more than 20mg/l. COD of samples vary between 2 -6 mg/l as shown in the figure 7 and is within the permissible limit.

CONCLUSION

In this work, we assessed the quality of soil and water in the industrial area of Angamaly. From the study, it can be concluded that all the parameters such as pH , TDS, and Chloride content of all samples were within the permissible limits set by BIS as well as WHO standards. But sample 5 and sample 1 have low dissolved oxygen content and diminutive COD value. Electrical conductance and hardness of sample 5 is also high. So these need some water treatments before it is used for drinking for reducing health risks. Overall study shows that, from the collected water samples of the studied area, sample 3 is of good quality since all the water quality parameters are within the permissible limits.

TABLES & FIGURES
Table 1 Physico – chemical quality parameters

SampleNo.	pH	TDS (mg/l)	Electrical conductance (dSm^{-1})	Calcium Hardness (mg/l)	Magnesium Hardness (mg/l)	Total Hardness (mg/l)	Dissolved Oxygen (mg/l)	Chloride (mg/l)	COD (mg/l)
1	6.1	70.99	0.11	39.83	4.12	43.95	2.83	12.4	4
2	7.5	203.94	0.54	48.94	5.91	54.85	4.62	159.17	6
3	7.3	129.23	0.25	43.25	5.52	48.77	4.18	14.33	2
4	7.6	165.97	0.48	51.22	6.21	57.43	4.55	43.98	3.8
5	7.6	255.74	0.79	202.94	20.72	223.66	3.63	189.65	3.5
IS 10500: desirable limit	6-8.5	500	0.5	100	30	300- 600	4-6	250	20

Figure 1 pH of samples
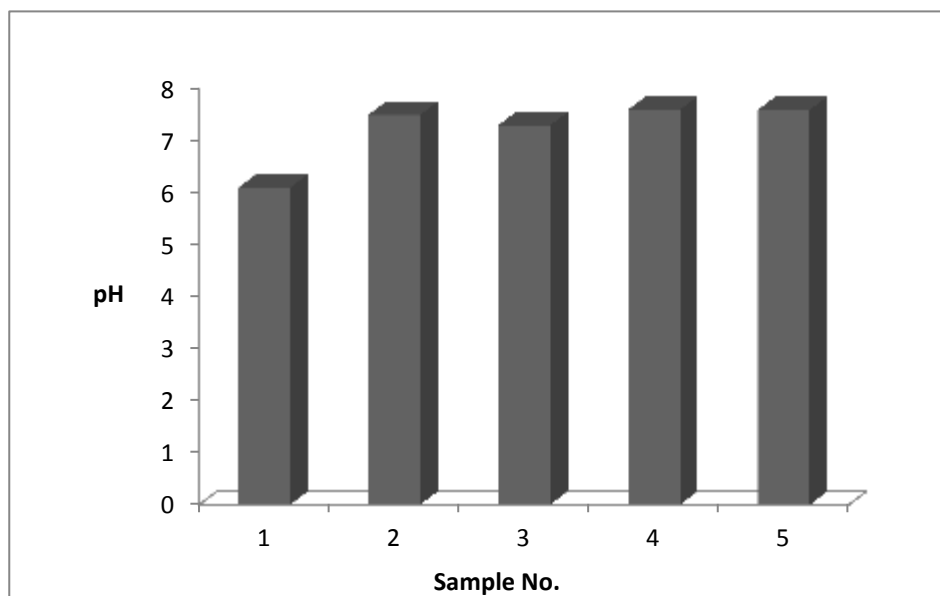
Figure 2 TDS of samples
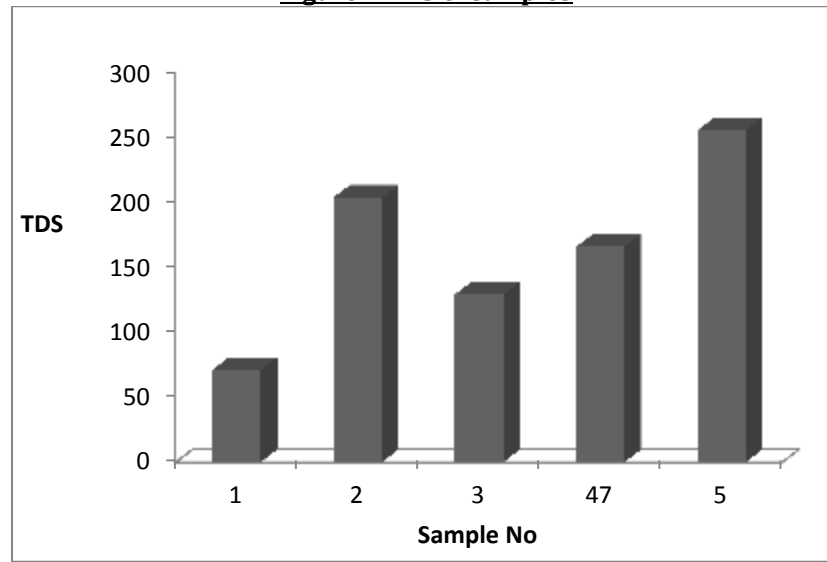
Figure 3 Electrical conductance of samples
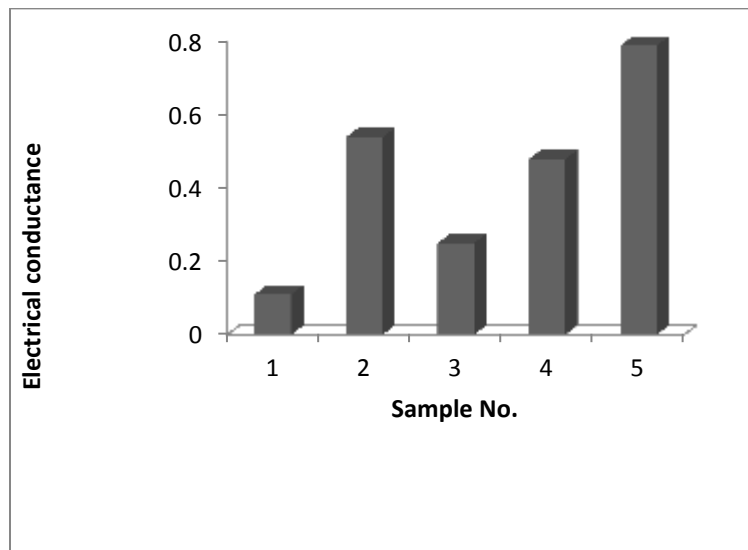
Figure 4 Hardness of samples
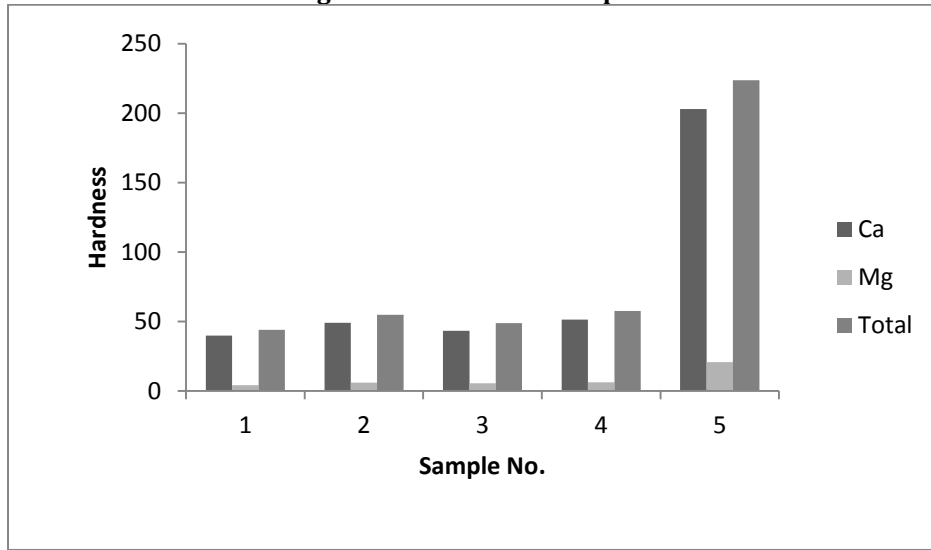
Figure 5 Chloride content of samples
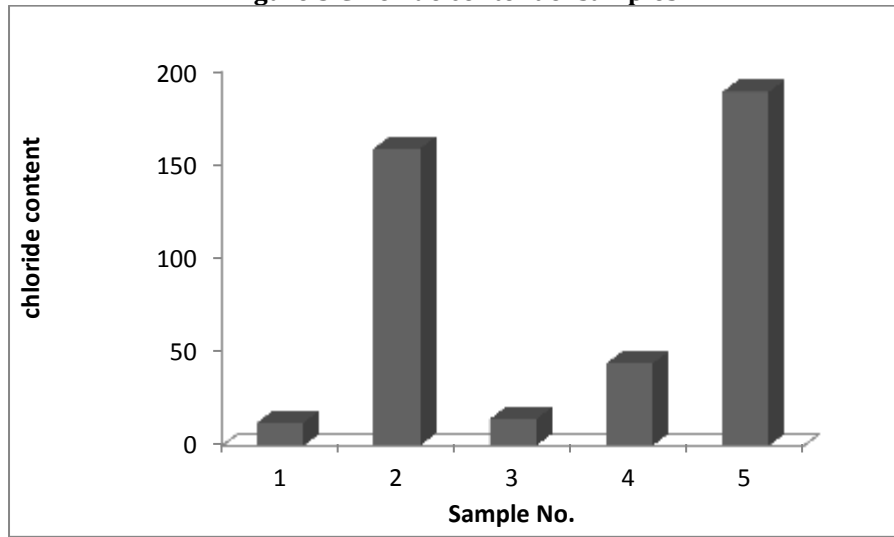
Figure 6   Dissolved oxygen of samples
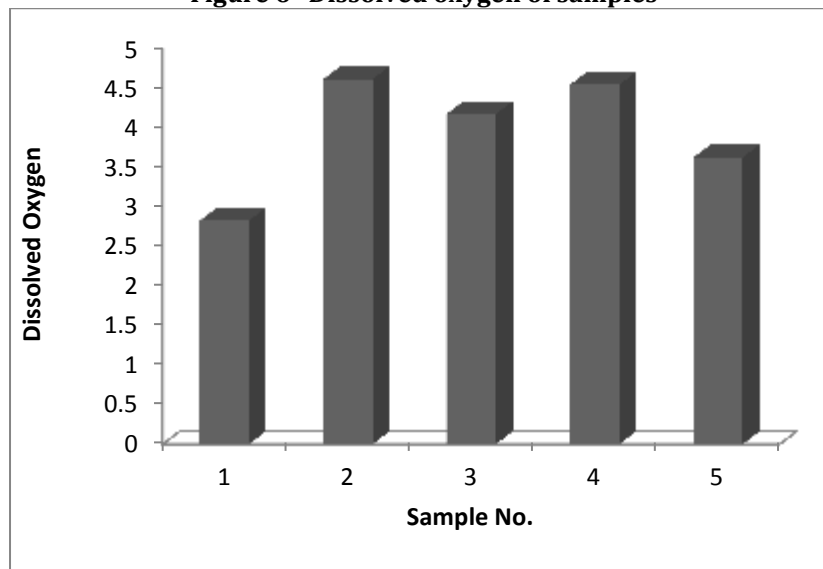
Figure 7   COD of samples
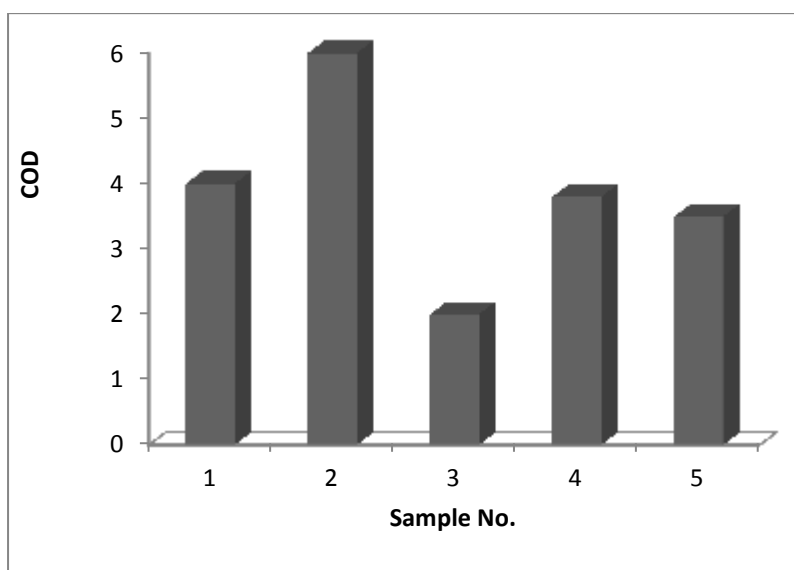
ACKNOWLEDGEMENT

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PRELIMINARY APPROACH TO CLADOGRAM PREPARATION USING SELECTED TAXA OF BICARPELLATE

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Abstract

Phylogenetic systematics (cladistics) is a theory of phylogeny reconstruction and classification widely used in zoology**.** Taxa are grouped hierarchically by the sharing of derived (advanced) characters. The information is expressed in a cladogram, a best estimate of a phylogeny. Cladistics has recently evolved as a method of more precisely achieving these goals. Here we tried to construct a cladogram by using selected members of bicarpellate. It is concluded that cladistic analysis presents the best estimate of the natural hierarchy of organisms, and should be adopted by plant systematists in their assessment of plant interrelationships. . We recommend the routine practise of cladistics in revisionary studies or in any other type of investigation which focuses on the development of phylogenetic trees. This presents certain advantages over inferring phylogeny by the conventional method, the most important of which is to facilitate discussion by a clear presentation of procedures and evolutionary assumptions

Key words: Cladogram, bicarpellata, phylogeny, systematic, primitive

Introduction

The angiosperms, or flowering plants, are one of the major groups of extant seed plants and arguably the most diverse major extant plant group on the planet, with at least 260,000 living species classified in 453 families (Judd et al., 2002; APG II, 2003; Soltis et

al., 2005). Despite their diversity, angiosperms are clearly united by a suite of synapomorphies (i.e., shared, derived features) including 1) ovules that are enclosed within a carpel, that is, a structure that is made up of an ovary, which encloses the ovules, and the stigma, a structure where pollen germination takes place, 2) double fertilization, which leads to the formation of an endosperm (a nutritive tissue within the seed that feeds the developing plant embryo), 3) stamens with two pairs of pollen sacs, 4) features of gametophyte structure and development, and 5) phloem tissue composed of sieve tubes and companion cells (see Doyle and Donoghue, 1986; Judd et al. 2002; P. Soltis et al., 2004; and D. Soltis et al., 2005, for further discussion). All available evidence strongly rejects hypotheses of more than one evolutionary origin of extant angiosperms. Although any of the described methods are potentially help- ful in this way, Hennig (1966a) proposes a formal method, especially for ranking.

Phylogenetic Classification

A classification is an orderly arrangement of organisms (as taxa) or objects in a hierarchical series. The kind of relationships revealed in a classification depends on the criteria or characters used in its construction. If characters are quantified and statistically assessed on the basis of overall similarity, the relationships are called phenetic. **Ingroup** analysis uses only the characters of the immediate group under study and assumes that the frequency of a given character state is correlated with its polarity (ancestral vs. derived state). Ingroup analysis may be useful in determining similarities within a group, but is generally unsatisfactory for phylogenetic classifications because of its failure to account for character polarity.

The principal method used for assessing polarity is **out-**

group analysis. **Outgroup** analysis typically involves the group under study (ingroup) and one or more groups that are more distantly related. The character states for each taxon needs to be documented before the analysis can be made. For a given character, the states for each of the taxa are determined. If the same character state is found in the outgroup and some members of the ingroup, then that character state is ancestral (plesiomorphic) and the other state is derived (apomorphic). In outgroup analysis, phylogenetic relationships are determined by the shared derived characters (synapomorphies). In the following example, there are two taxa (A and B) and two character states (a and a') of a single character. Without any further information it is impossible to know which character state is derived and which is ancestral.

Cladistics is a method commonly used to determine phylogenies or ancestordescendant relationships in monophyletic groupings of taxa using outgroup comparisons. The term is derived from clade, which refers to a monophyletic group. A branching pattern (cladogram), which depicts the divergence of the taxa based on the distribution of shared derived character states, may be constructed.

To carry out the cladistic method, the following need to be accomplished: establish monophyly for the study group, document the character variation for the study group, recognize the most closely related groups (sister groups or outgroups) and document the characters in those groups, and determine character polarity by comparison of outgroups with the study group. After the character polarities can be determined, branching patterns of a cladogram can be constructed. If several outgroups are used, and several cladograms are constructed, the parts of the cladograms that are similar or congruent are

considered to be the most reliable. In modern computer programs designed to facilitate analysis of complex data sets, a branching network, or unrooted tree, is first constructed based on the data from the ingroup and outgroup simultaneously. Then the tree is 'rooted' along the branch connecting the outgroup(s) to the rest of the tree. Because our knowledge of characters is rarely, if ever, complete, we need to remember that all classifications remain hypotheses of relationships.

Review of literature

Since the publication of Darwin's On the Origin of Species by Means of Natu- ral Selection (1859), interest among systematists has developed toward un- derstanding the evolutionary histories of organisms. This interest has continued and intensified until, at the present time, attempts to recon- struct phylogenies are regarded by most workers as a necessary and important part of systematic investigations. Some critics, in fact (e.g., Sokal and Sneath, 1963; Colless, 1967) have suggested that phylogenetic evaluations be left apart from attempts to achieve m-ax- imally predictive classifications. This viewpoint has led to the well-known and useful area of "numerical taxonomy," which already has made many important contributions to systematic biology (cf. Sneath and Sokal, 1973, for a review). Other workers have focused on the logical and philosophical aspects of phylogenetic systematics (e.g., Buck and Hull, 1966; Hull, 1967, 1974).

These later attempts to de- termine more clearly the phylogeny of organisms, and in particular their evolutionary branching patterns, have been given the label "cladistics" (Mayr, 1965, 1969). Different cladistic approaches have been developed over the past 20 years, and one of the earliest and most influential was that of Hen-

nig (1950, 1966a). His ideas, although difficult to follow, provided a strong basis for future work. At about the same time, a method was developed by Wagner at the University of Michigan in the late 1950's, which has now become known as the Wagner Groundplan/ Divergence meth- od (Wagner, 1961, 1966). From these two initial approaches have come several others, most of which can be viewed as belonging to two basic types (Estabrook, this volume): (1) Parsimony, and (2) Character Compatibility. These two approaches represent the principal options available at the present time which are most useful for the plant system- atist.

The relative position of character-state transitions determines branch lengths—effectively, the amount of evolution between the speciation events encompassed by the cladogram. This allows measurement of the phylogenetic distance among analyzed taxa as disparity (the number of characters separating taxa through their most recent shared divergence point) rather than as raw similarity (Bateman 1998, Briggst *et al* 199 Foote M. 1994), The enhanced ability to understand character evolution is at least as valuable as recognizing clades, particularly where the analysis includes morphological data (Bateman 1994, 96,98). In contrast, the adaptive model (DiMichele et al. 1992, Donoghue1989) assumes that the accumulation of developmentally independent character states in response to selection pressures is gradual, and probably involves phylogenetically intermediate species absent from the sampled terminal taxa (either deliberately excluded or not yet known to science). These have proved especially valuable for comparing taxa that are early land plants 279 highly morphologically divergent, plesiomorphically simple, or secondarily simplified by reduction (and hence have insufficient clearly homologous structures)and for elucidating cases of parallel evolu-

tion (Bateman 1996.) Often, nonmolecular characters are "mapped" across molecular phylogenies rather than included in the parsimony analysis (Givnisliand , Sytsma KJ,1997); this approach is preferable for ecological and continuously variable phenotypic characters but is a suboptimal way of analyzing discrete phenotypic characters(Bateman 1996).

Material and Methods

Choice of the taxa :In this study we selected five medicinally important plants of Bicarpellate belonging to different families. The plants selected were Andrographis paniculata, Leucas aspera, Calotropis gigantea,Catharanthus roseus and Solanum torvum . These plants were considered as taxa for ingroup. At the same time Emilia sonchifolia was selected as outgroup.

Determination of the characters: Features of the taxa were examined each to determine the character states to decide whether each taxon does or does not have each character. Floral analysis was done for all the selected plants. Illustration was also made. The various characters selected were presence of latex, habit, type of fruit, inflorescence, placentation (apomorpies)

Determination of the polarity of characters: It was also examined whether each character state is original or derived in each taxon. Examining the character states in outgroups to the taxa helped to determine the polarity

Grouping taxa by synapomorphies: Then the taxa were grouped based on the shared derived characteristics.

Cladogram construction: A cladogram was constructed with all

taxa go on the endpoints of the cladogram, never at nodes.All clado-
gram nodes have a list of synapomorphies which are common to all
taxa above the node .All synapomorphies appear on the cladogram
only once unless the character state was derived separately by evo-
lutionary parallelism

Results and Discussion

The proper cladogram was formed after four steps. In the first step an
unresolved cladogram was formed with one outgroup and all other
ingroup members considered to be originated from single ancestor.

In the second step Calotropis and Catharanthus were grouped
as parellels based on the presence of latex follicle and marginal pla-
centation (synapomorphies). The others (Solanum, Andrographis
and Leucas) were grouped into one on the basis of absence of latex,
follicle and marginal placentation (synapomorphies).

In the third step Calotropis and Catharanthus were got divert-
ed by considering the habit and inflorescense nature. The former is
having the shrubby nature and racemose inflorescence , while later
is herb and have cyme.

The fourth step Solanum and Andrographis were separat-
ed on the basis of habit, inflorescence and fruit. Solanum is shruby
with racemose inflorescence and berry , while Andrographis is herb
with cymose inflorescense and capsule. The one left behind, Leucas
go parallel with herbaceous habit , verticellaster inflorescence and
carcerulus fruit(autapomorphic).

In this study the ingroups were separated on the basis of
several selected characters. It is also assumed that all these taxa were

originated from a common ancestor, and later due to different morphological adaptations they were separated or grouped. *Calotropis and Catharanthus* shared common characters and grouped into one, even then they were again separated on considering the habit and inflorescence. *Solanum and Andrographis* were separated due to different habit, fruit and inflorescence. Leucas was separated from the *Solanum and Andrographis* by the characters like inflorescence and fruit. Parallel evolutionary trend was noted in all the cases.

Perhaps the most important feature of cladistic is its use in testing long-standing hypotheses about adaptation. It is also possible to compare the descendants of a single ancestor to look at patterns of origin and extinction in these groups, or to look at relative size and diversity of the groups. As with any other system in science, a model is most useful when it not only *describes* what has been observed, but when it *predicts* that which has not yet been observed. Cladistics produces hypotheses about the relationships of organisms in a way that, unlike other systems, predicts properties of the organisms

Table 1 showing the selected taxa and derived characters

Plants selected	Characters selected				
	Habit	Presence of latex	Inflorescence	Placentation	Type of fruit
Catharanthus roseus	*Herb*	*Present*	*Cymose*	*Marginal*	*Follicle*
Calotropis gigantea	*Shrub*	*Present*	*Racemose*	*Marginal*	*Follicle*
Solanum torvum	*Shrub*	*Absent*	*Racemose*	*Axial*	*Capsule*
Andrographis paniculata	*Herb*	*Absent*	*Panicle*	*Axial*	*Berry*
Leucas aspera	*Herb*	*Absent*	*Verticellaster*	*Axial*	*Carcerulus*
*Emilia sonchifolis(**Out group**)*	*Herb*	*Absent*	*Head*	*Basal*	*Cypcella*

Andrographis paniculata

Habit   Flower

Calyx   Corolla   Androecium   Gynoecium

Ovary C.S.   Flower L.S.   Floral Diagram
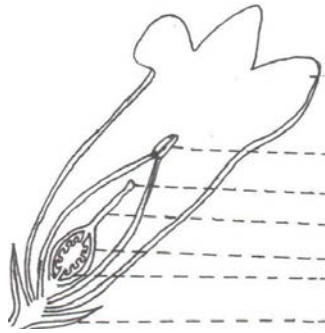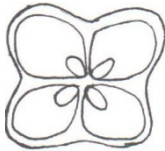
Andrographis

calyx
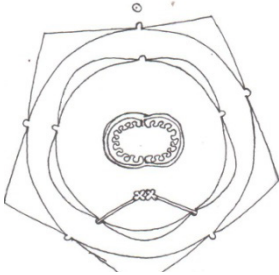
$FF:Br,\varphi OK_{(5)}C_{(5)}A_2G_{(2)\_}$

Solanum torvum

Habit
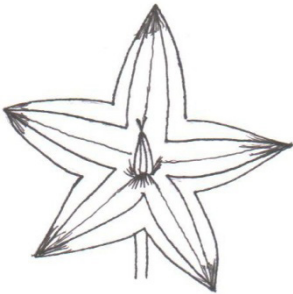
Flower

Calyx   Corolla   Androecium   Gynoecium

Ovary C.S.   Flower L.S.   Floral Diagram
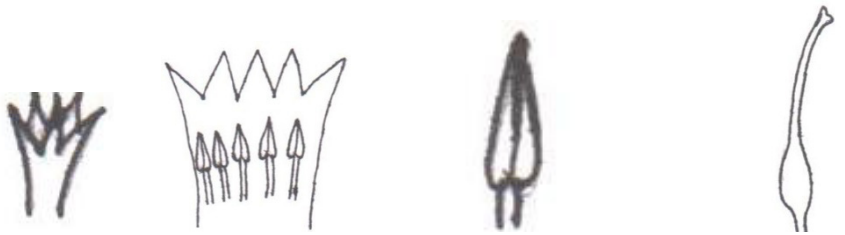
- COROLLA
- STIGMA
- ANTHER
- STYLE
- OVARY
- OVULE
- CALYX
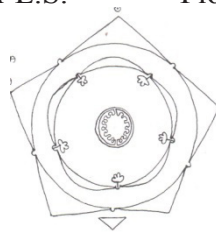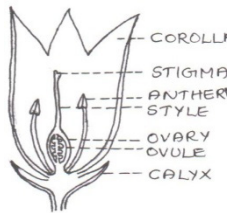
FF: $K_{(5)}C_{(5)}A_5G_{(2)\_}$

Catharanthus roseus

Habit

Calyx   Corolla tube opened   Androecium Gynoecium

Flower

Ovary C.S.   Flower L.S.   Floral Diagram
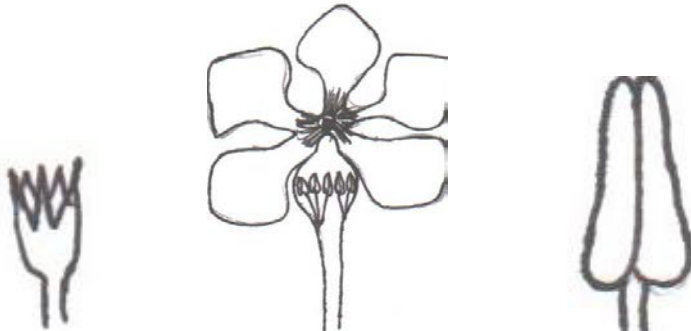
- COROLLE
- ANTHER
- STIGMA
- STYLE
- CALYX
- OVULE
- OVARY
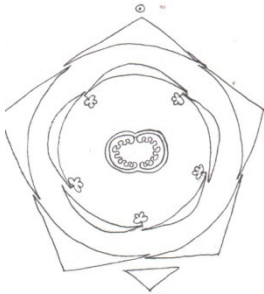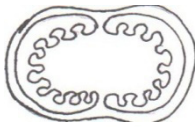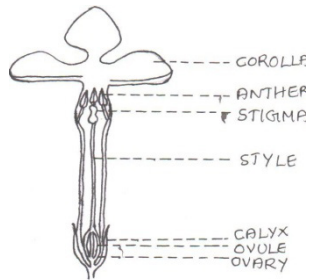
FF: $K_5 C_{(5)} A_5 G_{2\_}$

Leucas aspera

Habit
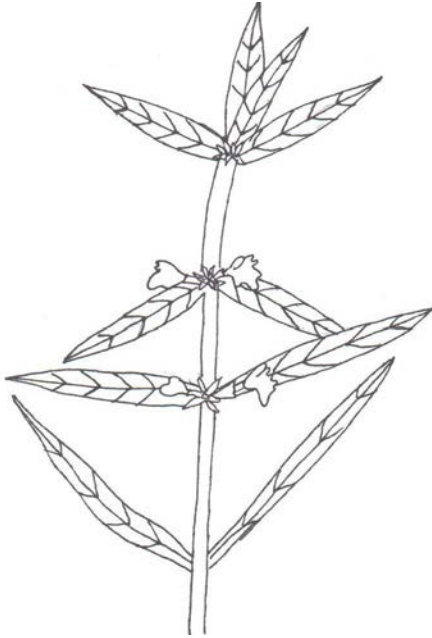
Flower

Calyx   Androecium   Gynoecium   Ovary C.S.
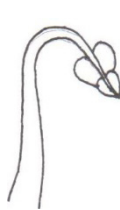
Flower L.S.   Floral Diagram
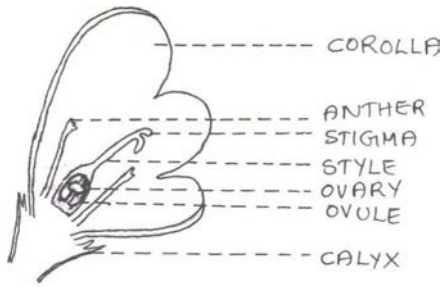
FF: Br,⚲,   K$_{(5)}$C$_{(2/3)}$A$_{2+2}$G$_{(2)\_}$

Calotropis gigantea

Habit
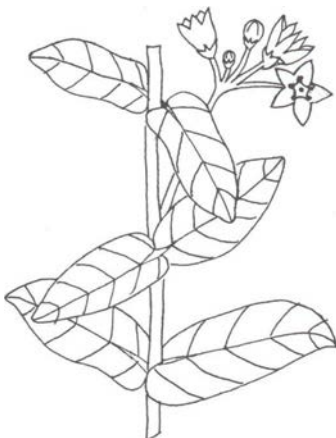
Flower

| **Calyx** | **Corolla** | **Corona** | **Gynostegium** | **Pollinia** |

Ovary C.S.
Floral Diagram

Flower L.S.
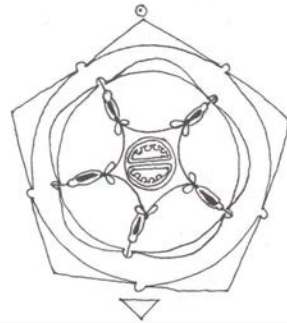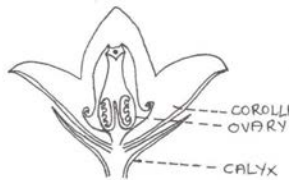
FF: $K_{(5)}C_{(5)}A_{(5)}G_{2-}$

Emilia sonchifolia

Habit

Head   Single flower

Corolla tube opened   Androecium   Gynoecium   Ovary C.S.

Flower L.S.   Floral diagram

Step 1

Unresolved cladogram

Catharanthus

Calotropis

Androgrphis

Solanum

Leucas

Out group

Step 2

Solanum

Androgrphis

Catharanthus

Leucas

Calotropis

Absence of latex

Out group

Presence of Latex

Step 3

Solanum

Androgrphis

Catharanthus

Leucas

Calotropis

Herb , cymose

Shrub, racemose

Absence of latex

Presence of Latex

Out group

Step 4

Androgrphis

Solanum

Leucas

Catharanthus

Herb, capsule

Shrub, berry

Absence of latex

Calotropis

Out group

Presence of Latex

Resolved Cladogram

Androgriphis

Leucas

Herb, capsule

Solanum

Catharanthus

Shrub, berry

Herb, verticellaster, carcerulus fruit

Calotropis

Herb , cymose

Absence of latex

Shrub, racemose

Out group

Presence of Latex

FF: Br, Brl, , ,K $_{pappus,}$ C$_{(5),}$A$_{(5),}$G$_{1—}$

SUMMARY AND CONCLUSION

An attempt was made to construct cladogram using selected members of Bicarpellate. For this purpose five taxa namely *Andrographis paniculata, Leucas aspera, Calotropis gigantea,Catharanthus roseus and Solanum torvum* were selected as ingroup and Emilia sonchifolia as out group. Apomorphic and synapomorphic characters were selected. Based on this cladogram was constructed in step by step process. Here the ingroups were separated on the basis of several selected characters. It is also assumed that all these taxa were originated from a common ancestor, and later due to different morphological adaptations they were separated or grouped. *Calotropis and Catharanthus* shared common characters and grouped into one, even then they were again separated on considering the habit and inflorescence. *Solanum and Andrographis* were separated due to

different habit, fruit and inflorescence. Leucas was separated from the *Solanum and Andrographis* by the characters like inflorescence and fruit. Parellel evolutionary trend was noted in all the cases.

It is concluded that cladistic methodology can and should be used to estimate phylogenies of the land plants. Objections to using the methodology are based on misunderstandings of the methods and their goals. A cladogram itself is not a phylogeny; it is a hierarchical expression of interrelationships based on levels of generality of attributes observed in nature. But, it may be taken as the current best estimate of the single real phylogeny on the assumption that nature itself is structured hierarchically as a result of the genealogical process. It is also tested by the discovery of additional derived characters; therefore, a given cladogram is potentially rejectable in favour of another that new data show to be more parsimonious. Current traditional attempts at reconstructing phylogenies, like all taxonomic schemes, zoological and botanical, dependent on a concept of overall similarity, lack refutibility, rigorous definitions of groups, and precise statements about the nature of group interrelationships.

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Determination of Reducing Sugar in Natural and Synthetic Fruit Juices

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Abstract

Many people consume fruit juices on a daily basis. Fruit juices are a convenient way for people to receive the benefits of various fruits. However, they may also have high sugar content. Although the sugar is natural, it may not be healthy in high quantities. It was suggested that too much sugar could pose harmful health effects, as people could develop diabetes, obesity, heart disease, and other complications from excess consumption.

1. INTRODUCTION AND LITERATURE SURVEY

Fruits contain many beneficial qualities to one's health; they provide an abundance of vitamins, minerals, anti- oxidants and fibers, which are all essential for the human diet. The variety of fruit juices available on any supermarket shelf (and even in some tiny convenience stores) is staggering. It is now common to get juices in all sorts of different combinations, including exotic tropical fruits such as mango, guava and more. Some juices, such as pomegranate, advertise additional health benefits from the antioxidants present in the fruit. And although many of these juices do contain a healthy amount of vitamins and minerals, almost all of them also have an

abundance of calories and sugar.

One glass of guava or orange juice can more than adequately provide your daily requirement of vitamin C. Most 100% fruit juices are also an excellent source of potassium (which is helpful in maintaining healthy blood pressure) and folic acid (which is recommended for all women of childbearing age as it prevents birth defects and is good for heart health).

Just a single 4-ounce glass of 100% fruit juice counts as one full serving of fruit, so if your busy schedule does not allow you to peel and eat an orange, you can grab a glass of juice. Although fruit juice does not contain the healthy fiber that whole fruits do, it is still better to drink some juice rather than get no fruit at all.

Enjoy the benefits of antioxidants and phytonutrients – Compounds such as lycopene, lutein, quercetin and resveratrol are important phytonutrients contained in many fruits that boost your immune system and protect against disease. The antioxidants that juice contains destroy the free radicals that contribute to the development of cancer and the aging of our skin and organs.

The high rate of sugar consumption in the typical Western diet has been implicated as one of the major contributors to the increasing rates of obesity plaguing the Western world. Children who are overweight drink 65 percent more sugary juices than children of normal weight, according to one study. Even sweetened soft drinks have less sugar than some fruit juices. For instance, grape juice contains 50 percent more sugar than Coca Cola.

One study found that drinking orange juice for only 5 days

was enough to reduce the hardness of tooth enamel by as much as 84 percent. Scientists believe that other juices may be just as bad, as the acidity they contain is similar. Dentists are increasingly seeing cavities and tooth decay in children as young as two or three years old, and they blame the increased intake of fruit juice as a major cause. The combination of acid and sugar create the perfect conditions for tooth decay. Dentists advise that children drink fruit juice no more than once daily, and drink more milk or water. If your child must drink fruit juice, it should be watered down to dilute the concentration of acid.

This study mainly focuses to detect the amount of reducing sugar in some natural and synthetic fruit juices used in daily life such as apple, pineapple, grape, orange and lemon. Analysis of elements was also done as it has influence in determining the quality of fruit juices. The pH values of selected samples were also determined. This study is mainly focused on the comparison of pH values and amount of reducing sugar present in selected samples.

2. MATERIALS METHODS

1. Sample preparation: 5g of sample is grinded in mortar. The extract is collected and filtered using a cloth. The filtered solution is transferred into the beaker.

2. Chemicals used: Diluted nitric acid, Concentrated nitric acid, Concentrared hydrochloric acid, Diluted hydrochloric acid, Diluted sulphuric acid, Concentrated sulphuric acid, Copper sulphate, Ammonium molybdate, Acetic acid, Picric acid, Pottasium permanganate, Ammonium Chloride, Ammonium hydroxide, Hydrogen sulphide, Disodium hydrogen phosphate, Cobalt nitrate, Maganeson reagent,

Fehling's solution, Tollen's reagent, Pottassium ferricyanide, Pottassium ferrocyanide, Ammonium thiocyanide.

Analysis

For the analysis of natural and synthetic fruit juices the following experiments were carried out.

1.Test for Potassium: A little of sample take in a test tube and add 2 ml of picric acid solution Shake for some times. Formation of a yellow precipitate indicates the presence of potassium ions.

2. Test for magnesium: A little of sample take in a test tube and add NH_4Cl, NH_4OH and excess of disodium hydrogen phosphate solution. Scratch the sides of the test tube with a glass rod. Formation of white precipitate indicates the presence of magnesium ions.

3. Test for phosphate: A little of sample taken in a test tube and add 1 ml of conc.HNO_3 and ammonium molybdate solution to it. The solution is heated and canary yellow colour of precipitate confirms the presence of phosphate ions.

4. Test for iron: A little of sample taken in a test tube and add 2 drops of conc.HNO_3. Heat for one minutes and then cool. Add 2 drops of ammonium thiocyanide solution. A blood red colour indicates the presence of iron.

5. Test for carbohydrate: A little of sample taken in a test tube and add 2 drops of 1% of alcoholic α-naphthol solution. Add about 1ml concentrated sulphuric acid carefully along the sides of the test tube. A violet ring at the junction of the two layers shows the presence of carbohydrate.

6. Test for glucose: Its presence is detected by the following test:

A. Fehling's solution test: A little of sample taken in a test tube and add few drops of Fehling's solution at equal amount. The test tube is heated in a water bath for 10 minutes. Appearance of brown precipitate confirms the presence of glucose in health drinks.

B. Tollen's test: A little of sample taken in a test tube and add 2 ml of Tollen's reagent. The test tube is heated in a water bath for a few minutes. Appearance of silver mirror confirms the presence of glucose.C.Benedict's solution test: A little of sample taken in a test tube and add a few drops of Benedict's reagent. The test tube was heated for a few seconds. Formation of reddish colour confirms the presence of glucose.

D. Osazone formation: Dissolve a little of sample in 1ml of water. Add 2ml of freshly prepared phenyl hydrazine reagent, shake well and heat on a boiling water bath for about 10 minutes. Orange yellow crystals indicate the presence of glucose.

7. Test for proteins: A little of sample taken in a test tube and add NH4OH add a drops of copper sulphate. Formation of bluish violet colour confirms the presence of protein.

8. Test for sodium: To a little of sample is made a paste with conc. HCl and flame test is conducted with this paste.

9. Test for zinc: To a little of sample ammonium chloride and excess of ammonium hydroxide solutions are added and then hydrogen sulphide passed through it. White (or dirty white) precipitate indicates the presence of zinc.

10. Test for copper: To a little of sample diluted hydrochloric acid is added and hydrogen sulphide is then passed through it. Black precipitate is indicate the presence of copper.

Determination of pH

pH, is a measure of acidity or alkalinity of water soluble substances. The pH of fruit juices were measured with the help of calibrated pH meter. The pH meter was placed in a beaker containing the buffer solution of Ph – 7. The root fruit juice samples were taken in a 100 ml beaker and the pH meter was immersed in it. The stabilized values are taken to find out the pH of the samples.

Estimation of Reducing Sugar

The amount of glucose in health drinks can be found out quantitatively by titrating with Fehling's solution is a mixture of two solutions A and B. Solution A is copper sulphate whereas B is sodium potassium tartrate and NaOH. On mixing A and B, cupric hydroxide is first formed dissolves producing copper complex, where copper is in cupric state. Glucose reduces Fehling's solution giving yellow to red precipitate of Cu_2O. The colur depending on the particle size. A disadvantage of this reaction is that it must take place under basic conditions where Cu^{2+} tends to form on insoluble precipitate with hydroxide ions. In order to prevent this precipitation, tartrate ions are added to solution in order to form a soluble complex with Cu^{2+}, isolating it from hydroxide. The oxidation-reduction reaction between Cu^{2+} and aldehyde portion of glucose is shown below.

$$R\text{-}CHO(aq) + 2Cu^{2+} + 5OH^- \longrightarrow RCOO^- (aq) + Cu_2O + H_2O$$
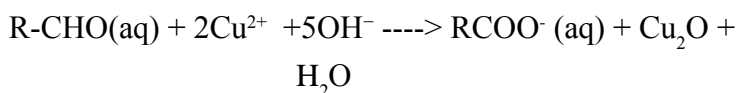
The reaction is self indication as the disappearance of the deep blue copper(II)- tartrate complex and appearance of Cu^{2+} in the solution decreases, however, it becomes difficult to see the actual equivalence point accurately. This leads to only a poorly reproducible, qualitative determination of amount of sugar present in the titrant. To compensate for this, after most of the blue from the Cu^{2+} complex is gone, the indicator Methylene blue is added to the solution.

3. RESULTS AND DISCUSSION

Mineral Analysis

The table showing the presence of various minerals is shown below.

	Orange		Grape		Pinapple		Apple		Lemon	
	Natural	Synthetic	Natural	Synthetic	Natural	Synthetic	Natural	Synthetic	Natural	Synthetic
Potassium	✔	✔	✔	✔	✔	✘	✔	✔	✘	✘
Magnesium	✔	✘	✘	✘	✘	✘	✘	✘	✘	✘
Phosphate	✔	✘	✔	✘	✘	✔	✔	✔	✔	✔
Iron	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Carbohydrate	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Glucose	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Protein	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Sodium	✔	✘	✔	✘	✔	✔	✘	✘	✘	✘
Zinc	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘
Copper	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘

Potassium ions are necessary for the function of all living cells. The transfer of potassium ions through nerve cell membranes is necessary for normal nerve transmission; potassium deficiency and excess can each result in numerous abnormalities, including an abnormal heart rhythm and various ECG abnormalities. Fresh fruits and vegetables are good dietary sources of potassium. The body responds to the influx of dietary potassium, which raises serum potassium levels, with a shift of potassium from outside to inside cells and an increase in potassium excretion by the kidneys.

Magnesium is the eleventh most abundant element by mass in the human body and is essential to all cells and some 300 enzymes. Magnesium ions interact with polyphosphate compounds such as ATP, DNA, and RNA. Hundreds of enzymes require magnesium ions to function. Magnesium compounds are used medicinally as common laxatives, antacids (e.g., milk of magnesia), and to stabilize abnormal nerve excitation or blood vessel spasm in such conditions as eclampsia.

Many natural foods also contain relatively high levels of phosphate. It is important to be aware of them and depending on the level of phosphate-sensitivity, to consume them in small quantities. We recommend eliminating all phosphate-rich foods from the diet for three to four weeks to see if there is an improvement in health. Then the foods below can be reintroduced into the diet, one at a time. Some of these foods may be tolerated by a sensitive person, providing they are consumed in small quantities.

Iron plays an important role in biology, forming complexes with molecular oxygen in hemoglobin and myoglobin; these two

compounds are common oxygen transport proteins in vertebrates. Iron is also the metal at the active site of many important redoxenzymes dealing with cellular respiration and oxidation and reduction in plants and animals. A human male of average height has about 4 grams of iron in his body, a female about 3.5 grams. This iron is distributed throughout the body in hemoglobin, tissues, muscles, bone marrow, blood proteins, enzymes, ferritin, hemosiderin and transport in plasma.

Carbohydrate are main source of energy, they help fuel of brain muscels and central nervous system. Fiber is a carbohydrates that aids in digestion, helps feel full and keeps blood cholesterol levels in check. Fiber also helps heart diseases under control. Lack of carbohydrate can cause low blood sugar ketosis.

Proteins form the very basis of life. They regulate a variety of activities in all known organisms, from replication of the genetic code to transporting oxygen, and are generally responsible for regulating the cellular machinery and determining the phenotype of an organism. Proteins accomplish their tasks in the body by three-dimensional tertiary and quaternary interactions between various substrates.

Sodium is an essential element for all animals and some plants. Sodium ions are the major cation in the extracellular fluid (ECF) and as such are the major contributor to the ECF osmotic pressure and ECF compartment volume. Loss of water from the ECF compartment increases the sodium concentration, a condition called hypernatremia. Isotonic loss of water and sodium from the ECF compartment decreases the size of that compartment in a con-

dition called ECF hypovolemia.

By means of the sodium-potassium pump, living human cells pump three sodium ions out of the cell in exchange for two potassium ions pumped in; comparing ion concentrations across the cell membrane, inside to outside, potassium measures about 40:1, and sodium, about 1:10. In nerve cells, the electrical charge across the cell membrane enables transmission of the nerve impulse an action potential when the charge is dissipated; sodium plays a key role in that activity.

Zinc is an essential mineral, including to prenatal and post-natal development. Zinc deficiency affects about two billion people in the developing world and is associated with many diseases. In children, deficiency causes growth retardation, delayed sexual maturation, infection susceptibility, and diarrhea. Enzymes with a zinc atom in the reactive center are widespread in biochemistry, such as alcohol dehydrogenase in humans. Consumption of excess zinc can cause ataxia, lethargy and copper deficiency.

Copper is essential to all living organisms as a trace dietary mineral because it is a key constituent of the respiratory enzyme complex cytochrome oxidase. In molluscs and crustaceans, copper is a constituent of the blood pigment hemocyanin, replaced by the iron-complexed hemoglobin in fish and other vertebrates. In humans, copper is found mainly in the liver, muscle, and bone. The adult body contains between 1.4 and 2.1 mg of copper per kilogram of body weight.

pH values

pH, quantitative measure of the acidity or basicity of aqueous or other liquid solutions. A solution with a pH less than 7 is considered acidic; a solution with a pH greater than 7 is considered basic, or alkaline.

Sample	Synthetic juice	Natural juice
Orange	2.8	3.8
Grape	2.6	3.3
Pineapple	3.2	3.8
Apple	3.2	4.6
Lemon	2.9	2.6

Natural Juice

Synthetic Juice:

Synthetic fruit juices of Orange, Grape, Pineapple and Apple has more acidic value than natural fruit juices. But in the case of Lemon, the synthetic sample has the pH 2.9 and for natural sample has the pH of 2.6.

Reducing Sugar:

Sample	Natural	Synthetic
Orange	6.1101g	10.2951g
Grape	9.1654g	9.2656g
Pineapple	5.0913g	5.1475g
Apple	6.1101g	4.2112g
Lemon	0.2235g	6.1770g

The amount of reducing sugar is higher in synthetic juices than natural juices except for apple. The natural juice gives the required energy for the metabolism of the body. Among the synthetic juices, sugar content is highest in orange sample followed by grape, pineapple, apple and lemon.

The high rate of sugar consumption in the typical Western diet has been implicated as one of the major contributors to the increasing rates of obesity plaguing the Western world. Children who are overweight drink 65 percent more sugary juices than children of normal weight, according to one study. Even sweetened soft drinks have less sugar than some fruit juices. For instance, grape juice contains 50 percent more sugar than Coca Cola.

CONCLUSIONS

1. All the samples contain reducing sugar. Synthetic fruit juices of Orange, Grape, Pineapple and Lemon contains more amount of sugar than natural fruit juices.

2. In the case of apple, the amount of reducing sugar in natural juice is higher than synthetic juice.

3. All the samples contain iron and protein.

4. Potassium is present in all the natural samples except Lemon. But it is absent in synthetic samples of Pineapple and Lemon.

5. Magnesium is present only in natural sample of Orange. But it is absent in all synthetic samples.

6. Phosphate is present in all natural samples. But it is absent in synthetic samples o Orange and Grape.

7. None of the sample contains Copper and Zinc.

8. Sodium is absent in natural samples of Apple and Lemon. But it is present in synthetic sample of Pineapple.

9. Synthetic fruit juices of Orange, Grape, Pineapple and Apple has more acidic value than natural fruit juices. But in the case of Lemon, the synthetic sample has the pH 2.9 and for natural sample has the pH of 2.6

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GLOBAL TRENDS IN EDUCATIONAL TECHNOLOGY ADOPTION

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Introduction

This paper explores some of the recent global trends in techolgy adoption in the field of higher education and also identify the advantages and opportunities these approaches and tools offer to the field of higher education. As NMC Horizon Report "The role of educators continues to change due to the vast resources that are accessible to students via the Internet. Education paradigms are shifting to include online learning, hybrid learning, and collaborative models" (NMC Horizon Report, 2013). The role of educators continues to change due to the vast resources that are accessible to students via the Internet. Education paradigms are shifting to include online learning, hybrid learning, and collaborative models (NMC Horizon Report, 2013) Prior studies relating to technology adoption and diffusion have emphasized the importance of collaboration, mentorship, and communities of practice in influencing the level of technology acceptance. Research in social networks has also shown that key actors within a network can assist with the dissemination of information (Mirriahi, Dawson, & Hoven, 2012) Factors that affect utilization and integration of electronic technologies comprise limited availability of the technologies; unreliability of the available technologies due to related issues like power outages and poor reception; lack of training; lack of technical, pedagogical and admin-

istrative support; and lack of faculty involvement in decision making relating to electronic technologies (Nyirongo, 2009).

I. Emergence of MOOCs as an alternative model for traditional education

A massive open online course (MOOC) is a model for delivering learning content online to any person who wants to take a course, with no limit on attendance. A massive open online course (MOOC) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials such as filmed lectures, readings, and problem sets, many MOOCs provide interactive user forums to support community interactions among students, professors, and teaching assistants (TAs). MOOCs are a recent and widely researched development in distance education which were first introduced in 2006 and emerged as a popular mode of learning in 2012. Early MOOCs often emphasized open-access features, such as open licensing of content, structure and learning goals, to promote the reuse and remixing of resources. Some later MOOCs use closed licenses for their course materials while maintaining free access for students.

Benefits

- **Improving access to Higher Education**
- **Providing an affordable alternative to formal education**
- **Sustainable Development Goals**

Coursera, EdX, Udacity, FutureLearn etc are the some of the notable MOOC providers. learners enjoy tremendous amount of flexibility in

terms of decisions on what to learn and when courses are delivered by world class faculty members and universities.

Coursera

Coursera is a one of the popular MOOC provider with wide variety of subject with different courses and specializations. It provides Courses, Specializations and Online Degrees
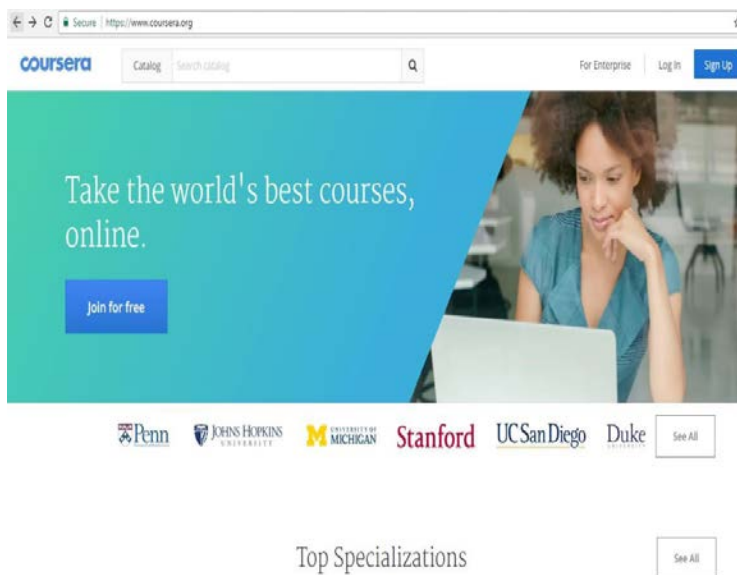
Figure 1: Coursera Home Page

a) Courses

Every course on Coursera is taught by top instructors from the world's best universities and educational institutions. Courses include recorded video lectures, auto-graded and peer-reviewed assignments, and community discussion forums. When you complete a course, you'll receive a sharable electronic Course Certificate.

- Online and open to everyone
- Learn a new skill in 4-6 weeks
- Priced at about $29-$99
- Earn a Course Certificate

b) Specializations

If you want to master a specific career skill, consider joining a Specialization. You'll complete a series of rigorous courses, tackle hands-on projects based on real business challenges, and earn a Specialization Certificate to share with your professional network and potential employers.

- Online and open to everyone
- Learn a new skill in 4-6 months
- Priced at $39-$79 per month
- Earn a Specialization Certificate

c) Online Degrees

Real career transformation sometimes requires a university-recognized degree. Coursera believes that transformation should be accessible to everyone, so we've worked with our university partners to offer flexible, affordable online degree programs in business, computer science, and data science.

- All online - admission required
- 1-3 years of study
- Currently priced at $15-$25,000
- Earn an accredited master's degree

II. Learning Management Systems

Learning Management System (LMS) is powerful software combined with digital frameworks for managing curriculum, training

materials, and evaluation tools. It allows any organization to devop electronic coursework, deliver it with unprecedented reach and flexibility, and manage its continued use over time. Moodle is the one of the most popular, widely used, open source and free LMS in the world.

Figure 3:Moodle Home Page

Moodle is an open source web application used to create interactive online learning sites. Moodle that is the acronym for **M**odular **O**bject-**O**riented **D**ynamic **L**earning **E**nvironment. It runs on almost all platform, supporting a lot of useful function and customization. It has a modular structure. it's available in 78 languages. It is used all over the world by teachers and educators and it's probably the best E-Learning tool in the net.

What Teachers can do with Moodle

- Create online courses
- Open forums

- Divide students into classes
- Upload files and lessons
- Create online tests and examinations
- Chat sessions

What Students can do with Moodle

- Follow the lessons
- Upload their homework and test
- Chat sessions
- Take part into forums

III.   Google Class Room

Google Classroom is available to schools and college with a Google Apps for Education (GAfE) domain. Classroom is a way to get all of your student in one place and allows you to easily assign work and for students to turn it in. Home base for google drive. Helps teachers create and collect assignments paperless. Includes time-saving features (i.e. make a copy of a Google Document for each student). Creates Drive folders for each assignment & student Students can keep track of what's due on the Assignments page and begin working with just a click. Teachers can quickly see who has or hasn't completed the work, and provide direct, real-time feedback and marks   from   within   Classroom.
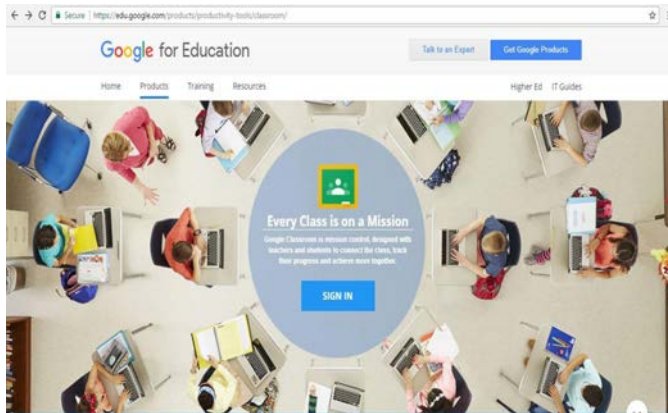
Figure 4: Google Class Room

Conclusion

These technologies promise to open up higher education by providing accessible, flexible, affordable and fast-track completion of universities courses for free or at a low cost for learners who are interested in learning. The popularity of MOOCs has attracted a great deal of attention from HE institutions and private investors around the world seeking to build their brands and to enter the education market. Institutions will need to look more closely at and learn from the different initiatives outside traditional institutions that are developing new business, financial and revenue models to meet the different needs of new groups of learners in an open HE marketplace. Open education brings new opportunities for innovation in higher education that will allow institutions and academics to explore new online learning models and innovative practices in teaching and learning. At a national and international level, new frameworks for HE funding structures, quality insurance and accreditation to support

different approaches and models for delivering higher education will be required. Implications of technology adoptions are:

▶ Shift from teacher-centered to learner-centered pedagogy

▶ Aligning usage of digital tools with clear learning outcomes

▶ Ongoing training and support to the faculty members to embrace technology

▶ Investment in technology infrastructure

▶ Developing a robust LMS

▶ Integrating technology adoption into the institutional strategy

▶ Institutional policy for leveraging opportunities like MOOCs

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ASSESSMENT OF DRINKING WATER QUALITY: A CASE STUDY OF THE INDUSTRIAL AREA IN ANGAMALY

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Abstract

Nowadays ground water pollution has emerged as one of the most significant environmental problem. The study of Physico-Chemical parameters such as pH, Acidity, Alkalinity, Total Dissolved Solids, Ca Hardness, Mg Hardness, Total Hardness, Chloride Content, Dissolved Oxygen, Chemical Oxygen Demand etc. determine the behaviour and quality of water. The present study was based on the assessment of drinking water quality of the industrial area of Angamaly. The water samples were collected from the wells situated at the premises of the five different industries of Angamaly and compared for the Physico-Chemical parameters. This result helps to found out the extent and the reason for the ground water pollution in the studied area.

Keywords: Total *Dissolved Solids, Total Hardness, Chloride Content, Dissolved Oxygen,*

Chemical Oxygen Demand

Introduction

Water is the most essential component of life. Fresh potable water is available only to the extent of about 1% in rivers, lakes and as ground water. In India and other developing countries, ground

water is the main source of water required for human consumption, agriculture and other needs. It is generally believed that ground water is pure and safe to drink . But nowadays, groundwater pollution has emerged as one of the most significant environmental problem. In modern economies there are a large number of industries functioning across the world. With the advancement of its functioning, the environment is getting more vulnerable to pollution. Dumping of industrial wastes containing large amount of various chemicals enhance the infiltration of harmful compounds to the ground water. Landfills, use of fertilizers, discharge of industrial effluent without proper treatment into nearby water bodies etc. are some human activities threatening the ground water.The basic monitoring on water quality has been necessitated to observe the demand and pollution level of water. Environmental security and monitoring of natural water is an imperative problem.

Drinking water, or potable water, is defined as having acceptable quality in terms of its physical, chemical, bacteriological parameters so that it can be safely used for drinking and cooking (WHO, 2004).WHO defines drinking water to be safe if and only if there is no significant health risks during its life span of the scheme and when it is consumed [1] .Good quality of water resources depend on large number of physico-chemical parameters, the magnitude and source of any pollution load. Parameters for drinking water qualities are chemical, physical and microbiological. Physical parameters include Total Dissolved Solids, color, odor etc.; chemical parameters comprise p^H, Dissolved Oxygen(DO) ,Total Hardness , Calcium Hardness , Magnesium Hardness , Chemical Oxygen Demand(COD), ,Oxalate Content , Chloride Content ,Fluoride ,Phosphate Content, Sulphate Content ,Heavy metals etc. and Microbio-

logical parameters include Biological Oxygen Demand(BOD) and MPN index[2-8].

Materials and Methods

The selected area for study is the Industrial area of Angamaly, Ernakulam District, which is located in Kerala state. Different samples were collected from the wells situated at the premises of five different industries located at Angamaly. Manual sampling with a plastic container in acquiescence with established standard norms was adopted. Labels were used to prevent sample misidentification. Sample preservation was done in tune with Ground Water Board guidelines with minimum possible time lapse between collection and analysis. Different methods of analysis have been done for the fortitude of quality of drinking water in this area. Physical analysis was done on the basis of TDS. pH of the water samples are determined with the help of pH meter. The chemical parameters such as Chloride content, Dissolved oxygen, Hardness and Chemical oxygen demand were computed by Argentometry, Winkler's titration method, Complexometry and back titration respectively [8-12].

Results and Discussion

The collected samples were analyzed on various physico -chemical parameters analysis include total dissolved solids, pH, calcium hardness, magnesium hardness, total hardness, dissolved oxygen, chloride and COD. The chemicals and reagents used for analysis were of annular grade. All the measurements were carried out in the temperature of 35^0C and are expressed in the unit of mg/l. The results are given in Table I.

Table I.- Physico -Chemical parameters of water.

Sample No.	pH	TDS (mg/l)	Calcium Hardness (mg/l)	Magnesium Hardness (mg/l)	Total Hardness (mg/l)	Dis-solved Oxygen (mg/l)	Chloride (mg/l)	COD (mg/l)
1	6.1	70.99	39.83	4.12	43.95	2.83	12.4	4
2	7.5	203.94	48.94	5.91	54.85	4.62	159.17	6
3	7.3	129.232	43.25	5.52	48.77	4.18	14.33	2
4	7.6	165.979	51.22	6.21	57.43	4.55	43.98	3.8
5	7.6	255.74	202.94	20.72	223.66	3.63	189.65	3.5
IS 10500: desirable limit	6-8.5	500	100	30	300- 600	4-6	250	20

From the table it is clear that the p^H of the water samples were found to be within the BIS range of 6 to 8.5. The total dissolved solids of the water samples were also within the permissible limits of 500mg/l. The value is maximum for sample 5 followed by sample 2, sample 4, sample 3 and sample 1. High TDS value attributed to higher amount of soluble salts in water. Hardness of water samples are determined by complexometric titrations. The maximum permissible limits of Ca and Mg hardness that need not any softening process is 100mg/l and 30mg/l respectively. All the samples except sample 5 showed hardness within the limits set by BIS as well as WHO standards. But sample 5 has hardness of 203.94, which exceeds the permissible limit which in turn showed that the water is hard and can't be used for washing purpose. It can be used after softening process. Chloride content indicates heavy pollution. Average chloride concentrations

of all samples never found to be exceeded the permissible limit of 250mg/l (BIS &WHO) in the study area.

Dissolved oxygen levels indicate the ability of water to purify itself through biochemical process.The permissible levels of DO according to BIS as well as WHO standards is 4-6mg/l. DO of the samples was never less than the permissible levels except for sample 1 and sample 5 (2.83 and 3.63) . The low amount of dissolved oxygen in water indicates the presence of high amount soluble salts and impurities. In the view of DO, sample1 and sample 5 are of least quality. COD determination is reliable and fast for the determination of organic pollutants as well as for the assessment of the quality of water. The COD of good and palatable drinking water should not be more than 20mg/l. COD of all samples were within the permissible limit. The graphical representation of the results is given below.
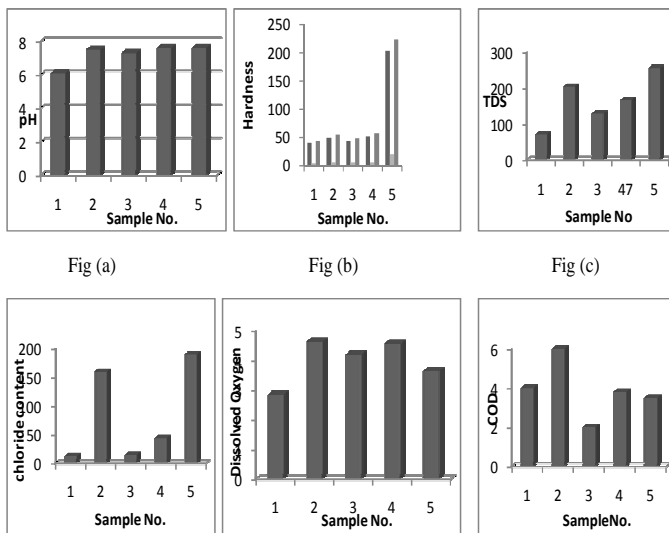
Figure 1:variation of (a) pH (b) Hardness (c) Total Dissolved Solids(TDS) (d) Choride content (e) Dissolved Oxygen(DO) and (f) Chemical Oxygen Demand(COD) of the tested water samples.

Conclusion

In this work assessed the quality of drinking water in the industrial area of Angamaly was assessed. From the forgoing study, it can be concluded that the ground water in the study area is of fair quality and is palatable since all the parameters such as p^H, TDS, & Chloride content of all water samples were within the permissible limits set by BIS as well as WHO standards. But sample 5 and sample 1 have low dissolved oxygen content and diminutive COD value. So these need some water treatments before used for drinking. This will helps in reducing health risks. The water sample 5 is hard also; so it can't be used for washing unless it is submitted to water softening otherwise there is wastage of soaps.

Overall study shows that, from the collected water samples of the studied area, sample 3 is of good quality since all the water quality parameters within the permissible limits.

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EFFECT OF CARBON BLACK TYPES ON THE RHEOLOGICAL AND MECHANICAL

PROPERTIES OF NATURAL RUBBER COMPOUND

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Abstract

Rubber compounds are reinforced with fillers such as carbon black and silica. A comparative study on the effect of two types of rubber-grade fillers on the rheological and mechanical properties of natural rubber compound was investigated. High abrasion furnace (N330) and intermediate super abrasion furnace (N220) carbon black fillers are used for the entire study. It is suggested that the surface area of carbon blacks strongly affects the physical properties of natural rubber/carbon black composites. Curing kinetics is studied by rheometer and the results indicate that the curing characteristics are influenced by combination of surface area, particle size and porosity of carbon black filler. The reinforcing nature of the carbon black is assessed from mechanical measurements such as hardness, elongation, tensile strength, modulus etc.

Keywords: carbon black, cure characteristics, mechanical properties

Introduction

Elastomers are presently used in wide areas of application, such as wires, cables and automobiles, due to their light weight, hydrophobicity, and easy maintenance and processing. Rubber composites have been developed to meet several industrial requirements, such

as the need for easier processing and broadening the range of properties, either by varying the type, relative content or the morphology of each component [1].Nowadays, considerable research interest is focused on new enhancement for rubbery materials obtained by addition a various types of fillers. The major feature of such process is improved processing characteristics and the mechanical properties [2]. Reinforcing fillers include carbon blacks, silica and resins, which increase the strength of vulcanized rubber more than tenfold [2]. Carbon black plays key role in the alteration of the rubber compound properties to suit the end product requirements for hysteresis, stiffness, hardness, compression set etc. Carbon blacks have reactive organic groups on the surface that cause affinity to rubber [3]. Filling carbon blacks in elastomers and plastics also reduces the cost of the end product and modifies the electrical and optical properties of the polymer matrix [4]. Reinforcement of rubber by carbon blacks has been intensively studied [5–7]. It is generally accepted that the reinforcement of elastomers and the improvement of other properties, to a large extent, are associated with the chemical and physical interactions between the polymer matrix and carbon blacks [8–12]. The ultimate aim of the present work is to study the Variations in mechanical properties of natural rubber with and without the addition o two different carbon black filler.

Experimental

Three Rubber compounds of following formulations were prepared at 30-45°C for about half an hour with the help of a two roller machine. About 8g of the each compound has been taken for finding out cure characteristics. Cure characteristics were obtained using oscillating disk rheometer at 140°C. From this cure time has been cal-

culated. Button and slab were molded in a hydraulic press at 140ºC. Slab was again cut into dumbbell shape of standard ASTM. Hardness was tested with the help of a shore A Mitutoyo hardness tester (durometer) followed by ASTM D2240. Using universal testing machine following ASTM D412, tensile strength and elongation at break of each sample has been determined. Densimeter was used for the determination of specific gravity.

Table 1: formulations

Ingredients	Loading(phr)		
	Compound 1	**Compound 2**	**Compound 3**
ISNR-20	100	100	100
ZnO	4	4	4
Stearic acid	0.5	0.5	0.5
CBS	0.75	0.75	0.75
TMTD	0.25	0.25	0.25
RGS	0.5	0.5	0.5
HAF	-	10	-
ISAF	-	-	10

Result and discussion

In table 2 shows the cure characteristics of each three compounds. It is obvious from the figure that the scorch time and optimum cure time decreases by the addition of filler. This may be due to the fact that there must be an increase in surface area after the addition of carbon black. Whereas comparing compound 2 and 3 there is only a smaller difference in scorch time and optimum cure time between

compound 1 and 2. HAF carbon black has a particle size of 28-36nm were as ISAF carbon black has a lower (24-33nm) particle size. While the surface area of HAF and ISAF are 80m^2/g and 120m^2/g respectively [13-14]. That is cure time and scorch time is reduced with increase in surface area and decrease in particle size.

In table 3 shows the physical characteristics of all the three compounds. All the physical properties show a drastic increase by the addition of carbon black filler. While comparing compound 2 and 3, the compound containing low particle size ISAF filler shows an increase in the properties like elongation, tensile strength, specific gravity and hardness. Whereas, with decreasing particle size modulus of the compound increases to the maximum and then decreases.

Table 2: Rheological properties

	M_H	Ts_1	Ts_2	T_{90}	Optimum cure
Compound 1	56.44	3.65	3.92	6.47	52.22
Compound 2	54.22	3.18	3.37	5.62	49.97
Compound 3	53.11	3.4	3.67	5.78	49

Table 3: mechanical properties

Mechanical properties	Compound 1	Compound 2	Compound 3
Hardness	32	37	39
Tensile strength	19.35	20.04	20.19
Elongation break	1267.252	977.2113	1048.1727
MD 100%	0.5496	0.7074	0.6135
MD 200%	0.8728	1.2405	1.1283
MD 300%	1.2234	1.9528	1.788
Specific gravity	0.947	.987	0.990

Conclusion

Preparation of rubber compounds with and without addition of filler represents effect of filler on the mechanical and rheological properties. It is seen that by the addition of carbon black fillers compounds show a large variation in their properties which is explained in terms of particle size and surface area of added fillers.

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COMPARATIVE STUDY OF VARIOUS BRANDS OF

TEA POWDER MARKETED IN KERALA

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Abstract

This research paper attempts an analysis of the content and the various properties of different brands of tea marketed in Kerala. Quality parameters like pH, colour absorbance, bulk density, caffeine content, acid content and calcium tannate content was determined and compared for eight different samples. Each measurement was repeated thrice and the average value is reported. It was found that the aqueous solutions of tea powders are acidic and the caffeine content and colour absorbance is lowest in green tea. Bulk density of the samples vary from 0.258 – 0.614 g/cm^3.

Keywords: Tea powders, pH, colour absorbance, bulk density, caffeine content, acid content and calcium tannate content

Introduction

India is the largest producer of tea powder in the world with annual production of over 900 million kgs, representing over 28% of the world production of 3.2 billion kg. Tea is made from the young leaves and buds of the tea plant. Tea leaves are rich in caffeine(alkaloid).Besides caffeine, tea leaves also contain tannic acid and colouring matter, such as polyphenolic compounds. The relative amounts of these substances are different in different varieties of tea leaves, which is why, their tastes and flavours are different.

Tea promotes health but at the same time it causes health problems due to its caffeine content. Thus, to get the benefits of tea, but at the same time minimizing the adverse effects of caffeine, we have to consume the lowest possible amount of caffeine. Many tea brands are present now a days but all are not similar, it differs based upon the availability, colour , texture, quality and cost. The caffeine levels are also different in individual tea powders.

Tea is one of the most popular beverages worldwide due to its taste, aroma, and health effects. Young shoots of tea bushes are mainly processed into black tea, green tea, and oolong tea. Among these, green tea is most beneficial to human health. Recently reported pharmacological properties, e.g., antioxidant, anti- inflammatory, antimutagenic, and anticarcinogenic effects also served to increase the popularity of green tea.Green tea powder, known as *matcha*, is an important tea product. It has also become a popular additive in the production of beverages, chocolates, candies, cakes, pastries, cookies, puddings, ice creams, etc.. Green tea powder is made from young shoots of tea bushes that have been shaded for a few weeks, which enriches the free amino acids content (e.g., theanine). In this manner, green tea becomes flavor-rich before it is hand-harvested. Shading leads to greener, tastier, and less astringent tea leaves and, thereby, attracts the consumer. After harvest, the young shoots are processed into green tea powder by series of processing steps: steaming; drying; removing of stems, midribs, and veins; and fine stone milling.

There are reported studies on green tea powder related to milling methods, particle characteristics and foaming properties. Catechin contents were also studied in green tea powder.

Experiments And Discussion

Different Brands of Tea Powders like Kannan Devan, Green tea, AVT, Premium, Kannamali, Sports tea, Koorq and Navaratna were selected for the study. The sample packets were used as they are purchased. The chemicals and reagents used were of analar grade.

Caffeine content was estimated by extracting the caffeine from the tea powder by boiling with water; precipitated using 10% lead acetate solution, followed by extraction with Chloroform. The percentage of Caffeine is calculated by using following formula-

Percentage of Caffeine = <u>Weight of substance Obtained</u>   X   100

Weight of Tea powder Taken

Acid content was estimated by the titration method using standard NaOH solution. pH of the 5% aqueous solution was measured using a pH meter. Calcium tannate content was determine by the precipitation method using calcium carbonate. Colour absorbance was measured using a colorimeter.

Results And Discussion1.Percentage of Caffeine

The results of caffeine estimation in different brands of tea powder samples are tabulated in Table1. A glance at this table indicates the presence of wide variation from 1.4 – 4.26 % in caffeine content between different sets of tea powder samples studied. The lowest caffeine content was seen in Green Tea, which had only 1.4g. Since variability of caffeine content depends on factors such as variety of tea, location, time of plucking, age of leaves, the particles size

and other agro-climatic conditions of tea plantation, it is therefore reasonable to pressure that the above factors might account for the observed variation in the caffeine content in different groups of tea samples.

(Table 1)

Sl. No	Percent-age of caffeine	Acid con-tent	pH	Weight of Calcium tannate (g)	Bulk density (g/cm³)	Colour absor-bance
1	1.84	2.3	5.1	0.540	0.554	0.48
2	1.4	2.4	5.4	0.37	0.258	0.17
3	1.96	3.2	5.5	0.339	0.528	0.45
4	1.6	2.2	5.2	0.323	0.614	0.50
5	1.52	2.6	5.0	0.372	0.500	0.42
6	1.66	1.8	4.9	0.337	0.420	0.68
7	4.26	2.2	5.7	0.301	0.310	0.34
8	2.02	3.0	5.3	0.328	0.543	0.37

2. Acid Content

The results of estimation of acid content in different brands of tea powder samples are shown in Figure 2. The acidic substances are more in sample 3 and the consumption of more tea is not good for health and will lead to acidity.

3 . Determination of pH

pH of different brands of tea powder samples are shown in figure 3.

The pH of the samples ranges from 4.9- 5.7. Sample 7 with a pH of 4.9, had a bitter taste that lingered on the tongue. And all other tea powders tasted only mildly bitter, which could be explained by their higher pH .

4. Estimation of the Percentage Composition of Calcium Tannate

The results of estimation of calcium tannate in different brands of tea powder samples are shown in Figure 4. The amount of tannic acid in tea leaves is proportional to the weight of calcium tannate precipitated. The amount of tannic acid is highest for sample 1 and sample 7 has the least. Tannic acid gives the tea to become more darker and also it has antimicrobial properties: effective against many bacteria, fungi and virus. But higher quantity may cause speeding of blood clotting, reduction of blood pressure and effect on the liver and immune system.

5. Analysis of Bulk Density

The results of bulk density of different brands of tea powder samples are shown in Figure 5. Bulk density is less for sample 2. So the weight of its consumption will be less.

6. Colour Absorbance

The brownish colour of the tea is due to the presence of polyphenolic compounds and some inorganic ions like manganese ion and ferric ion etc. From our analysis, we can see that sample 6 has high absorbance value and sample 2 has least in black teas, Green tea (sample 2) has the least value than all.

CONCLUSIONS

- Major content of tea powder is caffeine that vary from 1.4 – 4.26 % in the selected samples. Sample 7 contain more amount of caffeine than actually needed.

- pH of the samples vary from 4.9 to 5.7. From our analysis we can see that all tea powder samples are mildly acidic.

- Among the different samples Sample 1 contain high amount of tannic acid

- Bulk density of the samples vary from 0.258 – 0.614 g/cm^3.

- Among the colour absorbance of different samples, sample 6 has higher absorbance value which directly says small of amount of its powder makes tea darker. So it is more profitable than other tea powders.

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Research Article

Composition, antibacterial and anti-oxidant potentials of the essential oil of *Hedychium matthewii*

Composition, antibacterial and anti-oxidant potentials of the essential oil of *Hedychium matthewii*

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Abstract

Essential oils are known for their medicinal value since time immemorial and continue to be of vital importance until the present day. The present study describes the composition, antibacterial and anti-oxidant potential of rhizome oil of *Hedychium matthewii*. Thirty-five constituents of the oil were identified to account for 82.7%, of which 85.7% was monoterpes and the rest were sesquiterpnes. Most of the major constituents were alcohols and linalool was the prominent one (45.7%). The antibacterial assay showed the bactericidal effect of the essential oil and the most susceptible organism was *Streptococcus hemolyticus* with a zone of inhibition of 33.8 ± 1.7 mm. The reducing power and nitric oxide scavenging activity of the essential oil was far exceeding the reference compound ascorbic acid and it could be the sign of the potential anti-oxidant power of the oil isolated. The present study also revealed the prospective of *H. matthewii* as a new natural source of linalool, which has medicinal and various industrial applications.

Introduction

The genus *Hedychium*, an ornamental and ethnomedicinal plant comprises about 90 species, mostly distributed from India to South-East Asia (Raj et al., 2005; Thomas et al., 2015). *Hedychium* species are a good source of various essential oil compounds having medicinal and other industrial applications (Sakhanokho et al., 2013). The essential oil obtained from leaves of *H. coronarium* constituted β-pinene as the major compound (Raj et al., 2013), whereas β-ocimene and linalool as the major constituents in its flower oil (Báez et al., 2011) and 1,8 cineole as the major compound in rhizome oil (Joy et al., 2007).

Leaf and flower essential oils of *H. gardnarianum* reported the presence of α and β-pinenes as the major components (Medeiros et al., 2003). *H. flavum* was characterized by 1,8 cineole and linalool as major compounds in the essential oil obtained from the inflorescence (Báez et al., 2011). Rhizome oil of *H. larsenii* was dominated by linalool (Raj et al., 2005), whereas leaf and inflorescence oil dominated by ar-curcumin and *p*-cymene, respectively (Raj et al., 2013). It has been reported that rhizome oil of *H. thyrsiforme*, *H. flavum* and *H. bousigonianum* were dominated by 1,8 cineole, whereas linalool was the major constituent in *H. forrestii* and *H. coccineum*. β-Pinene was also found to be the major rhizome oil component in *H. elatum* and *H. flavescens* (Sakhanokho et al., 2013).

Essential oils obtained from *H. spicatum*, *H. aurantiacum*, *H. coronarium* and *H. ellipticum* exhibited good anti-oxidant potentials by quenching DPPH radicals and moderate to good Fe^{2+} chelating activity and may perhaps afford protection against oxidative damage (Joshi et al., 2008). Flower and leaf oils of *H. gardnerianum* showed good antimicrobial activity against *Staphylococcus aureus* and *Staphylococcus epidermidis* (Medeiros et al., 2003). The rhizome essential

oil and solvent extracts of *H. flavescens*, *H. venustum*, *H. ellipticum*, *H. aurantiacum* and *H. coronarium* showed a broad spectrum antimicrobial activity (Joshi et al., 2008; Joy et al., 2007; Sabulal et al., 2007). Essential oil of *H. spicatum* is reported to possess antimicrobial and anti-oxidant activity (Bisht et al., 2006; Joshi et al., 2008). Therefore, *Hedychium* species not only have ornamental value but also have medicinal and industrial value.

Hedychium matthewii, a recently reported taxon, is known only from Idukki, Kerala (Thomas et al., 2015). There are no reports available on the essential oil composition and their biological property of this species. Therefore, the present study aimed at analyses the composition, antibacterial and anti-oxidant potential of the essential oil isolated from rhizomes of this least studied taxon.

Materials and Methods

Plant material

The rhizomes of *H. matthewii* were collected from two populations at Idukki and brought to the laboratory and washed to remove adhering soil and dust particles. The rhizomes were cut into pieces and dried at room temperature. A voucher specimen (RHT65200) deposited in The Rapinat Herbarium (RHT), St. Joseph's College, Tiruchirappalli, Tamilnadu.

Chemicals

1, 1- Diphenyl-2-picrylhydrazyl (DPPH), sodium nitrite, sulfanilamide and ascorbic acid (AA) were purchased from Sigma chemical co. (USA). Potassium ferricyanide, trichloroacetic acid (TCA), sodium nitroprusside, α-napthyl-ethylenediamine and ferric chloride were purchased from Merck chemical supplies (Germany). All the chemicals used including the solvents, were of analytical grade.

Essential oil extraction

The dried rhizomes (25 g) were ground and hydro-distilled for 3 hours using a Clevenger-type apparatus. The distillate was dried over anhydrous sodium sulfate and stored in tightly closed vials at 4°C for analysis. The essential oil content was determined as a percentage on dry weight basis as an average of three independent extractions of each sample.

Characterization and identification of essential oil constituents

GC/MS analyses were performed using Shimadzu GC-2010 gas chromatograph (GC-FID) equipped with QP 2010 mass spectrometer (MS). Approximately 0.1 μL of pure oil sample was subjected to gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS) analysis. The column used was DB-5. The

oven temperature was programmed as follows; 70°C for 5 min and then increased to 110°C at the rate of 5°C/min, then up to 200°C at the rate of 3°C/min and again up to 220°C at the rate of 5°C/min, at which the column was maintained for 5 min; injector temperature of 250°C. Helium was used as carrier gas at a flow rate of 1 mL/min. Identification of the individual components was made by matching their recorded mass spectra and linear retention indices with the library (NIST and Wiley) provided by the instrument software, online database (http://webbook.nist.gov/chemistry; http://www.flavornet.org) and by comparing their calculated retention indices with literature value (Adams, 2009).

Test microorganisms

The bacterial strains used in the study were three gram positive, namely, *Streptococcus haemolyticus* (MTCC442), *Bacillus cereus* (MTCC430) and *Staphylococcus aureus* (MTCC87) and nine gram negative, namely, *Vibrio parahaemolyticus* (MTCC451), *Vibrio cholerae* (MTCC3904), *Salmonella paratyphi* (MTCC735), *Enterobacter aerogens* (MTCC111), *Escherichia coli* (MTCC433), *Klebsiella pneumoniae* (MTCC3384), *Proteus vulgaris* (MTCC426), *Salmonella typhi* (MTCC733) and *Pseudomonas aeruginosa* (MTCC741). All the tested strains are reference strains, and were collected from Microbial Type Culture Collection and Gene Bank, Institute of Microbial Technology, Sector 39-A, Chandigarh 160036, India.

Antibacterial activity test

The antibacterial activity of essential oil was carried out by disc diffusion method (Bauer, 1966), recommended by clinical and laboratory standards institute (CLSI), using 25 μL of standardized suspension of test bacteria $(1.5*10^8$ CFU/mL) spread on Mueller-Hinton agar (MHA, pH 7.3 ± 0.1) plates. The discs (6 mm in diameter) were impregnated with 20 μL of essential oil, followed by air-drying and were placed on seeded agar plates. Amoxicillin (30 μg/disc) was used as positive control to determine the sensitivity of bacterial strain. The plates were incubated at 37°C for 24 hours. Antimicrobial activity was evaluated by measuring the zones of inhibition against the tested bacteria. Each assay was carried out in triplicate.

Determination of reducing power

The reducing power of the essential oil was measured by making use of the method described by Yen and Duh (1993) with some modifications. Various concentrations (10, 20, 30, 40 and 50 μL/mL) of essential oil in methanol were taken separately and mixed with 2.5 mL of 0.2 M sodium phosphate buffer (pH 6.6). The dilute sample was then mixed with 5.0 mL of 1% potassium ferricyanide and the mixture was incubated at 50°C for 20 min 5.0 mL of 10% trichloroacetic acid was added to the mixture and was centrifuged at 3000

rpm for 10 min 5.0 mL of the supernatant solution was mixed with 5.0 mL of distilled water and 1.0 mL of ferric chloride (1%). The absorbance was measured spectrophotometrically at 700 nm (Shimadzu, UV-150-02). The ascorbic acid standard was used for comparison.

DPPH radical scavenging activity

The free radical scavenging activity of essential oil was measured using the stable DPPH radical, according to the method of Blois (Mani and Thomas, 2014) with minor modifications. Briefly, 0.1 mM solution of DPPH in methanol was prepared and this solution (1 mL) was added to essential oil in methanol (3 mL) at concentrations ranging from 10-50 µL/mL. The mixture was shaken well and left to stand for 30 min in the dark and the absorbance was then measured at 517 nm. The capability to scavenge the DPPH radical was calculated using the following formula:

$$(\%) = ((A_0 - A_1)/A_0) \times 100 \qquad (1)$$

Where, A_0 and A_1 are absorbance of the control and of the sample, respectively. Ascorbic acid was used as reference.

Nitric oxide (NO) scavenging activity

Nitric oxide scavenging effect was determined according to Griess Illosvoy reaction (Johnson, 1964) with slight modification. The reaction mixture contained: 10 mM SNP in 0.5 M phosphate buffer (pH 7.4) and various doses (10–50 µL/mL) of the essential oil in a final volume of 3 mL. After incubation for 60 min at 37° C, Griess reagent (0.1% α-napthyl-ethylenediamine in distilled water and 1% sulphanilamide in 5% H_3PO_4) was added. The pink chromophore generated during diazotization of nitrite ions with sulphanilamide and subsequent coupling with α-napthyl-ethylenediamine was measured spectrophotometrically at 540 nm. Ascorbic acid was used as a positive control. Nitric oxide scavenging ability (%) was calculated by using the equation (1).

Statistical analysis

Experimental results were expressed as the mean ± standard deviation (SD) of the number of experiments indicated in the legends. Statistical significance was tested using a one way analysis of variance (ANOVA) followed by an LSD test, where p<0.05 was considered significant.

Results

Essential oil characterization

The dried rhizomes were hydrodistilled to obtain a pleasant smelling, pale yellow oil at a yield of 2.6%. The gas chromatogram (GC) of the rhizome essential oil of

H. matthewii is shown in Figure 1. The GC profile indicates the presence of more than 50 compounds, of which 35 were identified by comparing and matching the mass spectra and GC retention index (RI) of the compounds with those of reference.
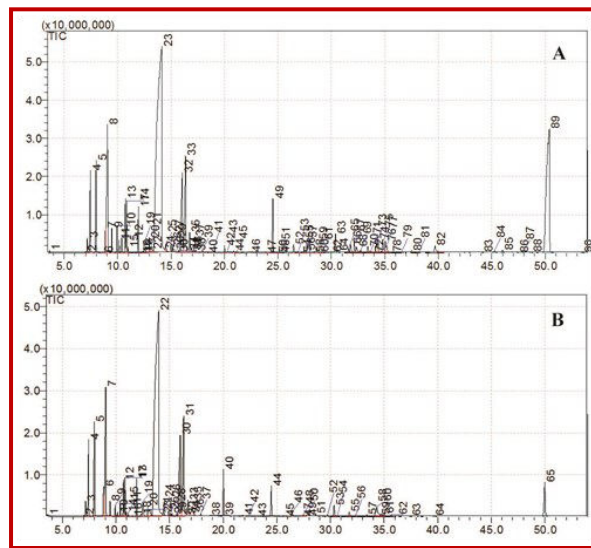
Figure 1: Total ion chromatogram (TIC) of the volatile compounds from the dried rhizomes of two populations (A and B) of *H. matthewii*

Table I depicts the volatile components indentified and those 35 compounds accounting for 82.7% of the oil hydrodistilled from the dried rhizome. 85.7% of the oil consisted of monoterpenes whereas rests (14.3%) accounted for sesquiterpenes. The constituents indentified consisted of fourteen monoterpene hydrocarbons (40%), sixteen oxygenated monoterpenes (45.7%), two sesquiterpene hydrocarbons (5.7%) and three oxygenated sesquiterpenes (8.6%). The analyzed oil contained esters, oxides, alcohols, phenols, aldehydes and ketones. The majority of essential oil constituents were found in the monoterpene class where the most prominent compounds were linalool (45.6%) followed by β-pinene (6.5%), borneol (6.3%), 4-terpineol (5.6%), camphene (3.3%) and α-pinene (2.5%).

Antibacterial assay

The results of the antibacterial studies, of the essential oil obtained, by the disc diffusion technique are given in Table II. By analyzing the antibacterial activity of essential oil, we observed that all the bacteria tested were susceptible and the essential oil showed hopeful antibacterial activity. A volume of 20 µL of essential oil showed nearly equal and effective inhibition against all the strains used in the present study. The most susceptible bacterium tested was *Streptococcus haemolyticus* with a zone of inhibition of 33.8 ± 1.7 mm. The bacteria such as *S. haemolyticus* and *Vibrio cholerae* were more susceptible towards essential oil than

Table I

Chemical composition of the essential oil from *H. matthewii*

SL. No.	Component	RI$_a$	RI$_b$	Composition (%)
1	α-Thujene	930	931	0.4 ± 0.1
2	α-Pinene	938	939	2.5 ± 0.5
3	Camphene	953	953	3.3 ± 0.9
4	Sabinene	972	972	1.2 ± 0.5
5	β-Pinene	981	980	6.5 ± 0.8
6	β-Myrcene	992	992	0.5 ± 0.04
7	α-Phellandrene	1007	1005	0.5 ± 0.2
8	3-Careen	1111	1011	0.2 ± 0.1
9	α-Terpinene	1012	1012	0.4 ± 0.05
10	o-Cymene	1026	1027	1.4 ± 0.1
11	D-Limonene	1031	1031	1.2 ± 0.03
12	1,8-Cineole	1033	1033	0.1 ± 0.02
13	trans-β-Ocimene	1050	1050	0.1 ± 0.1
14	γ-Terpinene	1059	1059	1.2 ± 0.1
15	α-Terpinolene	1063	1063	0.5 ± 0.2
16	trans-Linalool oxide	1065	1065	0.7 ± 0.5
17	Linalool	1098	1098	45.6 ± 3.9
18	Fenchol	1112	1112	0.02 ± 0.0
19	*p*-Menth-2-en-1-ol	1120	1121	0.2 ± 0.05
20	L-Camphor	1140	1139	0.1 ± 0.01
21	Borneol	1163	1162	6.3 ± 1.7
22	4-Terpineol	1180	1180	5.6 ± 1.5
23	α-Terpineol	1189	1189	0.7 ± 0.1
24	Myrtenal	1190	1190	0.2 ± 0.03
25	α-Phellandrene epoxide	1192	1192	0.1 ± 0.1
26	Piperitol	1199	1198	0.2 ± 0.1
27	Bornyl fomate	1232	1232	0.1 ± 0.01
28	Bornyl acetate	1283	1283	1.1 ± 1.0
29	Thymol	1284	1284	0.1 ± 0.02
30	α-Terpinyl acetate	1352	1352	0.03 ± 0.0
31	β-Caryophyllene	1418	1418	0.1 ± 0.1
32	α-Cedrene	1433	1433	0.2 ± 0.1
33	Caryophyllene oxide	1583	1583	0.1 ± 0.1
34	Guaiol	1597	1597	0.5 ± 0.2
35	10-epi-γ-Eudesmol	1619	1619	0.5 ± 0.2

Values are mean ± SD of two samples (n = 2); RI$_a$ and RI$_b$: Experimental and reference retention indices

Table II

Antibacterial activity of the essential oil from *H. matthewii*

Species	Zone of inhibition (mm)	
	Essential oil	Amoxicillin
Gram positive		
Bacillus cereus	19.3 ± 0.9	28.3 ± 0.6
Staphylococcus aureus	29.2 ± 0.8	30.2 ± 0.3
Streptococcus hemolyticus	33.8 ± 1.7	31.5 ± 0.9
Gram negative		
Enterobacter aerogens	20.6 ± 1.5	27.8 ± 0.3
Salmonella paratyphi	23.8 ± 1.2	30.5 ± 0.5
Vibrio cholerae	30.6 ± 1.04	27.8 ± 0.3
Salmonella typhii	28.0 ± 1.7	34.3 ± 0.8
Escherichia coli	21.0 ± 1.0	30.5 ± 0.9
Vibrio parahaemolyticus	26.3 ± 1.5	32.3 ± 0.6
Proteus vulgaris	28.2 ± 1.7	32.2 ± 0.3
Klebsiella pneumoniae	24.2 ± 1.04	26.0 ± 0.9
Pseudomonas aeruginosa	26.2 ± 1.6	28.3 ± 0.6

Values are presented as mean ± SD of triplicate experiments

agent as the standard antibiotic used in the study. Moreover, the essential oil inhibited the growth of both gram positive and gram negative bacteria; consequently it may be used as a broad spectrum natural antibacterial agent.

Anti-oxidant assay

Reducing power: The reducing power of a compound or extract was related to its electron transfer ability and might, therefore, served as an indicator of its potential anti-oxidant activity. The reducing power of the essential oil and ascorbic acid increased with the concentration (Figure 2). The oil exhibited significantly higher activity than the standard ascorbic acid. The results of the present study suggest that essential oil isolated from *H. matthewii* has potent reducing power and promising anti-oxidant activity.

DPPH radical scavenging

DPPH radical scavenging assay, commonly used for analyzing the radical scavenging ability of a compound or extract, is simple and highly sensitive (Miguel, 2010). The anti-oxidant potential of the essential oil obtained from *H. matthewii* was studied by analyzing the radical scavenging capacity and electron donating ability of the constituents in the essential oil. The DPPH radical scavenging activity of the essential oil and standard anti-oxidative compound (ascorbic acid) is shown in Table III. The result showed a dose-dependent inhibition of DPHH radical by both oil and the standard and there was no significant difference exists between the

antibiotic tested. The results also showed that the essential oil was found to be effective antibacterial

Table III					
DPPH radical and nitric oxide scavenging activityof rhizome oil of *H. matthewii*					
	Concentration (µL/mL)				
	10	20	30	40	50
DPPH radical					
Ascorbic acid (µg/mL)	12.6 ± 0.1[a]	30.4 ± 0.1[a]	49.2 ± 0.1[a]	72.5 ± 0.1[a]	97.4 ± 0.1[a]
Essential oil (µL/mL)	10.8 ± 0.1[a]	27.5 ± 0.2[a]	46.7 ± 0.1[a]	70.1 ± 0.2[a]	91.7 ± 0.1[a]
Nitric oxide					
Ascorbic acid (µg/mL)	10.3 ± 0.2[a]	21.2 ± 0.1[a]	32.6 ± 0.1[a]	41.1 ± 0.2[a]	52.2 ± 0.1[a]
Essential oil (µL/mL)	16.8 ± 0.1[b]	35.3 ± 0.1[b]	54.1 ± 0.1[b]	72.8 ± 0.1[b]	94.3 ± 0.3[b]

Values are mean ± SD of two samples analyzed individually in triplicate. Superscripts with the same letters within each column are not significantly different at $p < 0.05$
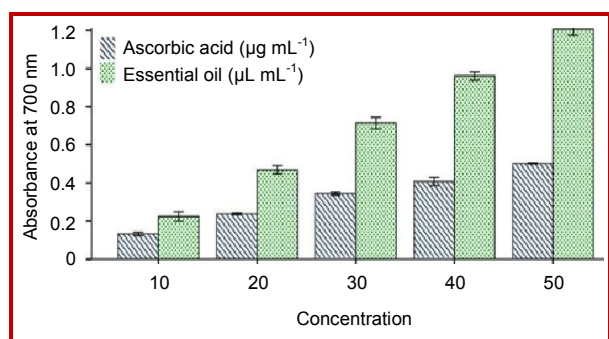
Figure 2: Reducing power of rhizome oil of *H. matthewii* and reference compound ascorbic acid (Values are mean ± SD of two samples analyzed individually in triplicate)

scavenging activity of the oil and the reference compound ascorbic acid. Concentration at which the oil decreased DPPH radical by 50% (IC_{50} value) was 31.5 µL/mL. Correspondingly, IC_{50} value for ascorbic acid, used as a standard, was 30.5 µg/mL.

Nitric oxide (NO) scavenging activity

Anti-oxidant activity of the essential oil was further determined by inhibition of nitric oxide radicals is shown in Table III. The nitric oxide scavenging capacity of extracts and the reference compound ascorbic acid was increased with increasing concentration. The results of the study showed that a significant difference ($p < 0.05$) was observed between the two experimental conditions. A total of 50% (IC_{50}) of the nitric oxide radicals was scavenged by essential oil at a concentration of 27.5 µL/mL, whereas that of the ascorbate was 48 µg/mL. The experimental analysis showed that, the essential oil of *H. matthewii* had good nitric oxide scavenging effect.

Discussion

The antibacterial activities of essential oils are well-known. Recently, the antibacterial activity of essential oils of *Buddleja asiatica, Caesalpinia bonducella, Ginkgo biloba* and *Ligustrum lucidum* are reported (Bajpai et al,

2015; Bajpai et al, 2016; Khan et al., 2015; Shukla et al, 2016). Previous studies showed that multiplication of pathogenic *Salmonella* spp., *Escherichia coli* (O157:H7), *Listeria monocytogenes, Helicobacter pylori* and *Mycoplasma pneumoniae* were inhibited by essential oils (Burt, 2004). Monoterpenes are good antibacterial and antifungal agent (Jirovetz et al., 2005; Soković et al., 2010) in particular the oxygenated compounds (Kotan et al., 2007). The major component in the essential oil of *H. matthewii* was linalool an oxygenated monoterpene, followed by 4-terpineol, β-pinene, camphene, borneol and α-pinene, together constitute 73% of the essential oil isolated. The earlier studies showed that linalool, β-pinene and 4-terpineol were found to be possessing good antibacterial properties against several microorganisms (Barel et al., 1991; Kotan et al., 2007; Park et al., 2012; Soković et al., 2010). Essential oil of *H. matthewii* showed a promising antibacterial activity might be attributed to these major constituents. Hence, essential oil from rhizomes of this plant can be used in the antibacterial formulations, which in turn broadens its applications in the pharmaceutical and other industries. Moreover, the broad-spectrum antibacterial activity of the essential oil of *H. matthewii* may perhaps due to the liposolubility of its constituents. It is a good indication of the antiseptic power of the essential oil isolated (Marino et al., 1999; Porter and Wilkins, 1999).

The anti-oxidant activity of essential oils is another biological property of great interest because they may have various industrial applications (Aruoma, 1998; Kamatou and Viljoen, 2010; Maestri et al., 2006). Reactive oxygen species (ROS) and reactive nitrogen species (RNS) are the two major classes of free radicals which oxidize various biomolecules and in turn lead to cellular damages and being responsible for diverse diseases even though they have important role in host defence mechanisms (Miguel, 2010). Again, the damaging effects are being increased by generating the peroxinitrite anion ($ONOO^-$) after reacting with the superoxide anion radicals (Gomes et al., 2008; Kostka, 1995; Miyasaka and Hirata, 1997; Nagano, 1999). Therefore, molecules or agents which can inhibit the generation of NO have potential applications in the

pharmaceutical industry.

Present investigation showed that the essential oil isolated from *H. matthewii* is a potent inhibitor and/or scavenger of DPPH and NO radicals. Linalool, a monoterpenoid possessing biological properties such as antibacterial and anti-oxidant activities (Liu et al., 2012), might be the major active molecule present in the oil of *H. matthewii*. Earlier studies showed that, linalool found to be a potent scavenger of DPPH radical, inhibit the production of NO radical and also showed bactericidal activities (Liu et al., 2012; Peana et al., 2006).

Anti-oxidant properties of essential oils such as reducing power, scavenging of free radicals, lipid peroxidation, chelating metal ions etc. are often come from their monoterpene hydrocarbons, oxygenated monoterpenes and sesquiterpenes (Loizzo et al., 2010; Tepe et al., 2005), hence the strong anti-oxidant activity of essential oil isolated from the rhizomes of *H. matthewii* may not only be related to linalool but also the sum of the effects of constituents in the essential oil. Therefore, the high anti-oxidant activity of this essential oil strengthens their application for possible use as natural anti-oxidants.

Conclusion

Analysis of the essential oil isolated from the dried rhizomes of *H. matthewii* revealed the presence of good amounts of monoterpenes especially oxygenated compounds. The antimicrobial and anti-oxidant properties of the oil recommend its use in pharmaceutical and other industrial products. The study helped in identifying, *H. matthewii*, a hitherto unexplored aromatic plant, as a novel natural source of linalool (45%).

Acknowledgement

Conflict of Interest

All authors have completed the ICMJE uniform disclosure form and declare no support from any organization for the submitted work.

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A new subspecies of *Celastrus* (Celastraceae) from the Palni hills of South India

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ABSTRACT: *Celastrus paniculatus* Willd. ssp. *angladeanus* S.J. Britto, B. Mani and S. Thomas new subspecies from the Palni hills, Western Ghats of Tamilnadu, South India is described and illustrated. The new ssp. is similar to *Celastrus paniculatus* ssp. *aggregatus* but differs in flame-coloured branchlets, terminal, erect and stiff panicles exceeding leaves, prominent gibbous and oblique capsules, flowers polygamous but predominantly pistillate and 3-seeded capsules.

KEY WORDS: *Celastrus paniculatus* ssp. *angladeanus*, India, New subspecies, Palnil hills.

INTRODUCTION

The genus *Celastrus* L. with *ca*. 31 species is mostly seen in (sub) tropical to warm temperate areas of Eastern Asia, India, N. America, New Caledonia, Australia, Madagascar and Sri Lanka (Wadhwa, 1996; Mabberley, 2008). In India it is represented by three species (Hou, 1962) namely *C. paniculatus* Willd., *C. hindsii* Benth., and *C. stylosus* Wall. *ssp. stylosus*. Earlier Hou (1955) had described 3 subspecies for *Celastrus paniculatus* based on the dimensions of leaves and geographical distribution but in his later revision of Celastraceae for the Flora Malesiana (1962) withdrew the above subspecies. Matthew (1996 & 1999) distinguished a subspecies and named it *Celastrus paniculatus* Willd. ssp. *aggregatus* K. T. Mathew.

During the floristic explorations of the Western Ghats of Tamilnadu, India, authors came across specimens of *Celastrus paniculatus* from the Palni hills that differed from the known *Celastrus paniculatus* ssp. *aggregatus*. *C. paniculatus* ssp. *paniculatus* is always characterised by inflorescence on terminal shoots diagnostically pendent, with flowers > 150 per cluster while ssp. *aggregatus* is with inflorescence on lateral shoots, flowers, < 25 per cluster. After critical examination of the new ssp. and comparison with specimens from other herbaria, it was concluded that the specimen deserves to be described as a new subspecies.

TAXONOMIC TREATMENTS

Celastrus paniculatus Willd. ssp. ***angladeanus*** S.J. Britto, B. Mani & S. Thomas, *ssp. nov.*   **Fig. 1**
    Type: India, Tamilnadu, Dindigul district, Palni hills, Thandikudi RF., 78°90′ N, 11°41′ E, alt. 1200 m, 15 Jan. 2008 *Britto sub* **RHT 56086** (holotype RHT; isotype MH)**.**

Celastrus paniculatus ssp. *angladeanus* is similar to ssp. *aggregatus* but differs in flame-coloured branchlets, terminal, erect and stiff panicles exceeding leaves, prominent gibbous and oblique and 3-seeded capsules, flowers polygamous but predominantly pistillate.

A woody *climber* up to 5 m high. Stem erect, pubescent and densely so at apices, characteristically flame coloured with prominent linear lenticels. *Leaves* variable but more often elliptic to broadly elliptic to suborbicular at time obovate, pubescent on both surfaces, $5.7 - 18 \times 3.5 - 13.7$ cm, base obtuse, sometimes cuneate, margin subserrate to subcrenate occasionally dentate, apex significantly and abruptly cuspidate at times acute or rounded. *Inflorescence* always terminal characteristically stiff, turgid and erect, pubescent, twice or more exceeding leaves. Bracts leafy, elongate, linear to 1.5×0.5 cm deciduous to semi persistent. *Flowers* $30 - 110$, polygamous but mostly pistillate, $6 - 9 \times 4.5$ mm. *Pistillate flower*: *Calyx* cupular. *Sepals* semi-orbicular or broadly ovate, $2\text{-}2.2 \times c$. 05 mm, ciliate imbricate, pale green to cream. *Petals* ovate, pale yellow, $3.1 - 3.4 \times 1.7 - 2.0$ mm, reflexed. *Disk* cupular with wavy margins. *Stamens* absent. *Staminodes* 5. *Ovary* ovoid, 3×1.5 mm, 3-celled with 2 ovules per cell; stigma distinctly and unequally 3-lobed, each lobe minutely 2-lobed, reflexed. Fruit stalk articulate at lower half but near to middle. *Capsule* obliquely globose to obovoid, very gibbous distally at the apex, asymmetrical, $6 - 9 \times 7 - 8$ mm, 3-valved, bright yellow becoming pale orange when mature, usually 3-seeded, one smaller in size. *Seeds* ellipsoid, unequal $3.5 - 7 \times 2 - 3$ mm, bright and distinctly reddish; aril orange.

Table 1. Comparison of key morphological characters of ***Celastrus paniculatus ssp. angladeanus*** with other subspecies.

Characters	*Celastrus paniculatus* ssp. *paniculatus*	*Celastrus paniculatus* ssp. *aggregatus*	*Celastrus paniculatus* ssp. *angladeanus*
Branchlet	Scandent, glabrous or pubescent	Scandent, glabrous	Erect, pubescent
Branchlet colour	Pale brown	brown	Flame coloured
Branchlet lenticels	Prominent or obscure, elliptic		Prominent, elliptic
Petiole	6–16 mm long, pubescent	Up to 10 mm long, glabrous	10–19 cm long, pubescent
Leaf blade	5–10 × 2.5–5 cm, polymorphic (elliptic, oblong, rectangular, ovate, obovate to suborbicular), glabrous	2–9 × 1–4.5 cm, broadly elliptic, elliptic to obovate, glabrous	5.7–18 × 3.5–13.7 cm, elliptic to widely elliptic, rarely obovate, pubescent on both surface
Leaf base	Cuneate	Obtuse	Cuneate to obtuse
Leaf apex	Mucronate to acuminate	Abruptly acute to retuse	Cuspidate to acute
Leaf margin	Serrate	Shallowly crenulate	Serrate
Lateral veins	5–7 pairs	7–8 pairs	4–7 pairs
Inflorescence	Terminal on terminal shoots, twice or more as long as the leaves, pendent	Terminal on lateral shoots, not exceeding the leaves, straight	Terminal, pubescent, exceeding the leaves, erect
Bracts	Deciduous; caducous	Deciduous; caducous	Leafy, elongate, deciduous to quasi persistent
Flowers	2–3 × 1.2–1.8 mm, polygamous	5–6 × 4–5 mm, polygamous	6–9 × 4–5 mm, polygamous, predominantly pistillate
Sepals	*c.* 2 × 0.5 mm, semiorbicular, ciliate, imbricate, pale green	Calyx cupular, *c.* 2 × 0.5 mm, suborbicular, pale green	Calyx cupular, 2–2.2 × *c.* 0.5 mm, ciliate, imbricate, green, semiorbicular
Petals	2.1–2.4 × *c.* 3 mm, oblong to obovate-rectangular, pale yellow	*c.* 2.5 × 3 mm, ovate to oblong, reflexed, pale yellow	3.1–3.4 × 1.7–2 mm, ovate, pale yellow, reflexed
Disk	Cupular, membraneous, slightly 5-lobed	Concave, 5-lobed	Cupular, margin wavy
Stamen	*c.* 3 mm, inserted on the margin of the disk *Staminate*: stamen 1.4 mm *Bisexual*: stamen 0.6 mm	inserted on the margin of the disk *Staminate*: Stamen 1.6 mm *Bisexual*: stamen 0.7 mm	*Pistillate*: Stamens absent. Staminode 0.9 mm
Ovary	c. 3 × 1.5 mm, globose	3–3.5 × 1.5 mm, ovoid, 3-celled, 2 ovules per cell	c. 3 × 1.5 mm, ovoid, 3-celled, 2 ovules per locule
Stigma	Obscurely 3-lobed	2 or 3- lobed	3-lobed, each lobe minutely 2-lobed or bifid.
Fruit stalk	5–8 mm long, glabrous	5–7 mm long, glabrous	5–10 mm long, pubescent
Articulation on fruit stalk	Lower half, close to the rachis	Lower half, close to the rachis	Lower half but near to middle
Capsule	1–1.3 cm in diam., globose, 3-valved, bright yellow, 3-6 seeded	1.2 × 1.1 cm, 1– (2–4) (–6) seeded	6–9 × 7–8 mm, globose, 3-valved, bright yellow, usually 3-seeded
Seeds	3.5–5.5 × 2–5 mm, elliptic, yellowish to reddish brown	6–7 × c. 4 mm, broadly ellipsoid, brownish	3.5–7 × 2–3 mm, elliptic, reddish
Aril	Orange-red	Deep orange	Orange
Flowering	April–June	June–July	April–May
Fruiting	June–September	August–December	September
Habitat	At low altitudes 800–1300 m	At high altitudes (1200) 1700–2200 m	In altitudes below 1300 m in shola border

Flowering **and** *fruiting*: June–December.

Distribution: Palni hills of Tamilnadu in shola periphery.

Etymology : The subspecies is named after Fr. Aloysius Anglade an eminent naturalist who contributed significantly to the flora and fauna of the Palni hills.

Conservation status: The subspecies population has been spotted in the Palni hills in the one locality only and the habitat is under severe anthropogenic pressure. It can be provisionally categorised as Data Deficient (DD) as per IUCN 3.1 version (IUCN, 2012).
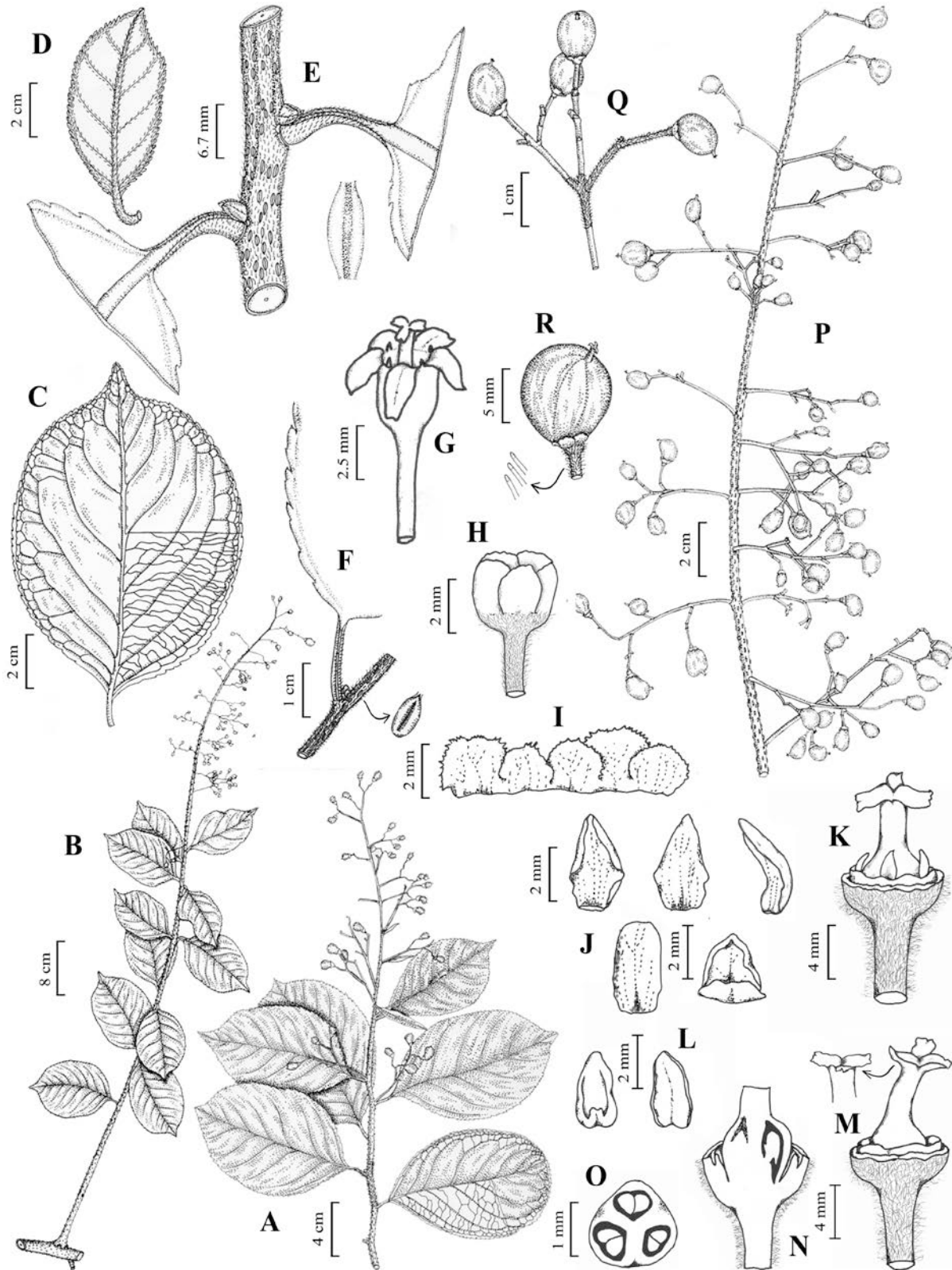
Fig. 1: *Celastrus paniculatus* Willd. ssp. *angladeanus* SJ. Britto, B. Mani & S. Thomas. **A**: Habit with young fruits. **B**: Habit with inflorescence. **C**: Leaf with cusp. **D**: Leaf with acute tip. **E**: Stem with lenticels. **F**: Leaf margin. **G**: Pistillate flower. **H**: Calyx. **I**: Calyx, spread out. **J**: Petals. **K**: Pistil with staminodes. **L**: Staminodes. **M**: Pistil with Stigma enlarged. **N**: Ovary, l.s. **O**: Ovary c.s. **P**: An infructescence. **Q**: Cluster of capsules. **R**: Capsule, enlarged.

Fig. 2: *Celastrus paniculatus* Willd. ssp. *angladeanus* SJ. Britto, B. Mani & S. Thomas. **A**: The plant habit with young fruits. **B**: Flowering branchlets. **C**: Close-up of flowers. **D**: An Inflorescence with bracts. **E**: An Infructescence. **F**: Close-up of a capsule. **G**: Capsule with seeds.

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SHORT COMMUNICATION

FIRST RECORDS OF TWO GINGER *LILYS HEDYCHIUM* (ZINGIBERACEAE) SPECIES FROM THE WESTERN GHATS, INDIA

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SHORT COMMUNICATION

FIRST RECORDS OF TWO GINGER LILYS *HEDYCHIUM* (ZINGIBERACEAE) SPECIES FROM THE WESTERN GHATS, INDIA

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Abstract: *Hedychium forrestii* Diels and *H. spicatum* Sm. (Zingiberaceae) are new distribution records from the Western Ghats, India, extending their range up to southern India. Detailed taxonomic descriptions are provided for the species along with photographs.

Keywords: *Hedychium forrestii, H. spicatum, H. cernuum,* labellum, southern India, Western Ghats.

Hedychium J. Koenig includes approximately 97 species with the centre of diversity in Southeast Asia. The diversity centres are the high altitude humid climatic zones in India, China, Vietnam, Indonesia, Myanmar and Malaysia. Forty-five taxa are reported from India and are primarily distributed in the northeast region (Thomas et al. 2015; World Checklist of Selected Plant Families 2016). Among the 45 taxa, only five [*Hedychium coronarium* J. Koenig, *H. flavescens* Carey ex Roscoe, *H. cernuum* Wight (=*H. venustum* Wight), *H. forrestii* var. *palaniense* Sanoj & M. Sabu and *H. matthewii* S. Thomas, B. Mani & S.J. Britto] are known from the Western Ghats, which is a biodiversity centre in southern India (Thomas et al. 2015).

During field surveys across different geographic and climatic zones in the Western Ghats, which is one of the renowned hotspots, the authors collected interesting specimens such as *Hedychium forrestii* Diels and *H. spicatum* Sm. from Sholayar, and Idukki and Periyavarai regions, respectively. As a result, the present work establishes two new distribution records of *Hedychium* from southern India in general and Western Ghats in particular.

Hedychium forrestii Diels

Notes Roy. Bot. Gard. Edinburgh 5: 304. 1912 (Images 1 & 3)

Type: China, Yunnan, Dali Valley, July 1906, Forrest 00211031 (Royal Botanic Garden Edinburgh, E!).

Rhizomatous perennial herbs; rhizome 3–3.8 cm in diameter, aromatic, covered by brown scales. Leafy shoots: 90–160 cm long, robust, semi-slanting, with 14–16 leaves; leaf sheath green, pubescent externally; ligule 2.8–4.6 × 1.8–2.2 cm, oblong, pubescent on the outer surface, pale green when young, papery brown on older shoots, apex entire; lamina sessile, 26–48 × 6–10.5 cm, narrowly elliptic, glabrous above, sparsely hairy below, base cuneate, apex caudate, twisted. Inflorescence: 16–24 cm long, lax, cylindrical, erect, composed of 22–41

Image 1. *Hedychium forrestii* Diels. A - Habit; B - Inflorescence; C - Single flower; D - Bract (d_1), bracteole (d_2) and calyx tube (d_3); E - Corolla-floral tube (e_1), dorsal lobe (e_3) and lateral lobes (e_2 & e_4); F - Lateral staminodes (f_1 & f_3), labellum (f_2) stamen (f_4) and pistil (f_5).

bracts; rachis green, pubescent; bracts 4.8–5.1 × 1.8–2.1 cm, lanceolate-ovate, lax, green, leathery, pubescent on the outer surface, involute, cincinnus two- to four-flowered; bracteoles 1.6–2.0 × 1.4–1.6 cm, ovate, pale green, pubescent externally, apex two lobed, non-tubular. Flowers: 12.4–13.2 cm long, white, slightly fragrant, spreading; calyx 3.7–4.1 cm long, tubular, shorter than bract, pale green, pubescent externally, unilaterally split up to 0.9–1.2 cm, shortly two-three toothed at apex; floral tube 6.5–6.8 cm long, white, glabrous externally, inner with dense and fine hairs throughout, apical end c. 3 mm diameter; corolla lobes linear, white, margins inflexed, drooping from flower, dorsal corolla lobe 4.6–4.9 × c. 0.5 cm, apex mucronate, c.4 mm, lateral corolla lobes 4.1–4.4 × c. 0.5 cm, mucro absent; lateral

staminodes 3.3–3.6 × 1.1–1.3 cm, oblanceolate-ovate, white, reflexed back; labellum orbicular, pale yellow blotch at centre, 3.5–3.8 cm long with distinct basal claw c. 5 mm long, claw 3–4 mm wide, white, apex 3.2–3.5 × 3.4–3.7 cm, orbicular, emarginated with incision 6–7 mm; stamens 5.3–5.5 cm long, white, exceeding the labellum; filament 4.1–4.4 × c. 0.15 cm, white, glabrous, straight, attached c. 3 mm above the base of dorsal side of the anther; anther 1.3–1.4 × c. 0.20 cm, linear, creamy white, connective white, glabrous, connate, anther suture pale orange; ovary c. 4 × 3 mm, pale green, puberulous, trilocular, ovules many, placentation axile; style filiform, white, pubescent towards apex; stigma c. 1 mm wide, green, densely pubescent, ostiole round, facing forward; epigynous glands two, 3–4 × 1–2 mm,

oblong, yellow. Fruits: loculicidal capsule, 3–3.4 × c. 1.5 cm, terete; seeds red, glabrous, brown when dry, aril red, lacerate.

Flowering and fruiting: August–November.

Habitat: It grows on thin soil over exposed wet rocks in evergreen montane forests at an elevation of 950–1,200 m.

Distribution: China, Laos, Myanmar, Thailand, northern Vietnam, India and Nepal. In India it is reported only from the east Khasi Hills and Jaintia Hills, districts of Meghalaya. Presently it is recorded for the first time from the Western Ghats in Idukki and Thrissur (Sholayar) districts of Kerala.

Specimens examined: China: 1908 Cavalerie 00211021 (E!); 1912 Forrest 00211015 (E!); Forrest 000574525 (The Natural History Museum London, BM!). Nepal: 1821 Wallich 000574704 (BM!). India: 5463, southern India, Western Ghats, Kerala, Sholayar, coll. Sasidaran (University of Calicut Kerala, CALI!); 65146, 10.30154444 N & 76.75944444 E, 15.viii.2013, coll. Thomas and Britto (Rapinat herbarium Tiruchirapalli, RHT!); 66461 (RHT), Sholayar 10.30154444 N & 76.75944444 E, 02.ix.2014, coll. Thomas and Britto; 70106, Kerala, Idukki 07.ii.1981, coll. Nair (Madras Herbarium Coimbatore, MH!); 65490 (RHT), Idukki, 9.81603889 N & 77.02777778 E, 28.vii.2013, coll. Thomas and Britto.

Hedychium spicatum Sm.

A. Rees, Cycl. 17: 8. 1811 (Images 2 & 4)

Type: Nepal, 1806, Buchanan Cat. No.8/27 (Linnean Society of London, LINN-HS!) (probably type collection).

Homotypic synonym (Govaerts 2004): *Gandasulium spicatum* (Sm.) Kuntze, Revis. Gen. Pl. 2: 690 (1891).

Heterotypic synonym (Govaerts 2004): *Hedychium acuminatum* Roscoe, Monandr. Pl. Scitam.: t. 47 (1824); *Hedychium trilobum* Wall. ex Roscoe, Monandr. Pl. Scitam.: t. 48 (1826); *Hedychium flavescens* Lodd. ex Lindl., J. Hort. Soc. London 7: 281 (1852), nom. illeg.; *Hedychium album* Buch.-Ham. ex Wall., Hooker's J. Bot. Kew Gard. Misc. 5: 325 (1853); *Hedychium sieboldii* Wall., Hooker's J. Bot. Kew Gard. Misc. 5: 371 (1853); *Hedychium spicatum* var. *acuminatum* (Roscoe) Wall., Hooker's J. Bot. Kew Gard. Misc. 5: 328 (1853); *Hedychium spicatum* var. *trilobum* (Wall. ex Roscoe) Wall., Hooker's J. Bot. Kew Gard. Misc. 5: 328 (1853); *Hedychium tavoyanum* Horan., Prodr. Monogr. Scitam.: 26 (1862); *Gandasulium sieboldii* (Wall.) Kuntze, Revis. Gen. Pl. 2: 690 (1891); *Hedychium spicatum* var. *khasianum* C.B.Clarke ex Baker in J. D. Hooker, Fl. Brit. India 6: 227 (1892).

Rhizomatous perennial herbs; rhizome 3.2–3.6 cm in diameter, creamy white internally, aromatic, covered with brown scales. Leafy shoots: 95–112 cm long, green, pink tinged, slender, slanting, with 10–12 leaves; leaf sheath green, pink tinged, pubescent externally, margin membranous; ligule 1.4–1.5 × 1.3–1.5 cm, widely elliptic-orbicular, pink tinged when young, papery brown on older shoots, pubescent externally, apex entire; lamina sessile, 31.7–37.5 × 9.7–10.8 cm, narrowly elliptic to lanceolate, green, glabrous above, pubescent below, base cuneate, apex long caudate, twisted. Inflorescence: 12–32 cm, lax, erect, composed of 16–62 bracts; rachis green, glabrous; bracts 2.6–4.7 × 0.9–1.5 cm, subulate, lax, green, involute, coriaceous, glabrous, apex hairy, cincinnus strictly 1–flowered; bracteoles 1.8–2.2 × c. 1.0 cm, tubular, pale yellow, glabrous, apex hairy, bilobed. Flowers: 10.6–12 cm long, spreading, slightly fragrant; calyx 3.4–3.6 cm long, tubular, glabrous, pale green, unilaterally split up to 6–7 mm, shortly three-lobed at apex; floral tube 5.3–5.6 cm long, pale yellow, red tinged towards apical end, outer surface glabrous, pubescent internally; corolla lobes linear, yellow, red tinged towards base, drooping from flower, margins inflexed, dorsal corolla lobe 3.8–4.4 × c. 0.5 cm, apex mucronate c.3mm, lateral corolla lobes 3.6–4.2 × c. 0.4 cm, mucro absent; lateral staminodes 4.6–5.1 × c. 0.3 cm, linear, creamy white, red tinged towards base, glabrous, apex retuse; labellum obovate, 4.9–5.4 cm long with distinct basal claw 9–12 mm long, claw 3–5 mm wide, pale red, apex 3.8–4.3 × 1.1–1.7 cm, obovate, creamy white, red tinged towards claw, deeply clefted with 2–3.7 cm incision; lobes narrowly acute to acute; stamen 3.2–3.6 cm long, red, shorter than labellum, bend at above the middle; filament 2.1–2.3 × c. 0.15 cm, red, glabrous, bend at apex, attached c. 2mm above the base of dorsal side of the anther; anther 13–14 × c. 2 mm, thecae red, straight, tuft of cilia present along the anther suture, minutely spurred at base, connective red, glabrous, emarginated with incision 3–8 mm; ovary 4–5 × c. 2 mm, pale green, glabrous, trilocular, ovules many, placentation axile; style filiform, pale yellow, glabrous; stigma c. 2mm wide, yellow, pubescent throughout, protruding from the centre of the anther, ostiole round, facing forward; epigynous glands two, 3–4 × 1–2 mm, oblong, yellow, bifid. Fruits: loculicidal capsule, 1.3–1.6 × 1–1.5 cm, sub-globose, glabrous; seeds 5–6 × c. 4 mm, clavate, red, base yellow, aril red, lacerate.

Flowering and fruiting: June–September.

Habitat: Moist and shady places under shola forests at an altitude of 1,500–1,600 m.

Distribution: It is largely distributed in northern India, Nepal, Bhutan, Myanmar, China and northern Thailand. It shows an extensive distribution in the
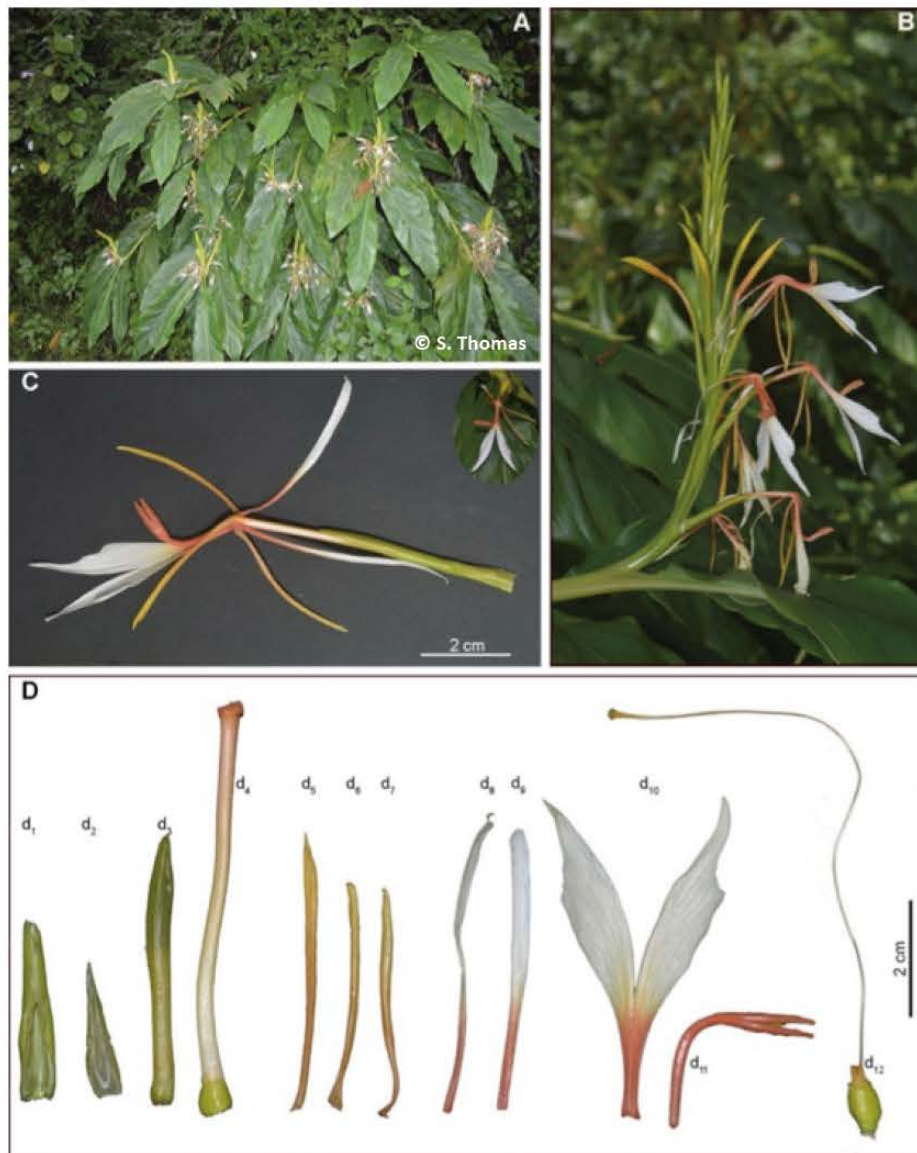
Image 2. *Hedychium spicatum* Sm.
A - Habit; B - Inflorescence; C - Single flower (inset: dorsal view); D - Floral parts: bract (d_1), bracteole (d_2), calyx tube (d_3), floral tube (d_4), dorsal corolla lobe (d_5), lateral corolla lobes (d_{6-7}), lateral staminodes (d_{8-9}), labellum (d_{10}), stamen (d_{11}) and pistil (d_{12}).

eastern Himalaya. Presently, it is recorded for the first time from the Western Ghats.

Specimens examined: Nepal: 1819, Wallich 000574705 (BM!); 1819, Wallich 000574708 (BM!). INDIA: Sikkim, 1887, Hooker 72407 (MH!); Khasia, 1887, Hooker 72408 (MH!); Meghalaya, Shillong, 03.viii.1885, Clarke 000574460 (BM!); 65121 (RHT!), southern India, Western Ghats, Kerala, Munnar, 10.11299167 N & 77.05805556 E, 16.vii.2012, coll. Thomas and Britto; 65122 (RHT!), Munnar, 10.11299167 N & 77.05805556 E, 03.vii.2013, coll. Thomas and Britto; 655015 (RHT!), Munnar, 10.11299167 N & 77.05805556 E, 15.vii.2014, coll. Thomas and Britto; 67225 (RHT!), Munnar, 10.11299167 N & 77.05805556 E, 28.vii.2015, coll. Thomas and Britto.

Notes: The present study enumerated two distributional records of *Hedychium* from the Western Ghats of India, such as *H. spicatum* Sm. and *H. forrestii* Diels. While analysing the various herbaria in India and abroad, we could not find any specimen identified as *H. forrestii* Diels from south India and there may not be any records in the literature for the occurrence of this taxon from the same geographical region. We could however distinguish herbarium specimens of *H. forrestii* from Sholayar (CALI!) and Idukki (MH!) and found that it had been misidentified as *H. flavescens* and *H. coronarium*, respectively. In the present study, we collected *H. forrestii* Diels from Sholayar and Idukki, which are the two moist and humid climatic regions of the Western Ghats, India. *H. forrestii* illustrated here showed slight

Table 1. Diagnostic morphological characters of *Hedychium forrestii* Diels and *H. forrestii* var. *palaniense* Sanoj & Sabu.

Characters	*H. forrestii* Diels (southern India)	†*H. forrestii* Diels (northeastern India)	†*H. forrestii* var. *palaniense*
Leafy shoot	90–160 cm high	100–200 cm high,	108–110 cm high
Leaves	14–16 in number	12–18 in number	10–13 in number
Ligule	2.8–4.6 × 1.8–2.2 cm, oblong	3–5.2 × 2–2.3 cm, oblong	4–4.7 × c. 2 cm, ovate
Lamina	26–48 × 6–10.5 cm, narrowly elliptic	34–55 × 6–13.3 cm, elliptic-lanceolate	38.8–43 × 8.5–7.7 cm, elliptic
Inflorescence	16–24 cm, lax	15–27.6 cm long, moderately lax	16.5–23.2 cm long, lax
Bracts	4.8–5.1 × 1.8–2.1 cm, lanceolate-ovate	4.8–5 × 2.5–2.7 cm, obovate	4.5–4.7 × 1.8–2 cm, lanceolate
Cincinnus	2–4 -flowered	2–5 -flowered	c. 3-flowered
Bracteoles	1.6–2.0 × 1.4–1.6 cm, ovate	3–3.7 × 2.1–2.3 cm, ovate	2.1–2.8 × 1.2–2 cm, ovate
Flower	12.4–13.2 cm long	10–12.2 cm long	15–15.2 cm long
Calyx	3.7–4.1 cm long, tubular, shorter than bracts	4.2–4.3 cm long, shorter than bracts	4.8–5.1 cm long, equal or slightly longer than bracts
Floral tube	6.5–6.8 cm long	5–7.1 cm long	9.2–9.4 cm long
Corolla lobes	linear, white; dorsal lobe 4.6–4.9 × c. 0.5 cm, apex mucronate c. 4 mm; lateral lobes 4.1–4.4 × c. 0.5 cm, mucro absent	oblanceolate, white; dorsal lobe 4.7–4.8 × c. 0.6 cm, apex mucronate 5–6 mm; lateral lobes 4.2–4.3 × c. 0.5 cm, mucro absent	oblong, white, dorsal lobe 4.8–5 × c. 0.65 cm, apex mucronate 3.5–4 mm; lateral lobes 4.5–4.7 × c. 0.65 cm, mucro absent
Lateral staminodes	3.3–3.6 × 1.1–1.3 cm, oblanceolate-ovate	3.4–3.7 × 0.8–1.4 cm, elliptic-oblanceolate	4.1–4.4 × 1.9–2 cm, elliptic
Labellum	3.5–3.8 × 3.4–3.7 cm, orbicular, apex 6–7 mm shallowly emarginated	3.5–3.8 × 3.1–3.5 cm, widely ovate-orbicular, apex 1.2–1.7 cm deeply emarginated	4.3–4.6 × 4–4.2 cm, widely depressed ovate, apex 1.9–2.1 cm deeply emarginated
Stamen	5.3–5.5 cm long, exceeding the labellum; filament 4.1–4.4 cm long; anther 1.3–1.4 × c. 0.20 cm, linear	5–5.5 cm long, longer than labellum; filament 4–4.5 cm long; anther 1.1–1.3 × c. 0.25 cm, oblong	5.6–6 cm long, longer than labellum; filament 4.4–4.5 cm long; anther 1.3–1.4 × c. 3 cm, elliptic
Ovary	c. 4 × 3 mm	4.5–5 × 3–3.5 mm	4–4.5 × 3.5–4 mm

† Sanoj et al. 2010

Image 3. Scanned herbarium specimen of *Hedychium forrestii* Diels.

differences from the type specimens especially by its sparsely pubescent lamina, large floral parts and 2–4 flowered cincinnus (Shu 2000). Moreover, recently a new variety of *H. forrestii* such as *H. forrestii* var. *palaniense* Sanoj & Sabu was reported from the Palani hills of the Western Ghats, India (Sanoj et al. 2010). The specimen described here, however, is allied to *H. forrestii* Diels than var. *palaniense* Sanoj & Sabu (Table 1).

Hedychium spicatum is common in the northeastern region of India, whereas this may be the first valid report of *H. spicatum* from the Western Ghats. While searching the major herbaria in India and digital herbaria abroad we found that there was no specimen similar to *H. spicatum* described here from southern India. *H. cernuum* Wight (=*H. venustum* Wight), the sister species of *H. spicatum*, is widely distributed in the Western Ghats (Thomas et al. 2015). Occasionally, *H. cernuum* is misidentified as *H. spicatum* from the Western Ghats (Sabu 2000). Whereas, further studies revealed that those specimens differ from *H. spicatum* and resemble *H. cernuum* in all features. *H. spicatum* could easily be distinguished from *H. cernuum* by its pink tinged and slender leafy shoot, comparatively small flowers, strictly 1–flowered cincinnii, sessile leaves, narrow labellum, shorter and bend stamen and spurred thecae. The green leafy shoot, 1–3 flowered cincinnii, broad labellum, long and arching stamen (equal or slightly shorter than labellum), non-spurred thecae are the diagnostic features of *H. cernuum*.

Previous studies showed that *H. spicatum* showed its distribution in China, Assam, Nepal, eastern Himalaya, Vietnam, Myanmar and Thailand (Govaerts 2004). The present study reveals the extent of occurrence of *H. spicatum* in southern India. *H. spicatum* with similar morpho-forms, as the type specimen (Linn.), from

Image 4. Scanned herbarium specimen of *Hedychium spicatum* Sm.

different localities and variants of type specimen were treated as separate taxa such as varieties, species and even genus (Govaerts 2004). R. Govaerts (2004), however, treated those epithets as synonyms of *H. spicatum* Sm. Likewise, *H. spicatum* described here shows similarity with *H. spicatum* var. *acuminatum* (Roscoe) Wall. in characteristics such as the shape of the labellum and length and shape of the stamen. We, however, treated it as *H. spicatum* Sm.

Finally, it is concluded that the present study established two new distribution records for the flora of the Western Ghats and to southern India.

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ZÜRICH

WILD ZOO
Threatened Taxa

Social Exclusion Faced by Elderly Women

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Abstract: Modern society has overburden feeling of ageing. Our society blessed with long life expectancy for female which becomes a curse due to the inability to incorporate this into modern atmosphere. Kerala is not an exception to this. Objective of this study is the major factors lead elderly to social exclusion. In this context descriptive method was undertaken. Analysis was based on primary and secondary data. Primary data is collected through structured interview schedule. Samples were selected with random sampling method from Thiruvananthapuram district. 100 samples selected from Thiruvananthapuram district, 50 are from home and 50 from old age home. To identify the factors which lead them to social exclusion, researcher asked questions in connection with it. According to their answer they are categorised. Based on the ranks given by the respondents to each factor a ranking analysis was carried out. Through this study researcher understood that the severity of the factors are different among elderly residing in home and old age home. Any one problem alone can acts as a leading factor for elderly to social exclusion. Several factors are together work hard to make an easy entrance to social exclusion. As age increases, the severity of the economic factor decreases among members residing in home and old age home.
Keywords: Elderly, Ageing, Social exclusion.

INTRODUCTION

The multidimensional word „social exclusion", indicates the existing inequalities in society. Social exclusion is the by-product of poverty, unemployment etc. It relates not simply to a lack of material resources, but also to matters like inadequate social participation, lack of cultural and educational capital, inadequate access to services and lack of power. Social exclusion relates to the complexity of powerlessness in modern society. It is the failure of society to provide certain individuals and groups with those rights and benefits normally available to its members, such as employment, adequate housing, health care, education and training etc. In the social world, whether one is heartily welcomed or not is the outcome of collection of social practices. So we can say that social exclusion is the creation of society whether it is appreciable or not. Social exclusion is social disadvantage and relegation to the fringe of society. Whenever our attention focused on elderly population, it throws some light on their alienation in society.

In this computerised era, demographic structure leads to kaleidoscopic changes in society. One of the major issues recognised by demographers is ageing of population. Ageing has become increasingly recognised as an important issue facing individuals, families, communities and nations. Increasing age is related to long-term health conditions, higher rates of disability and poorer reported health status. As Indian society is based on patriarchal theories, it favours men. In this modern era several initiatives have been taken to bring social inclusion in the society, still women are facing social exclusion in different walks of life, and be it social, political, economic etc. „Greying population" and „demographic feminization in ageing" are the two major challenges faced by the twenty first century. Our Society concentrated on the negative impact of these factors. Society"s major concentration on negative impact of greying population made elderly population in utter confusion and alienation. In this context descriptive method was undertaken to explore the factors of social exclusion of elderly women. Analysis was based on primary data collected through structured interview schedule. Samples were selected with random sampling method from Thiruvananthapuram ditrict.

Social exclusion in old age is one of the most common issues that are affecting older women constantly. In this industrialised era, social exclusion faced by elderly women is mainly because of the complexity of powerlessness in modern society. Older women, who are still living with their sons/daughters and grand-children are also suffering from emotional exclusion. Due to fast changing socio-economic scenario of the country, fast paced modern life style and

rapid urbanization across the country younger generations hardy interact with their elderly family members. Popularity of nuclear family system has virtually crushed strong traditional bond between grand-children and grandmothers. Longitudinal explosion of knowledge and transfer of economic authority made this alienation more severely and pathetically.

REVIEW OF LITERATURE

A literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. Literature reviews are a staple for research in nearly every academic field. Literature reviews are used as secondary sources. In the article, "On being old and female: some issues in quality of life of elderly women in India" by Indira Jai Prakash [1] analyses the socio-economic effect of ageing. Though ageing is a universal phenomenon, all aged persons are not alike. Ageing process is different for different persons. This is confirmed in this article. Some of the factors which affect the quality of life are race, gender, social status and marital status. In these, gender is most powerful factor. Due to low social status, poor reproductive health care, economic dependence, malnutrition and domestic violence women‟s wellbeing is adversely affected. „Gender ageing‟ increases the intensity of poverty. In countries like India, with a predominantly patriarchal ethos, older women face triple jeopardy-that of being female, of being old and of being poor. The factors which affect the quality of life of ageing women are marital status, living condition, and health status, socio-economic and political status. Chronic illness increases with age. Older women have more factors with activities of daily living. Probable widowhood is one of the after effects of prolonged life. Widowhood much lowers the socio-economic status of the women. This brings not only loneliness and depression but also economic dependence. Social and political power is achieved by active involvement in public and community life. In general older women do not participate in community activities. Rural elderly engage in agricultural work which has no retirement age as such. In the west „grey power‟ has become visible and viable. Older people go themselves organized to fight for their rights. They could achieve increased participation of women in labour force, policies of reservation for women in the political process and in decision making bodies. "Increased awareness regarding the demographic changes, improvements in the medical field that help control age related disabilities and more awareness on the part of the older people themselves could create a better society for older women of the next millennium".

H.S. Srivastava [2] analyzes the socio-economic effect of ageing along with health factors in his book, „Managing Age‟. There are three independent facts of age-physical age, mental age and moral age.

They have remote relationship. A carefree or care-shackled attitude of mind bears a direct relationship with ageing. Individual could be considered as old, when he is unable to perform his normal duties. Ageing is undoubtedly a normal biological process and there is no way of avoiding it, though there are many viable ways for slowing the process. Many changes that occur in old age are mainly due to disease and physical distress and the social and economic consequences of growing old. The loss of power and authority is a great disconcerting thing to happen and the individual suddenly finds himself at a loss to understand the phenomenon. The individuals in old age find it very hard to accept this situation when they are no more in power or authority. They feel as if adversity has caught them completely the characteristics which imbibe in young age tend to become more acute and compulsive in old age. A religious person can turn into a fanatic, a liar into a damn liar, a fastidious person into a cynic and so on. Life has become firefighting operation punctuated all the way by unanticipated emergencies. To the individual in old-age condition the long cherished values seem overturned. The things which old generations find as avoidable extravagance, the younger generations considered it as an unavoidable necessity.

In the book „The ageing world‟ which is written by Anil Bagchi [3], the socio-economic status of elderly examined. According to the author, elderly become out of step with the economic environment and the changing technology. The old get cast off from the mainstream of life. Social interaction with younger people becomes infrequent. Thus society makes the person old. The conventional definition of old age definition is not realistic. It leads to excessive depressing forecasts. In this changing social circumstances, even centenarians, show mental acuity comparable to those who are decades younger. According to the author, mental senility is a creation of society. Thus ageing cannot be considered as a physiological process wholly. It has some social factors also. Some people live their old age excellently and to some purpose. Fast living people are likely to age faster and die earlier‟. It is not a disease. It is the consequence of normal course of living. It is not the mischief of any foreign body. It is not due to any aberrant cell. The wealth difference existing between the nations is due to the difference in knowledge of sociology, science and technology. The increased wealth leads to the beginning of the formation of greater proportion of old age people—the greying of the developed countries. Thus there is a strong correlation between knowledge, wealth and greying. Wealth and culture among nations and communities are the important factors of grey dynamics. The less modern countries are now young. The traditional dependence of the elderly index is the number of the people above 65 divided by the number of people in the age group 18 to 64. Responsibility of elderly is considered as a national burden. In future, as the younger generation keeps growing wealthier than

their parents and grandparents, inheritance will have less than the all-important role that it plays today. This will have an effect on the inter-generational dependence. This leads to the independence of different generation. Some constraints associated with greying like political and security issues, ethical considerations are human creations and are therefore amenable to some extent. Within the boundary conditions we must look for solutions to the factors of our future. This book reveals the importance of sociological study in ageing.

Vijay Prakash Sharma [4], in his paper, „Tribal Aging in Jharkhand Health Perspective‟ analyzed elderly in traditional region. The old have traditionally been honoured and respected. Those who neglected their old parents earned social disrespect and were ridiculed. Government of Jharkhand in its new health policy-2004 has announced that provisions for care of aged will be made. In 2002-03 Govt. of Jharkhand reported construction of two old age homes for elderly. This gave an idea about the involvement of State for the wellbeing of old.

In the paper,`Status and Role of Elderly Persons in Tribal Communities of Chotanagpur (With Special Reference To Chik Baraik Of Jharkhand) by Karma Oraon and Pravin Kumar Jha [5] analyzed the social role performed by elderly. Changing pattern of family life brought repercussions on elderly folk. Elderly lead a happy life since time immemorial. One of the values of our society is the respect for elderly. They create a strong bond of union among the family members. Now the tribal family structure undergoes changes. This may be due to the impact of urbanization, industrialization, education, globalization and modernization. This paper gives the indication of factors which affect the elderly. According to the authors both generations have to make compromises and the failure to compromise leads to breakage of the family. Migration of children prompted older generation to migrate as well. But they don‟t get any engagements and are friendless. Thus they left for their village in despair and frustration. Their guardianship vanished. Educated younger generations are reluctant to respect them. Now a days, modernization leads to various attitudinal clashes. Elderly have to compromise to their fate. If this trend continues. India will lose her cultural glory.

However, an ongoing criticism of the social scientific study of ageing is that it lacks "theoretical rigor" and tend towards the descriptive. Thus research on ageing being primarily factor-driven rather than theory-driven. Kerala‟s elderly female folk are heterogeneous group. Factors of social exclusion of elderly women are different. We have to find out those factors which lead them to social exclusion.

METHODOLOGY

In Kerala as per 2011 census, the percentage of 60+ was 11.7 per cent and is projected to be 15.6 per cent in 2021. The elderly women represent the fastest growing age group in the population of Kerala. The threat of population ageing is more severe in Kerala than the rest of the country. Gender dimension of ageing is very significant in Kerala and female population predominates at all the stages of older ages. Population ageing could have profound implication for the economies as well as the societies. Thus the dependency ratio is greater.

A large number of elderly females are in the status of widowhood, illiterates, and non-working and belong to lower and or no income brackets. All these finding leads to the conclusion that the aged females are the vulnerable within vulnerable. Their miserable status makes them to appear more aged than actually what they are.`World Health Organisation Report ‟states that the percentage of the aged women who are 60+is going to be doubled within two decades. But so far no specific study has been done to elevate their status. There will be lesser and lesser people taking care of the elderly as the decades roll by. Traditional life guards of family care are dwindling due to industrialization, our migration, dual career, female job participation and growing consumerism. All these make the well-being of the elderly, a growing challenge of the 21st century. A significant aspect of challenge comprises the depressed elderly along with society who are unwilling to accept them.

An overview of available studies revealed the fact that the majority of researches concentrated on the factors faced by the elderly women. A study based on the Social Exclusion Faced by Elderly Women has not been done. So the present study is undertaken with a view to explore information to fill the existing research gap. It is hoped that such a study would be helpful to the policy makers and society.

The scope of study is limited to the elderly women (60 years and above) residing in Thiruvananthapuram district, Kerala. The study on factors which lead them to social exclusion was being primarily problem-driven. Kerala elderly womankind is a heterogeneous group. They have to face a lot of factors of social exclusion during their existence. So this analysis is based on these factors. A single theory cannot explain all these factors. Various factors deeply intertwined to each of it. Descriptive research design has been adopted for this study. The purpose of this research design is to explore the factors which lead elderly women to social exclusion and elicit new information about the elderly women residing in old age homes in Kerala.

The objective of this study is to find out major factors lead elderly to social exclusion. The design uses

primary and secondary data. The primary data about the elderly for the study have been collected through structured interview schedule among elderly women in Thiruvananthapuram district. Two questionnaires are used for it. One is for members residing in home and the other is for members belonging in old age home. The secondary data are derived from books, journals, reports, newspapers and online media on the subject.100 subjects from Thiruvananthapuram district is selected on simple random method. In the 100 elements, 50 residing in home and the remaining 50 from old age home. Data collected through structured interview schedule were analysed with SPSS.

OBJECTIVE

To explore the factors of social exclusion of elderly women.

DISCUSSIONS AND ANALYSIS

In this study 100 samples selected from Thiruvananthapuram district are considered as samples with the help of simple random sampling. Based on earlier studies the factors lead elderly to social exclusion are as: economic, familial, social, health, psychological and cultural. To identify the factors which lead them to social exclusion, researcher asked question in connection with it. According to their answer they are categorised. Based on the ranks given by the respondents to each factor a ranking analysis was carried out. Through this study researcher understood that the severity of the factors are different among elderly residing in home and old age home. Any one problem alone can acts as a leading factor for elderly to social exclusion. Several factors are together work hard to make an easy entrance to social exclusion.

Table-1: **Rank Given by Elderly Women to the Factors of Social Exclusion**

Major factors of elderly			
Rank	Home	Rank	Old Age Home
1	Health factors	1	Social factors
2	Economic factors	2	Economic factors
3	Family factors	3	Family factors
4	Social factors	4	Cultural factors
5	Psychological factors	5	Health factors
6	Cultural factors	6	Psychological factors

Old age is one of the stages in lifecycle. It is natural. In this stage they have to face life's most stressful experience [6]. In the above table (No.1) rank of the major factors of social exclusion of elderly residing in home and old age home are analysed. Major factors of social exclusion of elderly women are social, economic, familial, cultural, health and psychological. All factors are more severe in old age home. All these factors are faced by elderly residing in home, but not in a severe form. From this researcher found out that ranking of factors of elderly women residing in home and old age home are different. Elderly women residing in home give first rank to health factors while elderly residing in old age home give fifth rank to it. For elderly women residing in old age home, social factors are considered to occupy in the first rank. For both of them, economic factors have second rank and familial factors have third rank. Social factors have fourth place in ranking analysis for elderly in home. Psychological factors have fifth rank and cultural factors have sixth rank for elderly residing in home. Cultural factors have fourth place in ranking analysis for elderly in old age home. Health factors have fifth rank and psychological factors have sixth rank for elderly residing in old age home. Elderly residing in old age home are in a deteriorated position due to the high intensity of factors like, economic, familial, social, health and psychological. From this researcher found out that elderly residing in old age home are in a deteriorated position due to the high intensity of factors like, economic, familial, social, health and psychological. They are vulnerable within the vulnerable. Elderly residing in home have factors but their percent is very minute and the order of intensity is different. Number of elderly in home have high level factors are very meagre. Then the social, economic and familial factors analysed separately based on the independent variable.

Table-2: **Age and Social Factor**

Age	Social Factor								Total	
	Home				Old Age Home					
	Low	Medium	High	Total	Low	Medium	High	Total		
60-69	$_{73}29^{85}$	$_{50}4^{12}$	$_{50}1^{3}$	$_{68}34^{100}$	---	---	$_{39}19^{100}$	$_{38}19^{100}$	$_{53}53^{100}$	
70-79	$_{20}8^{67}$	$_{50}4^{33}$	---	$_{24}12^{100}$	---	---	$_{45}22^{100}$	$_{44}22^{100}$	$_{34}34^{100}$	
>80	$_{7}3^{75}$	---	$_{50}1^{25}$	$_{8}4^{100}$	---	$_{100}1^{11}$	$_{16}8^{89}$	$_{18}9^{100}$	$_{13}13^{100}$	
Total	$_{100}40^{80}$	$_{100}8^{16}$	$_{100}2^{4}$	$_{100}50^{100}$	---	$_{100}1^{2}$	$_{100}49^{98}$	$_{100}50^{100}$	$_{100}100^{100}$	

The table no.2 analyses age with social factor. Out of 100 elderly 53 percent belong to young old, 34 percent to medium old and 13 percent to old old. Out of 50 elderly residing in home, 80 percent (40) have low social factor, 16 percent (8) medium factor and 4 percent (2) high factor. Out of 50 elderly residing in old age home, 2 percent (1) have medium factor and 98 percent (49) high factor. Based on the above table (No.2) researcher found out that as age increases, the social exclusion also increases in home but in old age home as age increases, the significance of social factor in social exclusion decreases.

Table-3: **Education and Social Factor**

Education	Social Factor								Total
	Home				Old Age Home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Illiterate	$_8 3^{100}$	---	---	$_6 3^{100}$	---	---	$_{33}16^{100}$	$_{32} 16^{100}$	$_{19} 19^{100}$
Primary	$_{57}20^{71}$	$_{74} 8^{27}$	$_{100}2^{2}$	$_{60} 30^{100}$	---	$_{100}1^{1}$	$_{59}29^{99}$	$_{60} 30^{100}$	$_{60} 60^{100}$
Secondary	$_{29}13^{100}$	---	---	$_{26} 13^{100}$	---	---	$_6 3^{100}$	$_6 3^{100}$	$_{16} 16^{100}$
Degree	$_4 3^{100}$	---	---	$_6 3^{100}$	---	---	$_2 1^{100}$	$_2 1^{100}$	$_4 4^{100}$
>Degree	$_2 1^{100}$	----	----	$_2 1^{100}$	---	---	---	---	$_1 1^{100}$
Total	$_{100}40^{80}$	$_{100} 8^{16}$	$_{100}2^{4}$	$_{100} 50^{100}$	---	$_{100} 1^{2}$	$_{100}49^{98}$	$_{100} 50^{100}$	$_{100}100^{100}$

Table no.3 analyses education and social factor. Out of 50 elderly residing in home, 80 percent (40) belong to low factor category, 16 percent (8) to medium and 4 percent (2) to high. Out of 50 elderly residing in old age home, 2 percent (8) belong to medium and 98 percent (49) to high. From the above table (No.3) researcher found out that major share of elderly residing in home have low level factors irrespective of their educational qualification. But the major share of elderly residing in old age home have high level social factors which lead to social exclusion irrespective of their educational qualification.

Table-4: **Marital Status and Social Factor**

Marital status	Social Factor								Total
	Home				Old Age Home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Married	$_{68}27^{96}$	$_{12} 1^{4}$	---	$_{56}28^{100}$	---	---	$_2 1^{100}$	$_2 1^{100}$	$_{29} 29^{100}$
Widow	$_{30}12^{60}$	$_{88} 7^{35}$	$_{50} 1^{5}$	$_{40}20^{100}$	---	---	$_{76} 37^{100}$	$_{74} 37^{100}$	$_{57} 57^{100}$
Separated	---	---	$_{50} 1^{100}$	$_2 1^{100}$	---	---	$_4 2^{100}$	$_4 2^{100}$	$_3 3^{100}$
Unmarried	$_2 1^{32}$	---	---	$_2 1^{100}$	---	$_{100} 1^{5}$	$_{18} 9^{95}$	$_{20}10^{100}$	$_{11} 11^{100}$
Total	$_{100}40^{80}$	$_{100} 8^{16}$	$_{100} 2^{4}$	$_{100}50^{100}$	---	$_{100} 1^{2}$	$_{100} 49^{98}$	$_{100}50^{100}$	$_{100}100^{100}$

Table no.4 analyses marital status with social factor. Out of 100 elderly 29 percent (29) belong to married, 57 percent (57) to widows, 3 percent (3) to separated and 11 perecnt (11) to unmarried. From this researcher found out that there is relationship existed between marital status and social factor. There is very meagre percent have high level social factor residing in home. In the high level category widows and separated are included. This indicates the importance of marital status. In old age home the situation is different. Marital status has no significance in old age home. Majority of them belong to very high social factor. The atmosphere is horrible there.

Table-5: **Region and Social Factor**

Region	Social Factor								Total
	Home				Old Age Home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Rural	$_{88} 35^{76}$	$_{75} 6^{22}$	$_{100} 2^{2}$	$_{86} 43^{100}$	---	$_{100}1^{1}$	$_{95} 47^{99}$	$_{96} 48^{100}$	$_{91} 91^{100}$
Urban	$_{12} 5^{74}$	$_{25} 2^{26}$	----	$_{14} 7^{100}$	---	---	$_5 2^{100}$	$_4 2^{100}$	$_9 9^{100}$
Total	$_{100}40^{80}$	$_{100} 8^{16}$	$_{100} 2^{4}$	$_{100} 50^{100}$	---	$_{100} 1^{2}$	$_{100} 49^{98}$	$_{100} 50^{100}$	$_{100} 100^{100}$

Table no.5 analyses region and social factor. Out of 43 rural elderly residing in home 76 perecnt (35) belong to low social factor, 22 percent (6) to medium and 2 percent (2) to high. Out of 48 rural elderly residing in old age home 1 percent (1) belong to medium and 99 percent (47) to high. Village is considered as the basic unit of social policy. The inhabitants of the village had intimate social and economic relationship regulated by age old traditions and institutions [7]. From this researcher found out that there is more deteriorated position observed among rural elderly residing in home. But in old age home the urban elderly is more deteriorated.

Table-6: Income and Social Factor

| Income | Social Factor | | | | | | | | Total |
| | Home | | | | Old Age Home | | | | |
	Low	Medium	High	Total	Low	Medium	High	Total	
Nil	$_{72}29^{94}$	$_{25}2^{6}$	--	$_{62}31^{100}$	---	---	$_{97}46^{100}$	$_{92}46^{100}$	$_{77}77^{100}$
<500	$_{3}1^{50}$	--	$_{50}1^{50}$	$_{4}2^{100}$	---	---	$_{1}1^{100}$	$_{2}1^{100}$	$_{3}3^{100}$
500-1000	$_{5}2^{100}$	--	--	$_{4}2^{100}$	---	---	$_{1}1^{100}$	$_{2}1^{100}$	$_{3}3^{100}$
1000-2000	--	--	--	--	---	---	---	---	---
>2000	$_{20}8^{53}$	$_{75}6^{40}$	$_{50}1^{7}$	$_{30}15^{100}$	--	$_{100}1^{50}$	$_{1}1^{50}$	$_{4}2^{100}$	$_{17}17^{100}$
Total	$_{100}40^{80}$	$_{100}8^{16}$	$_{100}2^{4}$	$_{100}50^{100}$	---	$_{100}1^{2}$	$_{100}49^{98}$	$_{100}50^{100}$	$_{100}100^{100}$

Out of 100 elderly, 77 percent (77) belong to non-income class, 3 percent (3) to less than 500 rupees category 3 percent (3) to 500-1000 rupees category and 17 percent (17) to above 2000 rupees category. From this researcher found out that income has not much influence in social factor. Among high level factor holders equal number of elderly have less than 500 rupees category along with above 2000 rupees category. But the situation in old age home is entirely different. There major share has high level factors irrespective of their income. Their situation is very poor. They are vulnerable within the vulnerable.

Table-7: Age and Economic Factor

| Age | Economic factor | | | | | | | | Total |
| | Home | | | | Old Age Home | | | | |
	Low	Medium	High	Total	Low	Medium	High	Total	
60-69	$_{72}13^{38}$	$_{66}19^{56}$	$_{67}2^{6}$	$_{68}34^{100}$	---	---	$_{40}19^{100}$	$_{38}19^{100}$	$_{53}53^{100}$
70-79	$_{22}4^{34}$	$_{24}7^{58}$	$_{33}1^{8}$	$_{24}12^{100}$		$_{100}1^{5}$	$_{44}21^{95}$	$_{44}22^{100}$	$_{34}34^{100}$
>80	$_{6}1^{25}$	$_{10}3^{75}$	---	$_{8}4^{100}$	$_{100}1^{11}$	---	$_{16}8^{89}$	$_{18}9^{100}$	$_{13}13^{100}$
Total	$_{100}18^{36}$	$_{100}29^{58}$	$_{100}3^{6}$	$_{100}50^{100}$	$_{100}1^{2}$	$_{100}1^{2}$	$_{100}48^{96}$	$_{100}50^{100}$	$_{100}100^{100}$

The table no.7 analyses age and economic factor of elderly. Out of 50 elderly residing in home 68 percent (34) belong to young old, 24 percent (12) to medium old and 8 percent (4) to old old. Out of 50 elderly residing in old age home 38 percent (19) belong to young old, 44 percent (22) to medium old and 18 percent (9) to old old. From this researcher found out that members residing in old age home have severe economic factor than the members in home. By analysing the above (Table No. 7) researcher found out that as age increases the severity of the factor decreases among members residing in home and old age home.

Table-8: Education and Economic factor

| Education | Economic Factor | | | | | | | | Total |
| | Home | | | | Old Age Home | | | | |
	Low	Medium	High	Total	Low	Medium	High	Total	
Illiterate	---	---	$_{100}3^{100}$	$_{6}3^{100}$	---	---	$_{33}16^{100}$	$_{32}16^{100}$	$_{19}19^{100}$
Primary	$_{30}6^{20}$	$_{83}24^{80}$	---	$_{60}30^{100}$	---	$_{100}1^{3}$	$_{61}29^{97}$	$_{60}30^{100}$	$_{60}60^{100}$
Secondary	$_{50}8^{62}$	$_{17}5^{38}$	---	$_{26}13^{100}$	---	---	$_{6}3^{100}$	$_{6}3^{100}$	$_{16}16^{100}$
Degree	$_{15}3^{100}$	---	---	$_{6}3^{100}$	$_{100}1^{100}$	---	---	$_{2}1^{100}$	$_{4}4^{100}$
>Degree	$_{5}1^{100}$	----	----	$_{2}1^{100}$	---	---	---	---	$_{1}1^{100}$
Total	$_{100}18^{36}$	$_{100}29^{58}$	$_{100}3^{6}$	$_{100}50^{100}$	$_{100}1^{2}$	$_{100}1^{2}$	$_{100}48^{96}$	$_{100}50^{100}$	$_{100}100^{100}$

The table no.8 analyses education and economic factor of elderly. Out of 100 elderly 19 percent (19) belong to illiterate, 60 percent (60) to primary, 16 percent (16) to secondary, 4 percent (4) to degree and 1 percent (1) to above degree. From the above table (No.8) researcher found out that as education increases the severity of economic factor decreases in home, but this kind of relationship is absent in old age home. Among low factor holders residing in home, a gradual increase is observed as education increases. This gives an indication about the importance of education in economic factor. Among elderly residing in old age home, majority of them have high economic factor without any exception of any educational levels. Knowledge explosion and industrialization made a gigantic change to society. This upset socio-economic set up of society. Transfer of economic authority from father to son made a social conflict.

Table-9: **Marital Status and Economic Factor**

Marital status	Economic Factor								Total
	Home				Old Age Home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Married	$_{33}6^{21}$	$_{76}22^{79}$	---	$_{56}28^{100}$	---	---	$_2 1^{100}$	$_2 1^{100}$	$_{29}29^{100}$
Widow	$_{61}11^{55}$	$_{24}7^{35}$	$_{67}2^{10}$	$_{40}20^{100}$	---	$_{100}1^3$	$_{75}36^{97}$	$_{74}37^{100}$	$_{57}57^{100}$
Separated	$_6 1^{100}$	---	---	$_2 1^{100}$	---	---	$_4 2^{100}$	$_4 2^{100}$	$_3 3^{100}$
Unmarried	-----	---	$_{33}1^{100}$	$_2 1^{100}$	$_{100}1^{10}$	---	$_{19}9^{90}$	$_{20}10^{100}$	$_{11}11^{100}$
Total	$_{100}18^{36}$	$_{100}29^{58}$	$_{100}3^6$	$_{100}50^{100}$	$_{100}1^2$	$_{100}1^2$	$_{100}48^{96}$	$_{100}50^{100}$	$_{100}100^{100}$

Table number 9 is analysed marital status with economic factor of elderly. Among high factor category, 67 percent (2) belong to widows and 33 percent (1) to unmarried. From the above table (No.9), researcher found out that marital status has significance in homely atmosphere and not in old age home.

Absence of married members residing in home in high factor category may be considered as the importance of marital status. The deteriorated position of elderly women residing in old age home is also confirmed through this table.

Table-10: **Region and Economic Factor**

Region	Economic Factor								Total
	Home				Old Age Home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Rural	$_{78}14^{33}$	$_{97}28^{65}$	$_{33}1^2$	$_{86}43^{100}$	$_{100}1^2$	---	$_{95}47^{98}$	$_{96}48^{100}$	$_{91}91^{100}$
Urban	$_{22}4^{57}$	$_3 1^{14}$	$_{67}2^{29}$	$_{14}7^{100}$	---	$_{100}1^{50}$	$_5 1^{50}$	$_4 2^{100}$	$_9 9^{100}$
Total	$_{100}18^{36}$	$_{100}29^{58}$	$_{100}3^6$	$_{100}50^{100}$	$_{100}1^2$	$_{100}1^2$	$_{100}48^{96}$	$_{100}50^{100}$	$_{100}100^{100}$

Table no.10 analyses region and economic factor. Among high factor category, 33 percent (1) belong to rural and 67 percent (2) to urban. Among high factor category, 95 percent (47) belong to rural and 5 percent (1) to urban. From this researcher found out that rural elderly residing in home have less complicated economic factors than urban elderly. But the situation is entirely reversed among elderly residing in old age home. There rural elderly have more complicated economic factor for their social exclusion.

Table-11: **Income and Economic Factor**

Income	Economic Factor								Total
	Home				Old Age Home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Nil	$_6 1^3$	$_{93}27^{87}$	$_{100}3^{10}$	$_{62}31^{100}$	---	---	$_{98}46^{100}$	$_{92}46^{100}$	$_{77}77^{100}$
<500	$_6 1^{50}$	$_6 1^{50}$	--	$_4 2^{100}$	---	---	$_{1.4}1^{100}$	$_2 1^{100}$	$_3 3^{100}$
500-1000	$_6 1^{50}$	$_3 1^{50}$	--	$_4 2^{100}$	---	---	$_{0.6}1^{100}$	$_2 1^{100}$	$_3 3^{100}$
1000-2000	---	---	--	--	---	---	--	---	---
>2000	$_{82}15^{100}$	--	--	$_{30}15^{100}$	$_{100}1^{50}$	$_{100}1^{50}$	--	$_4 2^{100}$	$_{17}17^{100}$
Total	$_{100}18^{36}$	$_{100}29^{58}$	$_{100}3^6$	$_{100}50^{100}$	$_{100}1^2$	$_{100}1^2$	$_{100}48^{96}$	$_{100}50^{100}$	$_{100}100^{100}$

The table no.11 analyses income and economic factor. Out of 100 elderly 77 percent (77) to non-income class, 3 percent (3) to less than 500 rupees category, 3 percent (3) 500-1000 rupees category and 17 percent (17) to above 2000 rupees category. From this researcher found out that economic factor highly influenced by income among elderly residing in old age home but the influence is very much limited among elderly residing in home. As income increases, the severity of factor decreases.

CONCLUSION

The dawn of twenty first century presents a new demographic structure to society. „Ageing population‟ and „Feminization among elderly‟ are the major ingredients of this presentation. More awareness about the negative consequences of these makes the elderly female folk in utter confusion and misery which lead them to social exclusion. They struggle hard to acquire adequate spaces in society and majority of them fail to achieve. Objective of this study is major factors lead elderly to social exclusion. The design uses primary and secondary data. Primary data collected through structured interview schedule. Secondary data collected from books, journals, reports, newspapers and online media on the subject. Out of 100 samples from Thiruvananthapuram, 50 are from home and 50 from old age home. Collected data were analysed with SPSS.

Major findings of the present study are
- The rank order of factors of social exclusion of elderly women residing in home and old age home are different. Elderly women residing in home give first rank to health factor while elderly residing in

old age home give fifth rank to it. For elderly women residing in old age home, social factors are considered to occupy in the first rank.

- From this researcher found out that elderly residing in old age home are in a deteriorated position due to the high intensity of factors like, economic, familial, social, health and psychological.
- As age increases, the social exclusion also increases in home but in old age home as age increases, the significance of social factor in social exclusion decreases.
- Marital status has significance in social exclusion only for elderly residing in home but not in old age home.
- Researcher found out that there is more deteriorated position observed among rural elderly residing in home. But in old age home the urban elderly is more troubled.
- As age increases the severity of the economic factor in social exclusion decreases among members residing in home and old age home.
- As education increases the severity of economic factor decreases in home, but this kind of relationship is absent in old age home.
- When consider economic factor, researcher found out that marital status has significance in homely atmosphere and not in old age home.
- Rural elderly residing in home have less complicated economic factors than urban elderly.
- From this researcher found out that economic factor highly influenced by income among elderly residing in old age home but the influence is very much limited among elderly residing in home.

SUGGESTIONS
- Take necessary steps to increase awareness among elderly and society about their significant role have to play in old age.
- Make adequate action plans to increase their power and economic status.
- Steps should be taken to strengthen our familial and social bonds.
- Take necessary steps to increase the educational skills which help them an easy living in new advanced era and transferring this to increase income
- Help them to develop necessary precautions for managing their ageing process
- Should modify their communicative skills to prevent social exclusion
- Take necessary steps to increase their income.
- Make awareness among society members and elderly themselves about the importance of elderly.
- In this consumer world elderly must have contribute something to society.

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PRELIMINARY STUDY ON ANTIMICROBIAL ACTIVITIES OF SELECTED MEDICINAL PLANTS

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ABSTRACT

A preliminary experiment was conducted to study the antibacterial effect of selected medicinal plants namely Azadiracta indica, Adhatoda vasica, The selected plants were brought to the lab after cleaning well with tap water. The extract was prepared by using methanol and water. Agar well diffusion method was performed. Positive control used was gentamycin. The bacteria used were Stephylococcus aureus and Pseudomonas aeruginosa. Agar well diffusion method was conducted. After incubation for 24 hrs the inhibition zone was measured and antibacterial activity was confirmed. It was found out that during the experiment time all the four selected plants are with antibacterial effect however, Azadiracta showed more activity against Pseudomonas. The study showed that these plants were more powerful in the methanolic extract while compared with the water extract. The activities of both water and methanol extracts of Azadiracta indica, Adhatoda vasica, bacterial pathogens as revealed in this study support the local uses of these plants in traditional therapy for various diseases.

Key words: *Azadiracta indica, Adhatoda vasica, pathogen, antibacterial effect*

Introduction

The plant kingdom is a treasure house of potential drugs and in recent years there has been an increasing awareness about the importance of medicinal plants. Drugs from the plants are easily available, less expensive, safe, and efficient and rarely have side effects. Medicinal plants constitute an effective source of antimicrobial natural products. The use of medicinal plants all over the world predates the introduction of antibiotics and other modern drugs into Africa continent (Haslam *et al.,* 1989). Plants have been used in traditional medicine for many centuries as arbotifacients, contraceptives, for menstrual regulation, fertility control, as well for the treatment of ailments of both microbial and non-microbial origins (Gill and Akinwunmi, 1986). The Nigeria flora is rich in medicinal plants which are usually exploited by herbal doctors otherwise called ´´native doctor´´. The indigenous population in Southwest, Nigeria for example has developed a vast knowledge on the use of plants as traditional remedies (Ekundayo, 1986). Some of the plants collections are used against a variety of diseases such as typhoid fever gastroenteritis, dysentery, malaria and others which are typical diseases of tropical countries (Sofowora, 1993).

Herbal remedies are known to treat many infectious diseases throughout the history of mankind. Plant material continues to play a major role in the primary health care as therapeutic remedies in many developing countries. Thus, the discovery of medicinal plants as antimicrobial agents is useful in expanding the wide varieties of antibiotics available (Zaidan *et al.,* 2005).

There are several reports on the antimicrobial activity of different herbal extracts in different regions of the world (De Boer 2005). Worldwide, infectious disease is the number one cause of death accounting for approximately one-half of all deaths in tropical countries. Perhaps it is not surprising, but what may be remarkable is that infectious disease mortality rates are actually increasing in developed countries, such as the United states (Pinner *et al* 1996).

Azadirachta Indica (A. Indica) belongs to the family Meliaceae, commonly known as neem. It is used in traditional medicine as a source of many therapeutic agents. *A. indica* (leaf, bark and seed) are known to contain antibacterial, antifungal activities against different pathogenic microorganisms and antiviral activity against vaccinia, chikungunya, measles and coxsackie B viruses (Biswas K *et al.,* 2002). Different parts of neem (leaf, bark and seed oil) have been shown to exhibit wide pharmacological activities including; antioxidant, antimalarial, antimutagenic, anticarcinogenic, anti-inflammatory, antihyperglycaemic, antiulcer and anti-diabetic properties (Talwar *et al.,* 1997). The biological activities are attributed to the presence of many bioactive compounds in different parts.

Adhatoda vasica (Acanthaceae) commonly known as vasaka distributed throughout India up to an attitude of 1300m. the leaves, flowers, fruit, and roots are extensively used for treating cold cough, whooping cough, chronic bronchitis and asthma as sedative, expectorant and antispasmodic. The study aims at making a qualitative and quantitative analysis of certain chemicals in *Adhatoda vasica* (Panthi and Chaudhary, 2006*)*. The plant is recommended for a variety of ailements such as bronchitis, asthma,

fever, jaundice etc. The leaves & roots are efficacious in coughs, arthritis, diarrhoea and dysentery and have the best chemostatic quality. Leaves are anti-inflammatory, analgesic effective in skin dis orders, cardiotonic. This is one of the most potent anti tuberculosis drug. Vasicine is also reported for its anthelmintic and weak hypertensive activity (Ilango *et al* 20094).

The agar diffusion test is a test of the antibiotic sensitivity of bacteria. It uses antibiotic-impregnated wafers to test the extent to which bacteria are affected by those antibiotics. In this test, wafers containing antibiotics are placed on an agar plate where bacteria have been placed, and the plate is left to incubate. If an antibiotic stops the bacteria from growing or kills the bacteria, there will be an area around the wafer where the bacteria have not grown enough to be visible. This is called a zone of inhibitionto the development of synthetic drugs. The size of this zone depends on how effective the antibiotic is at stopping the growth of the bacterium. A stronger antibiotic will create a larger zone, because a lower concentration of the antibiotic is enough to stop growth.

Staphylococcus of spherical, Gram-positive bacteria that generally occur in irregular clusters or short chains: the pathogenic species (esp. *S. aureus*) and include causative agents of various diseases (as skin infections, food poisoning, and endocarditis) cause of pus formation in boils, abscesses etc. Bacteria in the genus *Staphylococcus* are pathogens of man and other mammals. *Pseudomonas* is a genus of gram-negative, strictly aerobic, motile, straight or curved rod-shaped bacteria. Most species are saprophytic, but some are pathogenic for plants and animals Pseudomonas

infections are diseases caused by a bacterium from the genus *Pseudomonas*. The bacteria are found widely in the environment, such as in soil, water, and plants. They usually do not cause infections in healthy people. If an infection does occur in a healthy person, it is generally mild. *Pseudomonas aeruginosa* is a common Gram-negative, rod-shaped bacterium that can cause disease in plants and animals, including humans. A species of considerable medical importance, *P. aeruginosa* is a multidrug resistant pathogen recognised for its ubiquity, its intrinsically advanced antibiotic resistance mechanisms, and its association with serious illnesses – especially hospital-acquired infections such as ventilator-associated pneumonia and various sepsis syndromes.

The present study was undertaken to explore the anti bacterial activity of four selected plants against the above mentioned bacteria by the agar well diffusion method.

Review of Literature

There is evidence of herbs having been used in the treatment of diseases and for revitalizing body systems in Indian, the Egyptian, the Chinese, the Greek and the Roman civilizations. Plants have a vast potential for their use as curative medicine. In India, medicinal plants are widely used by all sections of people both directly as folk medicines in different indigenous systems of medicine like Siddha, Ayurveda and Unani and indirectly in the pharmaceutical preparations. India has about 4.5 million plant species and among them, several thousands have been claimed to possess medicinal properties against human diseases. Although traditional medicinal healers have used medicinal plants for treatment

of ailments for hundreds of years, there has always been a lingering question in scientific circles about their therapeutic efficacy. As a consequence, the pharmacological activity of many medicinal plants has been studied, even though the vast majority of medicinal plants remain to be studied for their phytochemical components and pharmacological effects.

Microorganisms are closely associated with the health and welfare of human beings. Some are beneficial and some are detrimental. Plants are used as medicines since time immemorial. Reported for its anthelmintic and weak hypotensive activity. India has rich heritage of using medicinal plants in traditional medicines such as siddha, ayurvedha, and unnani.. Antibacterial properties of various plant parts like leaves, seeds, and fruits have been well documented for some of the medicinal plants for the past two decades. Antibiotic principles are the distributed widely among angiosperm plants. A variety of compounds is accumulated in plant parts accounting for their constitutive antimicrobial activities (Vlietinck and Lindsay 1995).

Azadirachta indica is a wonder plant with valuable economic and health significance attached to all its parts. In fact,it is a well know versatile medicinal plants with wide spectrum of biological activities (Siddique *et al*., 2004). For example, its leaf, back, roots, fruit coat, seed and flowers have been demonstrated to exhibit immunomodulatory (Haque *et al*., 2006), anti-inflammatory (Akihisa *et al*., 2011), anti-hyperglycaemic and antidiabetic, antiulcer (Chattopadhyay *et al*., 2004), antimalarial (Isah *et al*.,2003), antifungal (Natarajan *et al*., 2003), antibacterial (Thakurta *et al*., 2007), antiviral (Parida *et al*., 2002) anticarcinogenic (Kumar *et al*.,

2006) and spermicidal (Khillare and Shrivastav, 2003) properties and antifertility agent (Gbotolorun *et al*., 2008).

Adhatoda vasica nees (Acanthaceae) commonly known as vasaka distributed throughout India up to an attitude of 1300m. the leaves, flowers, fruit, and roots are extensively used for treating cold cough, whooping cough, chronic bronchitis and asthma as sedative, expectorant and antispasmodic. The study aims at making a qualitative and quantitative analysis of certain chemicals in *Adhatoda vasica (*Panthi MP and Chaudhary RP, 2006*)*. Antifedent and toxic activity damaging potential, photosynthetic activities of *A. vasica* is available. The study aims at making qualitative and quantitative analysis of certain chemicals in *Adhatoda vasica* to quantify the phytochemical variation in different season of the year, to establish the fact that there is annual post rotation in *adhatoda* altering the quality of the active ingredients and to study the damaging potential of the various insect, pests in different seasons (Maikhuri and Gangwar 1993).The plant is recommended for a variety of ailements such as bronchitis, asthma, fever, jaundice etc. The leaves &roots are efficacious in coughs, arthritis, diarrhoea and dysentery and have the best chemostatic quality. Leaves are anti-inflammatory, analgesic effective in skin dis orders, cardiotonic. This is one of the most potent anti tuberculosis drug. Vasicine is also reported for its anthelmintic and weak hypertensive activity (Ilango *et al* 2009).

Materials and Method

Collection of Raw Materials and Preparation of Extracts

Four plants namely, *Azadiracta indica, and Adhatoda vasica, i* were selected for the experiment. They were collected from the

Carmel College campus and washed thoroughly with tap water and removed the traces of water. Water and methanol extract were made by using 5 gram of sample and 5 gram of water and methanol respectively and grinding well with the help of motor and pestle.

Bacterial Strains

Bacterial strains used for testing included *Staphylococcus aureus), Pseudomonas aeruginosa.* These were collected from Poly clinic laboratory, Thrissur.

Antibacterial Activity

Antibacterial activity of the water and methanolic extract of the selected plants were studied using agar well diffusion method. Petridishes were sterilized thoroughly and 10 ml of Muller Hinton agar medium were prepared and poured into the pertridish after sterilization, wells were made in the agar medium using sterile tips of micropipettes. The bacteria cultured in the nutrient broth and was inoculated in the medium. There was 5 wells in each pertidish, one was inoculated with water extract and other one with methanol extract, third one with control ie, gentamycin as positive , fourth and fifth were water and methanol as negative control. Then they were inoculated with for 24 hrs at 37°C. For each plant two bacterial strains were tested. The assessment of antibacterial activity was based on the measurement of zone of inhibition observed around the well. After the incubation period, each plate was examined. If there is the resulting zone of inhibition, uniformly circular zone of inhibition will be formed. The diameters of complete zone inhibition were measured to the nearest whole

millimeter by using a ruler. The results of the measurement were recorded and the pictures of the plates were taken.

Results and Discussion

For the plants there was inhibition zone for the methanol extract. That for water extract was present in all except *Azadiracta.* The measurement of inhibition zone formed against Staphylococcus is given in Table 1. Against Staphylococcus Azadiracta showed the greatest zone of inhibition (28mm), followed by *Adhatoda* (10mm) in the Methanol Extract. Pictures are given in Plate 1 and 2.

Against *Pseudomonas* the inhibition zone formed in methanol extract by *Azadiracta* was more (22 mm), it was followed by *Adhatoda* (14mm). Water Extract of *Adhatoda* was similar (8mm) Table1 and 2

In short *Azadiracta* showed more activity against *Pseudomonas*. Graphical representation giving a comparative account of the antimicrobial activities of various extracts of these selected plants against *Staphylococcus* and *Pseudomonas* is given in Figure 1 and 2 respectively.

The results of the antibacterial sensitivity test showed that the antimicrobial potential of the extracts in methanol was more effective than water extraction solutions herein studied. The antibacterial properties of *Azadirachta indica* leaves in this study is in line with the report by Faiza aslam *et al. (*2009). In accordance with the present findings, Kapur *et al*. (1995), had reported *Azadirachta indica* in the treatment of vaginal infections. Similarly, in a 2-week double-blind, placebo-controlled clinical trial of 55

women with abnormal vaginal discharge due to bacterial vaginosis, treatment with *Azadirachta indica* oil was reported to cure the symptoms of the infection (Chinnasamy *et al*., 1993). Also, *Azadirachta indica* leaves has been reported to possessed good anti bacterial activity and this lead to conclude it confirmation as a great potential of bioactive compounds and is useful for rationalizing the use of this plant in primary health care Vlietinck AJ and Lindsay S, 1995.

Josephin Sheeba.B and Selva Mohan in the year 2012 reported that *Adhatoda vasica* showed the antimicrobial activity *against Staphylococcus aureus, Streptococcus pyogens, Escherichia coli, Pseudomonas aeruginosa, Proteus vulgaris and Klebsiella pneumoniae* which also exhibited the highest activity in methanol extract than the aqueous extract.

Our present study conformed with these previous findings. Antibiotic resistance is a major concern and development of new agents from plants could be useful in meeting the demand for new antimicrobial agents with improved safety and efficacy (Srivastava *et al* 2000). In this study, we have shown that the methanol extracts of the four plant leaves exhibited highest antimicrobial activity com-pared with the water extract. The the antimicrobial efficacy could be due to variable distribution of phytochemical compounds in different parts. Newer antimicro-bials from plant extracts could also be useful in food, dairy and pharmaceutical industries to prevent contamination by limiting the microbial growth.

Table 1   Showing the inhibition zone of selected plants on *Staphylococcus* in mm

Name of the plant	Name of the bacteria				
	Pseudomonas				
	Methanol Extract	Water Extract	Positive control	Water	Methanol
Azadiracta	22	0	34	0	0
Adhatoda	14	8	24	0	0

Table 2   Showing the inhibition zone of selected plants on *Pseudomonas* in mm

Name of the plant	Name of the bacteria				
	Staphylococcus				
	Methanol Extract	Water Extract	Positive control	Water	Methanol
Azadiracta	20	0	22	0	0
Adhatoda	10	0	16	0	0
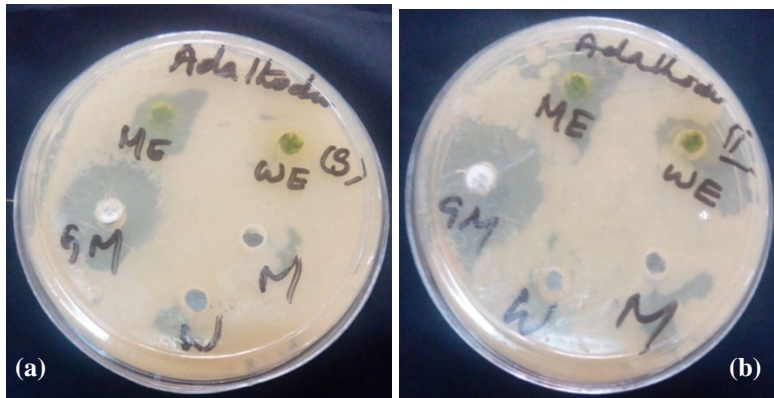
Plate 1. Inhibition zones of *Adhatoda*

   a. Inhibition zones of Adhatoda against Staphylococcus
   b. Inhibition zones of Adhatoda against Pseudomonas c and
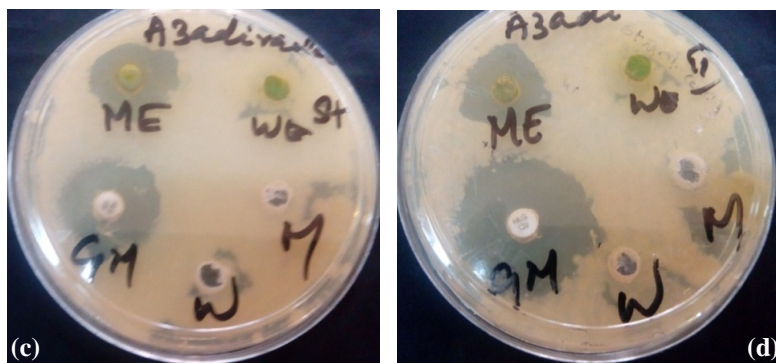
Plate 2. Inhibition zones of *Azadiracta*
           c. Inhibition zones of Azadiracta against Staphylococcus
           d. Inhibition zones of Azadiracta against Pseudomonas

Summary and Conclusion

In the present experiment the preliminary study on antimicrobial activities of four selected plants namely *Azadiracta indica, Adhatoda vasica, Elephantopus scaber and Phyllanthus niruri* were studied by busing the water and methanol extract in agar well diffusion method. Both positive and negative control was used. Each plant extract was tested for two bacteria namely *Staphylococcus aureus and Pseudomonas aeruginosa*. Intensity of activity was measured against the size of the inhibition zone formed after incubation period. The study showed that these plants were more powerful in the methanolic extract while compared with the water extract. It was also concluded that this antimicrobial activity may be due to the phytochemicals present in them.

The activities of both water and methanol extracts of *Azadiracta indica, Adhatoda vasica, Elephantopus scaber and Phyllanthus neruri* on bacterial pathogens as revealed in this study support the local uses of these plants in traditional therapy for gastroenteritis. Some of the

phytochemical compounds in these plants extracts may be responsible for the antibacterial activity observed and thus justifying their traditional use as medicinal plants for the treatment of bacterial gastroenteritis. It is essential to carry out the detailed study of the extracts in order to determine the exact antibacterial compound(s)

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MACROFLORAL AND MICROALGAL DIVERSITY IN THE MANGROVE AREAS OF MALA, THRISSUR (DIST)

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ABSTRACT

Mangroves are the evergreen tidal forest that grows only in tropical and subtropical countries. They regarded as the one of the most productive and biodiverse wetland forest group on earth. The present work was carried on the diversity of mangrove ecosystem in Mala, Thrissur Dist. Three mangrove stations under Mala Grama panchayath were selected for this study. During this study five true mangroves and ten associated mangroves were observed from the study area. Acrostichum aureum, L and Avicennia officinalis, L are the major type of true mangroves. The associated mangroves varied in their distribution in three stations.   Line transect method was adopted to study of plant diversity. Also 15 genus of plank tonic microalgae were identified. Station 1 and station 2 posses more plant and algal diversity than station 3, because these stations were situated in a non-polluted area. This also reveals that the pollution is one of the major reasons for decreasing the diversity of mangrove ecosystem.

Keywords: True mangroves, microalgae, pollution

Introducion

Mangroves are the ecological group of evergreen and salt tolerant plant groups. They play an important role in replenishing the fertility of the coastal regions and thus supporting the coastal inhabitants socio-economically. This ecosystem is also considered as most productive and biodiversity providing significant functions in the coastal zones as buffer against erosion, storms and tsunami. Mangroves act as filters for upland runoff; it also serves as habitat for many marine organisms and other invertebrates and wildlife such as birds and reptiles. The diversity of mangrove plants mainly depend on many hydrological parameters like salinity, alkalinity, pH, nitrate and dissolved oxygen etc .Of this Salinity was the main factor which determine the diversity of true mangroves. Improper anthropogenic activities also influence the mangrove diversity adversely.

Materials and Methods

The study area is located in Mala Grama Panchayath in Thrissur district. It is s located between north latitude of 10°15'0" N and east longitude of 76°1'0" E. The mangroves of Mala were mainly distributed in 3 regions i.e., Karingachira, Neithakudy and Mala chaal. Plant collections made at the natural habit and identified taxonomically with the help of Flora of the Presidency of Madras (Gamble)[1]. Plant diversity analysis was done by line transect method. The quantitative analysis was conducted on the basis of Frequency, Density and Abundance. The water samples are collected for identification of microalgae and take photograph with the help of research microscope.

Results & Discussion

Mangroves flora of mala comprises 5 true mangrove species from 5 families. List of true mangroves collected from the study area are shown in Table 1. They were *Acanthus ilicifolius,* L, *Acrostichum aureum,* L, *Aegiceras corniculatum*, Blanoco*, Avicennia officinalis*, L and *Excoecaria agallocha,*L. But in station 3 *Acanthus ilicifolius,* L and *Aegiceras corniculatum*, Blanoco were totally absent. There werealso 10 mangrove associated species from 8 families, mainly *Bacopa monnieri,* Linn, *Cayratia carnosa*, Gagnep, *Clerodendron inerme,* Gaertn., *Cyperus rotundus,* Linn, *Derris uliginosa,* Benth, *Eclipta postrata,* Hassk, *Fimbristylis ferruginea,* Vahl, *Mariscus javanicus,* Houtt, *Passiflora foetida*, Linn and *Waltheria indica,* Linn. These plants were also reported in Poyya back water[2] (sheela 2013) except *Waltheria, Passiflora and Eclipta*. Which was never reported from any other mangroves areas.

15 genus of planktonic microalgae were also identified during the study. Class Bacillariophyceae was the dominant group among the mangrove planktonic algae. Diatoms were represented by 10 genus (67%), green algae by 3 genus (20%) and blue green algae were represented by 2 genus (13%). The genus were *Rhizoclonium*, *Trentepohlia*, *Spirogyra*, *Fragilaria***,** *Eunotia***,** *Achnanthes***,** *Navicula*, *Anomoeoneis***,** *Caloneis***,** *Pleursosigma*, *Scoliopleura*, *Cymbella***,** *Nitzschia***,** *Microcystis* and *Oscillatoria*. These algae were also reported in the study of Kodungallur brackish water. In station 3 *Trentepohlia, Fragilaria, Anomoeoneis and Scoliopleura* were totally absent and also there was an increased presence of Cyanophycea. This high amount of blue green algae indicates the presence of pollution in station 3.

List of true mangroves collected from the study area			
No	Scientific name	Family	Locality
1	*Acanthus ilicifolius,*L	Acanthaceae	KA, NK
2	*Acrostichum aureum,*L	Pteridaceae	KA, NK & MC
3	*Aegiceras corniculatum*, Blanoco.	Myrsinaceae	KA, NK
4	*Avicennia officinalis,*L	Avicenniaceae	KA, NK & MC
5	*Excoecaria agallocha,*L.	Euphorbiaceae	KA, NK & MC

List of associated mangroves collected from the study area			
No	Scientific name	Family	Locality
1	*Bacopa monnieri,*Linn	Scrophulariaceae	KA , MC
2	*Cayratia carnosa*, Gagnep.	Vitaceae	KC, NK ,MC
3	*Clerodendron inerme,* Gaertn.	Verbenaceae	NK
4	*Cyperus rotundus,* Linn.	Cyperaceae	KA, NK , MC
5	*Derris uliginosa,* Benth.	Papilionaceae	KA, NK , MC
6	*Eclipta postrata,* Hassk.	Asteraceae	KA , MC
7	*Fimbristylis ferruginea,* Vahl.	Cyperaceae	KA, NK ,MC
8	*Mariscus javanicus,* Houtt.	Cyperaceae	NK ,MC
9	*Passiflora foetida*, Linn.	Passifloraceae	KA ,MC
10	*Waltheria indica,* Linn.	Sterculiaceae	KA, NK ,MC

KA: Karingachira, NK: Neithakudy, MC: Mala chaal

Plant diversity analysis result:

1. Density, 2. Abundance, 3. Frequency
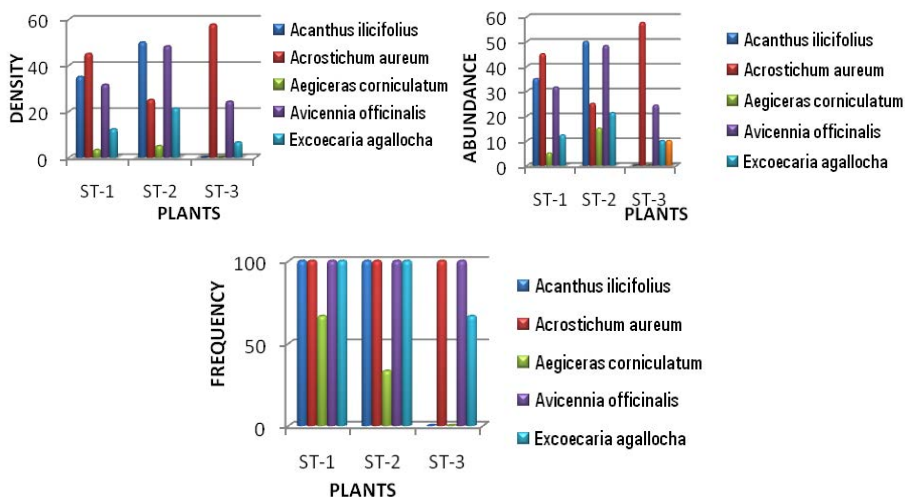
Summary & Conclusion

The present study reveals the current state of mangroves and associated micro flora in Mala.The quantitative analysis of these mangroves gives an idea about their distribution. They include 5 true mangrove species and ten associated mangroves. *Acrostichum aureum*,L and *Avicennia officinalis*,L were the most abundant true mangroves. The distribution of associated mangroves varied from station to station. But comparatively its rate was less in station 3.The plank tonic microalgae identified included 15 genus from three major divisions. Class Bacillariophyceae was the dominant group among the planktonic algae . In station 3 there were large amount of Blue green algae, which indicates the presence of high pollution. This study also reveals   how the human activities like land encroachment, organic and plastic waste deposition in mangrove areas affect the diversity of mangrove ecosystem. So we should conserve our mangroves for the sake of our next generation and also for maintaining the ecological balance of the nature.

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[1]   Gamble,J.S1915.Flora of Presidency of Madras

[2]   Sheela Franasis.K 2013 Identification of mangroves and mangrove associates of Thrissur, Dist. Kerala, their adaptive biology, germination study and nutritive value.

True Mangroves Collected From the Study Sites:

1

2

3

4

5

1.*Acanthus ilicifolius,*L., 2. *Acrostichum aureum* L., 3. *Aegiceras corniculatum*, Blanoco., 4. *Avicennia officinalis, L,* 5. *Excoecaria agallocha ,* L

Associated Mangroves Collected From the Study Sites

1. *Bacopa monnieri,*Linn, 2.*Cayratia carnosa*, Gagnep, 3.*Clerodendron inerme,* Gaertn, 4. *Cyperus rotundus,* Linn, 5. *Derris uliginosa,* Benth, 6. *Eclipta postrata,*Hassk. 7. *Fimbristylis ferruginea,* Vahl, 8. *Mariscus javanicus,* Houtt.9. *Passiflora foetida*, Linn., 10. *Waltheria indica,* Linn.

A COMPARATIVE STUDY ON THE PHYSICOCHEMICAL PARAMETERS OF SOIL IN MALA BLOCK PANCHAYAT, THRISSUR, KERALA

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ABSTRACT

The physico-chemical study of soil is based on various parameters like Moisture content, pH value, Soluble salts/ Electrical conductivity, Gypsum Requirement, $CaCO_3$/Lime Requirement, Nitrogen content, Phosphorus content etc. Soil fertility identification of a region plays an important role in the context of sustainable agricultural production. The proper proportions of nutrients present in the soil represents the fertility status which helps to control the yield of crops. The Mala Block Panchayat of Thrissur district of Kerala was selected for the study. The soil samples(depth 0-15cm) were collected randomly and compared for their physico-chemical properties. These results help agronomists, agriculture engineers and farmers for finding the problems related to soil, nature and nutrient status and improve the sustainable agricultural production.

Keywords: *Moisture content, pH value, Electrical conductivity, Gypsum Requirement, $CaCO_3$/Lime Requirement, Nitrogen content, Phosphorus content*

Introduction

Soil fertility is the inherent capacity of the soil to provide the essential plant nutrients in adequate amounts and in proper proportions for the plant growth [1]. Soil characterization of a region is an

important aspect in relation to sustainable agricultural production. The macronutrients and micronutrients are important soil elements that control its fertility and enhance the yield of crops [2]. If we fail to supply the proper nutrients in the proper concentrations, the plant function is affected.

All agricultural productions and development depends upon physico-chemical parameters of the soil used for it. Straight off a day's need of soil testing is increased due to interest of the public in the caliber of products obtained from it and different practices carried for their output. The soil quality analysis includes an analysis of parameters and processes which effects on soil to operate efficiently as a component of a sound ecosystem. Soil quality may include a capacity for water retention, carbon sequestration, plant productivity, waste remediation, and other functions, or it may be defined more narrowly [3-4].

Materials and Methods

Collection of Soil Samples

The selected area for our study is Mala Block Panchayath, Thrissur District, which is located in Kerala State. Sample 1 was collected from the paddy field at Ashtamichira where there is no cultivation for long time. Sample 2 was collected from nearby lands of Pigments India Ltd. at Kannikkara. Sample 3 was collected from the poultry farm area at Kombodinjamakkal. Sample 4 was collected from plastic and other waste dumping area at Mala. Sample 5 was collected from Nita Gelatin Company (NGIL), at Kathikudam. Sample 6 was collected from the paddy field at Poyya where there is no cultivation for long time.

The collected samples were subjected to different processes like Sieving, Drying, Grinding, Mixing, Coning, Quartering and Storing. Soil samples were collected in polythene bags and were labeled carefully.

Physico-Chemical Analysis of Soil

The soil samples were dried in oven to 1050C for about 24 hours and grinded more finely. The samples were tested for, Moisture content, pH value, Soluble salts/ Electrical conductivity, Gypsum Requirement, $CaCO_3$/Lime Requirement, Nitrogen content, Phosphorus content etc. Each of the analysis was performed in triplicates. The standard techniques and methods were followed for physical and chemical analysis of soil samples[5].

Results and Discussion

The comparative trend of the data is both tabulated and plotted (figures 1-7).

Soil sample	Moisture Content%	Phosphorous content mg/g	pH	Electrical conductivity dSm^{-1}	Nitrogen content mg/g	$CaCO_3$ %	Gypsum requirement %
1	0.08	0.28	6.4	0.15	0.84	2.31	13.02
2	0.17	0.34	6.5	0.22	.76	2.89	16.28
3	0.21	1.27	7.2	.42	.68	4.85	3.37
4	0.08	0.21	6.2	.28	.90	2.14	11.57
5	0.14	0.21	5.7	1.34	.52	1.88	18.15
6	0.12	0.22	6.2	0.25	0.87	2.21	14.53

Soil Ph

The pH of the soil provides information regarding the potency of toxic substances present[6-8]. pH of the soil samples vary from 5.7-7.2. The pH range of 6.8 to 8.0 has been recommended optimum for plant's growth[9,10]. One of the samples are acidic, three of them were slighty acidic and two of them were neutral. Soil sample 5 is not good for cultivation of crops. The variation in pH of the soil samples is graphically represented in Figure 2.

Electrical Conductivity

Low value of EC is found to be appropriate for growth of plants indicating higher fertility.Proper amount of pH and EC leads to the maximum availability of the nutrients, reduced accessibility of the toxic elements and increased activity of micro-organisms [10]. The electrical conductivity of soil samples varied from 0.15 - 1.34dSm^{-1}. The electrical conductivity may be ascribed to the leaching of salts to lower horizons[2]. Most of the soil samples except sample 5 have low conductivity. This low EC values indicate that the area is not prone to salinity threats and the soils will support many crops; but sample 5is not good for cultivation. The variation in conductivity of the soil samples is graphically represented in Figure 2.

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HERBAL PLANTS IN COOKING – AN ANALYSIS AND NUTRIENT STUDY

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ABSTRACT

Civilized man does not eat at all, the food as it available in nature. He cuts, Crushes, Cooks, processes and modifies in many ways before consuming, adding variety to the diet. To maintain good health, ingesting a diet is one which contains nutrients in correct amount. Sometimes we are forgetting that some herbal leaves are used for cooking which gives double benefits in our daily diet. This project mainly focuses to analyze the nutritional information of some herbal leaves used in cooking such as Curry leaves, Tulasi, Celery, Mint leaves, Wheat grass and Aoe Vera. This study is mainly focused on mineral analysis and vitamin C estimation. The P^H and moisture content of selected samples were also determined.

Introduction and Literature Survey

Leaves are the manufacturing organs of plants where the life-giving process of photosynthetic takes place. Generally green leafy vegetables are good source of vitamins and minerals. Green leafy vegetables contain vitamin C and can be used as substitute for fruits if needed. Green leafy vegetables are also rich in iron content. Some leaves contribute calcium in our diet. The availability of calcium and iron to the body is limited as green also contains oxalic

acid. Greens are generally are high in moisture and easily withered and need to preserve properly. Herbs have a variety of uses including culinary, medicinal, and in some cases spiritual. General usage of the term "herb" differs between culinary herbs and medicinal herbs.

This study is mainly focused on herbal leaves used in cooking such that curry leaves, Tulasi, Celery, Mint leaves, Wheat grass and Aoe Vera. Many research shows that curry leaves have properties that can help in lowering one's blood cholesterol levels. Packed with antioxidants, curry leaves prevent the oxidation of cholesterol that forms LDL cholesterol (bad cholesterol). This in turn helps in increasing the amount of good cholesterol (HDL) and protects your body from conditions like heart disease and atherosclerosis. It is also very effective in treating damaged hair, adding bounce to limp hair, strengthening the shaft of thin hair, hair fall and treats dandruff.

Celery is often incorrectly thought to be a "negative-calorie food," the digestion of which burns more calories than the body can obtain. In fact, eating celery provides positive net calories, with digestion consuming only a small proportion of the calories taken in [1]. Celery is among a small group of foods that appear to provoke the most severe allergic reactions; for people with celery allergy, exposure can cause potentially fatal anaphylactic shock [2].

Wheatgrass is also a source of protein. Adding other foods with complementary amino profiles to this food may yield a more complete protein source and improve the quality of some types of restrictive diets [3].

Aloe Vera is a plant species of the genus *Aloe*. It grows wild in tropical climates around the world and is cultivated for

agricultural and medicinal uses. Aloe is also used for decorative purposes and grows successfully indoors as a potted plant.[4]

Tulasi is considered to be an adaptive [5] balancing different processes in the body, and helpful for adapting to stress [6]. Marked by its strong aroma and astringent taste, it is regarded in Ayurveda as a kind of "elixir of life" and believed to promote longevity [7].

There are various foods that are rich in vitamin C, including: Citrus fruits like oranges, grapefruit, limes and lemons, berries such as blackcurrants, strawberries, raspberries, blueberries and cranberries, vegetables such as spinach, green and red peppers, tomatoes, cauliflower, cabbage, broccoli, Brussels sprouts and potatoes. Certain foods such as cereals are fortified with vitamin C, which means that they have vitamin C added to them. Vitamin C is also found in fresh milk, fish and offal such as liver and kidney. Persistent lacks of vitamin C in your diet can lead to a condition called scurvy. Symptoms of scurvy include easy bruising, easy bleeding and joint and muscle pains. Vitamin C deficiency can be treated with supplements of vitamin C and a diet rich in vitamin C.

Deficiency, or a lack, of vitamin C in your body happens because of a lack of sufficient amounts of vitamin C in your diet. Over time, a lack of vitamin C means that new collagen cannot be formed. This causes various tissues in your body to start to break down and the health and repair of your body become affected. Persistent vitamin C deficiency, usually over a period of around three months or more, can lead to an illness known as scurvy.

Vitamin C deficiency can be prevented by making sure that you have a healthy, balanced diet that contains plenty of fruit and

vegetables including those high in vitamin C that are listed above. If not diagnosed and treated, vitamin C deficiency can also lead to shortness of breath, nerve problems, high temperature (fever) and fits. Bleeding inside the brain and around the heart can cause death in some people with untreated vitamin C deficiency. However, this is extremely rare.

Materials Methods

1) Sample preparation: 5g of sample is grinded in mortar with 50 ml of water. The extracted is collected and filtered using a cloth. The filtered solution is made up to 100 ml in a standard flask.

2) Chemicals used: Dilute Sulphuric acid, Sodium hydroxide, concentrated Nitricacid, Concentrated Sulphuric acid, Ammonium molybdate, Potassium permanganate, Manganese dioxide, Tollen's reagent, Lead acetate, Accetic acid, Ammonium thiocynate, Ammonium chloride, Ammonium hydroxide, Hydrogen sulphide, Fehling's solution, Tartaric acid, concentrated Hydrochloric acid, Disodium hydrogen phosphate, Potassium iodate, Potassiumiodide and Ascorbic acid.

Analysis

For the analysis of herbal juice the following experiments were carried out:

1. **Test for Potassium**: Take little of the sample solution in test tube and add 2 ml of picric acid solution, shake for some time. Formation of yellow precipitates indicates the presence of potassium ion.

2. **Test for Magnesium**: Take a little of sample solution in a test tube and add NH_4Cl, NH_4OH and excess of disodium hydrogen phosphate solution. Scratch the sides of the test tube with glass rod.Formation of white precipitate indicates the presence of magnesium.

3. **Test for Phosphate** : A little of sample solution is taken in a test tube and add 1 ml of con.HNO_3 heat and cool. Add one drop of this solution to ammonium molybdate solution. Canary yellow precipitateconfirms the presence of phosphate ions.

4. **Test for Iron:** Take a little of the sample solution in a test tube and add con $HNO_3$and heat and coolthen treat with ammonium thiocynate.A little of sample is acidified with dilH_2SO_4 and dil $KMnO_4$is added drop wise. Colorof $KMnO_4$ is discharged. This indicates the presence of iron.

5. **Test of Sodium**: The mixture is made up a paste with con.HCl on a watch glass. A little of paste is taken at the end of a platinum loop and shown near the flame. To one portion an equal volume of potassium pyroantimonate solution is added and shakes well. Inner side of the test tube below the liquid level is scratched. White precipitate shows the presence of sodium.

6. **Test of Calcium:** To a little of sample, ammoniumchloride, ammonium hydroxide and excess of ammonium carbonate solutions are added. White precipitates indicate the presence of calcium.

7. **Test for Tannins:** The substance (plant extract) mixed with sodium hydroxide and lead acetate solution. Formation of white precipitate indicates the presence of Tannins.

8.   **Test for Saponins:** The substance (plant extract) is shaken with water. Foam or lather formation indicates saponins.

9.   **Test for Quinines**: To test the substance sodium hydroxide was added. Blue, green, or red color indicates the presence of Quinones.

10. **Test for Carbohydrate:** *Molisch's test:* To an aqueous solution of the compound add two drops of 1% alcoholic alpha napthol solution add about 1 ml con.H_2SO_4 carefully along the sides of the test tube until the dense separate layer collects the bottom.

     Benedict's test: Prepare the first Benedict solution dissolve 86.5 gram of sodium citrate and 50 gram of sodium carbonate in about 400 ml of warm water. Filter the solution mean while dissolve 8.5 g of copper sulphate in about 500 ml of water. Add this solution to the first solution slowly with continuous stirring. Make up the total volume up to 500 ml. This solutions hold well before use.

     A little of the sample taken in a test tube and add a few drops of Benedict's reagent. The test tube was heated in a water bath for a few seconds. Appearance of rust brown color indicates the presence of reducing sugar.

11. **Test for Protein:** Action with con HNO_3: About 2 ml of concentrated aqueous solution of the compound adds to about 0.75 ml of Concentrated Nitric acid. A white crystalline precipitate indicates the presence of protein.

Determination of moisture content

The method is used for the quantitative determination of moisture in herbal leafs. Moisture in this method refers to the amount of free water and volatile substances that are lost by drying the leaves under controlled temperature in an air oven. It is expressed in g/5g of sample. Place cruciblewith sample in the air oven preheated to $100^{0}C$ for 2-3 hours. Transfer the container with the dried samples into a desiccator, cool for 30 min and weigh.

$$\text{Moisture (g/100g)} \quad = \frac{loss\ of\ weight}{Weight\ of\ sample} \times 100$$

Determination of P^h Content

P^H is a measure of acidity or alkalinity of water soluble substances. The P^H of the leaf extract was measured with the help of calibrated P^H meter. Digital read out have the advantages of exactness. The P^H meter was placed in the beaker containing buffer solution P^H -7. The herbal juice samples were taken in 100 ml beaker and the meter was immersed in it. The stabilized values of the P^H are taken to find out the P^H of the sample.

Estimation of Vitamin C

1 **Preparation of iodine solution:** 5.00g potassium iodide (KI) and 0.268g potassium iodate (KIO_3) where dissolved in to 500ml beaker with 200ml distilled water. 30 ml of 3 M sulphuric acid was added in to the beaker and then diluted with distilled water until 500 ml solution.

2 **Preparation of vitamin C standard solution:** 0.250 g ascorbic acid was dissolved in the beaker with 100 ml

distilled water. The solution was transferred to 250 ml volumetric flask and diluted to the mark with distilled water.

3   **Standardization of iodine solution:** 20 ml of vitamin C solution was pipetted into a 125 ml Erlenmeyer flask. 4 drops of 1% starch solution were added and then titrated against iodine solution until blue black color was observed. The titrations were repeated for concordant values.

4   **Titration of herbal juices:** 20 ml of sample was pipette into a 125 ml Erlenmeyer flask. Followed by 20 drops of 1% starch solution and titrated against iodine solution until blue-black was observed. Titrations were repeated three times and average values are taken.

Results and Discussion

Mineral Analysis

The table showing the presence of various minerals is shown below.

	Wheat grass	Aloe Vera	Celery	Tulasi	Mint leafs	Curry leafs
Potassium	✔	✔	✔	✔	✔	✔
Magnesium	✔	✔	✔	✔	✔	✔
Phosphate	✔	✘	✔	✔	✔	✔
Iron	✔	✔	✔	✔	✔	✔
Calcium	✔	✔	✔	✔	✔	✔
Carbohydrate	✘	✔	✘	✘	✔	✔
Protein	✔	✘	✔	✔	✔	✔
Tannins	✔	✔	✘	✔	✔	✔
Flavonoids	✘	✔	✔	✔	✔	✔
Saponins	✔	✔	✔	✔	✔	✔
Quinines	✔	✔	✔	✘	✔	✔

Potassium is an essential mineral micronutrient and is the main intracellular ion for all types of cells. It is important in maintaining fluid and electrolyte balance in the body. It is found in especially high concentration with in plant cells. A severe shortage of potassium in body fluids may cause a potentially fatal condition known as hypokalemia. Hypokalemia typically results from loss of potassium through diarrhea, dieresis, or vomiting. From the table it is clear that potassium is present in all the samples.

Magnesium is the central element in chlorophyll and the basis of early life on the planet. Magnesium ions regulate over 300 biochemical reactions in the body through their role as enzyme co-factors. They also play a vital role in the reactions that generate and use ATP, the fundamental unit of energy within the body's cells. It was observed that all the sample contain magnesium.

An important occurrence of phosphates in biological systems is as the structural material of bone and teeth. Energy production and storage in the body depend upon phosphorylated compounds such as adenosine tri –phosphate (ATP). Phosphate compounds are also important body buffers for controlling acid- base balance (Ph). Phosphorus plays an important role in keeping the kidneys healthy. Phosphorus deficiency may cause bone diseases such as rickets in children and osteomalacia in adults. The table showed that except Aloe Vera all the elements contain phosphate.

The health benefit of iron is related to the proper growth of human body. Iron is a vital element for muscle health. It is present in the muscle tissue and helps to provide the supply of oxygen required for contraction of muscles. Iron deficiency may often cause

severe fatigue, body weakness and other related health ailments. Iron deficiency may include brittle nails swelling or soreness of the tongue cracks in the sides of the mouth. Anemia also cause shortness of breath, dizziness, headache, coldness in your hands and feet pale skin etc. Table shows that all the samples contain iron.

Calcium is an essential macronutrient for humans. The average adult body contains in total approximately 1 kg, 99% in the skeleton in the form of calcium phosphate. Calcium stabilizes blood pressure and builds strong bones and teeth. Calcium deficiencies can affect all part of the body, resulting in weak and muscle contraction. Calcium deficiency can eventually lead to thinning of bones and osteoporosis when the calcium stores in the bones are not replaced. Muscle cramps are initial symptoms of calcium deficiencies. Calcium is present in all samples.

Carbohydrate are main source of energy, they help fuel of brain muscles and central nervous system. Fiber is a carbohydrate that aids in digestion, helps feel full and keeps blood cholesterol levels in check. Fiber also helps heart diseases under control. Lack of carbohydrate can cause low blood sugar and ketosis. Carbohydrate is present in all samples, except wheat grass, celery and Tulasi.

Protein is an important building block of bones, muscles, cartilage, skin and blood. It includes production and smooth functioning of enzymes and hormones and provides cellular and muscular health. It facilitates molecular transportation. Cell repair and regeneration and provides mechanical and structural support to the bones and skin. Protein deficiency is a disorder that increases

the risk of developing abnormal blood clots the condition can be mild or sever. Protein deficiency leads to arthritis, and muscle deterioration as well as heart problems. Except Aloe Vera all other samples contain protein.

Tannins are water-soluble polyphones that are present in many plant foods. They have been reported to be responsible for decreases in feed intake, growth rate, feed efficiency, net metabolizable energy, and protein digestibility in experimental animals. Therefore, foods rich in tannins are considered to be of low nutritional value. Recent findings indicate that the major effect of tannins was not due to their inhibition on food consumption or digestion but rather the decreased efficiency in converting the absorbed nutrients to new body substances. Tannins are present in all samples except celery.

Flavonoids have an antioxidant power that provides important health benefits. Diets rich in flavonoids have been associated with reduced risk of variety of diseases. It has an anti inflammatory activity, antiviral activity. Flavonoids are present in all samples except wheat grass.

Saponins, affect the immune system in ways that help to protect the human body against cancers, and also lower cholesterol levels. It decreases the developing of certain form of cancer to tumors. Saponins are present in all samples

Quinine is a bitter chemical present in the bark of the cinchona tree. The chemical has some important medical benefits. It is used as a prescription medicine for malaria. Common side

effects include headache, ringing in the ears, trouble seeing, and sweating. More severe side effects include low blood platelets, irregular heartbeat. Quinine is present in all samples except Tulasi.

Moisture Test

Water content is used in a wide range of scientific and technical areas, and is expressed as a ratio, which can range from 0 to the value of the materials' porosity at saturation. From the table it is clear that the moisture content is highest for in the case of sample Aloe-Vera and the minimum in the case of curry leaves.
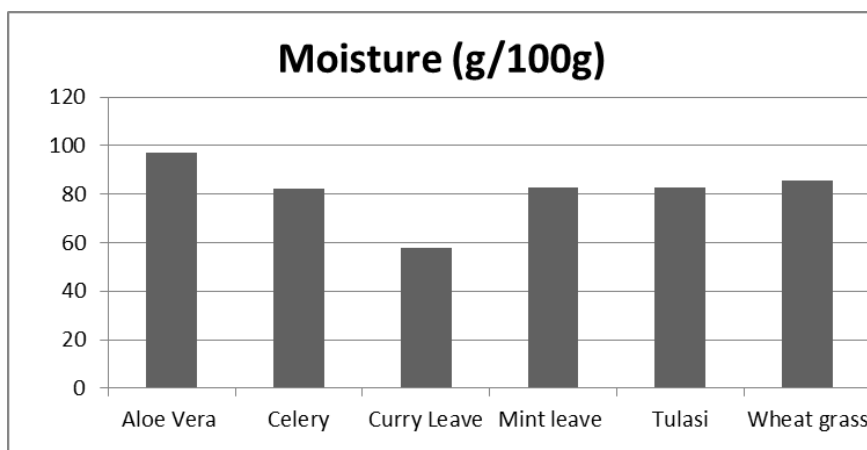
P^H values

The term pH refers to the concentration of hydrogen ions in a solution. The hydrogen ion concentration can be determined empirically and expressed as the P^H. From the graph it is clear that slightly acidic nature is for the Aloe Vera and basic nature is for the Wheat Grass.

PH
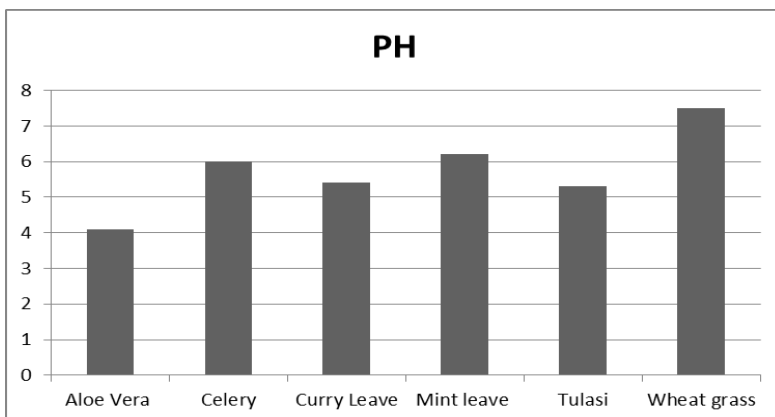
Vitamin C

No	Sample	Vitamin C(mg/5g)
1.	Wheat grass	0.586
2.	Aloe Vera	0.262
3.	Celery	0.463
4.	Tulasi	0.841
5.	Mint leaves	0.555
6.	Curry leaves	0.041

Vitamin C is the enolic form of 3-oxo-Lgulofuranolactone also known as ascorbic acid. It is powerful water-soluble antioxidant that boosts the immune system and helps to prevent cancer and heart disease. To enhance the antioxidant properties, it will be best to take it with the other antioxidants, as there is strong evidence of synergy between all of them. The human body cannot produce ascorbic acid, and so it must be obtained entirely through one's diet. Results showed that the highest value of vitamin C is in Tulasi (0.8413) followed by Wheat grass (0.586), Mint leave (0.555), Celery (0.463), Aloe Vera (0.262) and Curry leave (0.041).

Conclusions

- All the samples contain calcium, potassium, magnesium, iron and saponins.

- Phosphate and protein is present in all the samples except Aloe Vera.

- Aloe Vera, mint leave and curry leaves show the presence of carbohydrate.

- Tannis is present in all samples except Celery

- All the samples contain flavanoid except Wheat grass.

- Quinine is present in all samples except Tulasi .

- Results showed that the highest value of vitamin C is in Tulasi (0.8413) followed by Wheat grass (0.586), Mint leave (0.555), Celery (0.463), Aloe Vera (0.262) and Curry leave(0.041).

- Moisture content is found to be maximum for Aloe Vera and minimum for Curry leave.

- Aloe vera is slightly acidic while all other samples are almost neutral.

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WOMEN WRITING ON WRITING WOMEN: A STUDY

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Helene Cixous exhorts women to "write," breaking the silence: "Woman must write her self: must write about women and bring women to writing, from which they have been driven away so violently as from their bodies – for the same reasons, by the same law, with the same fatal goal. Woman must put herself into the text as into the world and into history – by her own movement…" (Marks, 245). Cixous means that woman must put her body as the text to find a place in the canons and annals of history. In other words, the textual politics of *ecriture feminine* incorporates the politics of the female body as a text as well as a site of resistance. The resistance to patriarchy is articulated through writing.

The problematic interrelationship between creativity and sexuality is illustrated through women's fictional writings. The present study gives insights to psychological factors that qualify the woman character-writer's life, how the female writer-protagonist's psychic conflicts related to her gender and sexuality turn out to be artistically productive, offering a new dimension to women's writings. This study examines women writing on writing women's responses to male domination in sexuality and creativity. It is an attempt to find out how women have created spaces of resistance to the dominant discourses of patriarchy. These women writers strive to recontextualise, recreate and rewrite the past in their writings

with a view to retrieving the submerged female identity and moving to the centre from their marginalized positions. They articulate their voices of dissent and resentment towards multiple oppressions in patriarchal, capitalist and racist society. The reading of selected novels of women writing on writing women gives a kaleidoscopic view of woman's predicament in different cultures.

Sylvia Plath's only novel, *The Bell Jar* portrayed the traumatic experiences of suicide and depression through the character of Esther Greenwood. This makes *The Bell Jar* one of the most haunting and captivating novels about nervous breakdown. It gives an account of Esther's misandrinism, neurosis and creativity. *The Bell Jar* describes Plath's own predicament: the inability to combat self-destruction and neurosis through creativity. The novel also reflects the conflicts between domesticity and self-reliance she experienced as an extra-ordinarily talented woman. *The Bell Jar* is the story of a successful suicide maniac writer who wrote the story of an unsuccessful suicide maniac writer unsuccessful in writing about a writer. It is the novel written by Sylvia Plath about an adolescent writer suffering from writer's block, Esther Greenwood, who is unable to write about Elaine, her character-writer. So *The Bell Jar* has the structure of a story-within-a-story-within-a-story. The novel explores how the conflicting views of sexuality, creativity and neurosis intersect in the life of a woman writer and her created character.

The embedded Esther-doubles and their double experiences in the novel provide information about sexuality, creativity and insanity in the American society of the 1950's. Plath has successfully

portrayed the different categories of sexuality through multiple voices in the novel. She enhances the quality of objectivity by the creation of multiple voices of the protagonist. The multiple voices bring in polyphony to the text. The novel's themes like female sexuality, marriage, motherhood and madness are represented through the images of fragmentation, alienation, purgation, colours, seasons, landscape and animals. Self-expression is a sort of empowerment for Esther. By writing a novel about herself she finds a voice and identity in her society. As she is suppressed by the societal norms, she has to find some way to reveal her repressed emotions. She finds writing as the most suitable way to express her suppressed feelings. As Elaine is the mouthpiece of Esther, Esther herself is the voice of Sylvia Plath who reveals the double standard of ethics, values and aesthetics followed by the patriarchal society.

Doris Lessing's *The Golden Notebook* analyses the life of the writer, Anna Wulf, the protagonist, through her creative acts. She is a divorced mother of a young daughter and a once-successful writer experiencing writer's block. She has spent years unable to write a sequel to her one novel, a wartime story that was commercially and critically successful. The novel comprises of the four notebooks – black, red, yellow and blue - in which Anna keeps the record of her life, and her attempt to tie them all together in a fifth, the golden notebook. Each notebook is revisited four times, combined with episodes from *Free Women*, creating non-chronological, overlapping sections that intersect with one another. The last book puts an end to the fragmentation. The collaborative work by Anna and her American lover, Saul Green leads to her recovery and reintegration from her fragmented self.

Doris Lessing lays bare the confused and depressed psyche of Anna Wolf who always dreams freedom within the structure. She has given voice to her experience through the written word. At times, the resistance is even overt and vocal. The text focuses on the different aspects of creativity and their relation with the unconscious, especially the psychic energies diffused as neurosis and self-destruction. Through the portrayal of Anna Wulf, Lessing discusses many issues like gender, creativity, sexuality, neurosis, Marxism and fictional process. The novel has set new conventions by discussing female sexuality from the female point of view.

The Canadian writer Margaret Laurence's *The Diviners* is the culmination and completion of her celebrated Manawaka novels. The epic novel is dense with themes including mother-daughter relationships and dispossession, besides creativity, sexuality and resistance. This is the powerful story of an independent middle-aged writer, Morag Gunn, who lives in a farmhouse on the Canadian prairies.

The Diviners, written in the 1970's, portrays the obstacles a woman writer faces in achieving her goals. It is narrated through the memories of Morag Gunn, an independent single-mother, who struggles to understand the loneliness of her eighteen-year-old daughter, Pique. Morag, with all her strengths and weaknesses, searches for her identity. It gives the picture of the aging writer concluding her very last novel by digging up her past through a sequence of "Memory Bank Movies." Throughout these movies we gain knowledge of Morag's rough and hard rearing in Manawaka and her pursuit of individuality, knowledge and true home through

the subsequent years. Morag, though beaten down many times, has a goal and vision, and she has repudiated to let things impede her from getting there. Laurence, the writer, has created a woman-writer, Morag Gunn, whose experience is that of all dispossessed people in search of their birthright and who stands as a motivating representation of bravery and survival. The creator-writer, Margaret Laurence as well as the created writer, Morag Gunn offers a resistance that is an exercise of power against the oppression and injustice of power structures which degrade them to the point of objectification and commodification. The novel seeks to locate the manifestations of a woman writer's attempt to find a room of her own.

The Indian writer Shashi Deshpande's *The Binding Vine*, deals with the different aspects of woman's life like motherhood, sisterhood, creativity, sexuality, resistance and identity. Urmi in Deshpande's novel is educated, sensitive and middleclass. After the death of her one-year-old daughter, she finds solace and strength in Mira, her dead mother-in-law's writings. Mira takes writing as a means of her redemption from all sorts of oppression. Resistance to hegemony exists in her writings. She has transmitted it through her poems. The title of the novel has been taken from one of the poems of Mira which is about creation and binding love. The potential for resistance to power is through strategies like "manipulations within the domestic sphere, the subversions of religious and cultural resources and the deployment of sexuality" (Sunder Rajan, 161). Her covert resistance emerges from a craving to construct identity. Mira's existence had been a sort of internal colonization on the one hand, and a double colonization on the other. Her identity as a Third

World woman intensifies her oppression. By writing about the doll-like existence of herself, she could find a voice to express her anger and disgust against the patriarchal society.

The Third World women experience a different and more intense kind of oppression than that of men. The Third World women are the gendered subalterns with a stifled voice. Her predicament is appropriately expressed by Gayatri Chakravorthy Spivak: "…if the subaltern has no history and cannot speak, the subaltern female is even more deeply in shadow" (296). For Spivak, the silenced subaltern women are like shadowy figures due to their non-representation in the colonial discourses. She exhorts women writers to retrieve the authentic voices of the female subaltern from their mute condition and to rediscover their history in the subaltern consciousness. In the novel, *The Binding Vine*, Urmi makes an effort to resurrect the works of her mother-in-law by publishing them and giving them voice. Kalpana, a subaltern rape victim, has to live under conditions of fear, anxiety and violence. Urmi shows the guts to maintain and retain Kalpana's dignity as a woman, as a human being, by giving her moral support. Through the portrayal of Urmi and Mira, Deshpande has given a powerful note of resistance and self-assertion to reclaim the female self of the subaltern.

The Latin American writer Julia Alvarez's *Saving the World*, shows how different narrators in different narrative contexts can highlight transvocalisation in the novel. Alma Huebner, a contemporary Dominican-American writer suffering from writer's block, instead of working on a Dominican family saga novel, spends her time reading about Dona Isabel Gomez who helped

Dr. Francisco Balmis, the leader of the Spanish Royal Philanthropic Expedition of 1803, to vaccinate twenty three orphans with cowpox and bring them as live carriers from Spain to Central America to save the world from smallpox epidemics. Alma's husband, Richard Huebner, an American, is involved in a project of testing a new vaccine in the Dominican Republic to save the world from AIDS in the twenty first century. These two stories, seemingly so different, begin to speak to each other through the narrators, Alma and Isabel, thus saving them from the world of depression.

Through the writer-protagonist, Alma Heubner, Julia Alvarez, the writer, is making an attempt to reconstruct their histories and reclaim their voices from double colonization of race and gender. Their dreams and aspirations become part of a wider struggle to change the material and social reality. Articulation is an inevitable consequence of struggle and it offers resistance by exhibiting dissent against the oppressive dominant discourses. Alma is of the impression that a writer will lose her freedom by succumbing to the glamour of the book-biz world. Her bitterness and disenchantment with the book-biz world and her self-conscious ethnicity reflect the attitude of the writer Alvarez. The writer-character thus becomes the voice of her writer-creator, Alvarez.

The Japanese American writer Ruth Ozeki's *A Tale for the Time Being* (2013), portrays the creative symbiotic relationship between the writer and the reader jettisoning geographical barriers. In a world of digital surveillance, Ozeki depicts the dilemma of a depressed teenaged girl Nao, who wishes to write a memoir on her 104-year-old great-grandmother, a Zen nun and feminist novelist, as

her extended suicide note. Ozeki worries herself about writing women and their predicament. Through her twin women-writer/reader characters—Ruth, the blocked writer and Nao, the diarist—Ruth Ozeki, the writer-creator, has made women the subject of 'her story' unveiling her/their search for self. The text(s) within the text *A Tale for the Time Being* could be read as a narrative(s) of woman learning to speak and to act for herself.

Women's writing on writing women is therefore a female body evolved from female sexuality and aestheticised in a reinvented female centered language. It is definitely a march towards action from speech, to assertion from silence. The modes of resistance shown by these characters in these fictional texts create new forms of resistance discourses. They raise the questions of oppression, marginalization and objectification in a convincing manner through their writer-protagonists. Their writings resist the forces of multiple oppressions in contemporary society. They deconstruct the mystique perpetuated around female body, female sexuality and female creativity. They have evolved a new politics of sexuality and a new aesthetic of body in their writings.

A close reading of select fictional texts by women writers on writing women reveals the various strategies women novelists adopt to articulate resistance and to assess the impact of specific socio-cultural and historical contexts on the authors' conceptualization of resistance. The ambivalence created by the binary division, the public/ private sphere develops into an artistically productive conflict and gets manifested in the form of resistance in their works. The lives of the female writer-characters certainly become

instrumental in creating a change in the social psyche, the collective unconscious of the readers, especially women readers.

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हिन्दी और विज्ञापन की दुनिया

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विश्वभर में हिन्दी भाषा का महत्व निरन्तर बढता जा रहा है। हिन्दी पूरे भारतवर्ष की भाषा बन गयी है। राष्ट्रभाषा आदि उपाधियों से भी बढ़कर हिन्दी आज व्यावहारिक जीवन की भाषा बन गयी है। संपूर्ण भारत में हिन्दी ही एकमात्र भाषा है जो विविध जनविभागें को, संस्कृतियों को एकसूत्रता में बाँधती है। हिन्दी का प्रयोग आज जीवन के विविध स्तरों में होता जा रहा है। हिन्दी आज केवल विचार विनिमय की भाषा के स्तर से भी ऊपर उठकर 'जीवन उपयोगी भाषा' बन गयी है। हिन्दी आज बोलचाल की भाषा ही नहीं, बल्कि कार्यालय, विज्ञान, वाणिज्य, व्यवसाय और विज्ञापन का भी भाषा है। इस नयी पहलूओं से गज़रकर हिन्दी भाषा का ढाँचा भी धीरे-धीरे बदलने लगी है। हिन्दी में आज इन प्रयोगों के कारण नयी शब्द, नयी शैली आ गयी है जो ज्यादा दिलचस्पी विषय है। कार्यालयी सन्दर्भ में, विज्ञान और सूचना प्रौध्योगिकी सन्दर्भ में हिन्दी में नया-नया परिवर्तन दिनोंदिन होता जा रहा है। व्यापार और वाणिज्य में प्रयुक्त होनेवाली हिन्दी का रूप भी निरन्तर बदलती जा रही है। इस क्षेत्र में विज्ञापनों का योगदान ज्यादा सराहतीय हैं।

हिन्दी भाषा का प्रचलन करने में विज्ञापनों का महत्वपूर्ण योगदान है। टेलिविज़न और अन्य संचार माध्यमों में निरन्तर हिन्दी विज्ञापन आते हैं। जो अहिन्दी प्रदेशों के सन्दर्भ में भी लागू हैं। हिन्दी विज्ञापनों के द्वारा हिन्दी में जो नये प्रयोग आते हैं, ज्यादा आकर्षक लगते हैं।

विज्ञापनों में हिन्दी का रूप क्या है और उसका प्रयोग संचार माध्यमों में किस प्रकार होता है जैसी मूद्दों पर ध्यान देना अनिवार्य है। इसके पहले विज्ञापनों की भाषा के बारे में चर्चा करना होगा। 'विज्ञापन वही समर्थ है जो लोगों को उत्पादों की ओर ले जाता है'। रेडियो, टेलिविज़न, समाचार-पत्र और नव

इलक्ट्रोनिक माध्यमों में विज्ञापन आते रहते हैं। विज्ञापनों के माध्यम से उत्पादक अपने उत्पाद को दूसरों के उत्पाद से बेहतर स्थापित करते हैं। इसी कारण विज्ञापनों का निर्माण के अवसर पर अनेक बातों पर ध्यान देना ज़रूरी हैं। विज्ञापनों की भाषा कलात्मक और व्यावसायिक ढंग से होना है, जिससे सुननेवाले या देखनेवाले का हृदय खींच सके। इसी कारण आकर्षणीयता बढाने के लिए भाषा की एकदम अलग रूप इस्तेमाल किया जाता है। भाषाई स्तर पर विज्ञापनों में एकदम कायापलट की स्थिति लायी गयी है। विज्ञापन तभी आकर्षक बनते है जब उसमें ताल हो, दृश्यात्मकता हो, और सरलता हो। भाषाई व्याकरण को उतना स्थान नहीं दिया जाता जितना दृश्य सौन्दर्य को दिया जाता है। भाषा ज़्यादा आकर्षक और बोधगम्य हो, और सबसे अधिक लोगा समझ सकनेवाला हो, यही शर्त विज्ञापन के सन्दर्भ में उल्लेखनिय है। ऐसी स्थिति में हिन्दी का स्थान भारत में सबसे ऊपर आ जाती है। विज्ञापनों में सबसे ज़्यादा प्रयोग होनेवाली भाषा के रूप में हिन्दी का स्थान अद्वितीय हैं।

आज भारत में वाणिज्य, व्यवसाय, स्वास्थ्य जैसी अनेक क्षेत्रों में हिन्दी का ही प्रयोग विज्ञापनों में के लिए उचित माना जाता है। इसकेलिए कई कारण हैं। जो निम्नलिखित है,

- हिन्दी भाषा भारत में सबसे ज़्यादा समझे जाते हैं।
- हिन्दी भारतीय संस्कृति से जुडी हुई भाषा है।
- हिन्दी राष्ट्रीय - एकता का बोध कराती है।
- हिन्दी सरल भाषा है।
- हिन्दी संगीतात्मक भाषा है।

हिन्दी का प्रचलन और हिन्दी विज्ञापन

दूरदर्शन का आविर्भाव हिन्दी प्रचलन में महत्वपूर्ण कदम है। जिससे हिन्दी प्रश्नों में हिन्दी अपना स्थान बरकरार रखने में कामियाब हुई। अहिन्दी

प्रदेशों में विज्ञापनों द्वारा हिन्दी को जो फैलाव मिली है, वह बहुत व्यापक है। फिल्मों के माध्यम से हिन्दी को जो जनप्रियता मिली है, उतनी हद तक हिन्दी विज्ञापनों से भी योगदान प्राप्त हुई है। आज प्रादेशिक चेनलों का भरमार है फिर भी टेलिविज़न पर हिन्दी कार्यक्रमों का आस्वादन करने में लोग हिचकते नहीं। इन कार्यक्रमों के बीचों-बीच जो हिन्दी विज्ञापन आते हैं, सबके मन को बहकाता है। विज्ञापनों का रूप - सजावट से मात्र आकर्षित होता है ऐसा कहना ठीक नहीं होगा। अपनी भाषा में सुनने और देखने में जो सुख और चैन मिलती है, यह भी हिन्दी विज्ञापनों की जनप्रियता के कारण बनी है। हिन्दी में जब विज्ञापन बनते है वह एकदम चुस्त और सुडौल बनते हैं, उसमें संगीतात्मक बनने की अपनी शक्ति भी होती है। उदाहरण के रूप में वार्षिंग पाऊडर निरमा का विज्ञापन देखिए,

'वार्षिंग पाऊडर निरमा
वार्षिंग पाऊडर निरमा
दूध सी सफेदी
निरमा से आयी
रंगीन कपडे भी
खिल खिल जाये
सबकी पसन्द निरमा
वार्षिंग पाऊडर निरमा
निरमा'

विज्ञापनों में भारतीयता का परिदृश्य

हिन्दी विज्ञापनों के माध्यमों से भारतीय संस्कृति का असरदार प्रयोग भी विज्ञापनकर्ता कर रहे हैं। हिन्दी भारत की सांस्कृतिक बोध-सी जुडी हुई भाषा है। भारतीय संस्कृति को सही माईने में प्रस्तुत करने योग्य और कोई का होना न के बराबर है। भारतीय संस्कृति से जुडे हिन्दी विज्ञापन के लिए 'ऋछड क्क्मऋक्षझ्' का

विज्ञापन प्रसिद्ध है जिसमें पिता - पुत्र संबन्ध को मनोहर ढंग से प्रस्तुत किया है। 'साईकिल ब्रान्डे अगरबत्रियाँ के विज्ञापन में यह निस्सन्देह कहते हैं कि ईशवर है, और प्रार्थना के लिए सबको एक कारण होते हैं। ऐसी विज्ञापन जब हिन्दी में आती है, तो वह ज़्यादा प्रभावी होते हैं।

भारतीय सरकार की ओर से जो विज्ञापन आते हैं हिन्दी में ही आते हैं। जिसका कारण हिन्दी का राष्ट्रभाषा होना या राजभाषा होने का मात्र नहीं बल्कि वह हमारी एकता की, संस्कृति, समझ की भाषा होने से हैं। राष्ट्रीय साक्षरता मिशन का विज्ञापन स्वास्थ्य सबन्धी विज्ञापन, स्वच्छ भारत मिशन का विज्ञापन, आयकर विभाग की विज्ञापन यह सब हिन्दी में ही आते हैं। हिन्दी विज्ञापनों के प्रयोग से हर नागरिक के मन में कहीं न कहीं भारतीय होने का गर्व और भारतीय एकता का बोध जागृत होता है।

प्रभावात्मक भाषा के रूप में हिन्ती

ऊपर कहे गये सभी कारणों के बजाय इस बात पर ध्यान देना होगा कि हिन्दी विज्ञापनों में वाक्यों का जो प्रयोग होता है वह हिन्दी भाषा - संबन्धी गुणों के कारण ज़्यादा असरदार स्थापित होता है। हिन्दी में शब्दों के बीच तालात्मक संबंध, और सौन्दर्यात्मक संबंध स्थापित करना सरल लगते हैं। लोगों के जबान पर निरन्तर विज्ञापन चलते रहते हैं, उसे याद करते हैं। और वही प्रोडक्ट लेने को उसे बाध्य कराते हैं। इसकेलिए कई उदाहरण मिल सकते हैं,

'लाइफबॉय है जहाँ तंदरुस्ती है वहाँ', लाइफबॉय

चुड़की में छिपकायें - क्ह्ह्द्धत्द्धद्धत्त्त्म

ज़रा सी हसी जरा सी दुलार - ऋह्ह्थ घ्ण्ड्ड घ्ड्ड्घ्द्ड्ढ दृढ ह्द्ड्डत्ड्ड

आज हिन्दी विज्ञापनों में शुद्ध हिन्दी का मात्र प्रयोग न करके 'हिंगलिश' का प्रयोग ज्यादा हो रहा है। यह हिन्दी भाषा के लिए खतरनाक हो सकत है, ऐसे सोचनेवाले हैं। असल में हिन्दी भाषा की जनप्रियता से अंग्रेज़ी के पक्ष में रहनेवाले

विज्ञापन कर्ताओं को भी सहमत होना पड़ता है। वे जानते है कि हिन्दी का प्रयोग करने से ही विज्ञापन प्रभावदायक होते हैं। एक विज्ञापन देखिए।

च्णदृद्रद्रत्दढ़ थ्ङ्व ख्छ्दट्ठ, थ्श्ङ्व्दत डुद्वद्यऩ

च्ड़ण्दृदृथ् त्ठ्व डुट्ठडदट्ठ थ्श्ङ्व्दत डुद्वद्यऩ

घ्व्दुट्ठन्ङ्व्द्वम च्त्ण्ठुदट्ठ थ्श्ङ्व्दत डुद्वद्यऩ

ऋद्वद क्ङ्व्द्वध्द्ध्ठुठ् ठ्ठुदडुङ्व्द च्ङ्व द्रद्वदृद्यङ्व्डुड्य ख्ख्द्वदट्ठ

थ्श्ङ्व्दत म्ठुडडमङ्व्ड डट्ठुडुत डुद्वद्यऩ

ग्ख्द्वत एङ्व्द्यत

ग्ख्द्वत क्रद्वद्यऩ

यह विज्ञापन ग्च्क कंपनी का है, जिन्होंने हिन्दी भाषा को अंग्रेज़ी में लिखा है। जिन्हें अंग्रेज़ी का प्रयोग करने में दिलचस्पी है, लेकिन वह जानते है कि अंग्रेज़ी जाननेवालों के बीच में भी हिन्दी ज्यादा प्रभावी भाषा है। इसलिए उनको 'च्व्द्वट्ठुदम्थ्द्यट्ठुद्वद्यत्दृद' करना पडा है। 'ग्ऩ डुट्ठुद्वढ़ण्द्यङ्व्द्व त्म श्र डुद्वद्यऩ' से भी ज्यादा प्रभावात्मक प्रयोग 'ग्ख्द्वत एङ्व्द्यत ग्ख्द्वत क्रद्वद्यऩ' ही है। इस प्रकार अपने विज्ञापनों का ज्यादा असरदार बनाने के लिए 'हिंगलिश' का प्रयोग ज्यादा हो रहा है, जैसे,

'यह दिल माँगे मोर'

'नो उल्लू बनाविंग'

'स्वाद में बेस्ट - मम्मी और एवरेस्ट'

'यही है राईट च्वाईश बेबे'
'हमें लिख भेजिए राईट नाऊ'

हिंगलिश विज्ञापनों का निर्माण आज निरन्तर होते रहते हैं फिर भी अनेक ऐसे विज्ञापन हैं जो हिन्दी में बनाये हुए हैं। सरल हिन्दी में भी प्रभावी विज्ञापन आसानी से बनाया जा सकता है। शुद्ध हिन्दी में बने गूगिल का विज्ञापन इसका उदाहरण है। संवाद और संगीत की दृष्टि हिन्दी में बने विज्ञापन प्रभावी बन पड़ा है।

उदाहरण देखिए,

''जोर लगाके हाइसा

शोर लगाके हाइसा

    टूटेगा नहीं

    फेविकाल का काम है.''

''अनोखी शुद्धता

अनोखा असर - धारा घी''

    ''थोड़ी थोड़ी भारी

    थोड़ी थोड़ी हल्की

    थोड़ी सी पेटपूजा - काडबरीस''

    ''हर घर

    अमूल घर''

    ''स्वर्थ खाओ

    तन मन के खाओ - टाईगर बिस्कृट''

हिन्दी में बने संगीतात्मक विज्ञापन के लिए उदाहरण देखिए।

''कुछ खास है

हम सभी में

कुछ बात है

हम सभी में

बात है, खास है

कुछ स्वाद है, क्या स्वाद है ज़िन्दगी में

    'काडबरीस डायरी मिल्क'
    असली स्वाद ज़िन्दगी का-'

हिन्दी भाषा का विकास और हिन्दी विज्ञापनों की संभावनाओं को परखते यह ज्ञातव्य होता है कि हिन्दी भाषा को ज्यादा ओजस्वी और प्रवाहमयी बनाने में

हिन्दी विज्ञापनों का महत्वपूर्ण योगदान है। आज हिन्दी विज्ञापनों को ज़्यादा जनप्रियता मिलती है और अधिक स्वीकार्य हो गयी है। अपने उत्पाद को हिन्दी विज्ञापनों के माध्यम से प्रस्तुत करने से विज्ञापन कर्ता को भी लाभ है। अनेक भाषाओं में डब्बिंग करने का खर्च से वह बच जाता है। विज्ञापनों में आम बोलचाल की हिन्दी का प्रयोग करके विज्ञापनों को सरल और बोधगम्य भी बनाते जा रहे हैं। भारत की सांस्कृतिक जीवन को प्रस्तुत करने में हिन्दी विज्ञापन ज्यादा सक्षम स्थापित हुए हैं। हिन्दी भाषा को सशक्त बनाने और नई ढाल में डालने की हिन्दी विज्ञापनों का योगदान निरन्तर होता रहेगा।

സിൽവിയ പ്ലാത്ത് – സാഹിത്യത്തിലെ വെള്ളിവെളിച്ചം

Dr. Bincy Dominic

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ചില ചരിത്രാവലോകനങ്ങൾ കാലത്തിന്റെ പുതിയ വെളിപ്പെടുത്തലുകളെന്ന നിലയിൽ വ്യക്തിബോധത്തിൽ നിന്ന് സമൂഹബോധത്തിലേക്ക് തുറക്കുന്ന പ്രവേശികയായി മാറുന്നത് അസാധാരണമായ കാഴ്ചയല്ല. മൗനകുടീരങ്ങൾക്ക് ശബ്ദം ലഭിക്കുമ്പോൾ ചിലപ്പോഴെല്ലാം അവ വലിയ വിസ്ഫോടനങ്ങളിലേക്ക് നയിക്കപ്പെടുന്നു. കാലത്തെ വെളിപ്പെടുത്തുന്നതോടൊപ്പം പല കീഴ്ജീവിതങ്ങളേയും അതിന്റെ പൂർണാർഥത്തിൽ കാഴ്ചപ്പെടാനും അവയ്ക്ക് പ്രാപ്തിയു . സാമ്പ്രദായിക വേലിക്കെട്ടുകൾ തീർത്ത ഇടനാഴികളിൽ ഞെരിഞ്ഞമരുന്ന ദീനവിലാപങ്ങൾക്ക് വിശ്വസാഹിത്യത്തോളം ചെന്നെത്താനുള്ള ഊർജം ലഭിക്കുന്ന സന്ദർഭങ്ങളുമു . ശൂന്യമാക്കപ്പെട്ട ഇടങ്ങളിൽ നിന്ന് വരുന്ന പല വാക്കുകൾക്കും മറച്ചുവയ്ക്കപ്പെട്ട കാലത്തിന്റെ തീവ്രതയുണ്ടാകാം. അവ പലപ്പോഴും ചരിത്രനിർമിതിയുടെ ഭാഗമായി മാറുകയും ചെയ്യുന്നു. സിൽവിയ പ്ലാത്തിന്റെ എഴുത്തും ജീവിതവും ഇത്തരത്തിലുള്ള വായിച്ചെടുക്കലുകളായി സാഹിത്യലോകത്ത് ഇടം നേടിയെടുത്തതിന് ചരിത്രം സാക്ഷിയാണ്. വ്യവസ്ഥാപിത സങ്കൽപങ്ങളെ അട്ടിമറിക്കുന്ന ഒന്നായി എഴുത്തിനേയും മരണത്തേയും അടയാളപ്പെടുത്തി എന്നതിലുപ്പുറം ആഗോളതലത്തിൽ സ്ത്രീജീവിതത്തിന്റെ വ്യത്യസ്തസാഹചര്യത്തെ പുനരവലോകനം ചെയ്യാനും അവരുടെ മരണം ഒരു കാരണമായെന്നു പറയാം. ചരിത്രത്തിന്റെ പൊതുഭൂമികകളിൽ സ്ത്രീ സംവേദനത്വം ഒരു പ്രശ്നമെന്ന നിലയിൽ ചർച്ചചെയ്യാനുള്ള അവസരമൊരുക്കി എന്നതാണ് പിന്നീടങ്ങോട്ടുള്ള പഠനങ്ങൾ വ്യക്തമാക്കുന്നത്. ഫെമിനിസം, മനോവിശ്ലേഷണം തുടങ്ങിയ സൈദ്ധാന്തികാവലോകനങ്ങൾക്കും അവ വേദിയൊരുക്കി. സ്ത്രൈണാവസ്ഥയിൽ ഭാഷയുടെ പരിമിതി വിശദീകരിക്കുന്നവയായിരുന്നു അവരുടെ രചനകൾ.

സാഹിത്യകൃതികൾ എഴുത്തുകാരുടെ ജീവിതത്തിന്റെ പ്രതിഫലനങ്ങളായാണ് പൊതുവെ വായിക്കപ്പെടുന്നത്. സ്വാർജിതകലയുടെ പതിപ്പെന്ന നിലയിൽ അവ ആ കാലത്തേയും സമൂഹത്തേയും പ്രതിഫലിപ്പിക്കുന്നുമു . പൊതു- സ്വകാര്യ ഇടങ്ങളുടെ ശേഷിപ്പുകൾ സാംസ്കാരിക ഉൽപന്നങ്ങളിൽ കേന്ദ്രീകരിക്കപ്പെടുന്നതിന്റെ ഫലമായി സങ്കീർണമായ സാമൂഹ്യ സാമ്പത്തിക വ്യതിയാനങ്ങളും ഉ ാവുന്നു. അങ്ങനെ വരുമ്പോൾ വ്യക്തിതാൽപര്യങ്ങളും ലോകവും തമ്മിലുള്ള സംവേദാത്മക

അമ്പതുകളുടെ അവസാനവും അറുപതുകളുടെ തുടക്കവും അമേരിക്കയിലെ സ്ത്രീജീവിതത്തെ ഒരു കോൺസൻട്രേഷൻ ക്യാമ്പിനോടാണ് ബ്രെറ്റിഫ്രീദൻ ഉപമിക്കുന്നത്. പുറമേ കാണുന്ന ആർഭാടങ്ങൾക്കുമപ്പുറം അവർ നേരിടേ 1വന്ന അടിച്ചമർത്തലുകൾ സർഗാത്മകമായ ദാരിദ്ര്യത്തിലേക്ക് അവരെ നയിച്ചു. സാമൂഹികവും സാമ്പത്തികവുമായി കീഴ്നിലയിലായിരുന്നു അവരുടെ ജീവിതം. ആത്മാവിഷ്കാരത്തിന്റെ ഉത്ക്കടമായ മുഹൂർത്തത്തിൽ മനസും ശരീരവും സർഗവേദനയുടെ ക്രൂരവിപര്യയത്താൽ തളർന്നില്ലാതാകുന്ന അവസ്ഥ സിൽവിയയുടെ രചനയിലെ ചിതറിയ ബിംബങ്ങൾ ഓർമിപ്പിക്കുന്നു. വൈയക്തികതയുടെ പുറംകാഴ്ചകൾക്കപ്പുറം സാമൂഹികവും ചരിത്രപരവുമായ അടിസ്ഥാനം അവയിലു ്. കവിതയിൽ കോറിയിടുന്ന ബിംബങ്ങളിൽ പലതും നാസി കോൺസെൻട്രേഷൻ ക്യാമ്പിലെ രൂപകങ്ങളാണ്. തീയും ബോംബുകളും യുദ്ധഭൂമികളും വിക്ഷോഭങ്ങളായി പ്രവഹിക്കുന്നതിനിടയ്ക്കും കടന്നുവരുന്ന അടുക്കളബിംബങ്ങളും ഐസ് ബോക്സും ആശുപത്രിബിംബങ്ങളും എല്ലാം കൂടിമറിഞ്ഞുകിടക്കുന്ന *ദ ആപ്ലിക്കന്റ്* എന്ന കവിത ഉദാഹരണമാണ്.

വ്യക്തിയും ലോകവും ഒന്നായിമാറുന്നത് അവയിലെ ഭാവാവിഷ്കാരത്തിന്റ സവിശേഷത കൊ ുകൂടിയാണ്. സാമ്പ്രദായിക പാശ്ചാത്യ സംസ്കാരത്തിന്റെ ചിത്രം കാഴ്ചപ്പെടുത്തുന്നതോടൊപ്പം കാലികമായ മാറ്റത്തിന്റെ അനിവാര്യതയിലേക്കുകൂടി അവ വിരൽചൂ ുന്നു. ക്യാപ്റ്റലിസ്റ്റ് സാമ്പത്തിക വ്യവസ്ഥയുടെ സംഭാവനയായ പിതൃദായക കുടുംബ വ്യവസ്ഥയുടെ വ്യക്തമായ ചിത്രം അവയിലു ്. വ്യവസ്ഥാപിത നിയമഘടനകൾ സ്ത്രീയെ പരിമിതപ്പെടുത്തുന്ന വിധം *ദ ആപ്ലിക്കന്റിന്റെ* പ്രധാന ചർച്ചയാണ്. തിരഞ്ഞെടുപ്പുകൾക്ക് അവസരമുള്ള പുരുഷനും, തൊഴിലിടങ്ങളിലും ജീവിതത്തിലും തിരഞ്ഞെടുപ്പുകൾക്ക് അവസരം നിഷേധിക്കപ്പെടുന്ന സ്ത്രീയും തമ്മിലുള്ള വൈരുദ്ധ്യത്തെ സിൽവിയ പ്ലാത്ത് അവതരിപ്പിക്കുന്നത് 'എഴുതിത്തുടങ്ങാത്ത ശൂന്യപത്രമെന്നാണ്'. എല്ലാ മേഖലയിലും ഇത്തരം പരിമിതപ്പെടുത്തലുകൾ അവളെ കാത്തിരിക്കുന്നു. അനുവദനീയമായവ സ്വീകരിക്കുക എന്നല്ലാതെ മനസ്സുപറയുന്നത് നേടിയെടുക്കാനാവാത്തതിന്റെ ശൂന്യതയാണ് ഇവിടെ പ്രതിപാദ്യമാകുന്നത്. അവർ ജീവിച്ചിരുന്ന കാലത്തെ ശക്തിബന്ധങ്ങളെക്കുറിച്ചുള്ള വ്യക്തമായ കാഴ്ചപ്പാടും വസ്തു-വിഷയ സംബന്ധിയായ സംവേദനാത്മകബന്ധത്തെക്കുറിച്ചുള്ള അവബോധവും ഭാവിയെക്കുറിച്ചുള്ള സ്വയാവബോധവും കവിതയിലെ വിഷയമായി മാറുകയായിരുന്നു. ലളിതമെങ്കിലും ശക്തമായ വാക്കുകളിൽ നിറഞ്ഞുനിന്ന സ്വാനുഭവത്തിന്റെ ഊർജമാണ് വിശ്വസാഹിത്യത്തിന്റെ അതിരുകൾക്കപ്പുറം നയിക്കപ്പെടാനുള്ള ചൈതന്യം രചനകളിൽ നിറച്ചത്.

മുപ്പതുവർഷത്തെ ഹ്രസ്വമായ ജീവിതംകൊ ് അവർ പറഞ്ഞുവച്ചത് അര നൂറ്റാ ിനപ്പുറം പഠനവിധേയമാകാനുള്ള കാരണവും മറ്റൊന്നല്ല. 'ദൈവമാകാൻ മോഹിച്ച പെൺകുട്ടി' എന്നു വിളിക്കപ്പെടാൻ ആഗ്രഹിച്ച (1949 നവംബർ 13 ലെ ഡയറിക്കുറിപ്പ്) അവൾ പറയുന്നു. 'വാക്കുകൾ കൊ ് ഞാനൊരു ലോകം തീർക്കും. അവ എനിക്ക് ബൗദ്ധികവും വൈകാരികവുമായ ശക്തി നൽകുന്നു'. വാക്കുകൾ കൊ ് പലതും സൃഷ്ടിക്കാനും നശിപ്പിക്കാനുമാകുമെന്ന തിരിച്ചറിവ് അവരെ തികച്ചും ഉദ്ബുദ്ധയാക്കി. സൈദ്ധാന്തികവും അക്കാദമികവുമായ ചർച്ചകൾക്ക് ഇടം നൽകിയ ആ രചനകൾ തലച്ചോറുള്ള സ്ത്രീക്ക് ശരീരവും ആത്മാവും ഒന്നുതന്നെയാണെന്ന ചിന്ത പ്രകാശിപ്പിക്കുന്നു. സ്ത്രീജീവിതത്തിന്റെ വ്യത്യസ്തകാഴ്ചപ്പാടുകൾ നൽകുന്ന ഭാവബന്ധങ്ങൾ ഹർഷോന്മാദത്തോടെ വാക്കുകളിൽ നൃത്തം ചെയ്യുന്നു. കാലിക ചരിത്രാവബോധത്തിന്റേറ്റ പ്രഹരങ്ങളായി മാറിയ ആ കവിതകളിൽ സ്ത്രൈണതയുടെ പ്രസരിപ്പും ആത്മവീര്യവും പോരാട്ടങ്ങളും ഒപ്പം നിസ്സഹായതയുടെ അമർഷവും ഏകാന്തതയുടെ കയ്പും ഇടകലർന്ന സമ്മിശ്രഭാവമാണുള്ളത്.

മാതൃത്വത്തിന്റെ ആനന്ദാനുഭൂതികൾക്കൊപ്പംതന്നെ അഴുക്കുനിറഞ്ഞ പാത്രങ്ങളും അവരെ വേട്ടയാടി. അവയ്ക്കിടയിൽ ബാലൻസു ചെയ്യാൻ പാടുപെടുന്ന സംഘർഷമുഖരിതമായ അന്തരീക്ഷത്തിൽ നിന്നാണ് വാക്കുകൾ പിറക്കുന്നത്. അവിടെ തടുത്തുനിർത്താനാകാത്ത സർഗ്ഗാത്മകതയുടെ കുതിപ്പുകൾ ഒലിച്ചുപോകാതെ കാത്തുസൂക്ഷിക്കാമെന്ന പ്രതീക്ഷയും അതിന്റേ ആഘാതവുമാണ് അവരുടെ തകർച്ചയുടെ കാരണമായി സൈദ്ധാന്തികർ വിലയിരുത്തുന്നത്.

കവിതയും ജീവിതവും ര ല്ലെന്ന വാദപ്രകാരം എഴുത്തുകാരിയുടെ ജീവിതത്തിലേക്കുള്ള യാത്ര കവിതയുടെ ആഴങ്ങളിലേക്കുള്ള തിരച്ചിലുകളായി മാറുന്നു. 1950കളിലെ സാമ്പ്രദായിക കുടുംബത്തിലെ വളർന്ന അവരെ പിതൃമരണത്തിന്റെ അരക്ഷിതത്വവും ഭയവും ജീവിതകാലം മുഴുവൻ വേട്ടയാടിക്കെ ിരുന്നു. അവരുടെ രചനകളിലെ ഇലക്ട്രാകോംപ്ലക്സിന്റെ സാന്നിധ്യം സൈദ്ധാന്തിക വിശകലനങ്ങൾക്ക് ഇടം നൽകിയിരുന്നു. സുഹൃത്തായ ഡിലൻ തോമസിലും ഭർത്താവായ ടെഡ് ഹ്യൂഗ്സിലും അവർ തേടിയത് നഷ്ടപ്പെട്ട പിതൃവാത്സല്യമാണ്. അത് ലഭ്യമാകാത്തതിന്റെ ആഘാതം അവർക്കു മരണതുല്യമായിരുന്നു.

പ്രകൃതിയെ സ്നേഹിച്ച ആ കലാകാരിയുടെ മരണത്തിന് പ്രകൃതിയും പശ്ചാത്തലമൊരുക്കി. നൂറുവർഷക്കാലത്തിനിടയ്ക്ക് ല ൻ ക ഏറ്റവും ഭീകരമായ ശൈത്യകാലത്ത് ര ു പിഞ്ചു കുഞ്ഞുങ്ങളുമൊത്ത് തന്റെ ജീവിതത്തിന്റെ ഭയാനകമായ ദിവസങ്ങളെണ്ണിക്കഴിയുന്ന പ്രതിഭാധനയായ എഴുത്തുകാരിയുടെ ജീവിതത്തിലെ

അവസാനകവിതകളിലൂടെ കടന്നു പോകുമ്പോൾ ഈയൊരവസ്ഥയുടെ തീവ്രത കാണാനാകും.

എട്ടാം വയസ്സിൽ രചനാലോകത്തേക്ക് കടന്നുവന്ന സിൽവിയയുടെ ആദ്യകവിതാസമാഹാരം 1960ലാണ് പ്രസിദ്ധീകരിച്ചത്. 1963 ഫെബ്രുവരി 11 ന് സ്വയം ജീവനൊടുക്കി. അമ്മയ്ക്കും സഹോദരനും എഴുതിയ 696 കത്തുകൾ *ലെറ്റേഴ്സ് ഹോം* എന്ന പേരിൽ പ്രസിദ്ധീകരിച്ചത് മരണശേഷമാണ്. 14-ാം വയസ്സിലെഴുതിയ *ഐ തോട്ട് ദാറ്റ് ഐ കുഡ് നോട്ട് ബി ഹേർട്ട്* എന്ന കവിതയിൽതന്നെ ശൂന്യമായ ഹൃദയത്തിന്റെ വേപഥുവാർന്ന നിസ്വനം കേൾക്കാനാകും.

"എന്റെ ആത്മാവ് ആനന്ദം കൊ ˘

നിറഞ്ഞിരുന്നു എന്നിട്ടും

ആനന്ദത്തിനുമാത്രം

കൈക്കൊള്ളാനാവുന്ന മൂർച്ചയേറിയ

വേദന ഞാനനുഭവിച്ചു

പെട്ടന്ന് എന്റെ ലോകം ചാരനിറമായി

ഇരുട്ട് എന്റെ ആനന്ദത്തെ തുടച്ചു മാറ്റി

വേദനിപ്പിക്കുന്ന, വിരസമായ

ശൂന്യതമാത്രം അവശേഷിപ്പിച്ചു."

ഈയൊരു ശൂന്യത അവരുടെ രചനകളിലും ജീവിതത്തിലും ഒഴിവാക്കാനാവാത്ത സാമീപ്യമായി. *ദ ആപ്ലിക്കന്റ്* എന്ന കവിതാസമാഹാരം ഉദാഹരണമാണ്. 1962 ൽ ഭർത്താവ് ടെഡ് ഹ്യൂസിന് ആസിയ വിവെൽ എന്ന കുടുംബസുഹൃത്തുമായുള്ള ബന്ധം അറിഞ്ഞതുമുതൽ കടുത്ത വിഷാദം അവരെ കീഴടക്കി. ഏറെ പ്രശസ്തമായ *ബെൽജാറിന്റെ* (വിക്ടോറിയ ലൂക്കാസ് എന്ന തൂലികാനാമത്തിലെഴുതിയത്) ര ാംഭാഗമായ *ഡബ്ൾ എക്സ്പോഷർ* എന്ന നോവൽ കത്തിച്ചുകളയാൻമാത്രം പോന്നതായിരുന്നു അതേതുടർന്നു ായ മാനസികസംഘർഷം.

ഒരു ചിത്രകാരി കൂടിയായ സിൽവിയയുടെ കവിതകളിലെ വർണങ്ങൾ നൽകുന്ന അർഥവ്യാപ്തി ബഹുമുഖശോഭ കൈക്കൊള്ളുന്നു ˘. അവ മനസ്സിന്റെ പ്രതിഫലനങ്ങളെന്നോണം കവിതയിൽ വ്യാപിച്ചുകിടക്കുന്നു. *ഏരിയലിലെ*

കവിതകളിലും ചിത്രകലാസങ്കേതങ്ങൾ പ്രയോജനപ്പെടുത്തുന്നതു കാണാം. പ്രഭാതത്തിൽ കുതിരസവാരി നടത്തുന്ന സ്ത്രീയുടെ ചിന്തകളെ അപഗ്രഥിക്കുന്ന ഈ കവിത തുടങ്ങുന്നതുതന്നെ ഇരുട്ടിനെ അഭിസംബോധന ചെയ്തുകൊ ാണ്. എഴുത്തുകാരിയുടെ സ്വരൂപാന്തരണം നിരൂപകർ ഈ വരിയിൽ വായിച്ചെടുക്കുന്നു ്. കുതിച്ചുപായുന്ന കുതിര ഇവിടെ എഴുത്തുകാരിതന്നെയാണ്. ഇരു ഭൂപ്രകൃതി, കറുപ്പ്, വെളുപ്പ്, ചുവപ്പ് നിറങ്ങൾ കവിതയിലെ നിത്യസാന്നിധ്യമാണ്. ഇരുളിലെ സ്ഥൈര്യം, നനുത്ത നീല, ഇരു രക്തച്ചുവപ്പ്, ചുവന്ന മേഘങ്ങൾ ഇവയെല്ലാംകൊ ് നിറഞ്ഞ കാവ്യാന്തരീക്ഷത്തിൽ ചിത്രകലാസങ്കേതങ്ങൾ പ്രയോജനപ്പെടുത്തി ഭാവാവിഷ്കരണം നടത്തിയിരിക്കുന്നു. കറുപ്പ്, വെളുപ്പ് ദ്വന്ദ്വങ്ങളുടെ സംയോജനത്തോടൊപ്പം ചുവപ്പും കവിതയിലെ മുഖ്യവർണമായി നിറഞ്ഞു നിൽക്കുന്നു. എഴുത്തുകാരിയെ പിന്തുടരുന്ന ഇരുളിന്റെ പ്രതീകമാണ് *ഡാഡി* എന്ന കവിതയിലെ 'കറുപ്പ്', 'കറുത്ത ഷൂ', 'കറുത്ത മനുഷ്യൻ', 'കറുത്ത ടെലഫോൺ', 'കറുത്തഹൃദയം' തുടങ്ങി ചുറ്റുപാടുമുള്ള കറുപ്പിന്റെ ഭയാനകത കവിതകളിലുടനീളം മനസ്സിന്റെ പ്രതീകങ്ങളായി വ്യാപിച്ചു കിടക്കുന്നു. *നിക്ക് ആന്റ് കാൻഡിലിൽ* 'കറുപ്പ്' പിതാവിന്റെ മരണത്തിന്റേയും, 'മേഘത്തിന്റെ വെണ്മ' മകളുടെ പരിശുദ്ധിയുടേയും പ്രതീകമാണ്. ചുവപ്പ് ഹൃദയരക്തത്തിന്റെ നിറമാണ്. മെഴുകുതിരിയുടെ വെളുപ്പ് നിറം, തേനീച്ചക്കൂടിന്റെ വെള്ളനിറം, മരണത്തിന്റെ വെണ്മ തുടങ്ങി വെളുപ്പിന് അത്ര ശോഭനീയമല്ലാത്ത അർഥവും നൽകുന്നു. ആകാശത്തിന്റെ മങ്ങിയ നീല, മെഴുകുതിരി വെളിച്ചത്തിന്റെ മഞ്ഞയും നീലയും കലർന്ന നിറം എന്നിവയും കവിതയിൽ സാന്നിധ്യമറിയിക്കുന്നു ്.

ബിംബങ്ങളും പ്രതീകങ്ങളും പ്രകാശിപ്പിക്കുന്ന അർഥതലങ്ങൾ, വാക്കുകളുടെ വിന്യാസമാതൃക ഉയർത്തുന്ന ശക്തിചൈതന്യം ഇവ സിൽവിയ പ്ലാത്തിന്റെ രചനകളുടെ സവിശേഷതകളായി വിലയിരുത്തപ്പെടുന്നു. അടുക്കളോപകരണങ്ങൾ, പാചകം, ഭക്ഷണപദാർഥങ്ങൾ തുടങ്ങിയ ഇമേജുകൾ സ്ത്രീയെന്ന നിലയിലുള്ള സ്വയാവബോധത്തിന്റേയും കടലാസ്, പേന, ടൈപ്പ്റൈറ്റർ തുടങ്ങിയ ബിംബങ്ങൾ സർഗ്ഗചേതനയുടേയും ബിംബാവലികളാണ്. ജീവിതത്തിൽ നിന്നും കലയെ അകറ്റുന്ന എന്തിനേയും മടുപ്പോടെ വീക്ഷിക്കുന്ന മനസ്സ് രചനകളിൽ കാണാനാകും. ശൈത്യകാലം നഷ്ടബോധത്തിന്റെ സാന്നിധ്യമായാണ് കടന്നുവരുന്നത്. അന്തരീക്ഷത്തിന്റെ തണുപ്പിനേക്കാൾ മനസ്സിന്റെ മരവിപ്പാണ് ഇവിടെ വിഷയമാകുന്നത്. ഭൂദൃശ്യങ്ങളും മനസ്സും തമ്മിലുള്ള സമാന്തരത്തെ അവ ഓർമിപ്പിക്കുന്നു. അവസാനകൃതികളിൽ മാതൃത്വത്തിന്റെ ചെറിയ സന്തോഷങ്ങളു ്. എന്നാൽ അതിനെയെല്ലാം കടത്തിവെട്ടി കടന്നുവരുന്നത് നെഗറ്റീവ് ബിംബങ്ങളാണ്. ഭേദപ്പെടാത്ത മുറിവുകൾ, മരുന്നുകൾ, അലോസരപ്പെടുത്തുന്ന മഴ, തലയോട്ടി തുടങ്ങിയവയെല്ലാം ഉദാഹരണങ്ങളാണ്.

സാംസ്കാരിക സാമൂഹികവീക്ഷണത്തിൽ സമീപിക്കുമ്പോൾ അത്തരമൊരു വ്യവസ്ഥയിലേക്ക് സ്വയം പരുവപ്പെടാനുള്ള അവരുടെ പരിശ്രമങ്ങൾ കവിത കാഴ്ചപ്പെടുത്തുന്നു. ജീവിതം അതിന്റെ സന്ദർഭഘടനയിൽ സവിശേഷ പ്രകടനപാടവത്തോടെ രചനകളിൽ കടന്നുചെന്നു. പൊതു-സ്വകാര്യ ഇടങ്ങൾ തമ്മിലുള്ള അതിരുകൾ മാറ്റിമറിക്കപ്പെടുന്നു. ഇരുപതാംനൂറ്റാ ിലെ അമേരിക്കൻ സ്ത്രീജീവിതങ്ങളുടെ അടയാളപ്പെടുത്തലുകൾ എന്നതിനപ്പുറം കാലത്തെ അതിജീവിക്കുന്ന യാഥാർഥ്യങ്ങളിലേക്കുള്ള ചു ുപലകകളായി ഈ രചനകൾ മാറുന്നു. സർഗ്ഗധനയായ എഴുത്തുകാരി അഭിമുഖീകരിക്കേ ി വരുന്ന പ്രശ്നങ്ങളിലേക്ക് അവ വിരൽചൂ ുന്നു. ദൈനംദിന ജീവിതത്തിന്റെ നൈരന്തര്യം വെളിപ്പെടുത്തുന്നതോടൊപ്പം സാമ്പ്രദായിക സങ്കൽപങ്ങളോടുള്ള മടുപ്പും വെറുപ്പും കൂടി പ്രകടമാക്കുന്നു ്. അതിനിടയിൽ ഞെരിഞ്ഞമരുന്ന സർഗ്ഗാത്മതയുടെ സാന്നിധ്യമായി കടലാസും പേനയും യാന്ത്രികതയെ ജീവിതത്തിന്റെ വിരസത പ്രകടമാക്കുന്ന ടൈപ്പ് റൈറ്ററും കവിതകളിൽ സ്ഥാനം പിടിക്കുന്നു. ഇതിനെല്ലാമിടയിൽ ടെഡിൽ നിന്ന് പ്രചോദനംകൊ ുായ പ്രകൃത്യുപാസനയുടെ ഭാഗമായി നിറഞ്ഞുനിന്ന പ്രകൃതിവർണന ജീവിതത്തിന്റെ യാന്ത്രികതയ്ക്ക് ദിവ്യൗഷധമായി പ്രകൃതി അവയിൽ സാന്നിധ്യമറിയിക്കുന്നു. ഇത്തരം ഇമേജറികളുടെ സമുചിതമായ സന്നിവേശത്തിലൂടെ കാലത്തെ അതിജീവിക്കുന്ന സാമൂഹ്യ ബോധത്തിലേക്ക് ചെന്നെത്തുന്നു. ഈ ബിംബങ്ങളും ചിഹ്നങ്ങളും അപനിർമിച്ച് കവിതയുടെ ഉൾത്തലങ്ങളിൽ നിന്നുള്ള വായനകൾ പല അടരുകളായി അർഥപ്രകാശനം സാധ്യമാക്കുന്നു. നിഗൂഢവും പരസ്പരവിരുദ്ധവുമായ ആശയങ്ങളിൽ നിന്ന് വ്യത്യസ്തതലങ്ങളിലേക്കുള്ള ആശയസംവേദനം നടക്കുന്നു. അവ സ്വത്വത്തിനും സത്യത്തിനുമിടയ്ക്ക് നവമേഖലകൾ കെ ത്തുകയും കാലദേശഭേദമെന്യേ അനുവാചകശ്രദ്ധയാകർഷിക്കുകയും ചെയ്യുന്നു. സൈദ്ധാന്തികാവലോകനങ്ങളായി, നോവലുകളായി, സിനിമ-നാടക രൂപാന്തരണങ്ങളായി, അക്കാദമികപഠനങ്ങളുടെ വിശാലശേഖരങ്ങളിൽ സിൽവിയ പ്ലാത്ത് ഇന്നും നിറഞ്ഞുനിൽക്കുന്നതിനു കാരണം ആ വാക്കുകളിലെ അനുഭവാവിഷ്കാരത്തിന്റെ തീവ്രതയും സത്യസന്ധതയുമാണെന്നു കാണാം.

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SINGLETON

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Abstract

The Singleton has emerged as a distinct social category in the rapidly changing Kerala society. The present study attempts to show the change from Spinster to Singleton and the generation differentials of single women in Kerala, India. The study also made an attempt to find out the factors that led women of Kerala to singlehood they have in their unique life style.

The focus of the study is single women of two generations, 225 spinsters and 225 singletons. Single women from three districts- Thiruvanathapuram, Ernakulam and Kozhikode constituted the sample for the study. The different aspects of the singlehood were collected with the help of Interview schedule and the scale developed was used for measuring adjustment of the single women. The economic theory of Marx, Women's economic empowerment theory of Blumberg, Dramaturgical model of role theorists, Becker's labelling theory of deviance, Michalo's Multiple-discrepancy theory are the theoretical framework of the study.

The analysis of the study reveals that there is difference between spinsters and singletons in all background variables and dependent variables. The findings of the study shows that the motivational factors-chance and choice of single women in two generations. Single women, who selected singlehood by their own choice and singletons with high expectations, have low level of life satisfaction, even though they have high adjustability in their life.

KEYWORDS: Single Women, Spinsters, Singletons, Generation Differentials.

Introduction

One of the most prominent characteristics of the developed and technological advanced societies of the present age is a high rate of mobility and fast social change. The great cultural diversity makes a range of life styles more possible. The young people of today especially in the urban higher economic sector want more freedom and no strings. Singleness is more prevalent in Europe and the United States and has increased over the last decades. Even in western countries single men have higher social status than women. In single women's experience, there is still a societal inclination to wonder if there is something 'wrong' with women who have not married (Kramarae Cheris, 2000).

Singleness among women is more typical in the west, but has increased elsewhere as well. This may be due to modernization or to a breakdown of social patterns. Spinster is an old fashioned word for women who never marry. To many, this word has a negative connotation. However, many also believe a woman who never marries is a woman on her own-a person who is independent and self-sufficient. A new stereotype has developed of a city single-"Singleton", who does not 'want' a man and is single through choice.

From there, the Indian unmarried women had faced many problems in every sphere of the life and faced low status in the society. The recent years have brought about a great change

in the life of women in Kerala, influencing their attitudes, values and aspirations. Educated, young malayalee women in the twenty first century are career oriented, happy and are remaining single- all by choice. The percentage of these single women is very small, but the growing economic independence of women as well as gradual changes in patterns of life style, may affect these rates, in the future. Higher education enables a girl to become aware of alternatives to marriage. Legally speaking the traditional idea of marriage has been replaced with a set of new ideas in which marriage is no longer a group concern. It is purely a personal affair leading a man and women to seek social, psychological and economic happiness by pursuing their own free will. The most conspicuous innovation is the women's achievement of an alternative-singleton to the once indispensable end in life-marriage. Young people of today especially in the urban higher economic sector are well informed independent. But the single status of women has yet not been socially recognized as a legitimate status for women. This paper tried to find out how Kerala singletons are surviving and what are the factors that leads them to singlehood.

OBJECTIVE:

1.   To understand the factors leading to singlehood.

Concept clarification

Singleton: Singleton is used here for those urban modern career oriented women who remain unmarried after the age of thirty-five. It means that they remain single by their own choice or by chance.

Modern singletons were expected to be found in urban areas. For the purpose of this study, researcher has collected the primary data from the Urban Kerala – Thiruvanathapuram, Ernakulum and Calicut. It was not possible to get a clear statistical record of the singletons in Kerala as they were grouped along with all unmarried women like religious people in the last census report. So in this study snow- ball sampling is used to identify the respondent. 225 samples were located from younger generations (35-50). A multi- dimensional interview schedule was used to collect data and available literature on singletons was extensively used to understand the factors of singlehood. The major variables used in this study are education, occupation and religion

Analysis and findings:

An analysis was made about the social and economic background of the singletons. This would help us to get a clear picture of the singletons in our study and aid in understanding how their backgrounds are related to the factors leading to singlehood. Kerala is a multy-religious society and religion is inextricably woven into the entire phenomenon in the society. It is a dominant factor in the life of the people and has its own code in matters relating to birth, marriage and death. Actually, this situation is increasing the rate of singletons in our society. Our study also supports this idea. That is, the Christian singleton rate is high compare to Hindu singletons.

Theodorson's (1968) study among Indians, Burmese and Chinese female college students in Singapore, points out that in all cultures motivation to marry was traditionally supported by strong sanctions. Krishnakumary (1987) also found in her study that family circumstances, financial constraints and a combination of several factors influenced a large number of females to remain single. However, she indicated that very few girls remain single out of

their own choice. In the study of singlehood, the motivational factor which motivates them to become single is very important. Many educated employed women who give importance to career and advancement prefer to remain single. Blumberg (2005) says that economic independence allows single women to 'life options,' allowing her to choose her own life style whether married or single. In Kerala not much study has been done in the field of 'singlehood', or to find whether girls deliberately decide not to marry or whether their marriage is deferred due to circumstances. So an attempt is made to find out the factors that made them single. The objective of the study is to find out the factors that motivated women in Kerala to singlehood. Analysis of earlier studies shows that the motivational factors can be grouped into chance factors and choice factors.

A. Factors in connection with their own choice
  1) Freedom and independence   2) Unhappy married life of others
  3) Did not meet the right person   4) Failure in love affair
  5) Social Service

B. Factors in connection with chance
  1) Financial   2) No one to take care
  3) Horoscope Problems   4) Physical appearance
  5) Dislike sex life and opposite sex

These are inter connected multiple reasons for singlehood. All these factors were given in the interview schedule and the respondents were asked to rank these factors, according to their situation. Based on the nature of their motivation (chance/ choice), the respondents were grouped into two groups- chance group and choice group as shown in the Table No.1. They belong to the section (A or B) where they got more score.

Table No:1 Motivational factors

Generation Motivational factor	Singletons
Chance	**99** *44*
Choice	**126** *56*
Total	**225** *100*

Out of 225 respondents, 56 per cent of them revealed that 'choice' led them to become single. At the same time, 44 per cent of them pointed out that their singlehood is connected with circumstantial or chance factors because the parents were unable to arrange the marriage of their daughter or other related factors. This rate is low in this study. The findings of the study is supported by Merchant (1935) in his work, "Changing Views on marriage and the family" which states that among the educated urban college students at Madras, majority (78 per cent) of them favoured life style by their own choice. That is, the term life style by choice means that they expected more freedom to marry or not to marry.

Based on the ranks given by the respondents to each factor a ranking analysis was carried out. The rank analysis as shown in table No: 2 shows that the factors that motivated singletons to singlehood are different.

Table No: 2 Rank given by singletons to the factors of singlehood

Rank	Singletons
1	Freedom and independence
2	Financial
3	Unhappy married life of others
4	Did not meet the right person
5	No one to take care
6	Failure in love affairs
7	Social service
8	Horoscope problems
9	Physical appearance
10	Dislike opposite sex and sex life

1.   Freedom and Independence

The term 'independence' usually refers to financial independence but sometimes it also refers to independence from the ties of marriage and family responsibilities. Modern society, give a golden chance to girls to enjoy the freedom and independence as equal to boys. This leads single women to thirst for more freedom and independence. With the passage of time, and of the advent of education the attitude of women changed immensely. The education and the employment of women, in turn, change her attitudes and opinions on the social aspects of various institutions such as marriage, family etc. Modern girls realize that marriage is a barrier for freedom and it is enslavement for women. Through modern singlehood, they try to attain, what Marx said for women emancipation, the female solidarity and group consciousness. So they avoid marriage. In the present study, 'freedom and independence' factor is considered the most important factor t for singletons and led them to singlehood.

Economic power gives women substantial "life options". The "life options" mainly deals with two things; "Voice and Vote" in marriage (whether, when and with whom) and relative freedom of movement. Here, these highly educated and employed singletons enjoyed economical power as well as social status in the society. So, it can be inferred that their economic power is the fundamental reason for their singlehood life style. The growing economic independence of women, as well as gradual changes in patterns of mate selection, may affect these rates in the future.

2.   Financial Factor

The analysis of the earlier studies compelled the researcher to find out how far the financial factor influenced the decision about singlehood. In the study, financial factor included all the financial aspects such as dowry, lack of economic security and poor economic back ground of single women's family and their salary as the sole income of the family. Financial

constraints are considered a very important factor for singlehood in our society. The rank analysis shows that this is second most important factor for singletons.

Unemployed women are settled earlier by their parents, but when their daughters are employed, parents become more selective and this tends to postpone marriage (Muriken 1975). Under present circumstances, an employed daughter is no longer able to help her parents once she gets married, but is expected to give her salary to her husband. So, her marriage may be postponed indefinitely (Blumberg and Dwaraki 1980). It seems that a highly educated daughter may now be considered eligible to take the son's place in supporting parents and younger siblings.

3.   Unhappy Married Life and Divorce

In the past, most of the couples enjoyed their married life. But now the condition has changed. The number of unhappy married couple's rate is increasing and it is giving a negative picture about marriage to the younger generation. It can be said that modern single women give more preference to happy life of singletons than unhappy married life.

4.   Did not meet the Right Person

Educated employed girls would not get educated boys. Table No: 2 show that this is the fourth factor for singletons. Singletons are economically independent and highly educated. So it is very difficult to find a suitable person for educated girls. They prefer to stay single than to suffer with a wrong guy. This might be the reason for them to remain single by choice.

5. No one to take Enough Care

In India, neighbors, relatives, friends as well as professional match makers may be involved in arranging marriages. Here, girls won't take personal interest for this. Among the single women, some of them indicated their singlehood is the result of lack of responsible person to arrange the marriage.

6. Failure in Love Affairs

Love is very common feeling and without love and romance, marriages do not take place in the western countries. But, in Indian continent arranged marriages are supported by all and even now, love marriages are not encouraged. The present study found that for the singletons this is the sixth important factor.

7.   Social Service

In the present study from table No: 2, it can be seen that it is only the seventh factor for singletons. It indicates that there is a general assumption that modern youngsters are more individualistic and not social service minded. From the analysis, it can be seen some women remained single to perform social services but this rate is decreasing gradually.

8. Horoscope Problems

According to Jethani (1994) single women's desire to remain unmarried has nothing to do with religion but with horoscope problems especially in Hindu religion. Table No: 2 depict this factor. It is still practiced in our society and its importance is not decreasing. To singletons this is the eighth one.

9. Physical Appearance

Pandey (2002) found in her study that the majority of Indian women who have chosen careers instead of marriage have done so because they are physically less attractive than others. The table No: 2 shows that this is not a significant factor to young generation. That is, this is the ninth one for current singletons.

10.   Dislike sex life and opposite sex

Respondents were not willing to reveal their sexual experiences to others. Their ranking procedure indicates that this factor is the last one. That Based on the rank analysis itself it can be seen that the factors that induced them to singlehood is different.

Conclusion

The lifelong singlehood has been a significant alternative to marriage throughout the history. In this chapter an attempt is made to find out whether these single women deliberately embraced it or whether, it was forced upon them. It was found that the factors for singlehood aroused by familial as well as personal specialties. One of the objectives of the study is to find out what motivated women in Kerala to singlehood. Based on the earlier studies the motivational factors were grouped into chance factors and choice factors. A rank analysis was carried out based on the ranks given by the respondents. While, it was freedom and independence that made the singletons to choose singlehood.

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Importance of 'Life Skills' in Elderly Woman's life with Special Reference to Elderly Women Residing in Thrissur

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Abstract

In the present ultra-modern computerized era, society work hard to outnumber the elderly with the old-age homes as a false part of social security. Certainly there is tremendous changes occurred in our society as an after effect of industrialization, individualization, modernization etc. These evolutionary changes molded social being into an individually oriented secluded person. The glorious position of elderly false steeply and we all have to pass through this phase. We have to explore their existing life skills which make them capable to live happily and prestigiously in their later age as this is an age of harvesting. In this context descriptive method was undertaken to explore their life skills. Analysis was based on primary data collected through structured interview schedule. Samples were selected with random sampling method from Thrissur district.

Introduction

According to WHO life skills are "abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life". "Life skills" refers to the skills usually associated with managing and living a better quality of life. They help us to accomplish our ambitions and live to our full potential. There is no definitive list of skills necessary for human being. Life skills are behaviours used appropriately and responsibly in the management of personal affairs. They are set of human skills acquired through learning or direct experience that are used to handle problems and questions commonly encountered in daily human life. These vary greatly depending on social norms and community expectations. We all want to accomplish anything in life. For that we should realize our full potential. Mastering certain skills is very important for this. Life skills are learned ones and mindfully incorporated in our behaviour.

All over the world the population of aged is increasing. Subtle examination of demographic structure stresses two points-ageing population and feminization in elderly. Old age is visualized as diminished physical and psychic activity and a plethora of problems. India is not exempted from this. Among Indian states, Kerala has the largest proportion of elderly population and the growth rate among the aged is increasing. Life skills has significant role to execute the daily activities in everyone's life especially for elderly. Inter personal communication has been described as a critical tool for life adjustment, linking people to their environment. People use communication to perform many functions in their day-to-day activities, including employment, social and leisure activities, community involvement,

personal relationships, and meeting needs for daily living. Many of these functions change with typical aging. People retire from careers. Their social circles and personal relationships may change as they adjust their life roles and change their activity patterns. Social skills help elderly to communicate and interact with each other, both verbally and non-verbally.

Review of Literature

Compton (2009) in his book 'The indispensable book of practical life skills' states that all those skills that you never quite managed to learn but that older generations seem to know intuitively will suddenly be at your fingertips-whether it be skinning an animal, making compost or mending a hem. This guide is utterly indispensable. Terry Herley, in his article 'Cognitive activities for the elderly' described that there are a number of elderly people that never show any signs of an age-related decline in cognitive functions'. According to Herley, cognitive skills are the mental capabilities that a person has which allow them to process all the information they receive from their senses. According to Yorkston, Bourgeois and Baylor (2011), interpersonal communication has been described as a critical tool for life adjustment, linking people to their environment. In 'Becoming Human the Origins and Development of Women's Human Rights', Fraser (2003) states that the original contributors to women's human rights were those who first taught women to read and thus to explore the world outside the home and immediate community. The prerequisites for development and implementation of women's human rights are education.

Chakrabarti (2006), in 'Aged Artisans in Tribal Society a Note on Creative Talents of the Aged Tribal', states that among artisans in tribal society the old persons are not treated as liabilities but assets for their family and society. Attaining old hood is valuable for hem as the aged are regarded as the storehouse of the experience and knowledge. The tradition of crafting the objects or depicting sketches, painting follows a definite indigenous technique that is transmitted by the aged skilled experienced craftsman to younger generation through oral tradition. So the tribal aged experienced artisans are more respected by the fellowmen as they transmit the cultural heritage of the community.

Early theories of ageing, appeared in the1960s. Modernization theory argued that the Industrial Revolution and the development of nations had negative consequences for the old (Burgess 1960). Influenced by functional and development perspectives, disengagement theory (Cumming and Henry, 1961) argued that both the ageing individual and society benefit from the withdrawal of older persons from aspects of social life, particularly from the labour force. According to disengagement theory, decreased interaction between aging individuals and society was assumed to be a universal process that relieves older individuals of the pressures of adhering to societal norms and eases the transition to death. However, an ongoing criticism of the social scientific study of ageing is that it lacks "theoretical rigor" and tend towards the descriptive. Thus research on ageing being primarily problem-driven rather than theory-driven. Kerala's elderly female folk are hete- rogeneous group. Their socio-economic status deeply intertwined with religious cultural patriarchal factors. Other than this there are some other factors which should not appear to our eye sight may also come into play. We have to find out these factors which play among the elderly.

Methodology

In Kerala as per 2001 census, the percentage of 60+ was 10.48, and it is 11.7 per cent in 2011 and is projected to be 15.6 per cent in 2021. The elderly women represent the fastest

growing age group in the population of Kerala. The threat of population ageing is more severe in Kerala than the rest of the country. Gender dimension of ageing is very significant in Kerala and female population predominates at all the stages of older ages. A large number of elderly females are in the status of widowhood, illiterates, non-working and belong to lower and or no income brackets. All these finding leads to the conclusion that the aged females are the most deprived among the deprived. Their miserable status makes them to appear more aged than actually what they are. 'World Health Organization Report' states that the percentage of the   aged women who are 60+ is going to be doubled within two decades. But so far no specific study has been done to elevate their status. There will be lesser and lesser people taking care of the elderly as the decades roll by. Traditional life guards of family care are dwindling due to industrialization, our migration, dual career, female job participation and growing consumerism. All these make the well-being of the elderly, a growing challenge of the 21st century. A significant aspect of challenge comprises the unawareness of life skills.

An overview of available studies revealed the fact that the majority of researches concentrated on the health problems faced by the elderly women. A study based on the **Importance of 'Life Skills' in Elderly Woman's life** has not been done. So the present study "**Importance of `Life Skills' in Elderly Woman's life With Special Reference to Elderly Women Residing in Thrissur**" is undertaken with a view to explore information to fill the existing research gap. It is hoped that such a study would be helpful to the policy makers and planners. In turn it is benefited by our society.

Scope of the study is limited to the elderly women (60 years and above) residing in Thrissur. The study on life skill of elderly woman was being primarily problem-driven. Kerala elderly womankind is a heterogeneous group. They have to face a lot of problems during their existence. So this analysis is based on these problems. A single theory cannot explain all these problems. Various factors deeply intertwined to each of it.   Descriptive research design has been adopted for this study. The purpose of this research design is to explore the life skills of elderly women and elicit new information about the elderly women residing in family atmosphere and in old age homes in Thrissur. The design uses primary and secondary data. The primary data about the elderly for the study have been collected through survey conducted among elderly women in Thrissur district with a structured schedule. Two questionnaires are used for it. One is for members residing in home and the other for members belonging in old age home. The secondary data are derived from books, journals, reports, newspapers and online media on the subject. These are already recorded for some other purposes but used with particular study project.100 subjects from Thrissur district is selected on simple random method. In the 100 element, 50 residing in home and the remaining 50 from old age home. Data collected through structured interview schedule were analyzed with SPSS.

Objectives

1. To explore the life skills of the elderly women

Results

Table.1. Age structure of elderly women residing in home.

Age	Own home	Old-age home	Total
60-69	$_{66}$ **33** ^{65}	$_{36}$ **18** ^{35}	$_{51}$ **51** ^{100}
70-79	$_{28}$ **14** ^{39}	$_{44}$ **22** ^{61}	$_{36}$ **36** ^{100}
>80	$_{6}$ **3** ^{23}	$_{20}$ **10** ^{77}	$_{13}$ **13** ^{100}
Total	$_{100}$ **50** ^{100}	$_{100}$ **50** ^{100}	$_{100}$ **100** ^{100}

In the above table out of 50 women residing in own home, 66 percentage (33) belongs to young-old elderly. 28 percentage (14) belongs to 70-79yrs age group. 6 percentage (3) in oldest-old section. Out of 50 elderly residing in old-age home 36 percentage (18) belong to young-old and middle-age group 44 percentage (22) and 20 percentage (10) in the last section. From the present study, researcher found out that as they are getting old, the chance for admission to old age home increases. As they getting aged the dependence—both physical and economical, may increase. Thus age has crucial role in assigning their socio-economic status in their own house. This factor is so powerful as to exclude from their home.

Table. 2. Age and marital Status

Age	Marital Status								
	Own home					Old-age home			
	Married	Widow	Unmarried	Separated	Total	Married	Widow	Unmarried	Total
60-69	$_{87}$ **20** ^{61}	$_{48}$ **11** ^{33}	$_{33}$ **1** ^{3}	$_{100}$ **1** ^{3}	$_{66}$ **33** ^{100}		$_{29}$ **8** ^{44}	$_{48}$ **10** ^{56}	$_{36}$**18**^{100}
70-79	$_{9}$ **2** ^{14}	$_{43}$ **10** ^{72}	$_{67}$ **2** ^{14}		$_{28}$ **14** ^{100}	$_{100}$ **1** ^{5}	$_{46}$ **13** ^{59}	$_{38}$ **8** ^{36}	$_{44}$**22**^{100}

> 80	$_4$ **1** ^{33}	$_9$ **2** ^{67}			$_6$ **3** ^{100}		$_{25}$ **7** ^{70}	$_{14}$ **3** ^{30}	$_{20}$**10**^{100}
Total	$_{100}$ **23** ^{46}	$_{100}$**23**^{46}	$_{100}$ **3** ^{6}	$_{100}$ **1** ^{2}	$_{100}$ **50** ^{100}	$_{100}$ **1** ^{2}	$_{100}$ **28** ^{56}	$_{100}$ **21** ^{42}	$_{100}$**50**^{100}

The above table no.2 deals with the marital status of elderly along with their age. As the age increases married members percentage decreased steeply. Chronic illness increases with age. Older women have more problems with activities of daily living. Widowhood is one of the after effects of prolonged life. Widowhood lowers the socio-economic status of the women. This brings not only loneliness and depression but also economic dependence. Living arrangements influences the amount and type of care a person receives, social support, help they need during emergency and long term care. Very meager percentage of married females present in old-age home.

Table.3. Education and occupation of elderly residing in home and old-age home

	Occupation								
	Home					**Old-age home**			
Education	**Household**	**Unskilled**	**Manual Labour**	**Govt.Employee**	**Total**	**Household**	**Unskilled**	**Manual Labour**	**Total**
Illiterate	$_{14}$ **4** ^{67}	$_{18}$ $_{33}$ **2**			$_{12}$ $_{100}$ **6**	$_{14}$ **4** ^{27}	$_{20}$ $_6$ **1**	$_{63}$ $_{67}$ **10**	$_{30}$**15**^{100}
Primary level	$_{76}$ **22** ^{69}	$_{73}$ $_{25}$ **8**	$_{100}$ $_3$ **1**	$_{11}$ $_3$ **1**	$_{64}$ $_{100}$ **32**	$_{79}$ **23** ^{70}	$_{80}$ $_{12}$ **4**	$_{37}$ $_{18}$ **6**	$_{66}$**33**^{100}
Secondary Level	$_{10}$ **3** ^{37}	$_9$ $_{13}$ **1**		$_{45}$ **4** ^{50}	$_{16}$ $_{100}$ **8**	$_7$ **2** ^{100}			$_4$ **2** ^{100}
Degree				$_{22}$ **2** ^{100}	$_4$ $_{100}$ **2**				

Above degree				$_{22}$**2**^{100}	$_{4}$$_{100}$**2**						
Total	$_{100}$**29**^{58}	$_{100}$**11**^{22}	$_{100}$**1**^{2}	$_{100}$$_{18}$**9**	$_{100}$$_{100}$**50**	$_{100}$**29**^{58}	$_{100}$$_{10}$**5**	$_{100}$$_{32}$**16**	$_{100}$**50**^{100}		

Relationship of education and occupation of elderly residing in home and old-age home analyzed in the table no.3. Among the illiterates residing in home, 67 percentage (4) engaged with household activities and remaining 33 percentage (2) engaged with unskilled jobs. Among the illiterates residing in old-age home, 27 percentage (4) belong to household, 6 percentage (1) to unskilled and remaining 67 percentage (10) to manual labour. Among elderly, major share contributed by primary levels. From the present study it is found out that elderly do not possess high educational skill. This is further decreased in old-age home. We have to achieve more to enhance their happy living.

Table.4. Occupation and income of elderly residing in home and old-age home

Occupation	Home						Old-age home			
	Nil	<500	500-1000	1000-2000	>2000	Total	Nil	<500	>2000	Total
Household	$_{78}$**21**^{73}	$_{86}$**6**^{21}	$_{25}$**1**^{3}		$_{9}$**1**^{3}	$_{58}$**29**^{100}	$_{59}$**27**^{93}		$_{100}$**2**^{7}	$_{58}$**29**^{100}
Unskilled	$_{22}$**6**^{55}	$_{14}$**1**^{9}	$_{75}$**3**^{27}	$_{100}$**1**^{9}		$_{22}$**11**^{100}	$_{8}$**4**^{80}	$_{50}$**1**^{20}		$_{10}$**5**^{100}
Manual Labour				$_{9}$**1**^{100}	$_{2}$**1**^{100}		$_{33}$**15**^{94}	$_{50}$**1**^{6}		$_{32}$**16**^{100}
Govt. Service					$_{82}$**9**^{100}	$_{18}$**9**^{100}				
Total	$_{100}$**27**^{54}	$_{100}$**7**^{14}	$_{100}$**4**^{8}	$_{100}$**1**^{2}	$_{100}$**11**^{22}	$_{100}$**50**^{100}	$_{100}$**46**^{92}	$_{100}$**2**^{4}	$_{100}$**2**^{4}	$_{100}$**50**^{100}

Member's occupation and income were analyzed in the previous table. Majority of the members residing in home belong to household activities and do not possess any income.

Majority of the current elderly in India are illiterate, their living conditions mostly depend upon their co-residence with children and their ability to work beyond the official designated retirement age. This study confirms their pitiable condition in the case of income. Their law educational and occupational skills along with patriarchal condition of society yield them to this.

Table.5. Region of elderly residing in home and old-age home

Region	Home	Old-age home	Total
Rural	$_{88}$ **44** ^{48}	$_{94}$ **47** ^{52}	$_{91}$ **91** ^{100}
Urban	$_{12}$ **6** ^{67}	$_{6}$ **3** ^{33}	$_{9}$ **9** ^{100}
Total	$_{100}$ **50** ^{50}	$_{100}$ **50** ^{50}	$_{100}$ **100** ^{100}

In the above table (No.5) region of elderly were analyzed. Major share from rural area in this. Xhakraborti and Ray (2006) stated that there are significant socio-economic differences between the urban and rural elderly in India.

Table. 6. Importance of education in co-operation among elderly

Education	Co-operation							
	Home				Old-age home			
	Good	Satisfactory	Bad	Total	Good	Satisfactory	Bad	Total
Illiterate	$_{10}$ **2** ^{34}	$_{8}$ **2** ^{33}	$_{33}$ 2 ^{33}	$_{12}$ **6** ^{100}		$_{29}$ **8** ^{53}	$_{78}$ 7 ^{47}	$_{30}$15^{100}
Primary level	$_{65}$ 13 ^{41}	$_{64}$ **16** ^{50}	$_{60}$ 3 ^{9}	$_{64}$ **32** ^{100}	$_{100}$13^{39}	$_{71}$ **20** ^{61}		$_{66}$33^{100}

Secondary Level	$_{20}$ **4** ^{50}	$_{16}$ **4** ^{50}		$_{16}$ **8** ^{100}			$_{22}$ **2** ^{100}	$_{4}$ **2** ^{100}
Degree	$_{5}$ **1** ^{50}	$_{4}$ **1** ^{50}		$_{4}$ **2** ^{100}				
Above degree		$_{8}$ **2** ^{100}		$_{4}$ **2** ^{100}				
Total	$_{100}$**20**^{40}	$_{100}$ **25** ^{50}	$_{100}$**5**^{10}	$_{100}$**50**^{100}	$_{100}$**13**^{26}	$_{100}$ **28** ^{56}	$_{100}$ **9** ^{18}	$_{100}$**50**^{100}

In the table (6), importance of education in co-operation skill is analyzed. As the education levels increased, co-operation skills increased. The present study found out that elderly residing in home were more co-operative than their counter parts hailing in old-age home.

Table. 7. Importance of education in participation in domestic responsibility

	Home			Old-age home		
Education	Participated	Not participated	Total	Participated	Not participated	Total
Illiterate	$_{13}$ **6** ^{100}		$_{12}$ **6** ^{100}	$_{37}$ **7** ^{47}	$_{26}$ **8** ^{53}	$_{30}$ **15** ^{100}
Primary level	$_{62}$ **29** ^{91}	$_{100}$ **3** ^{9}	$_{64}$ **32** ^{100}	$_{63}$ **12** ^{36}	$_{68}$ **21** ^{64}	$_{66}$ **33** ^{100}
Secondary Level	$_{17}$ **8** ^{100}		$_{16}$ **8** ^{100}		$_{6}$ **2** ^{100}	$_{4}$ **2** ^{100}
Degree	$_{4}$ **2** ^{100}		$_{4}$ **2** ^{100}			
Above degree	$_{4}$ **2** ^{100}		$_{4}$ **2** ^{100}			
Total	$_{100}$ **47** ^{94}	$_{100}$ **3** ^{6}	$_{100}$**50**^{100}	$_{100}$ **19** ^{38}	$_{100}$ **31** ^{62}	$_{100}$**50**^{100}

The participation of elderly in domestic responsibility in association with their education is analyzed in the table (no.7). Among the elderly residing in home, participation in domestic responsibility is very much greater than their counterparts. 100 percentage members (50) residing in home other than the primary levels participated in domestic responsibility. 91 percentage (29) of primary levels participated in the same. But in old-age home, 47 percentage (7) illiterates and 36 percentage (12) primary levels participated in domestic responsibility. The present study also stresses the informal care giving work of elderly women.

Table. 8. Leisure time activity (Home and old-age home)

Have leisure activity	Home	Old age home	Total
Yes	100 **50** 51	96 **48** 49	98 **98** 100
No		4 **2** 100	2 **2** 100
Total	100 **50** 100	100 **50** 100	100 **100** 100

100 percentage (50) members living in home have leisure time activity. According to the above table members hailing in old-age home also have the same. It   is   much   more behavioural reflex in the way of the life of mankind and the group as well. Socio-economic factors have much in influencing leisure and leisure use. By analyzing the above table, we get information about their enjoining. This is unavoidable in this later stage.

Table. 9. Communication skill (Home and old-age home)

Communication skill	Home	Old-age home	Total
Good	98 **49** 55	80 **40** 45	80 **89** 100
With difficulty	2 **1** 10	18 **9** 90	18 **10** 100
Very poor		2 **1** 100	2 **1** 100

Total	100 **50** 50	100 **50** 50	100 **100** 100

Major share in home, 98 percentage (49) have good ability in communication. In old-age home, 80 percentage (40) good ability in communication, 18 percentage (9) have some difficulty and remaining 2 percentage (1) were very poor in conversation. By analyzing the above table, one is confirmed that majority of elderly residing both in home and old-age home have good ability in communication. Thus they can adjust their present situation by linking people to their environment. Thus they can perform a social role and occupy significant status.

Table. 10. Frustration among elderly (home and old-age home)

Frustration	Home	Old-age home	Total
Yes	38 **19** 61	24 **12** 39	31 **31** 100
No	62 **31** 45	76 **38** 55	69 **69** 100
Total	100 **50** 50	100 **50** 50	100 **100** 100

Majority of elderly residing in home have no frustration in their situation. According to the study majority of them do not frustrated. This indicates their life skills which achieved through their experience.

Table. 11. Loneliness among elderly (home and old-age home)

Loneliness	Home	Old-age home	Total
Yes	38 **19** 66	20 **10** 34	29 **29** 100
No	62 **31** 44	80 **40** 56	71 **71** 100
Total	100 **50** 50	100 **50** 50	100 **100** 100

Majority of elderly residing in home do not feel loneliness in their situation.

Table. 12. Capacity to manage money, telephone possessions

Capacity to manage belongings	Home	Old-age home	Total
Dependent	$_{8}$ **4** ^{40}	$_{12}$ **6** ^{60}	$_{10}$ **10** ^{100}
Partially dependent	$_{8}$ **4** ^{11}	$_{62}$ **31** ^{89}	$_{35}$ **35** ^{100}
Not dependent	$_{84}$ **42** ^{76}	$_{26}$ **13** ^{24}	$_{55}$ **55** ^{100}
Total	$_{100}$ **50** ^{50}	$_{100}$ **50** ^{50}	$_{100}$ **100** ^{100}

By analyzing above table, it is clear that the elderly residing in old-age home were more dependent than their counter parts residing in home. May be this is one of the reason for admitting them in old-age home.

Conclusion

Ageing occurs due to biological, physical and psychological decay. Through this study we can understand elderly present condition which can be modified through systematic effort. From the present study, researcher comes into conclusion that as they are getting old, the chance for admission to old age home increases. Through the present study researcher comes into conclusion that their marital status have crucial role in deciding their social status. Relationship of education and occupation of elderly residing in home and old-age home analysis revealed that majority of them did not possess enough educational qualification which compels them to bind with unorganized unsecured sections. Due to this majority of them did not acquire enough financial support. This study also proclaims that elderly possess less occupational skill. According to this study elderly residing in home were more co-operative than their counter parts hailing in old-age home. Educational level positively affected to their co-operative skills but this has no effect on their household activities. They are not depending members, but they are dependable members of society. When we caged them in old-age home this situation is changed. Co-operative skills and participation in domestic responsibilities fluctuated. Majority of them possess enough skills for active participation in leisure time activity. Major share in home (98 percentage) have good ability in communication. According to the study majority of them do not frustrated. This indicates their life skills which achieved through their experience. Majority of elderly residing in home and old-age home do not feel loneliness in their situation. It is clear that the elderly residing in old-age home were more dependent than their counter parts residing in home.

According to the present work, it is capsulated that we should cultivate enough mindset to elevate life skills of elderly.

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EFFICIENT PROTOCOL FOR DIRECT SOMATIC EMBRYOGENESIS AND PLANT REGENERATION IN KAEMPFERIA GALANGA L FROM LEAF-SHEATH EXPLANTS

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Abstract: *Kaempferia galanga* Linn. of *Zingiberaceae* is a rhizomatous handsome herb.It is a valuable and highly medicinal plant. It is cultivated for its aromatic rhizomes and is used extensively as spice throughout tropical Asia. Taxonomic and phylogenetic studies of South Indian *Zingiberaceae* revealed that *Kaempferia galanga* has become endangered, due to indiscriminate collection from natural habitat for ayurvedic preparation, deforestation and conversion of forest land to plantation crops. Tissue culture provides efficient techniques for rapid and large scale propagation and conservation of germplasm. The present study intends to establish an efficient protocol for direct somatic embryogenesis and plant regeneration in *Kaempferia galanga.* Leaf-sheath explants produced proliferative burst in the epidermis and the beginning of cellular segregation on 20th day of culture in the medium supplemented with BAP (0.1-2.0 mg/l) and NAA (0.1-2.5 mg/l) . Somatic embryos formed directly at the upper surface of the leaf-sheath when subcultured on the same medium . Highest frequency (80%) with average number of somatic embryos (22.34 ± 1.58) were formed at NAA (2.0 mg/l) and BAP (0.5 mg/l. Matured embryos were transferred to half MS medium containing BAP (1.0 mg/l) and NAA (0.4 mg/l) or KN (1.0 mg/l) and NAA (0.4 mg/l) for germination. From the fourth to fifth week up to 60% of somatic embryos germinated with the emergence of shoot first, then the roots. The germinated plantlets were hardened and transplanted in the soil.

Keywords: *Kaempferia galanga ,* Micropropagation, Somatic embyos

Introduction: *Kampfeia galanga* is used extensively as a spice throughout tropical Asia and has a long history of medicinal use. It is a reputed remedy for respiratory ailments like cough, bronchitis and asthma. The powder extracted from the rhizome is mixed with honey and given for coughs and pectoral affections. The tuber is boiled in oil and applied externally for blocking of nasal tract (Kirtikar and Basu, 1935). The rhizome is chewed and ingested. The rhizomes are considered stimulating, expectorant, carminative and diuretic. They are used in the preparation of gargles and administered with honey in cough and pectoral affections (Wealth of India, 1959, 1992). Rhizome possesses camphoraceous odour, and a decoction of the rhizome is used for dyspepsia, headache and malaria. Rhizome extract is useful to cure skin diseases, wounds and spleen disorders (Kirtikar and Basu, 1997) and is useful to relieve irritation produced by stinging caterpillars (Bhattacharjee, 2000). Roasted rhizomes are applied hot in rheumatism and for festering tumours. Mixed with oil, the rhizomes are used as a cicatrizant (Chithra *et al.,* 2005).

Conventional propagation of this species is through rhizomes and there is no seed setting under natural conditions. Conservation of this medicinal plant and the capability to utilize them in a sustained manner are essential for the well being and continued survival of man. Taxonomic and phylogenetic studies of South Indian *Zingiberaceae* revealed that *Kaempferia galanga* has become endangered, due to indiscriminate collection from natural habitat for ayurvedic preparation, deforestation and conversion

of forest land to plantation crops (Sabu, 1991). Amalraj *et al.* (1991) included *K. galanga* under the category endangered species as per IUCN norms since it has been never seen in wild habitat.

To overcome these problems, development of rapid propagation techniques and conservation of germplasm are the most urgent measures to be taken to protect this plant from extinction. Tissue culture provides efficient techniques for rapid and large scale propagation and conservation of germplasm. Tissue culture studies on medicinal plant had already resulted in a spectrum of various technologies ranging from micropropagation and somatic embryogenesis to the production of artificial seeds. The present study intends to establish an efficient protocol for direct somatic embryogenesis and plant regeneration in *Kaempferia galanga.*

Materials and Methods: Healthy plants and fresh rhizomes of *Kaempferia galanga* L. were procured from the herbal garden of Kerala agricultural university, Vellanikkara, Trichur Dt., Kerala. The plants were identified at Rapinat Herbarium and Centre for Molecular Systematics, St. Joseph's College, Tiruchirappalli, South India. Leaf and leaf-sheath collected from *in vivo* and i*n vitro* raised seedling were used for preset investigation.

The medium consisted of semi-solid MS medium consisting of MS mineral salt, vitamins, 0.6% agar, 30g/l sucrose, auxins and cytokinines. The pH was adjusted to 5.8 before autoclaving at 121°C for 20 min. Leaves were cut into 1.2-1.5 cm squares, leaf-sheath ware cut into 1cm long segments in sterile petri dishes.

Figure 1.Habit of *Kaempferia galanga*
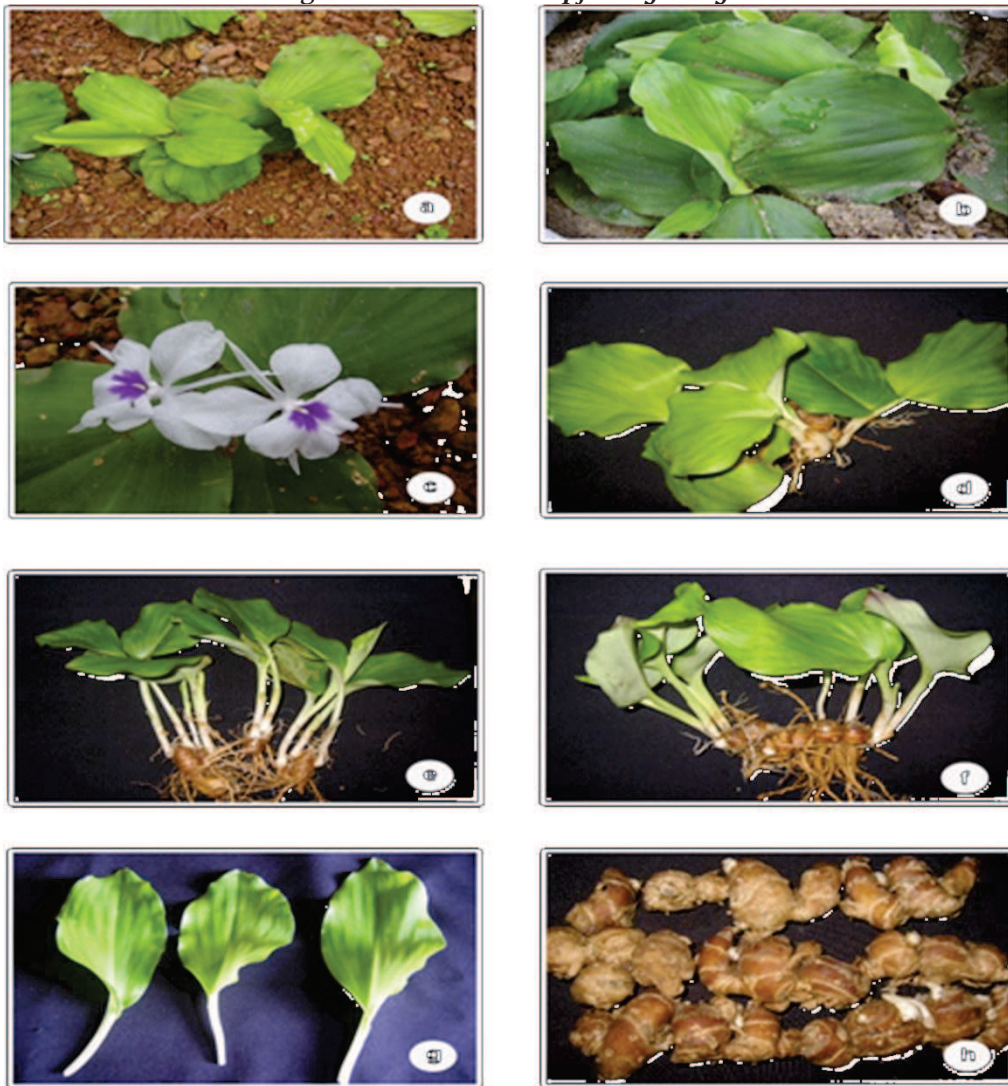
a.   *Kaempferia galanga* with smaller leaves
b.   *Kaempferia galanga* with larger leaves
c.   Flowers
d   *Kaempferia galanga* with medium sized leaves
e. & f.   *Kaempferia galanga* showing roots, rhizomes and leaves
g.   Leaves ,
h.   Rhizome

The explants were placed in 25 × 150 mm tubes containing 15 ml semisolid MS medium. The cultures were kept in dark for one week. After two weeks of incubation, the cultures were transferred to fresh media with the same composition.

For embryo development, embryogenic tissues were sub cultured on half strength MS medium containing NAA (0.1 mg/l) + BAP/KN (0.1-2.5 mg/l). Different stages such as globular, club, and banana shaped embryos were observed. Finally mature embryos were washed with hormone free proliferation medium and transferred to semi solid medium. Embryos at different stages of development were separated manually. Mature embryos, which were obtained in 28 days on the semi solid medium and then they were placed in germination medium. Samples were photographed at different stages during growth period.

Mature embryos were placed in culture tubes containing half MS basal medium 3% (w/v) sucrose,

BAP (1.0 mg/l) KN (1.0 mg/l) and GA$_3$ (0.5 mg/l) individually or in combination with NAA (0.1 - 1.0 mg/l). Embryos were incubated at 25 ± 2°C 80μE m^{-2} S^{-1} light intensity. After root shoot elongation, the plantlets were transferred to plastic cups containing 1:1 mixture of river sand and garden soil and later established in pots.

Results : Plantlets regenerated *in vitro* were found most suitable for explants sources. Among all the explants tested, only leaf-sheath explants produced proliferative burst in the epidermis and the beginning of cellular segregation on 20th day of culture in the medium supplemented with BAP (0.1-2.0 mg/l) and NAA (0.1-2.5 mg/l) (Fig.1. a). Somatic embryos formed directly at the upper surface of the leaf-sheath when subcultured on the same medium (Fig.1. b & c). Highest frequency (80%) with average number of somatic embryos (22.34 ± 1.58) were formed at NAA (2.0 mg/l) and BAP (0.5 mg/l) (Table 1.). Embryos were white or green, small and globular appearing individually or in clusters (Fig.1. d).

Somatic embryos proliferated into larger embryo masses by producing secondary embryos when subcultured in the same fresh medium. Matured embryos were transferred to half MS medium containing BAP (1.0 mg/l) and NAA (0.4 mg/l) or KN (1.0 mg/l) and NAA (0.4 mg/l) for germination. From the fourth to fifth week up to 60% of somatic embryos germinated with the emergence of shoot first, then the roots. Plantlets developed from somatic embryos with shoots and roots were easily separated into individual seedlings (Fig.1. f). The germinated plantlets were hardened and transplanted in the soil (Fig.1.h).

Discussion: Regeneration of *Onidium* through direct somatic embryogenesis has been achieved using young leaf explants (Chen *et al.*, 1999). Young leaves have high regeneration capacity and may provide large number of embryos and plantlets in a short period of time. Direct embryo formation on leaf explants was retarded by exogenous auxin, but promoted exogenous cytokinin (Chen and Chang, 2000). In the present investigation leaf-sheath explants produced embryos in the surface of the explants directly and this feature corresponds to previous works.

Induction of somatic embryogenesis was achieved on MS medium supplemented with NAA (5.37 μM) and BA (0.44 μM) from leaf explants of *Ostericum koreanum* (Cho *et al.*, 2003). In *Synogonium podophyllum* petiole explants produced somatic embryos when cultured on MS medium containing 2.5 mg/l TDS with 0.5 mg/l NAA (Zhang *et al.*, 2006). In *Cicer arietinum* somatic embryos were induced

from immature cotyledon on MS medium supplemented with 2, 4, 5 -T or NAA in combination with BA or KN (Kiran *et al.*, 2010). In the present investigation NAA (0.5 mg/l) with BAP (2.0 mg/l) induced high frequency of (80.0%) with maximum number of somatic embryos (22.34±1.58) directly from the leaf-sheath explants. This is in agreement with the previous work where the hormone combination induced successful somatic embryos.

In many plant species cytokinins individually or in combination with auxins were used for the maturation of the somatic embryos (Choi *et al.*, 1999; Kaur and Kothrari, 2004). Regeneration through the direct somatic embryogenesis could be potential solution to minimize the variation. Somatic embryos that were germinated on half strength MS medium supplemented with 0.01 mg/l BAP and 0.25 mg/l ABA promoted maturation and germination of somatic embryos of *Accacia arabica* (Nanda and Rout, 2003). Similar observations have been made in some crop plants (Das *et al.*, 1997 and Ortiz *et al.*, 2000). This is in contrast to the present study where best plant conversion frequency (80%) was obtained with cultured embryos on half strength MS solid medium containing BAP (1.0 mg/l) + NAA (0.4 mg/l). These results colloborate the previous fining of Zhang *et al*. (2006) where 85% somatic embryos germinated 5-10 weeks after transferring on to medium containing 2.0 mg/l BAP and 0.2 mg/l NAA. Tiny plantlets were transferred to the greenhouse for further development.

Conclusion: Direct somatic embryogenesis avoids the passage through callus and thus avoids the genetic instability often associated with somatic embryos obtained indirectly from callus. In the present study, a protocol was developed for induction of somatic embryogenesis directly from leaf-sheath and indirectly using rhizome bud explants. Successful regeneration of plants from leaf-sheath, *via*. direct somatic embryogenesis has been reported for the first time.

Table - 1

Influence of different concentrations of auxin (NAA) alone in combination with cytokinins

(BAP or KN) on induction of direct somatic embryogenesis from leaf sheath explants of

Kaempferia galanga

Total number of explants taken for observation =35 (each treatment consists of at least 7 explants and the experiments were repeated five times).

Mean value within column having the same alphabet are not statistically significant (P=0.05) according to New Duncan's Multiple Range Test.

Plant Growth Regulators (mg/l)	No. of explants responded	Percentage of culture responded	Mean no. of somatic embryos harvested per explants
NAA			
0.1	16	45.7[ef]	9.57±0.61[ef]
0.5	18	51.4[de]	10.67±1.14[e]
1.0	20	57.1[bc]	13.72±0.98[cd]
1.5	21	60.0[b]	14.08±1.15[c]
2.0	**27**	**77.1[a]**	**19.24±0.87[a]**
2.5	19	54.2[cd]	16.71±2.81[b]
NAA+BAP			
2.0+0.1	14	40.0[de]	11.48±1.18[d]
2.0+0.2	17	48.5[bc]	21.57±1.81[ab]
2.0+0.5	**28**	**80.0[a]**	**22.34±1.58[a]**
2.0+1.0	19	54.2[b]	14.08±2.15[c]
2.0+1.5	15	42.8[cd]	10.88±0.60[de]
2.0+2.0	13	37.1[ef]	10.35±0.40[ef]
NAA+KN			
2.0+0.1	19	54.2[b]	9.42±0.82[d]
2.0+0.2	**23**	**65.7[a]**	**15.17±1.88[a]**
2.0+0.5	15	42.8[c]	13.14±1.13[b]
2.0+1.0	13	37.1[cd]	12.14±1.20[bc]
2.0+1.5	12	34.2[de]	8.42±0.94[de]
2.0+2.0	11	31.4[ef]	7.87±0.77[ef]

Figure 2. Somatic embryos obtained from leaf sheath explants
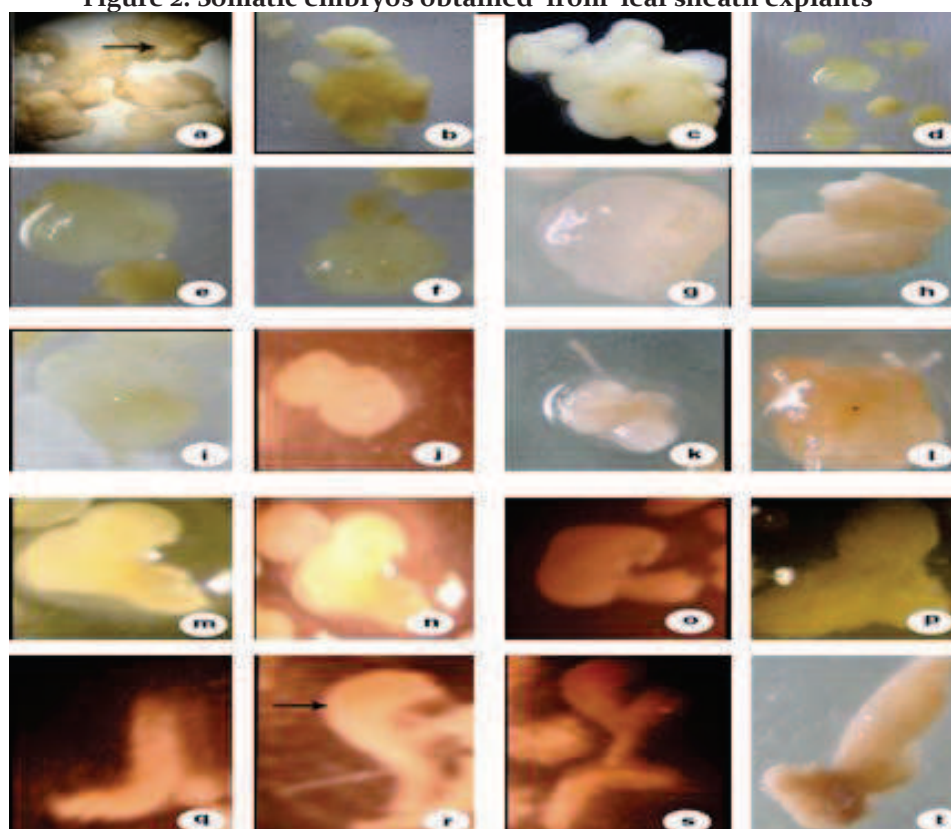
A-H	**:Small, round globular somatic embryos directly produced from leaf sheath surface.**
I, J&K	**:Mature embryos, dividing stage**
M,N,O,&P	**:Scutellar shaped somatic embryos established in cell suspension culture**
Q,R,S&T	**:Banana and club shaped somatic embryos.**

Figure 3. Direct somatic embryogenesis and plant regeneration from leaf sheath explants.
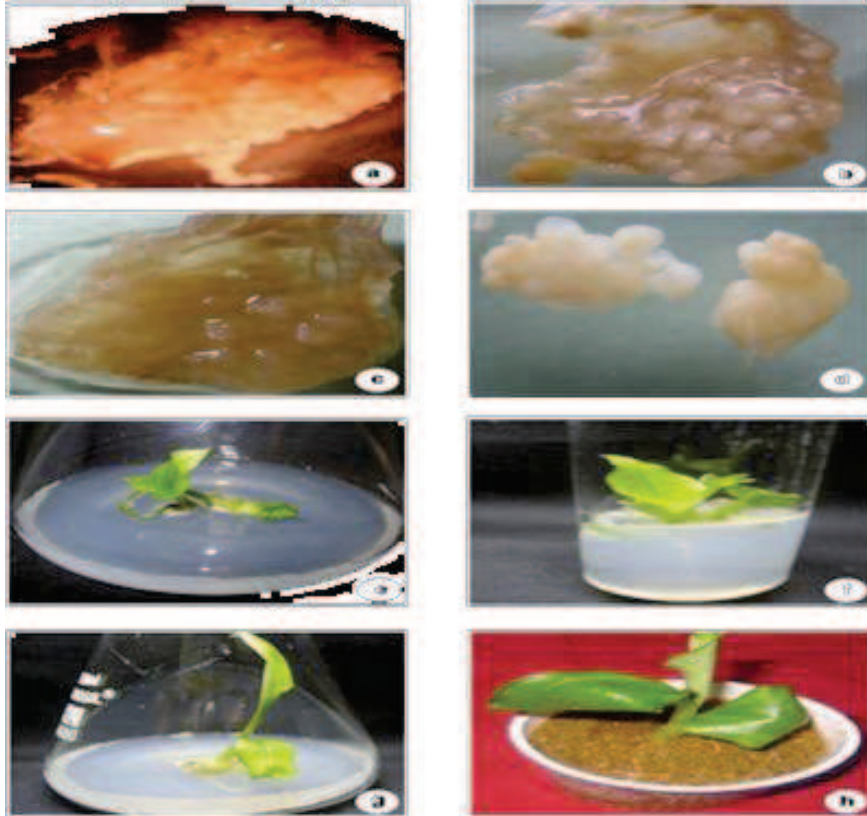
A: Early globular embryos formed at cut ends of the leaf sheath explant in 20 days on induction medium (BAP 0.5 mg/l and NAA 1.0 mg/l).

B, C &D: Matured globular embryos on MS medium with BAP 0.5 mg/l and NAA 1.0 mg/l .

E, F &G: *In vitro* germination of somatic embryos on germination medium.

H: Regenerated plantlet acclimatized to green house conditions with river sand, garden soil and farmyard manure in the ratio of 1:2:1, after 6 weeks.

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SOCIO-CULTURAL STATUS OF THE ELDERLY WOMEN

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ABSTRACT

Social gerontology refers to a specialized field of gerontology that examines the social aspects of aging. As human beings grow older, they go through different phases or stages of life. It is helpful to understand the socio-cultural status of elderly in the context of these phases as aging is not simply a physiological process. Many older adults remain highly self-sufficient. Others require more care. Because the elderly typically no longer hold jobs, finances can be a challenge. Due to cultural misconceptions, older people can be targets of ridicule and stereotypes. The elderly face many challenges in later life, but they do not have to enter old age without dignity. Objective of the study is to find out the socio-cultural status of the elderly. The present study found out that those who have medium and high social status will not enter into old age home.

Introduction

Socio-cultural status is a combined total measure of a person's work experience and of an individual's or family's socio-cultural position in relation to others, based on income, education, and occupation. It is often used as synonymous with social class, a set of hierarchical social categories that indicate an individual's or

household's relative position in a stratified matrix of social relationships. Social class is delineated by a number of variables, some of which change across time and place. Population ageing is one of the humanity's greatest achievements. It is also one of our hardest challenges. Population ageing is the increase in the number and proportion of older people in society. Population ageing has three possible causes: migration, longer life expectancy and decreased birth rate. In this new era, our minds are confused with the news of global ageing. Actually it is the outcome of advances in science and technology. But this achievement fails to incorporate social attitude to accept elderly as their old golden ages. As we enter the twenty first century, global ageing will put increased socio-cultural demands on all countries. Globalisation in its broader sense encompasses all types of socio-cultural transfer between nations and this leads to increase in income inequality between different sectors and groups (Devi, 2010). Modern cultural attitudes portray a negative picture to elderly. People are aware about their ageing process, only after they are entering into it.

Elderly imparts an important contribution to the fabric of our society. In this ageing world, demographic structure needs our attention as this leads several changes in different aspects of our daily life. Population ageing started in India with the decline in fertility and mortality levels. Kerala has the largest proportion of elderly women in India (Bhawsar, 2001; Gulati, 1998). Twenty first century is witnessing the 'Ageing Scenario' more rapidly than the preceding century did. In the ageing process, female population is more advanced in Kerala. The proportion of the aged women in Kerala was 20 percent higher than in the whole country. Socio-

cultural status is relevant to all realms of life. Some of the factors which affect the quality of life are age, sex, caste, religion, region, income and marital status. The American and Indian policies are equivalent means toward achieving social and economic justice for all by enhancing opportunities for disadvantaged, excluded and oppressed segments of their societies. In fact, poverty is a major concomitant and consequence of minority status- of disadvantaged 'races', ethnicities, genders, etc.

Many changes that occour in old age are mainly due to the social and economic consequences of growing old. When the individual unable to perform his normal duties, then onwards he becomes old. The loss of power and authority is act as the main catalyst in diminishing their status in society. We should not forget that there can be no better teachers of values than the old people with lifelong experiences to back them. They are also in a better position to supplement the inherent idealistic slant of the values with pragmatic realism of life situations. Social and political power achieved by active involvement in public and community life. In general older women are not participated in community activities. Changing pattern of family life brought repercussions on elderly folk. Elderly lead a happy life since time immemorial. The demographic changes emphasis the importance of the gerontology. The increase in number of older people as a proportion of population has resulted in the study of human ageing focusing on old age in general (Bond and Peace, 2001).

Though there is no obvious discrimination against women in the plans and programs, in implementation various social economic

forces have operated against them. Apart from economic factors, cultural, traditional and social beliefs combine to influence and generate an unfavourable discrimination against female in society (Rao and Subramayam, 2010). Though the women have been depicted as the incarnation of 'shakthi' in reality, she has been an inferior place in all walks of life. Women have deteriorated socio-cultural status.

Review of Literature

A literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. Literature reviews are a staple for research in nearly every academic field. Literature reviews are used as secondary sources. In the article, "On being old and female: some issues in quality of life of elderly women in India" by **Indira Jai Prakash** (2001) analyses the socio-economic effect of ageing. Though ageing is a universal phenomenon, all aged persons are not alike. Ageing process is different for different persons. This is confirmed in this article. Some of the factors which affect the quality of life are race, gender, social status and marital status. In these, gender is most powerful factor. Due to low social status, poor reproductive health care, economic dependence, malnutrition and domestic violence women's well being is adversely affected. 'Gender ageing' increases the intensity of poverty. In countries like India, with a predominantly patriarchal ethos, older women face triple jeopardy-that of being female, of being old and of being poor. The factors which affect the quality of life of ageing women are marital status, living condition, and health status, socio-economic

and political status. Chronic illness increases with age. Older women have more factors with activities of daily living. Probable widowhood is one of the after effects of prolonged life. Widowhood much lowers the socio-economic status of the women. This brings not only loneliness and depression but also economic dependence. Social and political power is achieved by active involvement in public and community life. In general older women do not participate in community activities. Rural elderly engage in agricultural work which has no retirement age as such. In the west 'grey power' has become visible and viable. Older people go themselves organized to fight for their rights. They could achieve increased participation of women in labour force, policies of reservation for women in the political process and in decision making bodies. "Increased awareness regarding the demographic changes, improvements in the medical field that help control age related disabilities and more awareness on the part of the older people themselves could create a better society for older women of the next millennium".

H.S. Srivastava (2010) analyzes the socio-economic effect of ageing along with health factors in his book, 'Managing Age'. There are three independent facts of age-physical age, mental age and moral age. They have remote relationship. A carefree or care-shackled attitude of mind bears a direct relationship with ageing. Individual could be considered as old, when he is unable to perform his normal duties. Ageing is undoubtedly a normal biological process and there is no way of avoiding it, though there are many viable ways for slowing the process. Many changes that occur in old age are mainly due to disease and physical distress and the social

and economic consequences of growing old. The loss of power and authority is a great disconcerting thing to happen and the individual suddenly finds himself at a loss to understand the phenomenon. The individuals in old age find it very hard to accept this situation when they are no more in power or authority. They feel as if adversity has caught them completely The characteristics which imbibe in young age tend to become more acute and compulsive in old age. A religious person can turn into a fanatic, a liar into a damn liar, a fastidious person into a cynic and so on. Life has become fire fighting operation punctuated all the way by unanticipated emergencies. To the individual in old-age condition the long cherished values seem overturned. The things which old generations find as avoidable extravagance, the younger generations considered it as an unavoidable necessity.

In the book 'The ageing world' which is written by **Anil Bagchi (2006)**, the socio-economic status of elderly examined. According to the author, elderly become out of step with the economic environment and the changing technology. The old get cast off from the mainstream of life. Social interaction with younger people becomes infrequent. Thus society makes the person old. The conventional definition of old age definition is not realistic. It leads to excessive depressing forecasts. In this changing social circumstances, even centenarians, show mental acuity comparable to those who are decades younger. According to the author, mental senility is a creation of society. Thus ageing cannot be considered as a physiological process wholly. It has some social factors also. Some people live their old age excellently and to some purpose. Fast living people are likely to age faster and die earlier'. It is not a

disease. It is the consequence of normal course of living. It is not the mischief of any foreign body. It is not due to any aberrant cell. The wealth difference existing between the nations is due to the difference in knowledge of sociology, science and technology. The increased wealth leads to the beginning of the formation of greater proportion of old age people—the greying of the developed countries. Thus there is a strong correlation between knowledge, wealth and greying. Wealth and culture among nations and communities are the important factors of grey dynamics. The less modern countries are now young. The traditional dependence of the elderly index is the number of the people above 65 divided by the number of people in the age group 18 to 64. Responsibility of elderly is considered as a national burden. In future, as the younger generation keeps growing wealthier than their parents and grandparents, inheritance will have less than the all-important role that it plays today. This will have an effect on the inter-generational dependence. This leads to the independence of different generation. Some constraints associated with greying like political and security issues, ethical considerations are human creations and are therefore amenable to some extent. Within the boundary conditions we must look for solutions to the factors of our future. This book reveals the importance of sociological study in ageing.

Vijay Prakash Sharma (2006), in his paper, 'Tribal Aging in Jharkhand Health Perspective' analyzed elderly in traditional region. The old have traditionally been honoured and respected. Those who neglected their old parents earned social disrespect and were ridiculed. Government of Jharkhand in its new health policy-

2004 has announced that provisions for care of aged will be made. In 2002-03 Govt. of Jharkhand reported construction of two old age homes for elderly. This gave an idea about the involvement of State for the well being of old.

In the paper, Status and Role of Elderly Persons in Tribal Communities of Chotanagpur (With Special Reference To Chik Baraik Of Jharkhand) by **Karma Oraon and Pravin Kumar Jha** (2006) analyzed the social role performed by elderly. Changing pattern of family life brought repercussions on elderly folk. Elderly lead a happy life since time immemorial. One of the values of our society is the respect for elderly. They create a strong bond of union among the family members. Now the tribal family structure undergoes changes. This may be due to the impact of urbanization, industrialization, education, globalization and modernization. This paper gives the indication of factors which affect the elderly. According to the authors both generations have to make compromises and the failure to compromise leads to breakage of the family. Migration of children prompted older generation to migrate as well. But they don't get any engagements and are friendless. Thus they left for their village in despair and frustration. Their guardianship vanished. Educated younger generations are reluctant to respect them. Now a days, modernization leads to various attitudinal clashes. Elderly have to compromise to their fate. If this trend continues India will lose her cultural glory.

However, an ongoing criticism of the social scientific study of ageing is that it lacks "theoretical rigor" and tend towards the descriptive. Thus research on ageing being primarily factor-driven rather

than theory-driven. Kerala's elderly female folk are heterogeneous group. Factors of social exclusion of elderly women are different. We have to find out those factors which lead them to social exclusion.

Methodology

In Kerala as per 2011 census, the percentage of 60+ was 11.7 per cent and is projected to be 15.6 per cent in 2021. The elderly women represent the fastest growing age group in the population of Kerala. The threat of population ageing is more severe in Kerala than the rest of the country. Gender dimension of ageing is very significant in Kerala and female population predominates at all the stages of older ages. Population ageing could have profound implication for the economies as well as the societies. Thus the dependency ratio is greater.

A large number of elderly females are in the status of widowhood, illiterates, non-working and belong to lower and or no income brackets. All these finding leads to the conclusion that the aged females are the vulnerable within vulnerable. Their miserable status makes them to appear more aged than actually what they are. `World Health Organisation Report 'states that the percentage of the aged women who are 60+ is going to be doubled within two decades. But so far no specific study has been done to elevate their status. There will be lesser and lesser people taking care of the elderly as the decades roll by. Traditional life guards of family care are dwindling due to industrialization, our migration, dual career, female job participation and growing consumerism. All these make the well-being of the elderly, a growing challenge of the 21st

century. A significant aspect of challenge comprises the depressed elderly along with society who are unwilling to accept them.

An overview of available studies revealed the fact that the majority of researches concentrated on the health problems faced by the elderly women. A study based on the 'socio-cultural status of the elderly women' has not been done. So the present study is undertaken with a view to explore information to fill the existing research gap. It is hoped that such a study would be helpful to the policy makers and society.

The scope of study is limited to the elderly women (60 years and above) residing in Kozhikode district, Kerala. The present study tries to find out socio-cultural status of elderly. A single theory cannot explain all these factors. Various factors deeply intertwined to each of it. Descriptive and comparative research design has been adopted for this study. The design uses primary and secondary data. The primary data about the elderly for the study have been collected through structured interview schedule among elderly women in Kozhikode district. Two questionnaires are used for it. One is for members residing in home and the other is for members belonging in old age home. The secondary data are derived from books, journals, reports, newspapers and online media on the subject.300 subjects from Kozhikode district is selected on simple random method. In the 300 elements, 150 residing in home and the remaining 150 from old age home. Data collected through structured interview schedule were analysed with SPSS.

Objectives

To find out the socio-cultural status of elderly women

Discussions and Analysis

Table 1. Age and Social Status of Elderly Women

Age	Social status								Total
	Home				Old age home				Total
	Low	Medium	High	Total	Low	Medium	High	Total	No
60-69	${}_{58}36^{36}$	${}_{73}56^{56}$	${}_{73}8^{8}$	${}_{67}100^{100}$	${}_{37}56^{100}$			${}_{37}56^{100}$	${}_{52}156^{100}$
70-79	${}_{27}17^{47}$	${}_{21}16^{45}$	${}_{27}3^{8}$	${}_{24}36^{100}$	${}_{44}66^{100}$			${}_{44}66^{100}$	${}_{34}102^{100}$
Above 80	${}_{15}9^{64}$	${}_{6}5^{36}$		${}_{9}14^{100}$	${}_{19}28^{100}$			${}_{19}28^{100}$	${}_{14}42^{100}$
Total	${}_{100}62^{41}$	${}_{100}77^{52}$	${}_{100}11^{7}$	${}_{100}150$	${}_{100}150^{100}$			${}_{100}150^{100}$	${}_{100}300^{100}$

Above table shows the age divisions and social status they enjoy in society. Out of 300 respondents 52 percent (156) of them belong to young old, 34 percent (102) to middle old and 14 percent (42) to old-old group. The present study found out that those who have medium and high social status will not enter into old age home. In old age home 100 per cent belong to low category. As a social being, elderly has some social rights. This is obstructed by ageing. The situation is horrible when we consider elderly in old age home. As they aged the social status diminished. Older persons have poorly integrated social networks (Black and Rubinstein, 2000).

Table 2. Age and Cultural Status of Elderly Women

Age	Cultural status								Total
	Home				Old age home				No
	Low	Medium	High	Total	Low	Medium	High	Total	
60-69	$_{45}4^4$	$_{66}81^{81}$	$_{83}15^{15}$	$_{67}100^{100}$	$_{38}40^{71}$	$_{36}16^{20}$		$_{17}56^{100}$	$_{52}156^{100}$
70-79	$_{33}3^8$	$_{24}30^{84}$	$_{17}3^8$	$_{24}36^{100}$	$_{48}50^{76}$	$_{36}16^{24}$		$_{44}66^{100}$	$_{34}102^{100}$
Above 80	$_{22}2^7$	$_{10}12^{93}$		$_{0}14^{100}$	$_{14}15^{52}$	$_{28}13^{48}$		$_{10}28^{100}$	$_{14}42^{100}$
Total	$_{100}9^6$	$_{100}123^{82}$	$_{100}18^{12}$	$_{100}150^{100}$	$_{100}105^{70}$	45^{30}		$_{100}150^{100}$	$_{100}300^{100}$

Above table shows the age divisions and cultural status they enjoy in society. Out of 150 respondents in home 67 percent (100) belongs to young old, 24 percent (36) to medium old and 9 percent (14) to oldest old. Among 150 members residing in old age home, 37 percent (56) are youngsters, 44 percent (66) middle old and 19 percent (28) high old. By analysing the table no.2, researcher found out that surely age has great influence in this process. There is increase in per cent in low status members from young old to middle aged elderly. But that graph changed when we come through the oldest old. But in the medium category a steady increase is observed. In the final group steady reduction is viewed. Through this table influence of age in cultural status is unavoidable one. From this researcher found out that absence of high cultural status leads them to old age home.

Table 3. Education and Social Status of Elderly Women

Education	Social status								Total
	Home				Old age home				
	Low	Medium	High	Total	Low	Medium	High	Total	No
Illiterate	$_{6}4^{40}$	$_{8}6^{60}$		$_{7}10^{100}$	$_{33}49^{100}$			$_{33}49^{100}$	$_{20}59^{100}$
Primary	$_{68}42^{46}$	$_{65}50^{54}$		$_{61}92^{100}$	$_{60}90^{100}$			$_{60}90^{100}$	$_{61}182^{100}$
Secondary	$_{23}14^{36}$	$_{22}17^{44}$	$_{73}8^{20}$	$_{26}39^{100}$	$_{6}9^{100}$			$_{6}9^{100}$	$_{16}48^{100}$
Degree		$_{5}4^{80}$	$_{9}1^{20}$	$_{3}5^{100}$	$_{0.5}1^{100}$			$_{0.5}1^{100}$	$_{2}6^{100}$
Above Degree	$_{3}2^{50}$		$_{18}2^{50}$	$_{3}4^{100}$	$_{0.5}1^{100}$			$_{0.5}1^{100}$	$_{1}5^{100}$
Total	$_{100}62^{41}$	$_{100}77^{52}$	$_{100}11^{7}$	$_{100}150^{100}$	$_{100}150^{100}$			$_{100}150^{100}$	$_{100}300^{100}$

The above table (3) deals with education and social status of elderly residing in home and old age home. Out of 300 respondents 20 percent (59) belong to illiterate, 61 percent (182) belong to primary levels, 16 percent (48) to secondary levels, 2 percent (6) to degree levels and 1 percent (5) to above degree levels. Out of 150 respondents 7 percent (10) are illiterate, 61 percent (92) primary levels, 26 percent (39) secondary, 3 percent (5) degree levels and 3 percent (4) above degree levels. From this researcher found out that education has significant role in assigning social status. Their low status increases the chance for deterioration. Educational level has crucial role in deciding the status of members in society. Researcher found out that there is direct relationship to education and social status. As the social status decreases the chances to entry into old age home increased. Thus education and social status act as a strong push factor to elderly to old age home.

Table 4. Education and Cultural Status of Elderly Women

Education	Cultural status								Total
	Home				Old age home				
	Low	Medium	High	Total	Low	Medium	High	Total	No
Illiterate		$_{8}10^{100}$		$_{7}10^{100}$	$_{30}32^{65}$	$_{38}17^{35}$		$_{33}49^{100}$	$_{20}59^{100}$
Primary	$_{44}4^{4}$	$_{66}81^{88}$	$_{39}7^{8}$	$_{61}92^{100}$	$_{61}64^{71}$	$_{58}26^{29}$		$_{60}90^{100}$	$_{61}182^{100}$
Secondary	$_{34}3^{8}$	$_{24}29^{74}$	$_{39}7^{18}$	$_{26}39^{100}$	$_{8}8^{89}$	$_{2}1^{11}$		$_{6}9^{100}$	$_{16}48^{100}$
Degree	$_{11}1^{20}$		$_{22}4^{80}$	$_{3}5^{100}$		$_{2}1^{100}$		$_{0.5}1^{100}$	$_{2}6^{100}$
Above degree	$_{11}1^{25}$	$_{2}3^{75}$		$_{3}4^{100}$	$_{1}1^{100}$			$_{0.5}1^{100}$	$_{1}5^{100}$
Total	$_{100}9^{6}$	$_{100}123^{82}$	$_{100}18^{12}$	$_{100}150^{100}$	$_{100}105^{70}$	45^{30}		$_{100}150^{100}$	$_{100}300^{100}$

The above table (4) deals with education and cultural status of elderly residing in home and old age home. Out of 150 respondents residing in old age home 33 percent (49) are illiterates, 60 percent (90) primary levels, 6 percent (9) secondary levels, 0.5 percent (1) degree levels and 0.5 percent (1) above degree levels. By examining this table, researcher found out the significance of education in cultural status. There is marked improvement observed in third category along with increasing education except above degree levels. In low status group also some relationship with education observed. As education increased, the contribution to low status group decreased except illiterates. In old age home major share comes under low cultural status group. From this researcher found out that education and cultural status have crucial role to elderly women to the admission in old age home. Low cultural status acts as a major push factor for elderly to old age home.

Table 5. Marital Status and Social Status of Elderly Women

Marital status	Social status								Total
	Home				Old age home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Married	$_{53}33^{40}$	$_{55}42^{51}$	$_{73}8^{9}$	$_{56}84^{100}$	$_{2}3^{100}$			$_{2}3^{100}$	$_{29}87^{100}$
Widow	$_{40}25^{41}$	$_{43}33^{54}$	$_{27}3^{5}$	$_{40}60^{100}$	$_{67}100^{100}$			$_{67}100^{100}$	$_{54}160^{100}$
Unmarried	$_{5}3^{60}$	$_{2}2^{40}$		$_{3}5^{100}$	$_{27}41^{100}$			$_{27}41^{100}$	$_{2}7^{100}$
Separated	$_{2}1^{100}$			$_{1}1^{100}$	$_{4}6^{100}$			$_{4}6^{100}$	$_{15}46^{100}$
Total	$_{100}62^{41}$	$_{100}77^{52}$	$_{100}11^{7}$	$_{100}150^{100}$	$_{100}150^{100}$			$_{100}150^{100}$	$_{100}300^{100}$

The above table deals marital status and social status of elderly women in home and old age home. Among married members 39 per cent (33) came under low social status, 51 per cent (43) belonged to medium and 10 per cent (8) to high. Among widows 42 per cent (25) involved in low, 53 per cent (32) in medium and 5 percent (3) in high. Among unmarried 60 per cent (3) belonged to low and 40 percent (2) to medium. When we consider separated members all of them belonged to low category. Among elderly in old age home all of them belong to low category. In this 2 per cent (3) are constituted by married members, 67 per cent (100) by widows, 27 per cent (41) by unmarried and 4 per cent (6) by separated members. Among elderly residing in home it is much better than the members residing in old age home. Again researcher found that among members hailing in home, there is not much difference between married and widows. But there is marked differentiation found among the unmarried and separated members. They acquire very low social status.

Table 6. Marital Status and Cultural Status of Elderly Women

Marital status	Cultural status								Total
	Home				Low	Medium	High	Total	
	Low		High	Total					
Married	$_{22}2^{3}$	$_{29}70^{100}$	$_{67}12^{14}$	$_{56}84^{100}$	$_{1}1^{33}$	$_{4}2^{67}$		$_{2}3^{100}$	$_{29}87^{100}$
Widow	$_{67}6^{10}$	$_{54}48^{100}$	$_{33}6^{10}$	$_{40}60^{100}$	$_{69}72^{72}$	$_{62}28^{28}$		$_{67}100^{100}$	$_{54}160^{100}$
Unmarried	$_{11}1^{20}$	$_{2}4^{100}$		$_{3}5^{100}$	$_{27}28^{68}$	$_{30}13^{32}$		$_{27}41^{100}$	$_{2}7^{100}$
Separated		$_{15}1^{100}$		$_{1}1^{100}$	$_{3}4^{67}$	$_{4}2^{33}$		$_{4}6^{100}$	$_{15}46^{100}$
Total	$_{100}9^{6}$	$_{100}123^{82}$	$_{100}18^{12}$	$_{100}150^{100}$	$_{100}105^{70}$	45^{30}		$_{100}150^{100}$	$_{100}300^{100}$

The above table deals marital status along with cultural status of elderly women in home and old age home. Among widows 10 per cent (6) involved in low, 80 per cent (48) in medium and 10 percent (6) in high. Among unmarried 20 per cent (1) belonged to low and 80 percent (4) to medium. When we consider separated members all of them belonged to middle categoryBy analysing the above table, researcher found that high status group mainly filled by married people. From this importance of marital status in assigning cultural status is clear. Absence of unmarried and separated members was noted here. Among the low status group widows were more followed by married and unmarried. This is not the case for elderly in old age home. There majority members included in low cultural status. In this major share is contributed by widows. Their pitiable condition is projected through this. In this patriarchal society woman's marital status has significant role in assigning her status. Even in this modern industrialized era marital status of elderly have a great significance in today's life. Researcher found

out that their low and middle cultural status put them in "recycle bin" that is in old age home.

Table 7. Income and Social Status of Elderly Hailing in Home and Old Age Home

Income	Social Status								Total
	Home				Old age home				
	Low	Medium	High	Total	Low	Medium	High	Total	
Nil	$_{58}36^{40}$	$_{69}53^{58}$	$_{18}2^{2}$	$_{61}9^{100}$	$_{86}129^{100}$			$_{86}129^{100}$	$_{73}220^{100}$
< 500	$_{10}6^{75}$	$_{3}2^{25}$		$_{5}8^{100}$	$_{11}16^{100}$			$_{11}16^{100}$	$_{8}24^{100}$
500 – 1000	$_{3}2^{40}$	$_{4}3^{60}$		$_{3}5^{100}$	$_{1}1^{100}$			$_{1}1^{100}$	$_{2}6^{100}$
1000-2000	$_{2}1^{50}$	$_{1}1^{50}$		$_{1}2^{100}$	$_{1}2^{100}$			$_{1}2^{100}$	$_{1}4^{100}$
>2000	$_{27}17^{39}$	$_{23}18^{41}$	$_{82}9^{20}$	$_{30}44^{100}$	$_{1}2^{100}$			$_{1}2^{100}$	$_{16}46^{100}$
Total	$_{100}62^{41}$	$_{10}77^{52}$	$_{100}1^{7}$	$_{100}150^{100}$	$_{100}150^{100}$			$_{100}150^{100}$	$_{100}300^{100}$

The above table shows income and social status of elderly residing in home and old age home. Out of 300 elderly 73 percent (220) have no income, 8 percent (24) have income less than 500 rupees, 2 percent (6) income between 500 to 1000, 1 percent (4) 1000 to 2000 rupees and 16 percent (46) have above 2000 rupees.

Researcher found out that elderly members' income have no influence in social status. Due to the impact of industrialisation and urbanisation, the family structure and functions are changed. As a result socio-economic complex changed. Modernisation leads to social distance between the two proximate generations. Thus the stability in the family structure is in the state of dissolution. Researcher found out that the economic dependency gave elderly

low social status which leads them to old age home. Feminisation of poverty points towards the importance of full economic participation and productivity.

Table 8. Income and Cultural Status of Elderly Women

| Income | Cultural status | | | | | | | | Total |
| | Home | | | | Old age home | | | | |
	Low	Medium	High	Total	Low	Medium	High	Total	
Nil	$_{44}4^{4}$	$_{67}83^{92}$	$_{22}4^{4}$	$_{61}91^{100}$	$_{98}103^{80}$	$_{58}26^{20}$		$_{86}129^{100}$	$_{73}220^{100}$
<500	$_{12}1^{12}$	$_{5}6^{76}$	$_{6}1^{12}$	$_{5}8^{100}$		$_{36}16^{100}$		$_{11}16^{100}$	$_{8}24^{100}$
500–1000		$_{3}3^{60}$	$_{11}2^{40}$	$_{3}5^{100}$	$_{1}1^{100}$			$_{1}1^{100}$	$_{2}6^{100}$
1000-2000		$_{1}2^{100}$		$_{1}2^{100}$	$_{1}1^{100}$	$_{2}1^{100}$		$_{1}2^{100}$	$_{1}4^{100}$
>2000	$_{44}4^{9}$	$_{24}29^{66}$	$_{61}11^{25}$	$_{30}44^{100}$		$_{4}2^{100}$		$_{1}2^{100}$	$_{16}46^{100}$
Total	$_{100}9^{6}$	$_{100}123^{82}$	$_{100}18^{12}$	$_{100}150^{100}$	$_{100}105^{70}$	45^{30}		$_{100}150^{100}$	$_{100}300^{100}$

The above table shows income and cultural status of elderly residing in home and old age home. Out of 300 elderly 73 percent (220) have no income, 8 percent (24) have income less than 500 rupees, 2 percent (6) income between 500 to 1000. 1 percent (4) 1000 to 2000 rupees and 16 percent (46) have above 2000 rupees. Researcher found out that there is no direct relationship with income and cultural status. Elderly become out of step with the economic environment and the changing technology.

Conclusion

Now a days, modernisation leads to various attitudinal clashes and structural differentiation in society. One of the significant after effect is that considering 'elderly' as a major problem. The deliberating effects of poverty during old age are most likely to be experienced by women. Discrimination against older people on the basis of age and devaluation of their contribution indicate the importance of study (Dominelli, 2006). The primary data about the elderly for the study have been collected through interview schedule conducted among elderly women in three districts of Kerala with a structured Interview schedule. One was for the elderly residing in own homes and the other for old-age homes. The secondary data are derived from books, journals, reports, newspapers and online media on the subject. The study was based on the primary data collected from the elderly women. This interview schedule was constructed by keeping in view the conceptual components of the study. The interview schedule consisted of personal data which is used to understand their socio-cultural status. Personal data includes age, religion, caste, education, marital status, income and region. The objective of the present study is to explore the socio-cultural status of the elderly women in Kerala.

Findings

- The present study found out that those who have medium and high social status will not enter into old age home.

- There is no direct influence for age in cultural status.

- Educational level has crucial role in deciding their social status of members in society.

- As education increased, the contribution to low cultural status group decreased except illiterates.

- Irrespective of their marital status, old-age home elderly possess low social status.

- Marital status has significant role in cultural status.

- Elderly members' income have no influence in social status.

- There is no direct relationship with income and cultural status.

Suggestions

- As education has significant power to elevate their social and cultural status, our society should take necessary steps for that.

- Mindful effort should take to decrease the importance of marital status.

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THE BINDING VINE OF CREATIVITY IN SHASHI DESHPANDE'S *THE BINDING VINE*

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The values and beliefs of the patriarchal Indian society have paved the way to the oppression of both women and nature. The male ways of thinking and action perpetuate the gendered binary "Masculine culture/Feminine nature." They argue that women are like Nature whose fundamental functions are reproduction and nurture just as the Mother Nature provides for the entire human race. By naturalizing woman and feminizing Nature, men dominate and exploit both women and Nature. The eco feminism views Nature as an interconnected/holistic web of life where no part is superior or inferior to another. According to Carol J. Adams meat eating, like heterosexuality, is viewed as a compulsory institutional norm that is "imposed, managed, organized, propagandized and maintained by force" for the purpose of ensuring male-dominated society's rightful access to nonhuman animal and to their flesh (Kheel, 329). According to her, woman is considered incomplete without a man, so too, vegetarian foods are viewed as incomplete without the addition of flesh.

Shashi Deshpande's *The Binding Vine*, deals with the different aspects of woman's life like motherhood, sisterhood, creativity, sexuality, resistance and identity. Urmi, the protagonist, in Shashi Deshpande's novel is educated, sensitive and middleclass. After the

death of her one-year-old daughter, she finds solace and strength in Mira, her dead mother-in-law's writings. The locus of the novel is rape and its trauma on women. Both Mira, the long-dead mother-in-law of Urmi and Kalpana are victims of rape. One is the rape in marriage and the other is the rape of an unmarried innocent girl.

Mira never wrote poems about love. Rather her poems give account of the harsh and stark realities faced by a marginalized woman living in the phallocratic culture of the past. "Symbolically, the woman is transferred in the wedding ceremony, like a commodity, from the property of the father to that of the husband" (Kheel, 334). Mira loses her identity in marriage just like the exploitation of nature by man in the name of culture. After marriage, Mira is renamed as "Nirmala." Her new name signifies purity. She writes

> A glittering ring gliding on the rice
> Carefully traced a name 'Nirmala.'
> Who is this? None but I,
> My name hence, bestowed upon me.
> Nirmala, they call, I stand statue-still.
> Do you build the new without razing the old?
> A tablet of rice, a pencil of gold
> Can they make me Nirmala? I am Mira. (101)

The loss of Mira's self-identity is reinforced by the loss of her name. Marriage is also thought to be consummated, by the husband's sexual access to his wife's flesh. When she becomes a mother, there occurs another (re)renaming — "Kishore's mother" which further intensifies her (m)othering. (101) She is the archetypal (m)other, the (m)othered.

Mira lived with her poems or rather "the gaps in one are filled by the other" (99). Her diaries and poems complement each other. If she goes against the norms of the manmade society, she is looked down upon as abnormal. She writes:

> They call me mad
> They, who cocooned themselves
> In bristly blankets
> And thought themselves warm
> When I spoke of my soul
> That boiled and seethed. (99-100)
> The lines in Mira's poems –
> But tell me, friend, did Laxmi too
> Twist brocade tassels round her fingers
> And tremble, fearing the coming
> Of the dark-clouded, engulfing night? (66)

find a parallel in her diary entry – "But he comes back, he is remorseful, repentant, he holds me close, he begins to babble. And so it begins. 'Please,' he says, 'please, I love you.' and over and over again until he has done, 'I love you.' Love! How I hate that word…… Why does it have to be me? (67). The second victim Kalapana's mother, Shakutai also raises this question, "Why does this have to happen to me? Why did it have to happen to my daughter?" (67). Mira's verses and diary entry, Shakutai's pathetic comment on hers as well as Kalpana prove that the world has not changed. The objectification, commodification and consumption make them submissive and helpless.

One can draw parallel between female body and Nature just like consumer industry and the meat-eating world. The flesh-eating and other forms of oppression recalls the binaries like man / woman, nature / culture, rational / non-rational, good / evil, hunter / hunted, seducer / seduced, dominating / dominated, colonizer / colonized and the like. The sexual politics of meat/flesh is clearly depicted through these dualisms. One cannot disagree with Marti Kheel, when she substantiates by introducing the symbol of hunting and meat-eating. Vegan feminist Carol J. Adams has noted that the exploitation of nonhuman animals is a patriarchal oppression. The ideology of eating their flesh, imprisoning them or even hurting them is the ideology of dominance just like the socialization processes and the numerous feminine stereotypes have trapped women to become socially accepted objects of male gaze.

The hunter / hunted image finds echo in the man's obsession with Mira after he saw her at a marriage function: "After which he became a man in single-minded pursuit of an object: marrying Mira" (47). Shakutai also comments on the voyeurs of the street pestering her daughter Kalpana. They are like "dogs panting after bitches" (118). She even considers Kalpana to become the second wife of Prabhakar, the husband of her elder daughter Sulu. Prabhakar who is mad after Kalpana rapes her when she decides to marry a boy of her own liking. Sulu knowingly gives breakfast to her husband, the seducer of her sister and commits suicide in order to save him from the police. Shakutai even requests Urmi to tell the doctor not to make the report of molestation of her dying daughter for she is worried about Kalpana's marriage. Shakutai's husband has abandoned her for a better younger woman. So she does not

want to repeat the history. She believes if Kalpana gets married, she is "safe from other men" (88). Prabhakar is not a bad choice for her. In both these cases Mira and Kalpana are looked upon by their seducers — husband and brother-in-law respectively as pieces of flesh / meat to be consumed. Rape is not only violence, but also a humiliation to the victim's feelings. It is an intrusion to her personal life. It's a traumatic experience to the violated. Sulu's chosen silence, eternal silence as her reaction to husband's raping of her sister Kalpana. Mira takes writing as a means of her redemption from all sorts of oppression:

> Come my brothers, come, my sisters,
> Let us join our hands;
> A new road, a new way
> A new age begins. (44)

Resistance to hegemony exists in her writings. She has transmitted it through her poems. The title of the novel has been taken from one of the poems of Mira which is about creation and binding love. The potential for resistance to power is through strategies like "manipulations within the domestic sphere, the subversions of religious and cultural resources and the deployment of sexuality" (Sunder Rajan, 161). Her covert resistance emerges from a craving to construct identity. Mira's existence had been a sort of internal colonization on the one hand, and a double colonization on the other. Her identity as a Third World woman intensifies her oppression. By writing about the doll-like existence of herself, she could find a voice to express her anger and disgust against the patriarchal society.

Meat eating is a deep-rooted practice in our culture. Consuming flesh signifies higher status, wealth and class. It is also associated with strength, sexual potency, virility and aggression. Abstaining from flesh eating signifies a different meaning in the spiritual sphere. The traditional concept reminds us that flesh eating arouses animal passions. Renouncing sex and flesh means rising above the carnal desires. According to Aristotle, plants function to give subsistence to animals and animals to give subsistence to Man, the rational being. So women and slaves are looked upon by the society as part of the inferior, non-rational word that simply exists to serve rational Man. Both Judaism and Christianity notions further cement the existence of woman and Nature to serve man's needs. The view of women and animals as flesh is accompanied by their image "as property or 'chattel,' a word that significantly derives from the same root word as 'cattle.' Women are owned by male husbands, just as cattle are owned by men who perform "animal husbandry" (332). Through Mira's poems Urmi experiences androcentric oppression. Mira notes:

> Fixed forever in our places
> Face to face the two of us
> Like Shiva and his nodding Bull. (82)

"Animals are kept on "farms," just as women are kept in "families." Significantly, the word "family" derives from the Roman word "famulus," meaning "slave" (Kheel, 332). This also refers to the notion of husband's legal ownership of his wife and children. The ownership of women in families and animals in farms suggests even man's control of their reproductive capacities too.

Mira writes in her diary after meeting the poet Venu to whom she has given her poems to read: "Why do you need to write poetry? It is enough for a young woman like you to give birth to children. That is your poetry. Leave the other poetry to us men" (127). She uses her pen as a sword against abuse and loss of her identity. The objectification and consummation of women's bodies trace parallel to that of Nature. Just like animal body parts, women's bodies are fetishised. Men's sexual "appetites" are aroused by women's bodies likewise their taste buds are aroused by animal flesh. Women are not literally consumed, their identities are lost. But some women have expressed their experience of sexual objectification in which they are treated like a piece of flesh.

Ecofeminists see a parallel between the devaluation of the earth and the devaluation of women. They call for consciousness raising, healing, and a communion with nature. Women weave life like the earth was weaved; women have a unique unity or special connectedness to the earth. In the past, that connectedness was acknowledged and valued. At present, the situation has changed. The title of the novel *The Binding Vine* suggests the binding vine of creativity, the womb-piercing joy of pregnancy, the binding vine of love. All life on the earth is connected together; therefore, exploiting one life upsets all the others. The violence towards women and violence towards Nature are linked together. Man of course, appreciates their beauty, only for his consumption. The globalization and industrialization has enhances man's power of devastation on both the earth and women.

The Third World women experience a different and more intense kind of oppression than that of First World of women. The Third World women are the gendered subalterns with a stifled voice. Their predicament is appropriately expressed by Gayatri Chakravorthy Spivak: "...if the subaltern has no history and cannot speak, the subaltern female is even more deeply in shadow" (296). For Spivak, the silenced subaltern women are like shadowy figures due to their non-representation in the colonial discourses. She exhorts women writers to retrieve the authentic voices of the female subaltern from their mute condition and to rediscover their history in the subaltern consciousness. In the novel, *The Binding Vine*, Urmi makes an effort to resurrect the works of her mother-in-law by publishing them and giving them voice. Kalpana, a subaltern rape victim, has to live under conditions of fear, anxiety and violence. Urmi shows the guts to maintain and retain Kalpana's dignity as a woman, as a human being, by giving her moral support. Through the portrayal of Urmi and Mira, Deshpande gives a powerful note of resistance and self-assertion to reclaim the female self of the subaltern.

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चील कहानी में स्त्री पुरुष मानसिकता का चित्रण

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हिन्दी के कहानीकारों में भीष्म साहनी का स्थान अद्वितीय हैं। उनकी एक प्रमुख कहानी है चील। कहानी का प्रारंभ चील का आकाश से नीचे झपट्ट मारते हुए आने की दृश्य से होता है। कहानी कभी दार्शनिक और कभी मानसिक व्यापारों का खेमा बन जाता है। कहानी का मुख्य पात्र ' मैं ' हुँ। कहानीकार ने विविध जीवन मुद्दों को हमारे सामने रखा हैं। कहानी का वातावरण भारती पार्क बनाया गया है, जहाँ नायक बैठा हुआ है। चील के माध्यम से कहानी विकसित होती है। "चील ने फिर झपट्ट मारा है। ऊपर, आकाश में मण्डरा रही थी,जब सहसा ,अर्धवृत्त बनातती हुई तेजी से नीचे उतरी और एक झपट्टे में ,मांस के लोथडे को पंजे में दबोच कर फिर से वैसा ही अर्धवृत्त बनाती हुई ऊपर चली गई "। यही कहानी का पहला दृश्य है।

नायक शाम के समय पार्क में बैठा हुआ था तब उसे लगता है कि कोइ दूर चलती जा रही थी,वह शायद उनकी ही पत्नी शोभा है जो उसे छोडकर चली गयी थी। वह कभी यह न सोचा था कि शोभा उसे छोडकर चली जायेगी। एक बार एक जानकार कहा था कि " हम आकाश में मण्डराती चीलों को तो देख सकते हैं पर आकाश इन्हीं की भांति वायुमण्डल में मण्डराती उन अदृश्य चीलों को नहीं देख सकते जो वैसे ही नीचे उतर कर झपट्टा मारती हैं,और लहु – लुहान करके या तो वहीं फेंक जाती हैं,या उसके जीवन की दिशा मोड देती हैं "। चील जीवन में झपट्ट

मारकर आनेवाले विविध घटनाओं का प्रतीक हैं। यह झपट्ट कभी- कभी अदृश्य होकर आती है और ज़िन्दगी को ही बदल देती हैं।

शोभा के प्रति उनके मन में अब भी वह प्यार है जो पहले भी था। उसे देखने पर उन्हें लगता है कि शोभा में वही मुस्कान आज भी है,लेकिन थोडा दुबली हो गाई है। चाल में अभी भी वही कमनीयता है। उसका मन चाहता था कि जाकर उनसे पूछे कि तुम कैसी हो ? लेकिन ऐसा न करके वह पेड़ के पीछे छुपता हआ उनकी पीछा करता है। यही आकर कहानी नयी मोड़ लेती है। शोभा की पीछा करते हुए नायक की मानसिक व्यापार धीरे-धीरे खुलने लगते हैं जो स्त्री-पुरुष मानसिकता के धरातल पर महत्वपुर्ण है। 'कई बार तुम्हारी व्यवहार से मेरी आत्म-सम्मान खो गयी थी'।स्त्री की व्यक्तित्व का माप-तोल करना कोइ आसान काम नहीं है। वह सोचता है कि ' जीवन की यह विड़म्बना है कि जहाँ स्त्री से बढकर कोई जीव कोमल नहीं होता, वहाँ स्त्री से बढकर कोई जीव निष्ठूर भी नहीं होता'।लेकिन वह स्वयं को इसका कारण मानता है जो हमेशा कुपित सा बर्ताव किया था।

शादी के पहली दिनों में जब कभी शोभा रुढ़ जाती थी किसी भी तरह खेल-मज़ाक करके उसे वह मनाते थे। धीरे –धीरे शेभा पर जो आकर्षणीयता थी घटने लगा था। दोनों के बीच खाई चौड़ी होती गई ,फैलती गई। शोभा कहने लगी कि, मुझे इस शादी से क्या मिला । तब वह पूछा कि मैंने कौन सा अपराध किया कि तुम सारा वक्त मुँह फुलाये रहो और मैं सारा वक्त तुम्हारी दिलजोई करता रहूँ ।यहाँ स्त्री-पुरुष संबन्धों के बीच की एक परम सत्य को कहानीकार प्रस्तुत करता है । वह कहानी के माध्यम से कहते हैं कि स्त्री-पुरुष संबन्धों में कुछ भी तो स्पष्ट

नहीं होता। भावनाओं के संसार के अपने नियम हैं,या शायद कोई भी नियम नहीं । कहानीकार यह कहना चाहते हैं कि स्त्री और पुरुष के बीच जो संबन्ध होता है भावनात्मक होता है,जिसे किसी नियम के अनुसार मापना मूर्खता होगी। उसमें आज जो रागात्मकता है वह शायद कल न होगा। यहाँ एक बडा सवाल हमारे सम्मुख आता है कि पति और पत्नी जीवन भर एक ही तीव्रता ,गतिशीलता और प्रवाह के साथ प्यार कर सकते हैं ? क्या उसके बीच तनाव के कारण प्यार हमेशा के लिए खत्म होता है ? कहानीकार इसका वस्तुनिष्ठ उत्तर नहीं दे पाते ।

दाम्पत्य जीवन में किन-किन छोटी – छोटी बातों को लेकर तनाव की स्थिति आ जाती है और तलाक हो जाती है । वैवाहिक जीवन के पहले दिनों में जो सहज-सद्भावना होती हैं, नष्ठ हो जाती है, और शोभा की सहज मुस्कान भी । नाक-नक्श और अदायें भी अपना जादू खो बैठा था। शोभा को देखते ही मन कहने लगा कि तू बड़ी मूर्ख लगती है।क्या पत्नियाँ भी ऐसे सोचते होंगे ? इस पर सोचना पाठक का दायित्व बन जाता है।

कई दिन बाद देखने पर शोभा के प्रति नायक के मन में अब भी वही तन्मयतापूर्ण प्यार का सुगन्ध है,जो पहले था। अपनी दृष्टिपथ से शोभा का गायब हो जाने से वह परेशान हो जाता है।और उनके मन में बार- बार यही आवाज़ आती है कि मैं तुम्हें खो नहीं सकता ।

शोभा को दुबली और निस्सहाय देखकर वह स्वंय को धिक्कारने लगते है। शोभा अपनी बालों पर लाल रंग का फूल टंकी हुई थी। यहाँ स्त्री और पुरुष मानसिकता का विशद चित्रण करके कहानीकार लिखते हैं कि " स्त्रीयाँ मन से

क्षुब्ध और बेचैन रहते हुए भी बन- संवर कर रहना ना भूलती।स्त्री मन से व्याकुल भी होगी तो भी साफ सुधरे कपड़े पहने, संवरे –संभले बाल ,नख-शिख से दुरुस्त होकर बाहर निकलोगी।जबकि पुरुष,भाग्य की एक ही थपेड़ खाने पर फूहड़ हो जाता है ''। यह ज़यादा विवादपूर्ण मामला है ।नायक अब पुनः मिलन की आशा में है। उसे लगाता है कि शोभा भी ऐसी सोचती है।कहानी के माध्यम से यह सवाल उठता है कि क्या आत्म सम्मान की भावना केवल पुरुष का हक है ? शोभा का बिना कहकर घर छोड़ने पर वह कहता है कि 'घर में तुम्हें न पाकर मेरे आत्म-सम्मान को धक्का लगा था '।ऐसे सोचने पर भी वह अपनी पत्नी को खोना नहीं चाहता। उसे भय है कि जीवन की समस्यारूपी चील शोभा को अपने पास से उड़ाकर न ले चलें।भय के कारण वह शोभा की पीछे भागता है। लेकिन पास पहूँचने के पहले शोभा पार्क के बाहर पहूँच गयी थी।

इस कहानी के माध्यम से स्त्री-पुरुष मानसिकता को ऑकने का कार्य किया गया है। चील के झपट्ट से जीवन में अचानक आनेवाले उलझनों का वर्णन हैं। उनमें से कुछ अदृश्य होते हैं,जिसको हम अपने ही मन में उपजाते हैं। कहानी का मूल ढाँचा मनोवैज्ञानिकता पर आधारित है।

THE POLITICS OF ENVIRONMENT IN KERALA

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ABSTRACT

We are all contemporaries of an age where development of both man and civilization is measured in terms of replacement or destruction of seemingly outdated or natural surroundings with artificial or manmade ones. Due to delayed or insignificant interferences the damages are very often beyond repair. A close observation brings to light the fact that in majority of the cases the wellbeing of seemingly primitive groups or communities are sacrificed for the advancement of the so called developed communities or groups, leading to a kind of environmental politics.

Keywords: environment, politics, development, movements

With the news of scams and murders and the everchanging political scenario throughout the world, climate and environment have remained the ultimate showstoppers. Whole of India, inspite of its diversity in landscape, topography and geographical dimensions, is facing immense pressure on a day to day basis, as far as environment is concerned. The case of the state of kerala is not very different. World famous as "God's own country", the people of kerala have an inseparable relation with the nature and the environment. Undoubtedly, that is also the reason behind the fact that the state though recently faced with an overall crisis of modernity, environmental politics often took centre stage, both as a

success story and a failure of modernity. Though much remains to be achieved in terms of environment and livelihood struggles, the people here have lead the way in environmental activism.Even as advanced countries have relied on potential parties and NGOs,to support their cause,as in the case of Germany and the U.S,in the tiny stateof kerala just like in many other regions of india , it was primarily the subalterns who unleashed their power of protest and invited other social sections to join them in creating history in terms of environmental politics in Kerala. This is particularly significant against the backdrop of an increasing normalization of environmental concerns, with the real causes of crises remaining hidden at the global level.

The uniqueness of Kerala lies in that it is one of the few regions in the world that has succeeded in ushering in modernity in the absence of advanced modernization or industrialization, understood as advances in technology, progress and economic development. The timely response of the collective public to the authorities, hegemony, injustice and systems of exploitation is what makes environmental politics an important part of social activism of the people. The history of modern environmental activism in Kerala could be traced back to the literary references to the scenic beauty of this piece of land. The affinity with nature has been a feature of Malayalam literature since long. The literary works of prominent writers like G Sankara Kuruppu, Vyloppilli Sreedharan Menon, P. Kunhiraman Nair, Changapuzha Krishnapilla, N. V. Krishna Varier, Edasseri Govindhan Nair, N.N Kakkad etc, seem to play a key role in the making of environmental awareness among the people of Kerala. The nomenclature Marakkavikal (tree poets) itself indicates

the dominance of environmental aesthetics in Malayalam literature. Dr Rathi Menon's Nishabda Vasantham, the translation of 'Silent spring' was another attraction of Malayalam literary ecology. In the field of activism, it was in 1964, the people of Vazhakkad, a village on the banks of river Chaliyar, who firstly registered a protest against water pollution caused by the discharge of chemical effluents from the Birla rayon factory in Mavoor. It was on the government's initiative that the factory was set up in Mavoor, with the Birlas being attracted to the state with its rich supply of cheap raw materials such as bamboo. The Kerala variant of social democracy was equally attractive to India's big capital. However, once factory operations were under way, the local people began feeling the ill-effects of toxic wastes generated by the plant. Although the dumping of toxic wastes and discharging of effluents by the pulp and fibre units of the Grasim factory were deemed illegal and unscientific, in the absence of a robust and effective waste treatment system, the waters of the Chaliyar became progressively more polluted, making it unfit for domestic use. A meeting of the Pollution Control Board, Grasim Industries and the local people was called, and an accord reached on the issue of waste management. However, the company continued to breach the agreement, forcing the local population to staging a massive protest in the late 1970s. K. A Rahman was the leader of this first environmental agitation in the state of Kerala. This also happened to coincide with the extension of the Kerala Shastra Sahitya Parishad's (KSSP) activities to people's livelihood problems that later led to the KSSP's critical role in the Save Silent Valley Campaign. However, it took many years for the struggle to turn into a full-fledged movement, and

despite the untimely demise of K.A. Rahman, who succumbed to cancer, the movement carried on until the forced closure of the factory in mid-2001. Rahman had based his campaign against the factory on the obvious rise in the prevalence of cancers in the region as a result of exposure to toxins discharged from the factory.Meanwhile, various scientific institutions conducted studies highlighting the environmental hazards stemming from the factory's operations. It was revealed that the levels of hazardous elements such as lead, mercury, chromium and so on, were far beyond the safe limits in the Chaliyar river. Apart from the rise in deaths due to cancer, there was also a sharp rise in mortality due to heart and lung diseases, including tuberculosis – more than two hundred in a short period of five years in the early '90s alone. John C Jacob also played a remarkable role in the history of environmental activism in Kerala. He started his career as a teacher at Devagiri College, Calicut where he found himself associated with environmental issues.) Early in 1960's, he paid visits to the villages on the banks of Chaliyar and interacted with on environmental issues. John C Jacob is mainly remembered for his educational programmes among the students. In 1972, he formed Zoological Club, the first environmental organization for the students in entire south India. He had maintained good relationship with World Wild Life Fund India, which helped him to organize the first nature study camp (1974) in Kerala at Ezhimala, in Kannur District.He was also part of the Silent Valley Movement.

Another important incident that brought before the world the environmental connections of the masses in kerala, was in a small village called Plachimada on the occasion of the Earth Day in April

2002, where the US owned Coca-Cola factory in Palakkad district had to face the wrath of the locals. The Anti Coca-Cola Peoples' Struggle Committee comprising both Gandhian as well as moderate-radical groups took a decision to blockade and picket the factory, declaring all out war until Coca-Cola quit Plachimada. This was only two years after the multinational had set up its factory in the midst of dalit and adivasi settlements. Massive groundwater mining and the disposal of treated effluents began to produce adverse effects, with the local villagers facing an acute shortage of water. Further, the little water that was available was found to be polluted and unfit for drinking or cooking. The complete dependence of the populace on these very sources of polluted water resulted in a wide range of diseases, particularly skin and stomach disorders. Coincidently, the multinational Coca-Cola, which had been banned in India in the '70s, re-entered the Indian market in the wake of the neo-liberal reforms of the central government and had set up its factory in Plachimada. The first major success of this solidarity was to persuade the local Perumatty panchayat – the local-level village council that had issued Coca-Cola its license in the first instance – to refuse a renewal of the production license. The panchayat pointed out that the digging of wells and borewells and the installation of electric pumps had not figured in the original agreement; not only had this led to the depletion of groundwater, making drinking water scarce, but the multinational's operations had also resulted in a hazardous contamination of groundwater. The panchayat also noted that the conversion of paddy lands for industrial use was in itself a rank violation of the Kerala Land Utilization Act of 1967 which restricts such conversions. Despite

steady pressure from various quarters to repeal its decision, as also the full knowledge that it would lose nearly half of its revenue and 300-odd jobs once the factory was closed, the panchayat steadfastly refused a renewal of the license to the multi-national giant. This was a historic move marking a major turning point in the Plachimada struggle, which also generated a spate of legal haggling between the multinational and the panchayat.Although Coca-Cola appealed against the panchayat decision, the Kerala High Court maintained that groundwater belonged to the people and that the company could not 'claim a huge share of it'; nor did the government have the power to allow a private party to extract it in such huge quantities, it being 'a property held by it in trust.'

Meanwhile, in yet another development, the Supreme Court of India directed the State Pollution Control Boards to issue closure directions to all manufacturing units which were operating in violation of the Hazardous Wastes (Management and Handling) Rules, 1989/2003. As the Coca-Cola factory came under the purview of the HW rules and as the company had no 'satisfactory facility for the disposal of hazardous waste generated' within the factory, authorization was refused to the multinational by the state, which in effect was a closure notice. At this point, Coca-Cola was also challenged by other agencies such as the Delhi-based Centre for Science and Environment (CSE) which revealed toxic pesticide residues in their products, a result further ratified by the Joint Parliamentary Committee, all of which gave an added impetus to the anti-Cola struggle.Thus, while the local community struggled to give voice to their subjugated knowledge, in an expression of the notion of environmentalism from below – with Mayilamma, a 56

year old woman belonging to the indigenous community, becoming an iconic leader – they were aided in their efforts by numerous agencies which again came together to form a transverse solidarity, finally bringing down the shutters of the factory; the struggle still continues with the agitators claiming compensation for the ecological damage caused by the multinational.

The aerial spraying of endosulfan in the state-owned cashew plantations in Kasargod is the next noteworthy case under environmental politics that defined the state of affairs in Kerala with regard to the environment and the masses. The first major complaint against the aerial spraying of pesticides was voiced in 1979 when a small farmer in a village close to the cashew plantation found that three of the calves born on his farm had limb deformities and stunted growth. As more reports of such birth defects began to come in – now affecting the children in the villages as well – the local panchayat councils took due note and passed a resolution demanding that the state desist from aerial spraying of pesticide. However, these interventions did not lead to a sustained campaign against the use of endosulfan owing to the contrasting claims regarding the cause and effect of pesticide use. The local panchayats kept up their efforts, highlighting the negative consequences of endosulfan spraying, exercizing their power as decentralized administrative units with a constitutional right to speak on behalf of the local communities. Gradually, a large number of environmental and civic groups and civil society organizations were drawn into the campaign, and the media too highlighted the protest movements and the suffering of the victims. The state was also persuaded to enter into the debate, not least because the cashew plantations were

owned by it and it was seen to be responsible for causing such a tragedy in the region.

In this instance too, the various scientific and non-scientific bodies conducted studies in an attempt to establish/refute the connection between aerial spraying and the kind of diseases – including liver and blood cancer – found in the region. This opened up fresh debates on the causalities and the claims and counterclaims regarding the possible effects of aerial spraying. There was thus a massive mobilization of local opinion and this, in alliance with the large number of civil society organizations in the state (the local cultural clubs, community organizations, the Society for Environmental Education in Kerala,KSSP, Thanal Conservation Action, the CSE, Delhi and so on), ultimately forced the state to stop the use of many harmful pesticides in the state.Thus India, one of the major exporters of endosulfan, and a country which had consistently opposed its ban, was forced to change its stand, and join more than 80 other countries in declaring a complete ban on its use. The endosulfan victims in the state belonging to the poorest agrarian communities, however, still await justice in terms of compensation and rehabilitation from the authorities. The anti Endosulfan movement has explored the vulnerability of state when it exposed to capitalism. The response of Plantation Corporation (PCK), a public sector undertaking fully controlled by the government of Kerala, towards the agitations was suspicious. The negative attitude of many government agencies, at regional and national levels, strongly supports this argument.

River Pollution in Kathikudam is another prominent environemental issue. Kathikudam is a village in Kadukutty Panchayath in Thrissur district in Kerala. This village is located on the banks of river Chalakkudy, the fifth largest river in Kerala famous for fish diversity. Experts have indentified more than 100 fish species from this river. Chalakkudy river basin is the only home to Kadar, a primitive hunter-gatherer tribal group in Kerala. The National Bureau of Fish Genetic Resources, Lucknow has recommended to declare the upper stream of Chalakkudy river as a fish sanctuary. The establishment of Nitta Gelatin India Ltd (NGIL) in 1975 became a turning point in the history of this small village. When the production started in 1979, the people of Kathikudam realized the consequences of unplanned and unregulated industrialization. On the one side, it extracted large quantity of water from Chalakkudy River without any permission from any relevant and authentic government agency. On the other side, it carelessly discharged the industrial waste into the same river without proper treatment. The leaching of wastewater, acid and heavy metals from the solid waste has contaminated the soil and ground water of the village. The air pollution and discharge of of toxic gas emissions from the factory has lead to several diseases in the village like breathlessness, suffocation, dizziness , nausea, asthma and lung infection. The environmental damage has lead to the contamination of water for drinking and domestic use, irrigation, fishing etc in the village. The people of the village feel sad about the damage caused to the river. The farmers of the area are afraid of to carry on cultivation and farming due to toxicity in the soil 75 and quite a few of them have stopped farming. Due to soil toxicity, the paddy fields have become

barren and walking in the fields gives rise to itching and other skin diseases. On the social side, the local people are facing social ostracism in the sense that people from other communities resist visiting their relatives in Kathikudam because of the poor quality of environment. There is a growing tendency to avoid marriage from this village. There are claims that the case of unmarried youth and long wait for marriage are increasing. The agitations against factory, which had started during 1980s, did not produce any positive results due to the pressure and inducement from the management.The KSSP and Jananeethi have done commendable work in preparing scientific reports on this issue. In 2008, the agitators formed an action council and decided to intensify the struggle against the company. The action council made it clear that they wanted the industry shut down permanently. Realizing the fact that no political party has a genuine interest in resolving the problem, the Action Council took a historic decision to participate in the Panchayath elections held in 2010. One of its candidates turned elected from the ward where NGIL is located. This shows the community support of the movement. According to one estimate, there are 57 non-governmental organizations in Kerala with a focus on environmental subjects. They include Kerala Sastra Sahithya Parishath(KSSP), Mithranikethan, Friends of Trees, Bio-Watch, Kerala Gandhi Smaraka Nidhi, Kottayam Social Service Society, Jananeethi, Society for the Protection of Environment- Kerala (SPEK), One Earth-One Life and Society for Environment Education Kerala (SEEK). The members of KSSP like, A. Achuthan and M.K Prasad had a very active role in the Chaliyar movement. KSSP had

conducted large number of scientific studies in connection with various environment related issues in Kerala.

There are at the moment hundreds of environmental struggles being waged in Kerala. They range from protests against the conversion of paddy lands and land-grabs, to the reclamation of backwaters, movements against quarrying and excessive trawling, thepollution of rivers such as the Periyar and so on. Perhaps the recent crises with respect to urban waste disposal in various parts of the state, particularly in Laloor in Thrissur and Vilappilsala in Thiruvananthapuram, demand special mention.In terms of the hierarchy of power relations, this issue highlights that the burden of urban waste disposal is differentially borne by those on the margins, who themselves do not generate waste for obvious reasons. From a transnational point of view, it is as objectionable a practice as waste shifting from the North to the South, with relatively higher levels of consumption – a signifier of the western notion of modernity – remaining the privilege of an elite few. While the global South, which does not produce waste has had to bear the brunt of western waste disposal, a similar process is mirrored in Kerala in the urban peripheries where the villages became the dumping grounds for urban waste.Many more struggles are fermenting in an illustration of what David Harvey calls accumulation by dispossession. The reclamation of paddy lands in Aranmula in the name of a greenfield airport, when there are already three international airports in the state and two on its border with Tamil Nadu (Coimbatore and Mangalore), indicates the predatory nature of corporate capital's land grab; this is in stark contrast with the struggles in Chengara and Muthanga where the dalits and adivasis struggle for a piece of

land for their livelihood - the forerunner of the contemporary 'occupy' events in the West. The emergence of a mafia in sand mining as well as quarrying, and land grabs in plantations whose lease periods have ended such as in Nelliampathy, are all indicative of the presence of a powerful lobby comprising capital and the state, often aided by diaspora remittances pushing for a privatization of public and environmental resources – by and large akin to the post-communist societies of Russia and Eastern Europe. These are often seen as avenues for quick profit and the struggles that lie ahead would be aimed at preserving these resources for livelihood and people's development, but also to retain the political space for the subaltern in Kerala. What sets this livelihood-environmental activism apart from environmentalism in the West is its subaltern origin and the broad-based support engendered in the course of the struggle. The first and foremost concern for these activists is their own livelihood and survival, which in turn is intimately related to the reproduction of nature and environment. It is to be understood that livelihood and environmental sustainability go hand in hand, that they combine their struggles and invite the support of other socially concerned sections to form a common platform for political-ecological justice. They do not declare war on globalization per se; nor do they militate against the symbols of globalization. Second, the state which was responsible for bringing in a corporate regime of accumulation as part of its wider developmentalist agenda was itself subjected to a wider conscientization through the agency of transverse politics/transverse solidarity.

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ALGAL DIVERSITY OF STAGNANT WATER BODIES OF CARMEL COLLEGE CAMPUS, MALA

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ABSTRACT

A study was conducted to analyze the diversity of algal components of selected stagnant water bodies of Carmel College, Mala. Three different water bodies in the campus were selected and the algal population was studied. Samples were collected from all the water bodies and preserved in formalin solution and the algal population was examined by using Olympus research microscope. Total of 24 algal genus were identified and Chlorophyceae was the dominant group in all the water bodies. The scanty prevalence of Cyanophyceae showed that there was no much pollution in these bodies. Some bacillariophyceae members were also present. Even though some water pollution tolerant algae like oscillatoria , phormidium etc were present , their lesser number shows that this area is free from heavy water pollution. But they are indicators of eutrophication. Thus, algal communities were used as bioindicator of organic pollution of stagnant waters.

Key word: *Chlorophyceae, Cyanophyceae, bacillariophyceae, oscillatoria, phormidium*

Introduction

Algae, which are the diverse assemblages of chlorophyllous organisms, are found growing in a variety of aquatic and terrestrial ecosystems. The term algae has been derived from a Latin word *Algae* which means sea weeds. Algae are small autotrophic plants

that fail to show any cellular differentiation and their sex –organs are unicellular and if multicellular all cells are fertile (Smith 1950). These lower plants are used as a feed, fodder, fertilizer and medicines. Their ecological status as primary producer in ecosystems has become a global interest in the contemporary world. Blue green algae one of the major group of algae, fix atmospheric nitrogen. The application of algal biofertilizers in various agricultural fields has been proved successful and eco-friendly. So the environmentally hazardous chemical fertilizer is now being gradually replaced by eco-friendly biofertilizers. It is equally important to understand the harmful effects of algae which produce phycotoxins as secondary metabolites that are toxic not only to human beings but also to many animals, birds, insects etc. It has also been found that chemicals produced by algae cause destruction to many building and important historical monuments. Algae are encountered in city's water supply that causes a lot of nuisance to drinking water. Many algae are troublesome for their ability to produce characteristic odour and taste. The algal blooms which form surface mats in the water bodies prevent penetration of oxygen thereby causes death of fishes. In contrast, algae that is dispersed and not in blooms or mats help in penetration of oxygen thereby helping bacterial decomposition of organic matter (Wetzel, 2001). The growth of algae is affected by pollution in number of ways such as (i) poor availability of light (ii) substance may be toxic (iii) effluent may be modify physical and chemical environment (iv) sudden competition with additional organisms (v) depletion of oxygen etc. At the same time some algae may form blooms, produce obnoxious odour and increase toxicity in water.

Indigenous fresh water systems are the hot spot of diverse and rare algal components as a result of varying micro habitats. Diversity in these localities is determined by habitat modification, harvest of native species and accidental introduction of exotic species. Algae, the principle primary producers, are photosynthetic thallophytes, usually microscopic, unicellular, and colonial or multi cellular organisms which perform the maximum quantum of photosynthetic activity than any living organisms in this world. Many forms spread throughout the water body and cause turbidity of water and algal blooms. Stagnant water bodies are the part of the lentic systems which also include pools, puddles, reservoirs, lakes and paddy fields. The ponds may contain different types of phyco components like free floating (planktons), benthos (attached to sediments), epiphytic (attached to plants and other objects) etc. The appearance of algae is most probably seasonal.

Bioindicator are taxa or groups of organisms that show signs that they are affected with environmental pressure because of human activities or the destruction of biotic system (McGeoch, 1998 and Shahabuddin, 2003). The major groups of organisms that have been used as indicators of environmental pollution include bacteria, fungi, protozoa, algae, higher plants, macro invertebrates and fish. The presence or absence of the indicator organisms reflects aquatic environmental conditions. Therefore to conserve valuable resources from further deterioration there is a need for regular monitoring of the atere bodies.

Algae are involved in water pollution in a number of important ways. Due to the enrichment of inorganic phosphorous

and nitrogen is responsible for the growth of algae in water bodies. Research in the freshwater ecology of algae related to water pollution is sparse, and it is necessary of detailed study for searching indicator species. The uses of algal communities correlating water pollution (Sonneman*et al.*, 2001). Algae are one of the most rapid bioindicator of water quality changes due to their short life spans, quick response to pollutants and easy to determine their numbers Plafkin*et al(1989)*

Review of Literature

Researches were undertaken by various workers all over the world in different field of phycology. In India, studies in phycology were initiated mostly by Englishmen working either in Botanical Survey of India or in the University of England. Thresh *et al.*, (1944) suggested that high chloride concentrations indicates the presence of organic matter, presumably of animal origin. The constant addition of even low levels of nitrogen and phosphorus to an aquatic environment could greatly stimulate algal growth and high level of total nitrogen was followed with the growth of Chlorophycean, Euglenincan and Cyanophycean forms Hastler (1947). Prescott, (1948) discussed the importance of temperature in the growth and periodicity of blue green algae. Number of algae was found dominant in the surface layers of the water at the time of low water level Evans (1959). Zafar (1964) reported that phosphates were observed in traces during winter season, and Cyanophyceae were in peak when the phosphate content is very low or even undetectable. Studies on diurnal variations in two shallow ponds in Delhi revealed some relationship between physico-chemical conditions of water and

plankton. High temperature favored the growth of certain taxa of *Chlorococcales* Singh (1961). Philipose (1967) observed that *Chlorococcales* can grow in a wide range of temperature. Williamson (1998, 1999, 2002a, b) has studied the desmid flora of Malaysia, South Africa, Scotland, and Iceland-Orkney respectively. Similarly, Kanetsuna (2002) has described the desmids of Japan, Combodia, Malaysia and Thailand. Feher (2003), and Novakova (2003) have also studied the desmids from Hungary, Lithuania and Czech Republic respectively. Our knowledge of Indian desmidiaceae is mainly through the works of Suxena and Venkataswarlu (1966a, 1968a, 1970), Vidyavati and Nizam (1970, 1974, 1975) from Andhra Pradesh; Sinha and Mishra (1967), Suxena and Venkataswarlu (1968c) from Kashmir; Ashtekar and Kamat (1979), Iyengar and Vimala Bai (1941), Iyengar and Ramanathan (1942), Saraswati (1946), Iyengar (1958), Ramanathan (1962, 1964) from Tamilnadu; Bharti (1965a, b, c, 1966, 1971) from Maharashtra and Karnatka; Bharti and Pai (1972), Hegde and Bharti (1980) from Karnatka; Agarkar and Agarkar (1973), Agarkar *et al.* (1979),Patel and Satyanarayan (1976) from Madhya Pradesh; Patel (1969, 1980), Patel and Asokakumar (1979, 1980,1981) from Gujarat; Mukherjee and Srivastava (1993) from West Bengal; Suxena *et al.*(1973), Patel *et al.* (1977), Patel (1982) from Kerala; An attempt is made in the present communication to focus attention on the studies relating to the collection and identification of algal flora upto generic level. Anand *et al.* (1987) have studied the Blue green algae in the rice fields of Kerala state. Sivadasan et al (1995) have studied the benthic algae of Cochin estuary. A survey of algal blooms in the ponds of Pallippuram, Kerala, India was conducted by Dhanya *et al.*

A great deal of research work has been done mainly with the growth of algae in polluted and Universal Journal of Environmental Research and Technology *80 Kshirsagar A. D.* non polluted waters of river Mula from Pune city. Gunale and Balkrishanan (1981) carried out study on the freshwater ecology of algae related to water pollution and it is necessary of detailed study for searching indicator species were used for water quality studies on Pavana, Mula and Mutha river flowing through Pune city, indicating that certain algal group were indicative of level of organic enrichment. Gunale, (1982) emphasized mainly on Biomonitoring of eutrophication in Pavana, Mula and Mutha river flowing through Pune city.

Materials and Methods

Algal collections were undertaken in all possible stagnant water-bodies present in Carmel College, Mala at an interval of 15 days for a period of 3 months i.e. from January to March 2016. the algal components were filtered from the water. Sterilized bottles were used and surface water from different locations were filtered through the mesh net. The filtrate collected over the nylon cloth was immediately transferred to the sterilized sample bottle and sealed immediately along with the water. The bottled algal samples were centrifuged in a centrifuge and the upper centrifugate was discarded. The filtrate was sucked slowly with the help of dropper and kept on a neat sterilized glass slide and mounted in glycerin using cleaned cover slips .The collected algal samples were preserved in formalin solution. Temporary slides were prepared and observed under microscope. Photography was done by an Olympus photomicroscope. The identification of phytoplankton was done with the help of standard books and monographs. The algae were identified using pertinent

standard algal keys like Desikachary (1958), Anand (1987), Prescott (1954) Smith 1950; Prescott 1951; Desikachary 1959; Randhawa 1959;Ramnathan 1964; Sarode and Kamat 1984 etc.

Results and Discussion

The analysis of water sample from the selected locations showed the presence of following algal forms (**Table 1**)

Table 1. Main algal species present in the three selected stations

	Site 1	Site 2	Site 3
Chlorophyceae 11			
Cosmarium	-	++	+
Oedogonium	+	-	-
Closterium	++	+	++
Pithophora	++	++	-
Cosmarium	+	++	-
Spirogyra	+	++	++
Chlorella	+	++	++
Scenedesmus	-	-	++
Ankistrodesmus	-	+	+
Pandorina	-	+	+
Monaraphidium	-	+	+
Bacillariophycea6			
Pinnularia	+	++	++
Nitzschia	+	++	+
Navicula	+	+	++
Cymbella	+	++	+
Synedra	-	+	+
Fragillaria	-	+	-
Cynophyceae5			
Chrococcus	-	+	+
Microcystis			+
Oscillatoria	+	+	
Phormidium			+
Gloeocapsa	+	+	
Spirulina	-	+	-
Euglenophyceae1			
Phacus	+	-	-

+present , _absent, ++abundant

Important Salient Features of the Identified Algal Species

1   *Scenedesmus* Cells 2-4, arranged in a single row, cells oval to oblong, all similar in shape, rounded at both ends, compactly and lateral adjoined with smooth walls, cells 4-8 μm in diameter, 6-16 μm long

2   *Chrococcus*: Single cells or cells in groups of a usually even number of cells (2 up to 32 - more frequently 2-4) inside mucilaginous envelope. Single cells are spherical, but when in groups they are often hemispherical due to the fact that daughter cells do not fully separate after division.

3   *Pinnularia*: Valves linear; elliptic with tapering rounded ends, 94.15-97.95 μm long,17.23- 21.62 μm broad raphe thick; axial area narrow, linear; central area rhomboid; striae slightly radial in middle and convergent at ends; 10-12 in 10 μm

4   *Ankistrodesmus*: Colonies 4-8 or more cells; cells acicular to narrow by fusiform with the ends tapering to acute apices , usually spirally twisted around one another in the mid region, but free at the ends, 22.54-30.16 μm long,2.17-3.20 μm broad; chloroplast 1'parietal, pyrenoids absent

5   *Pithophora*: Filaments highly branched, 112.23-116.43 μm long, 53.34-61.92 μm broad; chloroplast parietal; nucleus 6-8; pyrenoids 4-6;akinetes brownish green; cylindrical with rounded end; terminal and inter calary, 121.29-135.49 μm long and 78.24-88.17 μm broad

6   *Pandorina*: Colony spheroidal or oval; cells crowded, somewhat pyriform, with the broad ends all directed outwardly. The

flagella extend from the broad anterior ends of the pyriform cells in a more or less parallel fashion at first and then flare widely as they emerge from the colonial sheath

7   *Cosmarium*: Cells 14.78-17.49 µ long; 11.12-14.06 µ broad; margin entire; constriction deep; isthmus 3.51-4.44 µ broad; sinus linear; wall smooth; chloroplast axile; pyrenoids 2

8   *Navicula*: Cells elongate, lanceolate with acute apices, raphe straight; central nodule short; axial area narrow and indistinct; polar nodules small; valve surface striate; striae surface robust; reaching to the raphe; median ones scarcely radiant; striae 12 in 1

9   *Spirogyra*: Filaments of vegetative cells cylindrical, 153.64-160.93µm long, 57.12-60.56 µm broad; septa plane; chloroplasts 2 in each cell with 4-5 turns; conjugation scalariform; conjugation tube formed by both gametangia; fertile cells cylindrical,154.87-162.84µm broad; zygospores ellipsoid, mesospore wall smooth, brown

10 *Microcystis*: Colonies blue- green, spherical' ellipsoidal or elongate with diffluent colonial mucilage; clathrate arranged, 4.56-5.23µm broad; gas-vacuoles present

11 *Nitzschia*: Valves linear, tapering to sub-acute apices; in girdle view frustules bacilliform; keel marginal; margin convex, lanceolate with carnal dots, 18.24-21.63µm long, 3.78-4.25µm broad; ends rounded; keel eccentric; striae 20-22 in 10µm

12 *Fragilaria*: Frustules rectangular, attached together to form chain; valves linear, narrow towards ends ,18.26-129.47µm long

3.13-4.27µm broad; ends slightly constructed pseudo raphae linear lanceolate; central area not formed ; striae 16-18in 10µm

13 **Oscillatoria:** Thallus dark blue –green to brown; trichome more or less straight, dull blue green, brown or olive green, not constricted at the cross walls, or only slightly constricted ,11-20 (-22)µ,commonly 13-16µ broad; cells 113-116 as long as broad, 2-5 µ long cross walls frequently granulated; end cell flatly rounded with slightly thickened membrane

14 **Oedogonium:** Cells cylindrical, 16-26 µm in diameter , 49-120µm long ; basal cell tapering towards hold –fast; swollen at upper end; apical cell bluntly rounded, macrandrous, dioecious, chloroplast parietal, nucleus 1, pyrenoids 4-7, basal cell elongated

15 **Closterium:** Cells sickle shaped, strongly curved, apices bluntly pointed; 120.9-126.18 µ long, 13.15-21.00 µ broad; outer margin 125-130o arc, middle portion not tumid, wall smooth; chloroplasts 5-6 ridges; pyrenoids 7-8, in axial row; zygospore rounded, smooth walled, 45.0-58.0 µ in diameter

16 **Spirulina:** Trichomes loosely or tightly coiled; cross wall between cells not clear; sheath absent; apex not attenuated; terminal cell rounded; calyptra absent, reproduction by fragmentation

17 **Phacus:** Cell wall composed of a proteinaceous pellicle (as in *Euglena*), but too rigid to flex. Cells generally rounded and flattened (twisted in one species), with a pointed tail at one end and a flagellum at the other, emerging from a reservoir. There is a prominent red eyespot adjacent to the reservoir, and

usually a large ring of paramylon in the cell centre. The cell surface may be ridged. Chloroplasts are green and numerous.

18   *Phormidium:* Unbranched filaments of short cylindrical cells in a fine sheath. Filament may glide within the sheath. Cells may be at least as long as they are wide (cf. *Oscillatoria*). End cells often pointed/tapered, with a calyptra (thickened cap) on the terminal cell. Tapering may extend several cells from the end. Heterocytes absent. Organelles absent from the cells, but granules/vesicles common. Forms mats that may be dark brown, green, purple or blue-green.

19   *Gloeocapsa:* Gloeocapsa is a genus of cyanobacteria. The cells secrete individual gelatinous sheaths which can often be seen as sheaths around recently divided cells within outer sheaths, Colonial cells flattened along lines of division, embedded in dense mucilage formed by concentric layers of sheath each corresponding to a round of division Colonies of *Gleocapsa* usually contain more cells than *Chroococcus*, which often forms clusters of 4 cells that result from symmetric binary fission,

20   *Chlorella:* is a genus of single-cell green algae belonging to the phylum Chlorophyta. It is spherical in shape, about 2 to 10 μm in diameter, and is without flagella. *Chlorella* contains the green photosynthetic pigments chlorophyll-a and -b in its chloroplast. Through photosynthesis, it multiplies rapidly, requiring only carbon dioxide, water, sunlight, and a small amount of minerals to reproduce

21   *Spirulina:* The filaments are 0.3 – 1.0 mm in length.The filaments are coiled or helical for the most part though there

could be straight forms at times. The filaments are made up of many cells with clear and visible transverse cross walls. The cells making the filaments are shorter than broad. The width varies between 6-12 micrometers.

22 *Monoraphidium:* Single cells, fusiform, cylindrical, longer than broad, straight, curved or sigmoid, sometimes spiral, gradually tapered towards the apex, which may be tapered or rounded; smooth cell wall; parietal chloroplast, without pyrenoids. Reproduction by 4-8 autospores, arranged in series within the mother cell, which are released after breaking up the wall of the mother cell into two parts

23 *Cymbella:* Valves asymmetrical around apical axis and symmetrical to the transapical axis. Cells showing slight to pronounced dorsiventrallity. Ends rounded to subcapitate. Raphe central or slightly ventral, +/- straight to sinuous. Stigmata lacking or on the ventral side of the central area. Terminal raphe ends straight or deflected dorsally. Single H-shaped chloroplast in most species (*C. lanceolata* is the exception) with a central pyrenoid located towards the dorsal margin.

24. *Synedra:* Valves are lanceolate with attenuate and capitate ends, slightly swollen in the middle portion, width 3-5 μm, length 12-38 μm. Striae number 19-23 in 10 μm. The external openings of the areolae are apically elongated. Axial area is linear and very narrow. The central area is asymmetrical about the apical median plane, and ghost striae may be present in some specimens. One rimportula is present at a valve apex. Apical pore fields are present at both apices. The pores within the apical porefields are arranged in parallel rows.

Algae are group of organisms which grow in different environments. There is hardly any habitat in which algae are not encountered. A great majority of them are truly aquatic and grows in ponds, lakes, puddles etc. Besides occurring in aquatic habitats, algae are found abundantly on tree, trunks rocks and in association with other plants and animals. Hence the ecological relationship of algae are complex and varied. Algae have long been used as indicator of water quality. Because of their short life spans, they respond quickly to environmental changes. They flourish both in highly eutrophic waters while a few others are very sensitive to organic and/or chemical wastes. Some species have also been associated with noxious blooms sometimes creating offensive tastes and odours or toxic conditions. Because of their short life cycles they respond quickly to environmental changes, and hence the standing crop and species composition indicate the quality of the water mass in which they are found. It also demonstrated that algal assemblages could be used as indicators of clean water or polluted water. Clean water would support a great diversity of organisms, whereas polluted water would yield just a few organisms, with one or few dominant forms. The present work was aimed at studying the diversity and distribution of various species of algae in stagnant waters of Carmel College, Mala over a period of three months. During this period some interesting facts about the distribution were reported. In the present study,11 genera of Chlorophyceae,6 genera of Bacillorophyceae and 5 genus of Cynophyceae and 1 genes of euglenophyceae were recorded. The chlorophyceae is a group of algae having their photosynthetic pigments localized in chromatophores which are grass-green because of the predominance of chlorophyll – a

and b over the carotene and xanthophylls. In the present study eight genera of chlorophyceae class were recorded. Chlorophyceae was widespread among the plankton. The dominance of chlorophyceae might be due to high dissolved contents. It had also observed that the green algae prefer water with higher concentration of dissolve oxygen.

According to Akasaka et al. (2010) the land use pattern around the pond has direct effect on water quality and aquatic vegetation. The emergence of *Microcystis aeruginosa* bloom in kandy lake, Srilanka has been explained in terms of N-enrichment mainly by ammonium-N, and high turnover rates of dissolved phosphorus (Silva, 2003). Ahmed et al. (2007) relates the periodic cyanobacteria blooms in an urban river to increased dissolved organic nutrients, long sunshine hours and favorable water temperature. Species of *Oscillatoria* are reported to produce hepatotoxic microcystins (Ahmed et al., 2010). Welker et al. (2005) detected microcystins in thirty nine ponds related to occurrence of *Microcystis, Planktothrix* and *Anabaena*. The observation of potentially toxic genera of *Microcystis* and *Oscillatoria* in the present study is of concern. Medium growth of three species of Charophyta were observed all stagnant waters of the study. Charophytes are generally recognized as indicators of clean water ecosystems and they prefer hard alkaline waters rich in calcium. However Charophytes may persists under moderate fertility and turbidity (Klosowski et al., 2006). The survey has revealed the need for conservation, and the scale of restoration to be undertaken.
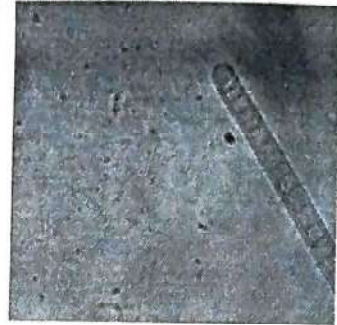
Plate 1: Algal diversity in the present study
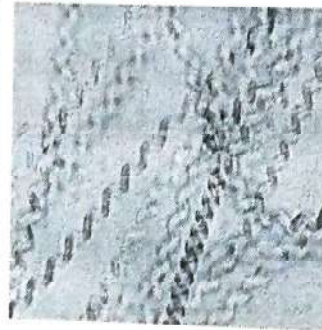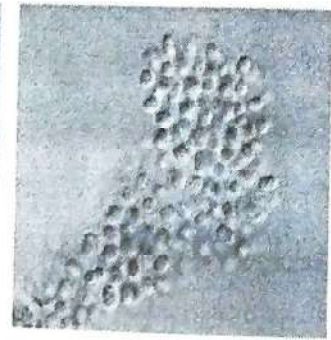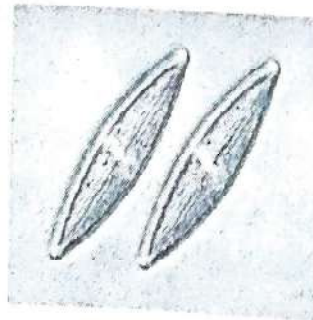

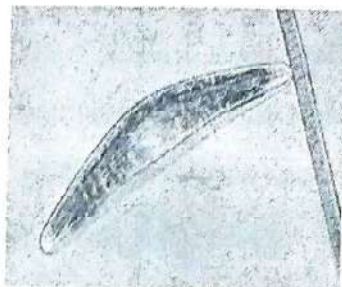Chroococcus

Gleocapsa

Oscillatoria
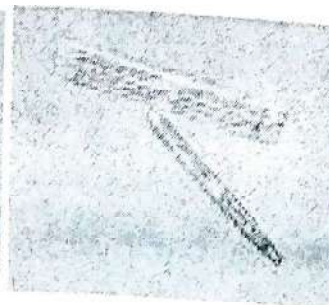
Phormidium

Spirulina
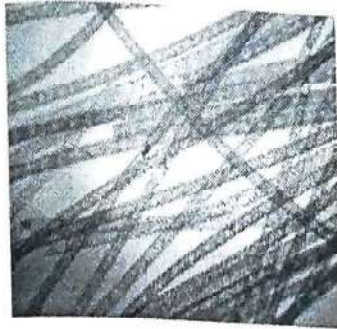
Micro rocystis

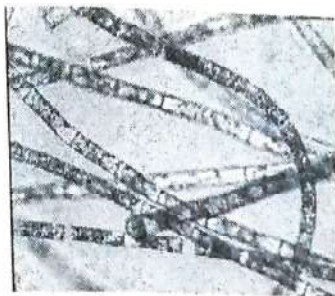Nitzschia

Navicula

Fragillaria

Cymbella

Synedra
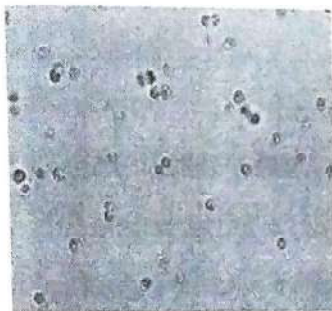
Pinnularia

Spirogyra

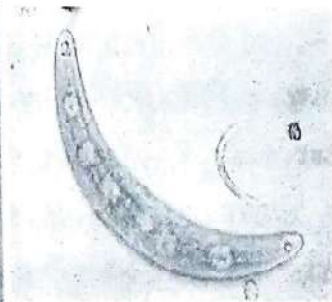Pithophora

Cosmarium

Oedogonium
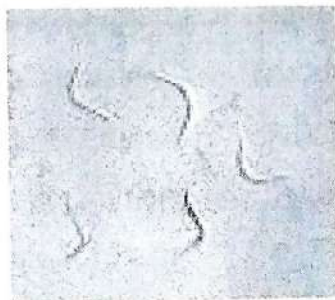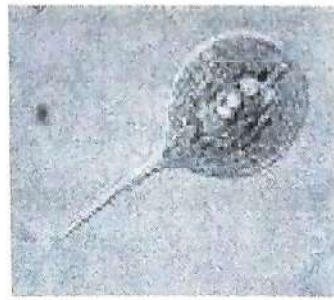

Pandorina

Scenedesmus

Chlorella

Closterium

Ankistrodesmus

Monaraphidium

Phacus

Conclusion

Therefore from the Present study it is concluded that the out of the various phytoplankton in stagnant waters of Carmel College Campus Chlorophyceae is dominant. It has been concluded that the water of this area shows high dominance of *Chlorella sp., Navicula sp., Nitzchia and synedra* which indicates that this area posses less amount of organic waste and therefore the water of the lake is not organically polluted.

The study of the diversity of algae showed the presence of 24 algae altogether with first site showing least number (13) followed by second with 19 and the second largest number was found in the third site (16). A few members are represented by both stations and some algal species was found common in all the three stations. The first station showed presence of 2 Cyanophyceae, 6 Chlorophyceae and 4 Bacillariophyceae and 1 Euglenophyceae member. The second site showed 4 Cyanophyceae, 9 Chlorophyceae and 6 Bacillariophyceae members. The third site showed 3 Cyanophyceae, 8 Chlorophyceae and 5 Bacillariophyceae members. It is very much clear that Chlorophyceae was the most dominant class of Algae in all the three stations. Less number of Cyanophyceae and Bacillariophyceae in all the 3 stations indicated that serious pollution has not happened in the selected sites.

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STUDY ON WATER QUALITY PARAMETERS AND ALGAL DIVERSITY OF NADAVARAMBA CHIRA

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ABSTRACT

Wetland ecosystems are one of the most productive ecosystems and play crucial role in hydrological cycle. Water quality plays an important role in maintaining wetland ecosystems. Wetlands are mostly now in an environmentally neglected and degraded form mainly due to eutrophication, weeding, siltation, etc. Nadavaramba chira is located at Thrissur district around 10.9 hectars of land at present. This study deals with the estimation of essential water quality parameters of eight selected stations from the study area. The various parameters were calibrated and it is compared with the international standards. Algal diversity of the above stations was analyzed and the similarity indices were calculated. The study revealed that due to the neglected state of the Chira, various parameters are far beyond permissible limits. It is a clear-cut example of how anthropogenic over-exploitation and negligence can deteriorate a well-established ancient agro-ecosystem.

Introduction

Wetlands defined as areas of land that are either temporarily or permanently covered by water, exhibit enormous diversity according to their genesis, geographical location, water regime and

chemistry. This means that a wetland is neither truly aquatic nor terrestrial; it is possible that wetlands can be both at the same time depending on seasonal variability. Because of their transitional nature, the boundaries of wetlands are often difficult to define. Wetlands are one of the most productive ecosystems and play crucial role in hydrological cycle. Three attributes that help to delineate a wetland:

(i) The area must be permanently or periodically inundated or water must be present for at least seven successive days during the growing season.

(ii) The area must support hydrophytic vegetation.

(iii) The substrate is predominantly hydric soils that are saturated or flooded for a sufficiently long period to become anaerobic in their upper layers.

From the utilitarian point, wetlands can be defined as transitional areas between permanently flooded deepwater environments and well drained uplands that contribute a wide array of biological, social and economic benefits. Wetlands support a wide array of flora and fauna and deliver many ecological, climatic and societal functions. Scientists often refer to wetlands as the "kidneys" of the earth and forests as the "lungs" of the earth.

The wetlands of the nation are being under threats of various origins like shrinkage, encroachment, siltation and polluted water influx. As the wetlands hold utmost potential to serving the livelihood, enough care must be taken for conserving them.

Kerala is one among the most thickly populated region in the world and the population is increasing at the rate of 14% per decade. As a result of the measures to satisfy the need of huge population the water bodies of Kerala have been increasingly polluted from the industrial and domestic waste and from the pesticides and fertilizers in agriculture. Urban growth, increased industrial activities, intensive farming, and overuse of fertilizers in agricultural production have been identified as drivers responsible for these changes. It is a well-known fact that a polluted environment has detrimental effect on health of people, animal life, and vegetation. Hence, the maintenance of water quality at acceptable level is an essential requirement for successful use of these water resources.

Discharge of toxic chemicals, over pumping of aquifer and contamination of water bodies with substance that promote algal growth are some of the today's major cause for water quality degradation. These impurities may give water a bad taste, colour, odor or turbidity and cause hardness, corrosiveness, staining or frothing. Water quality reflects the composition of water as affected by natural cause and man's cultural activities expressed in terms of measurable quantities and related to intended water use. So, the knowledge of extend pollution and status of water become essential in order to preserve the valuable sources of water for future generation.

Study site description

The Nadavaramba chira is a significant water body located about 3km away from Irinjalakuda town, Thrissur district, central part of the Kerala state. The total area of the chira calculated as

around 10.9 hectares at present. The area is 16 meters above the sea level and is located 37km towards south from district headquarters, Thrissur.

This is a highly productive paddy field at past, but now is in neglected state. This enhances the water percolation to the soil and recharge water table. So to a large extent it can influence the surface water level of surrounding wells. The water is highly murky now and surface is covered with weeds and algal biomass. An excessive growth of water hyacinth is also visible. In some region, there is foul smell evolving, making the life of neighborhood difficult.

Objectives of Present work

- To study H_2O quality parameters.
- To study Algal flora and Angiosperm flora.
- To study the correlation existing between water quality parameters.

Previous studies about water quality parameters

Evaluation of various water quality parameters of in Kottayam Chira by Rakesh V.B., et.al,(2013). The study revealed that due to neglected status of Chira, various parameters are far beyond permissible limits. It is a clear-cut example of how the anthropogenic over exploitation and negligence can deteriorate a well established ancient aquatic ecosystem.

Water quality of Wetland ecosystems was conducted by Dr. Deena Meria Jose (2013) conducted Kozhikode District, Kerala revealed the status of water Quality of wetland ecosystems.

Water quality status and Primary productivity of Valanthakad backwater in Kerala was conducted by S.Meera and S. Bijoy Nandan at School of Marine Science, Cochin university of Science & Technology. Significant spatial and temporal variations in temperature, phosphorous, nitrate-nitrogen as well as primary productivity was observed in the study. The study indicated that the water quality and productivity of Valanthakad backwater is impacted.

Muriyad wetlands- ecological changes and human consequences. Project report submitted to Kerala Research Programme on Local Development, Centre for Developmental Studies, Thiruvananthapuram by Principal Investigator Dr. John Thomas K., Dr. Sreekumar S, Dr.Jaya Cheriyan. Report explained fluctuations in all physio-chemical properties in site and Geo-environmental problems. It concludes by a warning that if current practice of Reclamation of the water bodies continued, the fringe areas will experience water shortage in the near future itself. The conflict between the agriculturists and fishermen could have been avoided if developmental projects were carried out with proper Environmental Impact Assessment studies

Materials and Method

Study area: The study was conducted in Nadavaramba chira, a significant wetland, 3 km away from Irinjalakuda town, Thrissur district. The total area of the chira is 10.9 hectars at present and it was divided into eight stations for our convenience.

Location of stations

Station 1: Near Bund road Nadavaramba.
Station 2: Near Thripayya temple.
Station 3: Near Krishna Bell metal CraftsPvt, Nadavaramba.
Station 4: Near Kodungallur- Shorunur road.
Station 5: Near palace road.
Station 6: Behind Ambekkar colony.
Station 7: Vellokkara Site1.
Station 8: Vellookkara Site2.

Determination of water quality parameters.

- Collection of water samples

Samples were collected carefully from eight selected stations points across the water body. Only clean sterilized pet jar containers were used for collecting samples. The collections were made during October 2014- January 2015.

- Determination of temperature:

  Water temperature was measured using Alcohol thermometer (accuracy $1^{\circ}C$, range 0-100) and the measurements were taken at the site itself.

- Determination of pH :

  pH of collected samples were determined using digital pH meter (Labtronics) at the sites itself, immediately after collection.

- Determination of D.O. & B.O.D.

  DO content was assessed immediately after collection using Winkler's method suggested by Anon . After 5 days DO content in dark was also assessed for BOD value.

- Estimation of dissolved CO_2

  The dissolved CO_2 is estimated using titration method.

- Determination of salinity.

  Salinity of collected water samples were determined using Salinometer

- Analysis of correlation

  Correlation indicates the degree and direction of relationship between two variables. The correlation coefficient gives a quantitative measure of the degree of relationship.

  For calculating this, we have to use the product-moment formula, given by Karl Pearson.

Study of Algal flora

- Collection and preservation of samples:

  The samples were mainly collected in studying season October 2014- January 2015. The surface water samples were collected for systematic analysis of micro flora of different stations.

- Tabulation and analysis of data .

  A comparative study was made to find out the common species in the selected stations from study area. Similarity index between two co- existing groups is calculated.

Samples stations	Temp.	pH	D.O. (mg/L)	BOD (mg/L)	Dissolved CO_2 (mg/L)	Salinity ppm
Station 1	24	8.8	2.4	5.2	13.2	0
Station 2	26	7.8	5.2	3.2	6.16	0
Station 3	24	7.6	6.4	2.8	5.28	0.5
Station 4	24	7.8	4.4	3.6	7.04	0
Station 5	26	8.2	3.2	4.4	9.68	0
Station 6	26	8.4	2.8	4.8	11.44	0
Station 7	28	8.8	2.0	6.0	14.08	0
Station 8	26	7.8	3.6	4.0	7.92	0
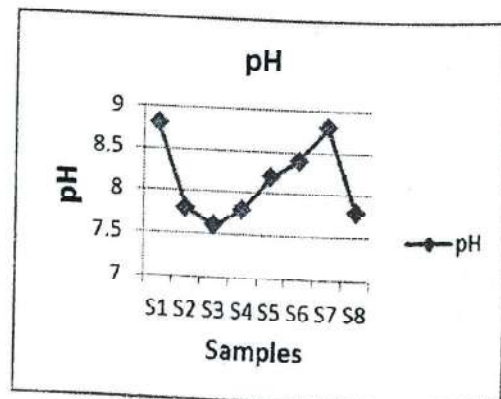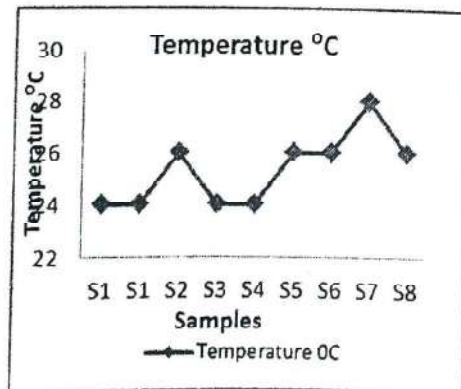
Graph 1: Variation Of temperature.

Graph 2: variations of pH.
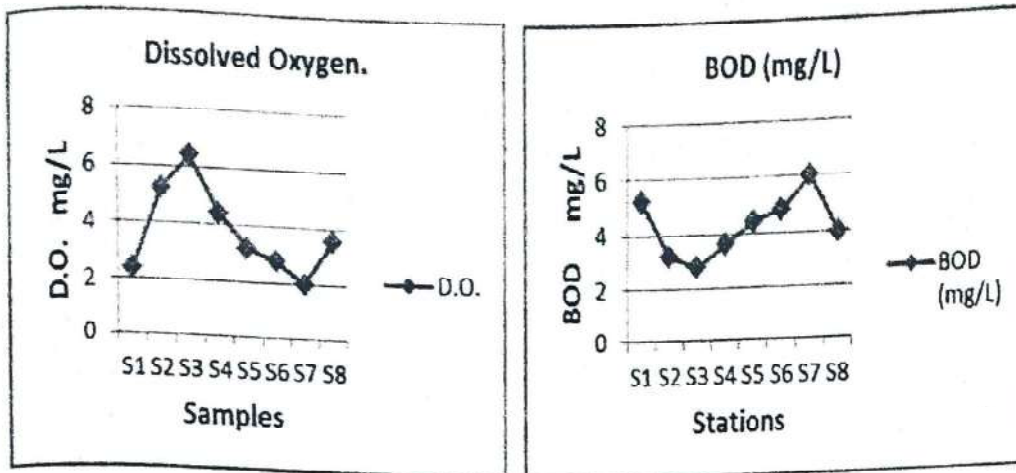
Graph 3- Variations of D.O.   Graph 4: Variations in BOD
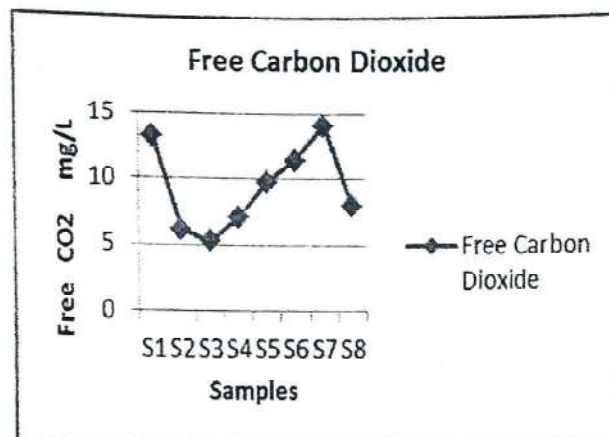
Graph 5: variations of Free Carbon Dioxide.

Correlation Analysis.

	Variable (X and Y)	Correlation Coefficient(r)(-1 to +1)
1	pH and Temperature	+ 0.38
2	pH and D.O	-0.9
3	pH and CO_2	+0.98
4	D.O and BOD	-0.96
5	D.O and CO_2	-0.94

The degree of relationship between different water parameters are calculated in terms of correlation coefficient 'r'. It is calculated by Karl Pearson's product-moment formula. The values of 'r' is generally ranges between -1.0 and +1.0.

The results of statistical analysis of five set of water quality parameters are showed in table 2. The 'r' value of pH and temperature is +0.38 which shows relationship in positive direction. An increase in temperature tends to give an increase in pH also. pH and D.O values shows perfect negative correlation, an increase in one parameter cause corresponding decrease in other parameters (-0.9). pH and CO_2 values shows perfect positive correlation, an increase in one parameter cause corresponding increase in other parameter (+0.98). D.O values also shows perfect negative correlation to BOD and CO_2 values (-0.96 and -0.94 respectively)

Algal Flora.

The algal diversity in the studied area is given in Table.

Table 3. Algal diversity obtained

Stations	Algaes detected in the region	Division	Number of Genera obtained
Station 1	1. Chara 2. Spirogyra 3. Oedogonium 4. Oscillitoria 5. Pithophora	Chlorophyta. Chlorophyta. Chlorophyta. Cyanophyta. Chlorophyta.	5

Station 2	1. Chara *	Chlorophyta.	7
	2. Chroococcus	Chlorophyta.	
	3. Closterium	Chlorophyta .	
	4. Oedogonium	Chlorophyta .	
	5. Oscillitoria*	Cyanophyta .	
	6. Pinnularia*	Bacillarophyta.	
	7. Spirogyra*	Chlorophyta.	
Station 3	1. Chara*	Chlorophyta.	6
	2. Chlorella	Chlorphyta .	
	3. Pinnularia*	Bacillarophyta.	
	4. Oscillitoria*	Cyanophyta.	
	5. Spirogyra*	Chlorophyta.	
	6. Volvox	Chlorophyta..	
Station 4	1. Chara	Chlorophyta.	5
	2. Oedogonium	Chlorophyta.	
	3. Oscillitoria	Cyanophyta.	
	4. Spirogyra	Chlorophyta.	
	5. Pithophora	Chlorophyta .	
Station 5	1. Chara	Chlorophyta.	4
	2. Oscillatoria	Cyanophyta.	
	3. Spirogyra	Chlorophyta.	
	4. Pithophora	Chlorophyta.	
Station 6	1. Chara	Chlorophyta	5
	2. Closterium	Chlorophyta	
	3. Oedogonium	Chlorophyta	
	4. Oscillatoria	Cyanophyta	
	5. Spirogyra	Chlorophyta	
Station 7	1. Chara	Chlorophyta.	5
	2. Chroococcus	Chlorophyta.	
	3. Oscillatoria	Cyanophyta.	
	4. Spirogyra	Chlorophyta.	
	5. Pinnularia	Bacillarophyta.	
Station 8	1. Chara	Chlorophyta.	5
	2. Oscillitoria	Cyanophyta	
	3. Pinnularia	Bacillariophyta	
	4. Spirogyra	Chlorophyta	
	5. Volvox	Chlorophyta	
		Total	42

A total of 42 algae were identified from all the eight stations. A total of ten genera were identified belonging to three main algal divisions. Seven of them belongs to Chlorophyta and they are Spirogyra, Chara, Oedogonium, Closterium, Chroococcus, Chlorella, Pithophora and Volvox. Oscillatoria belongs to Cyanophyta, Pinnularia belongs to Bacillariophyta. All of them are found to be fresh water members. All the eight stations showed the rich blooming growth of three algae Chara, Spirogyra and Oscillatoria, which are high pollution indicators.

Similarity index

Similarity index between station2 and station 3 is calculated from which more members obtained, 7 and 6 respectively.

Similarity index between station2 and station3.

Similarity index =

$$\frac{2\times \text{ number of common species of algae}}{\text{Total number of species}} \times 100$$

Similarity index = $\frac{2 \times 4}{13} \times 100$ = 61.54%

Number of algae from station2 =7
Number of algae from station3 =6
Total number of algae obtained =13
Total number of common algae =4

Summary and Conclusion

The study was conducted to assess the present status of water quality parameters and algal flora of Nadavaramba chira, which was a highly productive wetland agro ecosystem in past. From the results, it is clear that most of the water quality parameters tested during the study does not follow the standards prescribed for parameters. The entire water body is found to be stagnant since the parameters from different stations show considerable variations. Further studies shall bring out a yet better picture about the polluted and degenerated status of the water body. Algal studies from different stations reported the rich blooming growth of pollution indicator algae namely Chara, Oscillatoria and harting network of thalli of Spirogyra.

Malayala Manorama Daily dated on 15-01-2015 reported massive fish dealth in Chira

News paper reports are there during last months about the anthropogenic impacts of pollution in the chira. Due to continuous waste disposal, the state and extent of pollution is very serious in

the chira. Malayala Manorama daily dated on 15-01-2015 reported massive fish dealth in the chira. It may be due to suffocation and poisoning by the chemical pollutants or may be due to algal blooming.

The chira is a highly productive land in the past. The area is under wetland definition and plays a very important role in sustaining the life of diverse flora and fauna. It plays an important role in maintaining the ground water reserve. Some area of the chira is still utilized for paddy cultivation but is seasonal. The nearby people are totally unaware about the productive nature of the chira. This is right time to make awareness among the nearby local people because wetlands are the first and most target of human interference for various purpose like building construction, waste disposals etc. From the results obtained in the present work shows the neglected and threatened state of chira. So it can be concluded that the chira is in a serious state of degeneration and immediate measures has to be undertaken for its restoration. Thus Nadavaramba chira is a clear cut example for anthropogenic interference and its impacts to a fragile wetland ecosystem.

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Photographs of Some Algae in Nadavaramba Chira
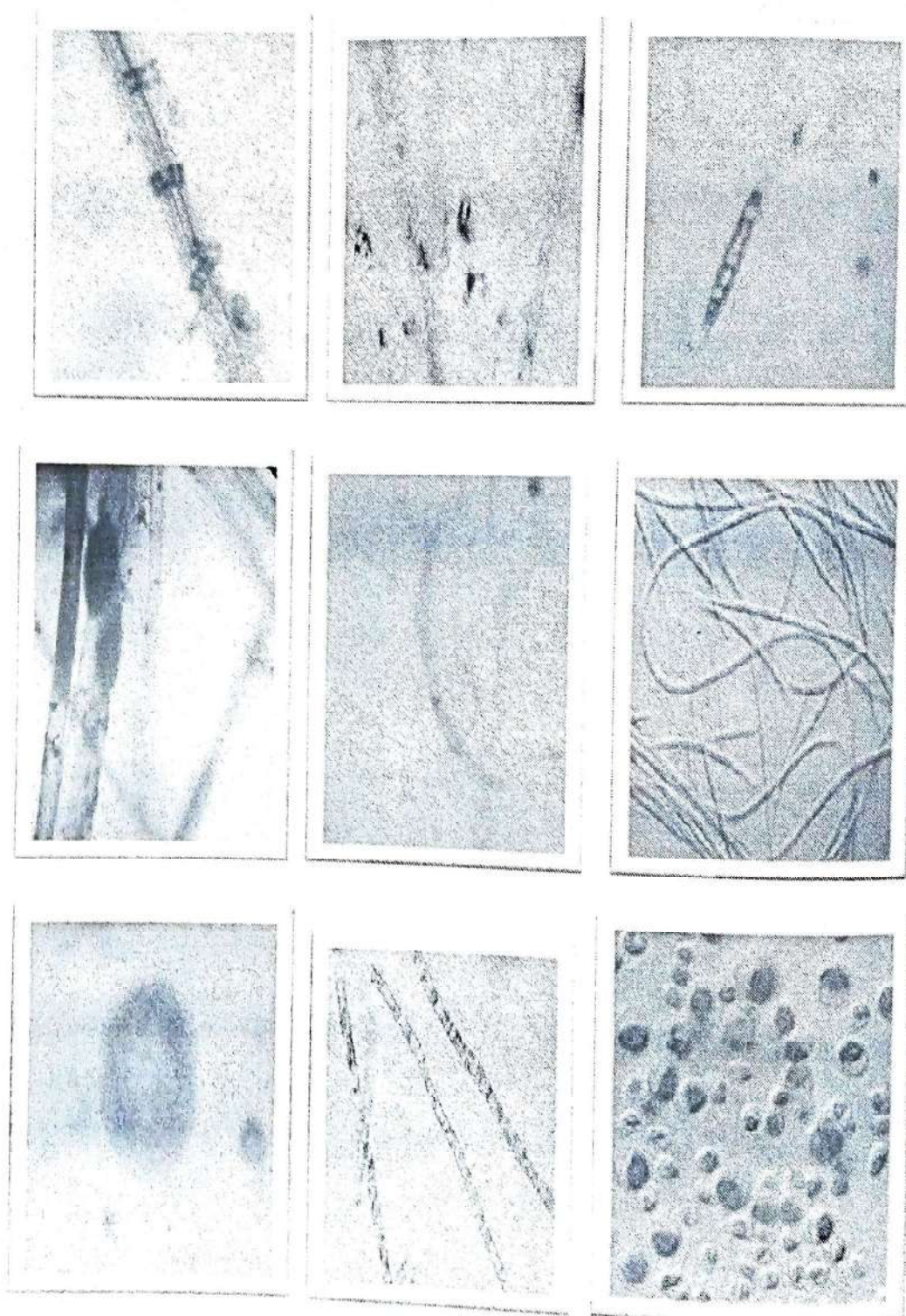
1. Chroococcus	2. Spirogyra	3. Pinnularia	4. Pithophora
6. Closterium	7. Oscilitoria	8. Volvox	9. Oedogonium
10. Chlorella	11. Chara		

COMPARATIVE STUDY OF THE PHYSICOCHEMICAL PROPERTIES OF SOME EDIBLE OILS

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ABSTRACT

Physiochemical properties of some brands of edible oils (namely:- coconut oil, sunflower oil and rice bran oil) were studied to determine their quality and compare the results after frying. All the oils were characterized for Density, Moisture content, Saponification value, Acid value, Ester value and Peroxide value using standard methods of analysis. The results obtained show that the density and moisture content of Sunflower oil is more than other samples; The pure coconut oil collected directly from the mill has the highest saponification value, acid value and ester value and the least is for rice bran oil; Fried bakery oil has highest peroxide value and Kaula sunflower oil has least peroxide value. It is also found that the peroxide value increase on frying- which indicate the degradation in oil quality on frying.

Keywords: *Density, Moisture content, Saponification value, Acid value, Ester value and Peroxide value*

Introduction

Vegetable oils constitute a significant part of the human diet as a source of energy, fat soluble vitamins and essential fatty acids[1]. They are extracted from seeds and nuts of various plants and are

composed mainly of triacylglycerols. Despite their importance, one major drawback in their handling and utilization is their ease of oxidative deterioration, which renders them less acceptable to consumers or for industrial use especially as food ingredients.

The quality of any oil is indicated by some physico-chemical properties. The specific value of some of these properties provides an indication of both the nutritive and physical quality of the oil. These properties include iodine value, peroxide value, saponification value, unsaponifiable value, free fatty acid, color appearance etc.

Considerable amount of attention has been given in recent years to test for the extent and nature of oil oxidation. Primary oxidation products are measured by peroxide value which is a value of the quantity of hydroperoxides present in the oil [2]. It is usually expressed in milli-equivalent of oxygen per kg of oil. The secondary oxidation products are assessed by measuring the Para or p-anisidine value. The p-anisidine value measures mainly the amount of alpha-beta unsaturated aldehydes (2-alkanals) and ketones present in the oil. The primary oxidation products (peroxide and hydro peroxides) are unstable and gives very little off-flavour, but the secondary oxidation products (aldehyde and ketones) gives undesirable off-flavour to the oil and cannot be completely removed on refining [3]. Some of the oxygenated decomposition products are implicated in degenerative diseases such as aging, membrane damage, heart disease and cancer; as a result the study of lipid oxidation has received great attention recently [4-12].

The sources and characteristics of a good number of edible oils are not known. It is therefore, very important that the quality

and oxidative stabilities of commercially available vegetable oils be examined to ascertain their suitability for consumption.

The aim of this study is to compare the quality of some brands of edible oils sold in our market and also compare the effect of frying on the oxidative stability of the oils by measuring the peroxide value.

Materials and methods

Sampling: Materials used for preparation and analysis consisted of conventional laboratory glasswares and an oven. All chemicals used were of analytical grade. Different types of oils like coconut oil, sunflower oil (2brands) and rice bran oil from the market, pure coconut oil from the mill and fried oil from bakery were collected. Frying was done in an aluminum cooking-pot with 250 mL heated refined sunflower oil and coconut oil. After frying, the oil was cooled to room temperature and determined their peroxide value.

Density measurement

Densities of oil samples were measured by using glass bottle with a capacity of 10 mL.

Determination of Acid value

Acid value is the mass of hydroxide (KOH) in milligrams is required to neutralize one gram of chemical substance. 2g of oil was taken in a conical flask and it was dissolved in a solution of 20ml ethanol and 10ml ether. 20ml of oxalic acid was added, stirred for some time to remove the oil layer and was titrated against KOH. The same procedure was repeated without oil sample.

Determination of Saponification value

The saponification value is determined by taking 1.0 g of oil sample in a conical flask to which is added 15 mL 1 N KOH and 10 mL of distilled water and heated under a reserved condenser for 30–40 min to ensure that the sample was fully dissolved. After this sample was cooled, phenolphthalein was added and titrated with 0.5 M of HCl until a pink endpoint was reached. A blank was determined with the same time conditions.

Determination of Peroxide value

The peroxide value is defined as the amount of peroxide oxygen per 1 kg of fat or oil. 2g of each sample of oil was pipetted into a beaker and considered one blank also. 5ml normal hexane was added and dissolved the oil. Then added 5ml dil.HCl, 20ml freshly prepared ferrous sulphate solution and 5ml ammonium thiocyanate in to each beaker. This mixture was stirred well using mechanical stirrer. The optical densities of these mixtures were determined using colorimeter. From the calibration graph, peroxide value was calculated.

Determination of Moisture content (volatile matter)

5 g each of the oil samples were taken in a previously weighed petridish. It was kept in an air oven maintained at 120°C for 1 hr. The weight of each petridish along with the oil was again weighed. The difference in weight gives the moisture content or volatile matter present in the oil.

Results and discussion

The quality of different oil samples was analyzed by evaluating physicochemical properties such as Density, Moisture content, Saponification value, Acid value, Ester value and Peroxide value. Results are presented in Table 1. The effect of temperature on frying of refined sunflower oil and coconut oil were also studied and results are tabulated in Table 2.

Table 1. Physico- chemical quality parameters of vegetable oils at room temperature

Sl. No.	Sample	Density (g/cm³)	Moisture content (%)	Acid value (mgKOH/g)	Saponification value (mgKOH/g)	Ester value (mgKOH/g)	Peroxide value (meqO₂/kg)
1	Coconut oil	0.9054	0.1887	5.1551	245	239.85	2.013×10^{-7}
2	Sunflower -oil	0.9134	0.018	0.648	181	180.35	5.638×10^{-8}
3	Kaula sunflower oil	0.8981	0.727	5.2246	178	172.77	2.819×10^{-8}
4	Rice bran-oil	0.8968	0.023	0.31677	144	143.68	3.423×10^{-7}
5	Roasted oil	0.8739	0.018	2.5675	230	227.43	2.8595×10^{-7}
6	Pure oil	0.9098	0.2661	7.407	258	250.59	4.02748×10^{-8}
7	Fried oil from the bakery	0.8631	0.3268	5.0592	239	233.94	9.263×10^{-7}

On comparing the density of different oils, we know that Sunflower oil has the highest density value and the least is for bakery oil. The lowering of density for bakery oil may be due to the effect of overheating during the repeated use of the oil.

Kaula sunflower oil has highest moisture content value and both sunflower oil and roasted oil have the same and least moisture content value.

Saponification value is an index of average molecular mass of fatty acid in the oil sample. On comparing different oils, we know that highest saponification value is for pure coconut oil collected directly from the mill . This may be due to the absence of any kind of preservative in the coconut oil which may cause the degradation of the sample and free fatty acids may be present and the least is for rice bran oil. The lower value of saponification values suggests that the mean molecular weight of fatty acids is lower or that the number of ester bonds is less. This might imply that the fat molecules did not interact with each other.

On comparing the ester value of different oils, we know that highest value is for pure coconut oil collected directly from the mill as that is observed for saponification value and the least is for rice bran oil.

On comparing the acid value of different oils, we know that highest value is for pure coconut oil collected directly from the mill and the least is for rice bran oil as that is observed for saponification value.

On comparing the peroxide value of different oils, Fried bakery oil has highest and Kaula sunflower oil has least peroxide value. Determination of peroxide value can give an idea about the early stages of oil oxidation. The peroxide values for the fresh oils were very low which indicate the high quality of the oils used in

this work. The peroxide values for the fried oil were progressively and significantly increased during the frying process.

Table 2. Comparative study of peroxide value after frying

SAMPLE	Peroxide value before frying	Peroxide value after frying
Coconut oil	2.0137×10^{-7}	3.0421×10^{-7}
Sunflower oil	5.638×10^{-8}	4.0274×10^{-7}
Kaula sunflower oil	2.81923×10^{-8}	3.1364×10^{-7}
Rice bran oil	3.423×10^{-7}	3.835×10^{-7}
Fried Oil from bakery	9.263×10^{-7}	9.327×10^{-7}

Table 2 shows the comparison of peroxide value of different oil samples. Peroxides are formed when the triglycerides in the oil oxidize in the presence of moisture, and are one of the key indicators of oil rancidity. In the presence of oxygen, moisture, trace elements and free radicals, physiochemical reactions such as thermoxidation, hydrolysis, polymerization, isomerization or cyclization take place at high temperatures of the frying process, thus leading to the decomposition of frying oil and formation of monomeric, polymeric, primary and secondary oxidative compounds, thereby affecting the quality of oil and fried product. Even though Sunflower oil has low peroxide value at room temperature, after frying, the value is higher than that of coconut oil. So sunflower oil can be considered as better vegetable oil at room temperature; but coconut oil is the best for frying purpose.

Conclusion

Deep frying and the use of same oil for frying many times is a general practice mostly in commercial and sometimes in domestic

cooking processes. This practice generates lipid peroxidation products that may be harmful to human health. Most of these compounds are non-volatile, so they remain in the frying medium and affect its physical properties at elevated temperatures in the presence of air and moisture causing the oxidative degradation of their amino acids and the partial conversion of these lipids to volatile chain-scission products, non-volatile oxidized derivatives and dimeric, polymeric or cyclic substances leading to the formation of toxic and/or carcinogenic compounds.

The results of this particular study may be forwarded in many aspects not only to enhance the quality of oil but also give public awareness not to expose edible oils to high temperatures for long periods many times.

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EFFECT OF CASEIN ON THE MECHANICAL PROPERTIES OF LOW DENSITY POLYETHYLENE

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ABSTRACT

Polyethylene (PE) is a thermoplastic widely used for packaging applications. But it posses a serious threat to the environment because the rate of environmental degradation of PE and assimilation into nature are extremely slow processes, typically lasting hundreds of years. Hence to make the continuous use of these materials viable, methods have to be devised to make PE biodegradable. This work is a small step in that direction. PE has been modified to improve its biodegradability by maleic anhydride (MA) grafting and subsequent blending with a biodegradable polymer, casein. The mechanical properties of virgin LDPE, MA-g –LDPE and the blends of each of these materials with casein have been compared. It is found that the technique of MA grafting has reduced to a great extend the possible deterioration of mechanical properties of casein blended PE. FTIR studies are also done to confirm MA grafting.

1. Introduction

Casein is a phosphoprotein found in milk and cheese. In milk it exists as a salt of calcium. Casein is not coagulated by heat. Casein consists of a fairly high number of praline peptides which do not interact. There are also no disulphide bridges. As a result, it has relatively little 2^0 structure or 3^0 structure. Because of this it cannot

denature. It is relatively hydrophobic making it poorly soluble in water. It is found in milk as a suspension of particles called casein micelles.

The ultimate aim of this study is to make PE biodegradable by modifying it with MA and subsequent blending with a biodegradable polymer, casein. In this part of the study the mechanical properties of virgin LDPE, MA-g-LDPE and casein blends of each of these materials have been investigated.

2. Experimental

The film grade LDPE used in this study was obtained from Reliance Industries Ltd, Mumbai, India and industrial grade casein was procured from Vikas Patel Group, Ahamadabad , India.

Preparation of MA-g-LDPE was carried out in a Brabender Plasticorder equipped with a pair of roller rotors at different (150,160,170 and 180^0C) temperatures for 10 minute. The rotor rate was maintained at 60rpm, adding LDPE first and then MA.

The samples were compression moulded into sheets using hydraulic press. The platens of the press were initially heated to 150^0C. Filled the pre-weighed sample into the compression mould and the assembly placed in the hydraulic press. Heated for 6 minutes without applying any pressure to ensure uniform heat flow through the material. The temperature was maintained at 150^0C for all the compositions of samples for 10 minutes at a pressure of 11.6 MPa which was applied gradually during the first 5 minutes. The sheet thus obtained was removed from the press

after cooling to room temperature. Spectroscopic evidence for grafting was obtained by FTIR spectroscopy.

3. Results and Discussion

3.1 Mechanical Properties

A series of measurements were carried out on mechanical properties of samples.

Tensile Strength

Referring to Fig.1, LDPE does not undergo any substantial reduction in tensile strength on MA grafting. It is notable that functionalisation has been achieved without weakening the virgin material too much.

Fig.2 shows that the addition of casein in both cases has not led to any serious reduction of tensile strength. The casein blend of both LDPE and MA grafted LDPE show similar tensile strengths. But MA grafted samples show slightly lower values. The presence of casein has not affected the strength of LDPE to any extend. Considering that this material is potentially biodegradable, this is a positive finding.
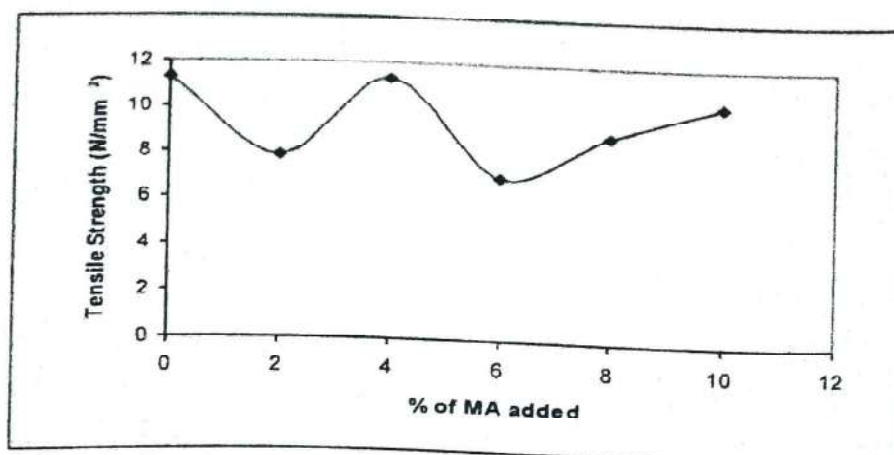

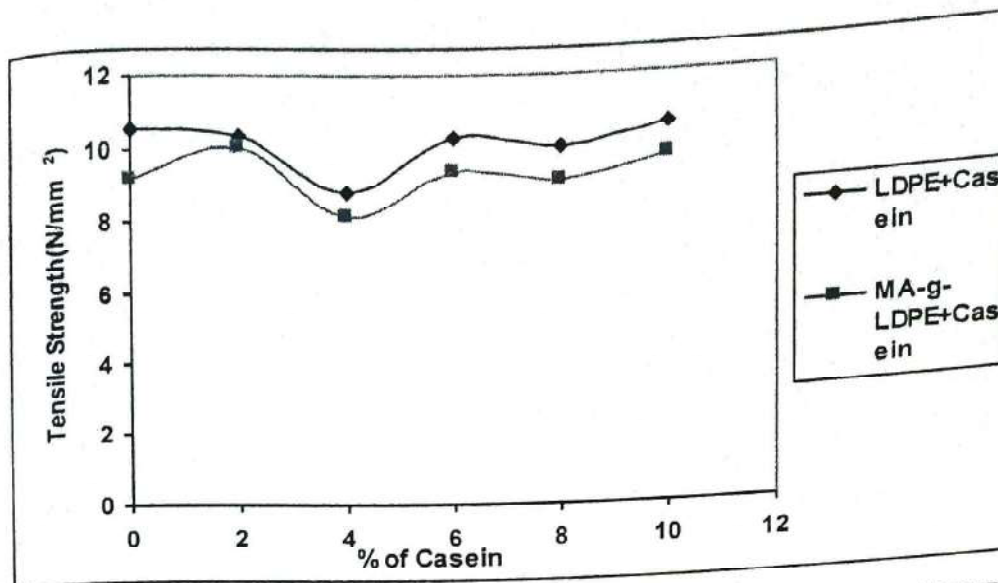**Figure1. Tensile Strength of pure LDPE and MA-g-LDPE**

Figure 2. Tensile Strength of Casein Blends of LDPE and MA-g-LDPE

Modulus

Referring to Fig.3, the modulus has remained unchanged by the MA grafting although at intermediate concentrations a slight fall is observed.

Fig.4 shows that in the presence of casein LDPE undergoes a fall in modulus. But this tendency is reversed when MA grafted LDPE is blended with casein. Here, the modulus shows an increasing trend. But after addition of casein LDPE shows lower modulus figures throughout even after MA grafting. This lower stiffness may or may not be an advantage from the viewpoint of biodegradability.
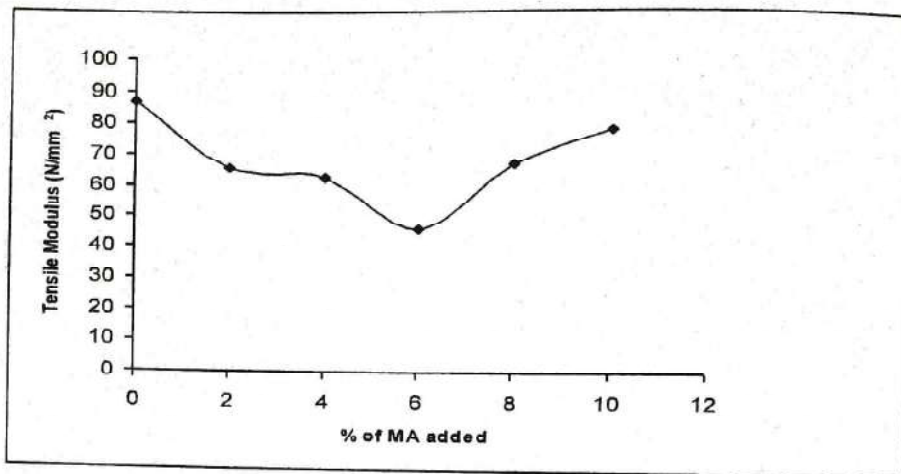
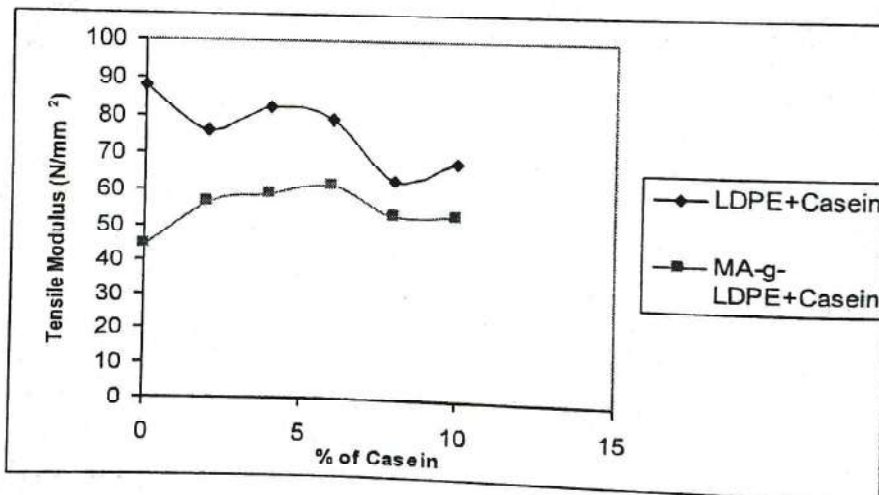**Figure 3. Tensile Modulus of pure LDPE and MA-g-LDPE**

Figure 4. Tensile Modulus of Cascin Blends of LDPE and MA-g-LDPE

Elongation

Elongation does not change on MA grafting (Fig.5). But on blending with casein, (Fig.6) there is a drastic fall in elongation at break. This lack of elasticity may be either due to crosslinks introduced via casein molecules or simply due to casein acting like a filler. More investigations are needed to draw a proper conclusion in this case. The lower elongation when casein is blended with MA grafted LDPE points to the possibility of chemical incorporation of casein into the polymer network.
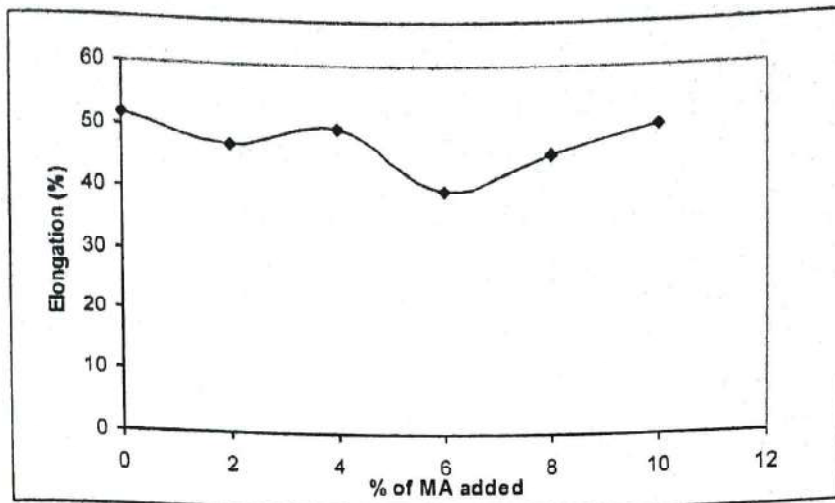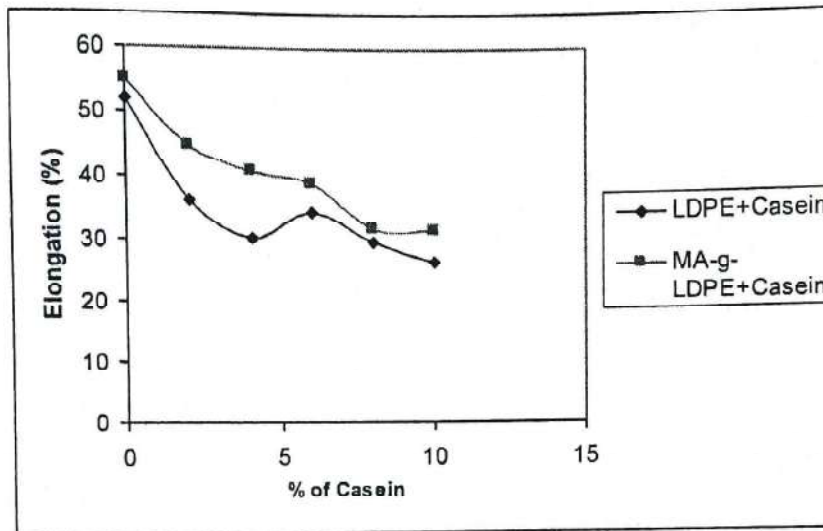
Figure 5. Elongation of pure LDPE and MA-g-LDPE

Figure 6. Elongation of Casein Blends of LDPE and MA-g-LDPE

3. Conclusion

It is found that after blending with casein, the tensile strength of MA-g-LDPE and LDPE do not change considerably. But modulus and elongation show some change from the original values. This is a satisfactory observation since MA grafted casein modified LDPE has potential biodegradability.

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3,3,5-TRIARYL-3*H*-FURAN-2-ONES: PHOTOCHEMICAL TRANSFORMATIONS

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ABSTRACT

3,3-Bis(4-chlorophenyl)-5-aryl-3H-furan-2-ones and 3,3-di(p-tolyl)-5-aryl-3H-furan-2-ones were synthesised by neat thermolysis of the corresponding (Z)-1,2-bis(4-chlorophenyl)-4-arylbut-2-ene-1,4-dione and (Z)-1,2-di(p-tolyl)-4-arylbut-2-ene-1,4-dione precursors respectively. Irradiation of these furanones were carried out under different conditions. While sensitized irradiation of these furanones in hexane resulted in exclusive formation of dimers, that in acetonitrile did not produce even a trace amount of it: 1,2-aryl migration leading to phenanthrofuranone along with decarbonylation was observed in this case.

Introduction

The construction of small and medium sized *O*-heterocyclic rings is a cornerstone of natural product synthesis. Dibenzoylalkene rearrangement is a useful method for the synthesis of a variety of such heterocyclic derivatives. Dibenzoylstyrene is conveniently synthesised by the base-catalyzed condensation between benzil and acetophenone. Thermolysis of related systems lead to 2(3*H*)-furanones, which exhibit rich photochemistry. By the application of Claisen-Schmidt condensation we synthesised several dibenzoylstyrene derivatives

from 4,4'-dichlorobenzil and 4,4'-dimethylbenzil using appropriate methyl ketones. Since 3,3,5-triphenyl-3*H*-furan-2-one could be prepared in good yields by the thermolysis of dibenzoylstyrene. Past investigations have shown that unsaturated lactones undergo a variety of phototransformations some of which includes decarbonylation, decarboxylation, solvent addition to double bonds, migration of aryl substituents and dimerisation. Phototransformations of a number of 2(3*H*)-furanones has been studied based on steady state irradiation, product analysis and laser flash photolysis.

Results and Discussion

In the present study, we have examined the sensitized photorearrangements of 3,3-bis(4-chlorophenyl)-5-aryl-3*H*-furan-2-ones **1 a,b** and 3,3-di(*p*-tolyl)-5-aryl-3*H*-furan-2-ones **1c,d** to explore the effect of two aryl groups at the 3-position in controlling the nature of these reactions. The required 2(3*H*)-furanones were synthesised by the cyclisation of (*Z*)-1,2-bis(4-chlorophenyl)-4-arylbut-2-ene-1,4-diones and (*Z*)-1,2-di(*p*-tolyl)-4-aryl-but-2-ene-1,4-diones respectively. To gain insight into the electronic makeup of the excited state in the photorearrangement of 2(3*H*)-furanones we examined the reactions of different furanones containing various substituents in the para position of phenyl group in polar and nonpolar solvents. Since it is well known that on direct irradiation almost all 2(3*H*)-furanones undergo decarbonylation, we attempted a few sensitized irradiation experiments.

1 a-d

2 a-d

3

4
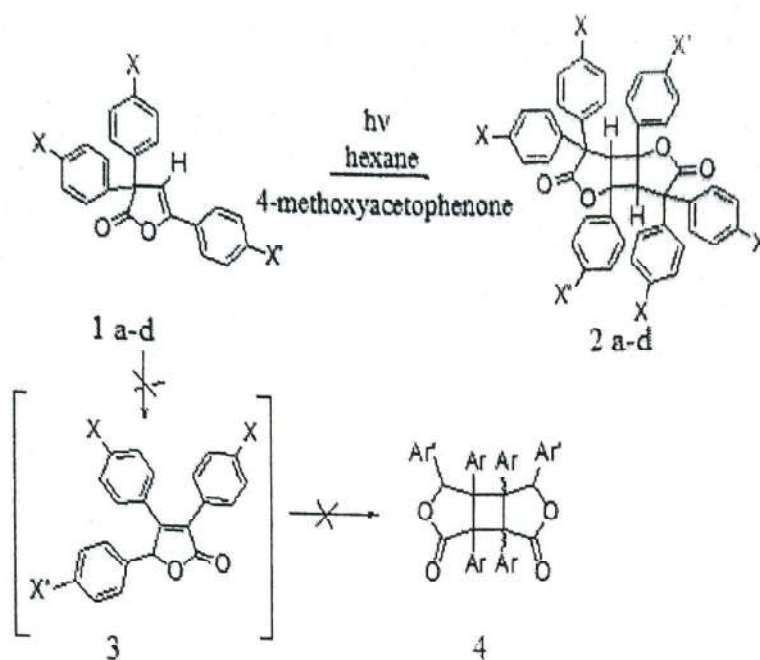
a) X = Cl   X' = H   b) X = Cl   X' = Cl   c) X = Me   X' = H   d) X = Me   X' = Cl

The photolysis (λ = 300 nm) of **1a-d** in hexane with 4-methoxyacetophenone as sensitizer yielded product that exhibited poor solubility in common organic solvents and melting above 315°C. Earlier reports on aryl substituted 2(3H)-furanones[18,19] suggested that these compounds on sensitized irradiation undergo 1,2-phenyl migration leading to 2(5H)-furanones which further undergo [2+2] addition to give corresponding dimer. Based on the literature precedence, we tentatively concluded that the product, indeed, is a dimer **2a-d**. Intriguingly, formation of other products arising through aryl migration such as 2(5H)-furanones and phenanthrofuranones was not detected. So we decided to examine the structure of the photodimer closely.

Though the products exhibited poor solubility in common solvents, we could record both ^{1}H NMR and ^{13}C NMR spectra of acceptable quality of a representative sample such as **2a**. ^{1}H NMR spectrum of the dimer **2a** showed a sharp singlet at δ 4.93. In the

^{13}C NMR spectrum, signals attributable to aliphatic carbons were observed at δ 62.84, δ 66.13 and δ 88.38. Out of these, the signal observed at δ 62.84 and δ 66.13 corresponds to a CH whereas the signal at δ 88.38 is attributable to the tetrasubstituted carbons. Based on the wide difference in the chemical shift positions of the two tetrasubstituted carbons, we concluded that the signal observed at δ 88.38 is due to a carbon attached to oxygen. If the dimer is arising through the dimerisation of the rearranged 2(5H)-furanone the methine signal would have appeared more downfield. Based on these data we concluded that the structure of the dimer is better represented as 2a arising through the head-to-tail dimerisation of starting 2(3H)-furanone. Compounds 2 b-d also showed related ^{1}H NMR results. The structure was further confirmed by elemental analysis, which gave acceptable data.
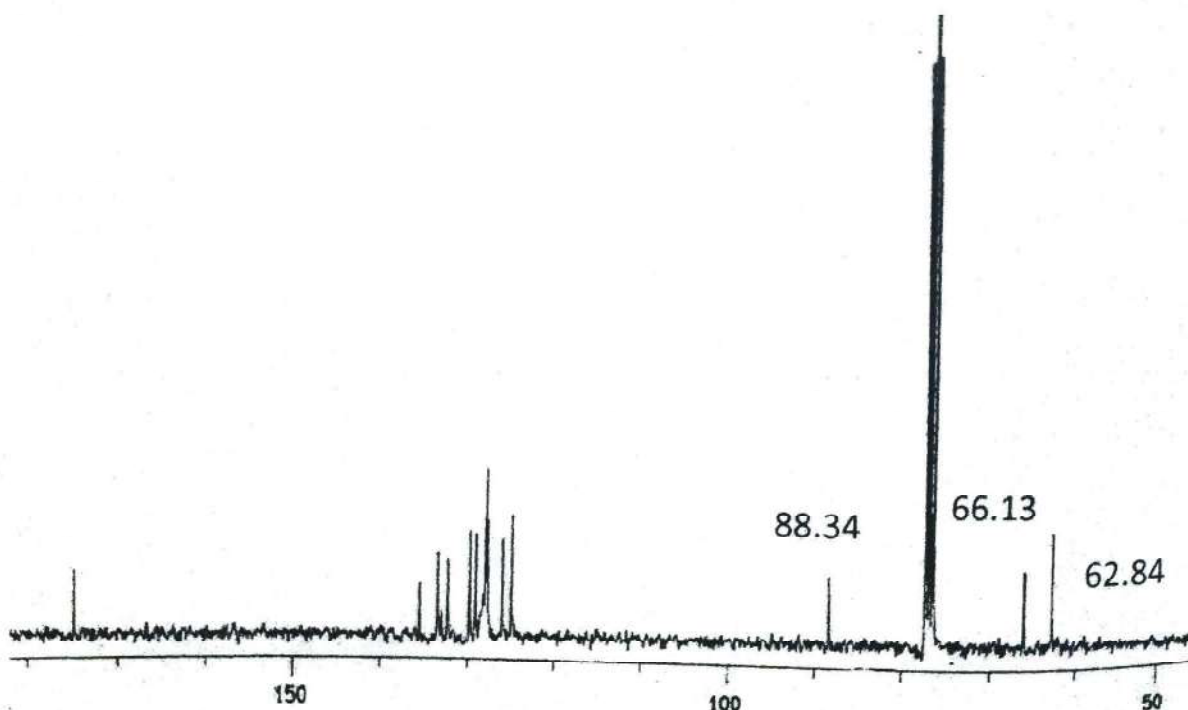

Figure 1: ^{13}C NMR Spectrum of 2 a

Compounds **1a-d** were again subjected to photolysis (λ = 300 nm) under 4-methoxyacetophenone sensitization in acetonitrile. With compounds **1a,b** workup of the photolysate afforded 6,9-dichloro-3-arylphenanthro[9.10-c]furan-1-(3*H*)-one **5a,b** as white solid in moderate yields (~33%). The structure of compounds **5a,b** were established on the basis of analytical results and spectral data. Compound **5a** obtained in 30% yield showed strong absorptions at 1760 cm^{-1} indicating the presence of carbonyl group in the compound. In the ^{1}H NMR spectrum, singlet at δ 6.64 corresponds to methine proton. Aromatic protons were observed as a multiplet between δ 7.23– 9.14. The structure was further confirmed by elemental analysis, which gave acceptable data. Compound **5b** also showed analogous spectral behaviour. The strong absorption at 1766 cm^{-1} in the IR spectrum showed the presence of carbonyl group in the compound. Here also a singlet at δ 6.36 in the ^{1}H NMR spectrum corresponds to methine proton. Aromatic protons were observed as a multiplet between δ 7.16– 9.17. It may be mentioned here that the ^{1}H NMR signal at ~δ 6.36 and carbonyl stretching frequency at ~1760 cm^{-1} are characteristic of 3,4,5-triaryl-2(5*H*)-furanone. For 3,3,5-triaryl-2(3*H*)-furanones, the corresponding signals appear at ~δ 6.2 and 1780 cm^{-1} respectively. Thus 2(3*H*)-furanone to 2(5*H*)-furanone isomerisation can be conveniently followed by ^{1}H NMR and IR spectral analysis.

a) X' = H   b) X' = Cl
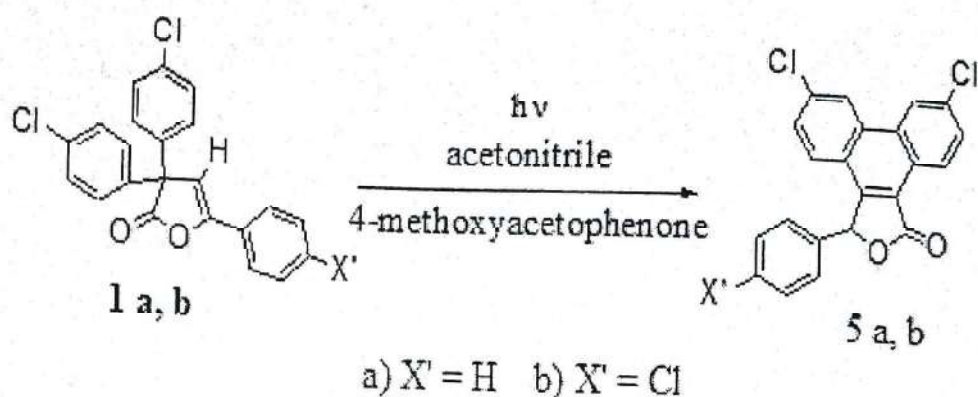
With compounds **1c,d** decarbonylation was also observed resulting in 1-aryl-3,3-di(*p*-tolyl)-propenone **6c,d** apart from photorearrangement to 6,9-dimethyl-3-arylphenanthro[9,10-c]furan-1-(3*H*)-ones **5c,d**. Compound **5c** obtained in 33% yield showed strong absorption at 1768 cm^{-1} indicating the presence of carbonyl carbon. In the ^{1}H NMR spectrum, peak at δ 2.40 corresponds to methyl protons and that at δ 6.67 indicates methine proton. Aromatic protons were observed as a multiplet between δ 7.19– 9.18. Structure of the photoproduct was further confirmed by elemental analysis that gave acceptable data. Compound **5d** also showed related spectral behaviour to that of compound **5c**. Compound **6c** was obtained in 20% yield and showed strong absorptions at 1658 cm^{-1} in the IR spectrum due to carbonyl groups. In the ^{1}H NMR spectrum, methyl protons were observed as a singlet in the region δ 2.45, the vinylic and aromatic protons were observed as multiplet around ~ δ 7.10– 7.54. Structure of the compound was further confirmed by elemental analysis that gave acceptable data. Compound **6d** also showed analogous spectral behaviour to that of compound **6c**.

c) X = H d) X = Cl
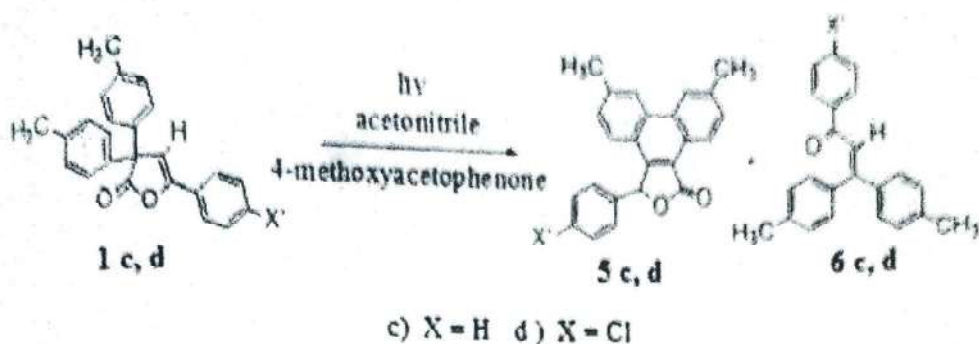
The triplet sensitized rearrangement of 2(3*H*)-furanones
1a-d to phenanthrofuranone **5a-d** can be explained in terms of
pathway shown below
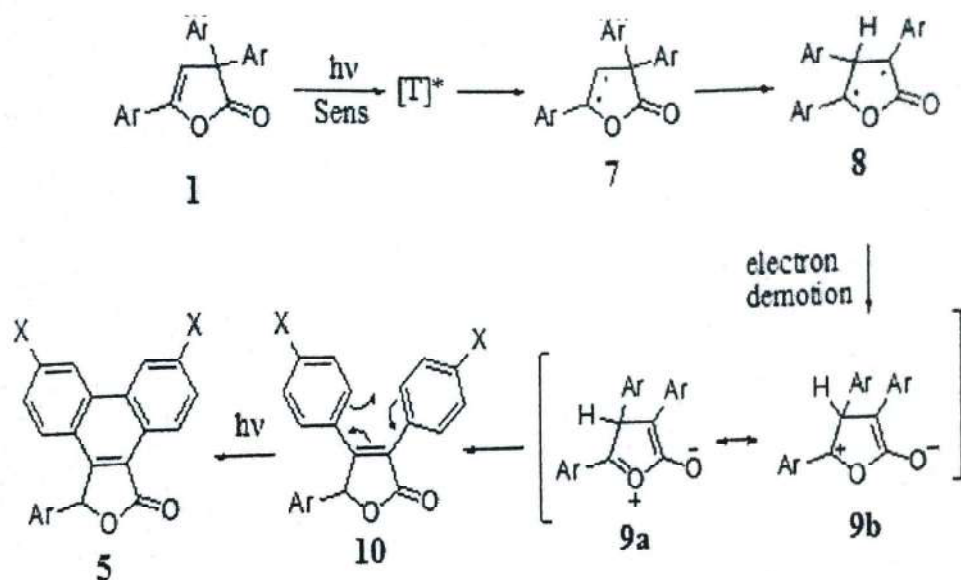
In the triplet excited state having substantial diradical
nature, one of the C-3 aryl groups migrates to C-4 to give the
rearranged diradical intermediate **8**. Electron demotion in **8** will
lead to a zwitterionic intermediate **9** which then undergoes a
hydride shift to give the rearranged 3,4,5-triphenyl-2(5*H*)-furanone
10. Further photocyclisation of this compound occur leading to
dihydrophenanthrofuranone **5** which under the condition of workup
gave phenanthrofuranone.

Based on the mechanism suggested by Padwa[35,36] to account for analogous 1,2-aryl migration in 3,5-diaryl-2(5H)-furanones, a di-π-methane rearrangement type mechanism may also be postulated here for the generation of diradical intermediate **8**.

Conclusion

In summery, 3,3-Bis(4-chlorophenyl)-5-aryl-3H-furan-2-ones and 3,3-di(p-tolyl)-5-aryl-3H-furan-2-ones were synthesised from (Z)-1,2-bis(4-chloro- phenyl)-4-arylbut-2-ene-1,4-dione and (Z)-1,2-di(p-tolyl)-4-arylbut-2-ene-1,4-dione precursor respectively. Sensitized irradiations of these 2(3H)-furanones were carried out in hexane and acetonitrile using 4-methoxyacetophenone as sensitizer. On sensitized irradiation in hexane they underwent [2+2] cycloaddition to yield the dimer whereas in acetonitrile 1,2-aryl migration was the major reaction.

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ANDROID OS

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ABSTRACT

Android is the first step in the vision of creating a better mobile phone. It is a complete open mobile platform software stack recently release by Google. Android can be run on mobile devices from companies that have come together to form the Open Handset Alliance. The Alliance currently consists of 34 companies including Motorola, T-Mobile and Sprint-Nextel. These companies have agreed to open access devices. This basically means that I, as a customer, can purchase a Motorola phone with service from one cellular network then later switch carriers but keep the same phone! Android would run on Open Handset Alliance devices. It includes an operating system, middleware and key applications such as email client, calendar, maps, browser, and contacts. It also takes the basics one step further by merging contacts with maps.

Index Terms: Android, The Birth of Android, Versions of Android, Android Architecture.

Introduction

ANDROID is a software stack for mobile devices that includes an operating system, middleware and key applications. Android is a software platform and operating system for mobile devices based on the Linux operating system and developed by

Google and the Open Handset Alliance. It allows developers to write managed code in a Java-like language that utilizes Google-developed Java libraries, but does not support programs developed in native code.

Figure 1. Android

The unveiling of the Android platform on 5 November 2007 was announced with the founding of the Open Handset Alliance, a consortium of 34 hardware, software and telecom companies devoted to advancing open standards for mobile devices. When released in 2008, most of the Android platform will be made available under the Apache free-software and open-source license.

The Birth of Android

Google Acquires Android Inc.

In July 2005, Google acquired Android Inc., a small startup company based in Palo Alto, CA. Android's co-founders who went to work at Google included Andy Rubin (co-founder of Danger), Rich Miner (co-founder of Wildfire Communications, Inc), Nick Sears

(once VP at T-Mobile), and Chris White (one of the first engineers at WebTV). At the time, little was known about the functions of Android Inc. other than they made software for mobile phones.

At Google, the team, led by Rubin, developed a Linux-based mobile device OS which they marketed to handset makers and carriers on the premise of providing a flexible, upgradeable system. It was reported that Google had already lined up a series of hardware component and software partners and signaled to carriers that it was open to various degrees of cooperation on their part.

Figure 2. Android History

Open Handset Alliance Founded

On 5 November 2007, the Open Handset Alliance, a consortium of several companies which include Google, HTC, Intel, Motorola, Qualcomm, T-Mobile, Sprint Nextel and NVIDIA, was unveiled with the goal to develop open standards for mobile devices. Along with the formation of the Open Handset Alliance, the OHA also unveiled their first product, Android, an open source mobile device platform based on the Linux operating system.

Figure 3. Open Handset Alliance

Hardware

Google has unveiled at least three prototypes for Android, at the Mobile World Congress on February 12, 2008. One prototype at the ARM booth displayed several basic Google applications. A 'd-pad' control zooming of items in the dock with a relatively quick response.

A prototype at the Google IO conference on May 28, 2008 had a 528 MHz Qualcomm processor and a Synaptics capacitive touch screen, and used the UMTS cellular standard. It had 128 MB of RAM and 256 MB of flash, showing that Android's memory requirements are reasonable. The demo was carried out using a 3.6 Mbit/s HSDPA connection.

Android Versions

The code names of android ranges from A to L currently, such as Aestro, Blender, Cupcake, Donut, Eclair, Froyo, Gingerbread, Honeycomb, Ice Cream Sandwitch, Jelly Bean, KitKat and Lollipop, Marshmallow and Android N. Let's understand the android history in a sequence.

- Android 1.0   23 Sept 2008
- Android 1.1   9 Feb 2009
- Android 1.5 (Cupcake)   27 April 2009
- Android 1.6 (Donut)   15 Sept 2009
- Android 2.0 (Éclair)   26 Oct 2009
- Android 2.2 (Froyo)   20 May 2010
- Android 2.3 (Gingerbread)   6 Dec 2010
- Android 3.0 (Honeycomb)   22 Feb 2011
- Android 4.0 (Ice cream Sandwich)   18 Oct 2011
- Android 4.1 (Jelly Bean)   9 July 2012
- Android 4.4 (KitKat)   31 Oct 2013
- Android 5.0 (Lollipop)   12 Nov 2014
- Android 6.0 (Marshmallow)   5 Oct 2015
- Android 7.0 (N)

Figure 4: Android Versions

Categories of Android Applications

There are many android applications in the market. The top categories are:

Music News Multimedia
Sports Lifestyle Food & Drink
Travel Weather Books
Business Reference Navigation
Social Media Utilities Finance

Figure 5: Android Application Categories

Android Architecture

Android architecture or Android software stack is categorized into five parts:

- Linux Kernel
- native libraries (middleware),
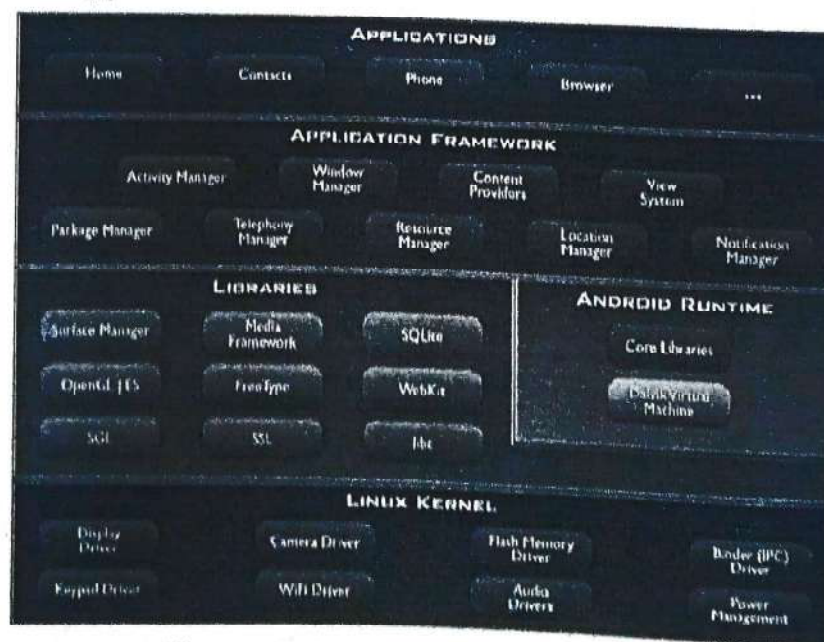- Android Runtime
- Application Framework
- Applications

Figure 6: Architecture of Android

Linux kernel

It is the heart of android architecture that exists at the root of android architecture. Linux kernel is responsible for device drivers, power management, memory management, device management and resource access.

Native Libraries

On the top of linux kernel, their are Native libraries such as WebKit, OpenGL, FreeType, SQLite, Media, C runtime library (libc) etc.

The WebKit library is responsible for browser support, SQLite is for database, FreeType for font support, Media for playing and recording audio and video formats.

Android Runtime

In android runtime, there are core libraries and DVM (Dalvik Virtual Machine) which is responsible to run android application. DVM is like JVM but it is optimized for mobile devices. It consumes less memory and provides fast performance.

Android Framework

On the top of Native libraries and android runtime, there is android framework. Android framework includes Android API's such as UI (User Interface), telephony, resources, locations, Content Providers (data) and package managers. It provides a lot of classes and interfaces for android application development.

Applications

On the top of android framework, there are applications. All applications such as home, contact, settings, games, browsers are using android framework that uses android runtime and libraries. Android runtime and native libraries are using linux kernal.

Advantages of Android

A. Android can Run Multiple Apps at the Same Time.

B. Android keeps information visible on your home screen. Android has is a customizable home screen which keeps active widgets right at your fingertips, always accessible and always visible – without having to launch an application first.

C. Android has a better application market compare to Apple's App because Apple's App store has over 180,000 applications, while the Android Marketplace has only just broken the 50,000 mark

D. Android gives you better notifications compare to iPhone. Because iPhone has some trouble with notifications. And it's restricted to pop-up notifications, it can only handle one at a time

E. Android is Hardware independent.

F. Android lets you install custom ROMs.

G. You can change your settings faster in Android. iPhone users are stuck digging around in the system settings every time they want to use the internet or a Bluetooth device. Android lets you use widgets to manage your settings directly from your home screen.

H. Android does Google and Social Integration but The iPhone can do this only through use of third party apps, and is nowhere near as seamless to use as the Android alternative.

I. Android gives you more options to fit your budget. Of course these are lower end Android devices, but they are still comparable in performance to the iPhone 3GS.

J. Innovative products like the location-aware services, location of a nearby convenience store etc., are some of the additive facilities in Android.

Disadvantages of Android

A. Connected to the Internet: Android can be said is in need of an active internet connection. At least there should be a GPRS internet connection in your area, so that the device is ready to go online to suit our needs.

B. Sometimes slow device company issued an official version of Android your own.

C. Android Market is less control of the manager, sometimes there are malware.

D. As direct service providers, users sometimes very difficult to connect with the Google.

E. Sometimes there are ads: because it is easy and free, sometimes often a lot of advertising. In appearance it does not interfere with the performance of the application itself, as it sometimes is in the top or bottom of the application.

F. Wasteful Batteries, This is because the OS is a lot of "process" in the background causing the battery quickly drains.

Conclusion

Android has been criticized for not being all open-source software despite what was announced by Google. Parts of the SDK are proprietary and closed source, and some believe this is so that Google can control the platform. Software installed by end-users must be written in Java, and will not have access to lower level device APIs. This provides end-users with less control over their phone's functionality than other free and open source phone platforms, such as OpenMoko. With all upcoming applications and mobile services Google Android is stepping into the next level of Mobile Internet. Android participates in many of the successful open source projects. That is, architect the solution for participation and the developers will not only come but will play well together. This is notable contrast with Apple and other companies, where such architecture of participation is clearly belated.

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SECURE DISTRIBUTED DEDUPLICATION SYSTEMS WITH IMPROVED RELIABILITY

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ABSTRACT

Data deduplication is a method for removing duplicate copies of data, and has been extensively used in cloud storage to decrease storage space and upload bandwidth. On the other hand, there is only one copy for each file stored in cloud even if such a file is owned by a huge number of users. Accordingly, deduplication system progress storage utilization while reducing reliability. In addition, the dare of privacy for sensitive data also take place when they are outsourced by users to cloud. Planning to address the above security test, this paper constructs the first effort to celebrate the idea of scattered reliable deduplication system. This paper recommends a new distributed deduplication systems with upper dependability in which the data chunks are distributed from corner to cornering multiple cloud servers. The safety needs of data privacy and tag stability are also accomplish by introducing a deterministic secret sharing scheme in distributed storage systems, instead of using convergent encryption as in previous deduplication systems.

1. Introduction

By the unpredictable development of digital data, deduplication techniques are broadly engaged to backup data and decrease network and storage transparency by notice and eradicate redundancy among data. As an alternative of maintaining multiple data copies with the same content,deduplication reducing redundant data by maintaining only single copy and referring other redundant data to that copy. Deduplication has inward much concentration from both academic world and industry since it can really recover storage utilization and keep storage space, particularly for the applications with high deduplication ratio such as archival storage systems. A number of deduplication systems have been projected based on various deduplication scheme such as client-side or server-side deduplication, file-level or block-level deduplications. Specially, with the advent of cloud storage, data deduplication procedure grow to be more gorgeous and essential for the management of ever-increasing quantity of data in cloud storage services which inspires Endeavour and club to outsource data storage to third-party cloud providers.

Today's cloud storage services, such as, Google Drive, Drop box have been pertaining deduplication to save the network bandwidth and the storage cost with client-side deduplication.

Two types of deduplication in terms of the size: (a) block-level deduplication, which find out and Eliminate redundancies among data blocks. (b) file-leveldeduplication, which determine redundancies between different files and eradicate these redundancies to decrease ability demands, and The file can be separated into lesser fixed-size.

Using fixed-size blocks shorten the calculation of block bound-arise, even as using variable-size blocks .

Furthermore, the challenge for data privacy also arises as more and more sensitive data are being outsourced by users to cloud. Encryption mechanisms have usually been utilized to protect the confidentiality before outsourcing data into cloud. Most commercial storage service provider is reluctant to apply encryption over the data because it makes deduplication impossible. The reason is that the traditional encryption mechanisms, including public key encryption and symmetric key encryption, require different users to encrypt their data with their own keys. As a result, identical data copies of different users will lead to different ciphertext. To solve the problems of confidentiality and deduplication, the notion of convergent encryption has been pro-posed and widely adopted to enforce data confidentiality while realizing deduplication. However, these systems achieved confidentiality of outsourced data at the cost of decreased error resilience. Therefore, how to protect both confidentiality and reliability while achieving deduplication in a cloud storage system is still a challenge.

2. Existing System

- A number of deduplication systems have been proposed based on various deduplication strategies such as client-side or server-side deduplications, file-level or block-level deduplications.

- Bellare et al. formalized this primitive as message-locked encryption, and explored its application in space efficient

secure outsourced storage. There are also several implementations of convergent implementations of different convergent encryption variants for secure deduplication.

- Li addressed the key-management issue in block-level deduplication by distributing these keys across multiple servers after encrypting the files.

- Bellare et al. showed how to protect data confidentiality by transforming the predicatable message into a unpredicatable message.

Disadvantages of Existing System:

- Data reliability is actually a very critical issue in a deduplication storage system because there is only one copy for each file stored in the server shared by all the owners.

- Most of the previous deduplication systems have only been considered in a single-server setting.

- The traditional deduplication methods cannot be directly extended and applied in distributed and multi-server systems.

3. Proposed System:

- In this paper, we show how to design secure deduplication systems with higher reliability in cloud computing. We introduce the distributed cloud storage servers into deduplication systems to provide better fault tolerance.

- To further protect data confidentiality, the secret sharing technique is utilized, which is also compatible with the distributed storage systems. In more details, a file is first split and encoded into fragments by using the technique of secret sharing, instead of encryption mechanisms. These shares will be distributed across multiple independent storage servers.

- Furthermore, to support deduplication, a short cryptographic hash value of the content will also be computed and sent to each storage server as the fingerprint of the fragment stored at each server.

- Only the data owner who first uploads the data is required to compute and distribute such secret shares, while all following users who own the same data copy do not need to compute and store these shares any more.

- To recover data copies, users must access a minimum number of storage servers through authentication and obtain the secret shares to reconstruct the data. In other words, the secret shares of data will only be accessible by the authorized users who own the corresponding data copy.

- Four new secure deduplication systems are proposed to provide efficient deduplication with high reliability for file-level and block-level deduplication, respectively. The secret splitting technique, instead of traditional encryption methods, is utilized to protect data confidentiality. Specifically, data are split into fragments

by using secure secret sharing schemes and stored at different servers.

Advantages of Proposed System:

- Distinguishing feature of our proposal is that data integrity, including tag consistency, can be achieved.

- To our knowledge, no existing work on secure deduplication can properly address the reliability and tag consistency problem in distributed storage systems.

- Our proposed constructions support both file-level and block-level deduplications.

- Security analysis demonstrates that the proposed deduplication systems are secure in terms of the definitions specified in the proposed security model. In more details, confidentiality, reliability and integrity can be achieved in our proposed system. Two kinds of collusion attacks are considered in our solutions. These are the collusion attack on the data and the collusion attack against servers. In particular, the data remains secure even if the adversary controls a limited number of storage servers.

- We implement our deduplication systems using the Ramp secret sharing scheme that enables high reliability and confidentiality levels. Our evaluation results demonstrate that the new proposed constructions are efficient and the redundancies are optimized and comparable with the other storage system supporting the same level of reliability.

4. System Architecture:
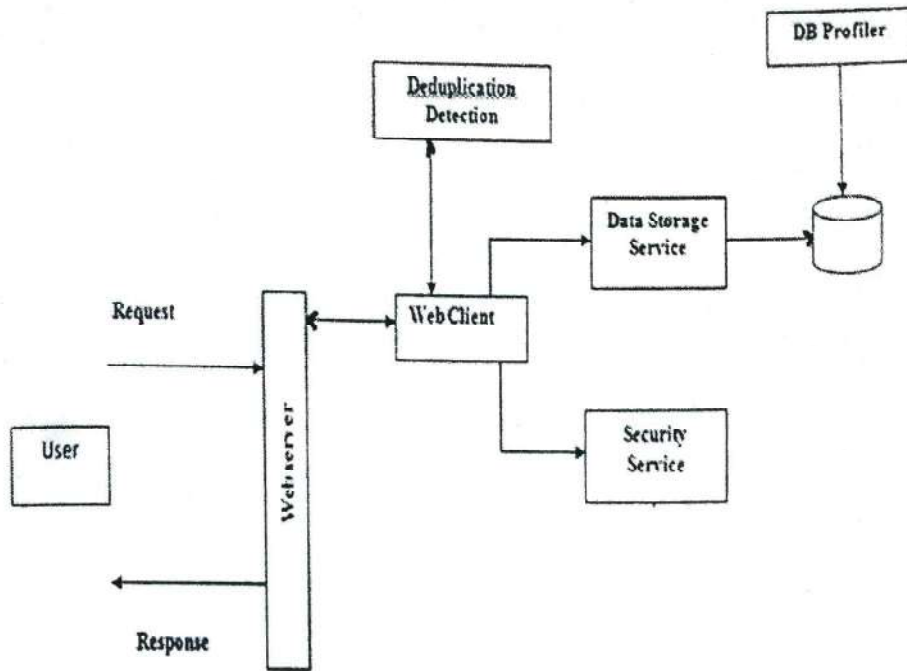
5. Conclusion:

The proposed distributed deduplication systems are to increase the consistency of data however attaining the privacy of the user's outsourced data without an encryption appliance. The security of tag consistency and integrity were attained. The implementation of deduplication systems using the Ramp secret sharing scheme here gives the demonstration that it acquires small encoding/decoding overhead compared to the network transmission overhead in regular download /upload operations.

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MUSICAL INSTRUMENTS OF KERALA TEMPLES

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Temples in Kerala were centers of religious as well as socio-economic and cultural activities of the people. Kerala temples have a long history of fostering culture. Medieval period witnessed the emergence of a new order essentially based on a new synthesis of a Aryan and Dravidian culture. Life in almost all the important towns of medieval period centered around the temples. In fact, the cultural life of the people centered on the local temple. They went there to listen to music, see plays, watch artistic works and attain peace. The temples in kerala has been all the time an amazing factor for its uniqueness in structure, rituals, tradition, offerings, festivals, customs etc. Some of these are connected with our great epics Ramayana and Mahabaratha.

Temples were centres of arts and culture. Temples were also institutions providing unofficial education through the arts. Arts were mainly associated with worship and festivals. The arts were considered to be peaceful method for pleasing the Gods. Temple arts developed in these socio – religious milieu. Many arts forms were evolved to attract people to the temple as a part of the revivalist movement. The ritualistic art form temple musical instruments are prominent among them. Kerala is rich in its variety of *"Vaadyas"* as the instruments are collectively addressed. Bharatha Munis" age old and famous work *Natya sastra* mentions ritualistic music. However, the use of musical instruments in kerala

temple worship adheres to the mandates laid down in the *Tantra Sastra*. Two texts are accepted as authorities throughout kerala. They are *Tantra Samuchayam* by chennas Manykkal Narayanan Nampoothiri of 15th century together with its commentary in Malayalam named kuzhikkattu pacha penned by Maheswara Bhattathiri of kuzhikkattu illam and Isana Gurudeva pandhati by Isana Sivagurudeva.The letter is given a time frame between the 9th and the 11th centuries though difference do exist.Ancient Tamil literature far back as the 2nd century B.C or perhaps even prior to it speaks of many instruments commonly in use in kerala temples. This is not surprising when the historic contacts, though not often friendly, between the *chera, chola, pandya* kingdoms and the linguistic medium, predominantly Tamil, are taken into consideration. One of the earliest Malayalam works wherein musical *vaadyas* appear is *Unnuneelisandesam* assigned to the 14th century.

The musical instruments of kerala broadly fall under three categories viz., classical traditional (theatrical and ritualistic) and folk. Among the classical instruments are included *veena, violin, tampuru, gattu vaadyam, flute, nagaswaram, mridangam, ganjira, ghatam, tavil* etc. Most of them are in use in the state, either as solo or as accompanying instruments in the field of karnatic classical music and dances like *mohiniyattom, bharatanatyam* etc. Since some of these instruments are common to all southern state where karnatic classical music prevails in a uniform nature, and since their introduction into the state in their present day character happens to be a later event, a little before the time of Swati Tirunal – they are not treated here as typical instruments of kerala.The folk field has a variety of instruments like *Pulluvanveena ,pulluvankudom ,udukku*

,*tampattam,sooryappira,ampilivalayam* etc. Which are selectively used in non – Aryan temple rituals and in religious songs, dances and also in some social ceremonies. A few of these instruments are found in certain parts of Tamil Nadu which were once part of old Tiruvitamkur.

The traditional theatricaland ritualistic musical instruments include *chenda,chengala, maddalam, thimila, edakka, maram* etc. and they assist the ritualistic and festive music of the Aryan temples and traditional dance dramas like *koothu, koodiyattam, kathakali* etc. Instruments like *chenda, maddalam, kuzhal* etc, are popular with non – Aryan temple rituals and theatrical performance also.

The following instruments are frequently referred to in ancient classic like *chilappathikaram, unnuneeli sandesam, chandrotsavam* and in the works of Chrusseri, Ezhuthassan, Nambiar and Karthika Tirunal, the author of the immortal work *Balarama Bharatam. Kshetra vaadyas* are broadly classified into three groups stringed, wind and percussion.

The majority of *kshetram* musicians belong to one of the *ambalavasi* communities (traditionally related to the temple) or the *Nayar*. The *kshetram* ensemble leaders and drummers nearly always belong to the traditional drummer communities *marar* or *pooduval*. They are regarded as the custodians of the *kshetram* genres. Professional performance skills on one (or ideally on all) the drums *chenda, timila, edaykka* and *maram* are still a prerequisite for male members of these communities. *Nayar* or related castes play *kuzhal, kombu, ilathalam* and the *maddalam* drums. Occasionally members of other *ambalavasi* castes like, *Warrier, Nambissan, Pisharoti* or *Kurup,*

are also professional artists. Note that the custodian of the ritualistic *nangiar kuthu* or *kutiyattam* performing art forms, the *Nambiar* (the *Mizhave* drummer) and the *Nangiar* (female dancer) also constitute a small *ambalavasi* community, but are outside the scope of our study.

In contrast to the *ambalavasi* castes, the *Nayar*, one of the biggest communities in kerala, are traditionally not on exclusive temple servent or musician community. There is still caste exclusion towards performers within some temple in kerala; though the tendency to accept musicians because of their playing skill is becoming more prominent.

The instrumental music of kerala is dramatic and lively with a large number of musical instruments such as *Chenda, Edakka, Mizhavu, Mridangam, Udukku, Takil* and *Timila* and a few percussion instruments. Wind instruments include *Kombu, Kuzhal, Nadaswaram* and *Sankhu* and soon. The varied stringed instruments include *Tamburu, Vina, Nandtuni.* The *chendamelam* has become an inseparable part of all the temple festivals of kerala. *'Thayampaka'* is another unique temple *vaadya. 'Panchavadyam'* consists of 5 musical instruments which are played together to create a melodious tune. It is an integral part of the festivals of the temples in kerala, especially in central kerala. The most celebrated performance is put up at Thiruvambadi Temple during the Thrissur Pooram.

Today, a reality that our Audio – visual media does not give much coverage to the Temple musical instruments of kerala. They are all interested in telecasting cinima, serials, sports and games. But the traditional art form which are using the temple instruments like, *Thimila, Maddalam, Nagaswaram, Sangu, Veena, Edakka, Udukku,*

Chenda, Mridangam, Tamburu, Kuzhal, Elathalam, Chengila etc. are not getting much importance in the media. Since the media is the strongest and easiest way to communicate we should use these device to familiarize these musical instruments and the art forms to the general public. The entry of Western musical instruments also reduced the importance of the temple musical instruments.

In this study of kerala *Kshetra Vaadyas*, along with the major and minor instruments, a few of non – kerala origin too have featured like the *Venu, Veena,* and *Nagaswaram* due to their enduring merger into the religious and cultural frame work of Malayala Nadu. By chance some indigenous instruments might stand omitted and, if that be so, the lapse is deeply lamented .Bypassing the superficial levels of perception, if deeper analysis is attempted, the incredible repertoire, rich and complex, of Kerala's *kshetra vaadyas* with come to light. The atmosphere they are capable of creating, the emotions they succeed in generating, from the thunder of terror to the softness that lulls an infant to slumber, inspire unfailing awe and appreciation. Like so many of kerala's art forms and cultural options, in the sphere as well, an entire age – old wonder world of melody, rhythm and sound of music in nuances and in degrees of orchestration stands revealed.

Kerala has a rich cultural heritage and art forms. Unfortunately our art forms are alienating from our land, now some of them are only in memories. It is our moral responsibility to protect and preserve it for the coming generations. The time is already overdue for taking remedial measures for the teaching, preservation and research in musical instruments.

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RELEVANCE OF DATA VISUALIZATION IN DATA MINING

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ABSTRACT

Data mining is the process of finding out the hidden information from a large collection of data. There are several types of data and also several types of mining process. Understanding the data in its clear form is the first and major process in data mining. It will reduce the complexity if mining process. Data visualization is a general term that describes any effort to help people understand the significance of data by placing it in a visual context. Patterns, trends and correlations that might go undetected in text-based data can be exposed and recognized easier with data visualization software. Today's data visualization tools go beyond the standard charts and graphs used in Excel spreadsheets, displaying data in more sophisticated ways such as info graphics, dials and gauges, geographic maps, heat maps, and detailed bar, pie and fever charts. The images may include interactive capabilities, enabling users to manipulate them or drill into the data for querying and analysis. Indicators designed to alert users when data has been updated or predefined conditions occur can also be included. Most business intelligence software vendors embed data visualization tools into their products, either developing the visualization technology themselves or sourcing it from companies that specialize in visualization.

Keywords: Data visualization, Weka, Classification, regression

Introduction

The amount of data stored on electronic media is growing exponentially fast. Today's data warehouses dwarf the biggest databases built a decade ago [1], and making sense of such data is becoming harder and more challenging. For example, online retailing in the Internet age is very different and easier than retailing a decade ago because the important factor "location" which is irrelevant for online stores. One of the greatest challenges we face today is making sense of all this data. Data mining, or knowledge discovery, is the process of identifying new patterns and insights in data, whether it is for understanding the Human Genome to develop new drugs, for discovering new patterns in recent Census data to warn about hidden trends, or for understanding your customers better at an electronic web store in order to provide a personalized one-to-one experience. The examples in this paper are mainly from the e-commerce world.

Data mining serves two goals:

1. **Insight**: identify patterns and trends that are comprehensible, so that action can be taken based on the insight. For example, characterize the heavy spenders on a web site, or people that buy product X. By understanding the underlying patterns, the web site can be personalized and improved. The insight may also lead to decisions that affect other channels, such as brick-and-mortar stores' placement of products, marketing efforts, and cross-sells.

2. **Prediction**: a data mining model predicts the result based on input data. For example, a model can be built to predict the

propensity of customers to buy product X based on their demographic data and browsing patterns on a web site. Customers with high scores can be used in a direct marketing campaign. If the prediction is for a discrete variable with a few values (e.g., buy product X or not), the task is called *classification*; if the prediction is for a continuous variable (e.g., customer spending in the next year), the task is called *regression*.

Data mining has been defined as the nontrivial extraction of implicit, previously unknown, and potentially useful information from databases/data warehouses. It uses machine learning, statistical and visualization techniques to discover and present knowledge in a form, which is easily comprehensive to humans [5]. Data mining, the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help user focus on the most important information in their data warehouses. Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge-driven decisions. The automated, prospective analyses offered by data mining move beyond the analyses of past events provided by retrospective tools typical of decision support systems. Data mining tools can answer business questions that traditionally were too time consuming to resolve. They scour databases for hidden patterns, finding predictive information that experts may miss because it lies outside their expectations. Data mining techniques can be implemented rapidly on existing software and hardware platforms to enhance the value of existing information resources, and can be integrated with new products and systems as they are brought on-line [6].

Data mining steps

1) Data cleaning- The removal of noise and inconsistent data.

2) Data integration - The combination of multiple sources of data.

3) Data selection - The data relevant for analysis is retrieved from the database.

4) Data transformation - The consolidation and transformation of data into forms appropriate for mining.

5) Data mining - The use of intelligent methods to extract patterns from data.

6) Pattern evaluation - Identification of patterns that are interesting.

7) Knowledge presentation - Visualization and knowledge representation techniques are used to present the extracted or mined knowledge to the end user [7].

Challenges

One of the major challenges is getting proper idea about data and makes data mining models comprehensible to business users. Business users need to understand the results of data mining. Few data mining models are easy to understand but still techniques need to be developed to explain or visualize existing ones or new models that are simple to understand with matching algorithms need to be derived. This is particularly hard for regression models. A related problem is that association algorithms usually derive too many rules and we need to find ways to highlight the "interesting" rules or families of associations.

The actual data mining task is the automatic or semi-automatic analysis of large quantities of data to extract previously unknown interesting patterns such as groups of data records (cluster analysis), unusual records (anomaly detection) and dependencies (association rule mining). This usually involves using database techniques such as spatial indices. These patterns can then be seen as a kind of summary of the input data, and may be used in further analysis or, for example, in machine learning and predictive analytics. For example, the data mining step might identify multiple groups in the data, which can then be used to obtain more accurate prediction results by a decision support system. Neither the data collection, data preparation, nor result interpretation and reporting are part of the data mining step, but do belong to the overall KDD process as additional steps [11][12].

Weka

Weka is a collection of machine learning algorithms for solving real-world data mining problems. It is written in Java and runs on almost any platform. The algorithms can either be applied directly to a dataset or called from your own Java code.

Features

- machine learning
- data mining
- preprocessing
- classification
- regression
- clustering
- association rules

- attribute selection
- experiments
- workflow
- visualization

Weka (Waikato Environment for Knowledge Analysis) is a popular suite of machine learning software written in Java, developed at the University of Waikato, New Zealand. Weka is free software available under the GNU General Public License. The Weka workbench contains a collection of visualization tools and algorithms for data analysis and predictive modeling, together with graphical user interfaces for easy access to this functionality [8].

Weka is a collection of machine learning algorithms for solving real-world data mining problems. It is written in Java and runs on almost any platform. The algorithms can either be applied directly to a dataset or called from your own Java code [9].

The original non-Java version of Weka was a TCL/TK front-end to (mostly third-party) modeling algorithms implemented in other programming languages, plus data preprocessing utilities in C, and a Makefile-based system for running machine learning experiments. This original version was primarily designed as a tool for analyzing data from agricultural domains, but the more recent fully Java-based version (Weka 3), for which development started in 1997, is now used in many different application areas, in particular for educational purposes and research.

Advantages of Weka include:

a) Free availability under the GNU General Public License

b) Portability, since it is fully implemented in the Java programming language and thus runs on almost any modern computing platform

c) A comprehensive collection of data preprocessing and modeling techniques

d) Ease of use due to its graphical user interfaces

Weka supports several standard data mining tasks, more specifically, data preprocessing, clustering, classification, regression, visualization, and feature selection. All of Weka's techniques are predicated on the assumption that the data is available as a single flat file or relation, where each data point is described by a fixed number of attributes (normally, numeric or nominal attributes, but some other attribute types are also supported). Weka provides access to SQL databases using Java Database Connectivity and can process the result returned by a database query. It is not capable of multi-relational data mining, but there is separate software for converting a collection of linked database tables into a single table that is suitable for processing using Weka. Another important area that is currently not covered by the algorithms included in the Weka distribution is sequence modeling [8].

Data Processing Using Weka

Here is an example of male, female ratio. The database is designed in MS-Access 2003 database management system to store

the collected data. The data is formed according to the required format and structures.

Further, the data is converted to ARFF (Attribute Relation File Format) format to process in WEKA. An ARFF file is an ASCII text file that describes a list of instances sharing a set of attributes. ARFF files were developed by the Machine Learning Project at the Department of Computer Science of The University of Waikato for use with the Weka machine learning software. This document descibes the version of ARFF used with Weka versions 3.2 to 3.3; this is an extension of the ARFF format as described in the data mining book written by Ian H. Witten and Eibe Frank [10][13].

After processing the ARFF file in WEKA the list of all attributes, statistics and other parameters can be utilized as shown in Figure 1.

There are 729 villages' data is processed with different attributes like population, health, literacy, village locations etc. Among all these, few of them are preprocessed attributes generated by census data like, percent_male_literacy, total_percent_literacy, total_percent_illiteracy, sex_ratio etc.The processed data in Weka can be analyzed using different data mining techniques like, Classification, Clustering, Association rule mining, Visualization etc. algorithms.

The Figure 2 shows the few processed attributes which are visualized into a 2 dimensional graphical representation. The information can be extracted with respect to two or more associative relation of data set. In this process, we have made an attempt to visualize the impact of male and female literacy on the gender

inequality. The literacy related and population data is processed and computed the percent wise male and female literacy.
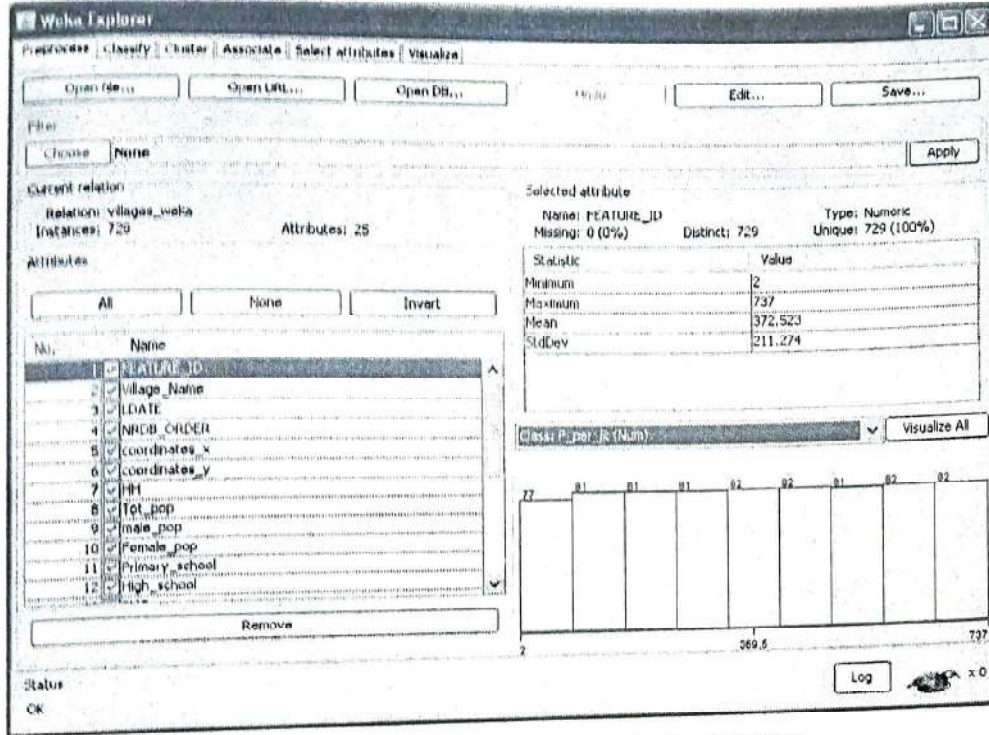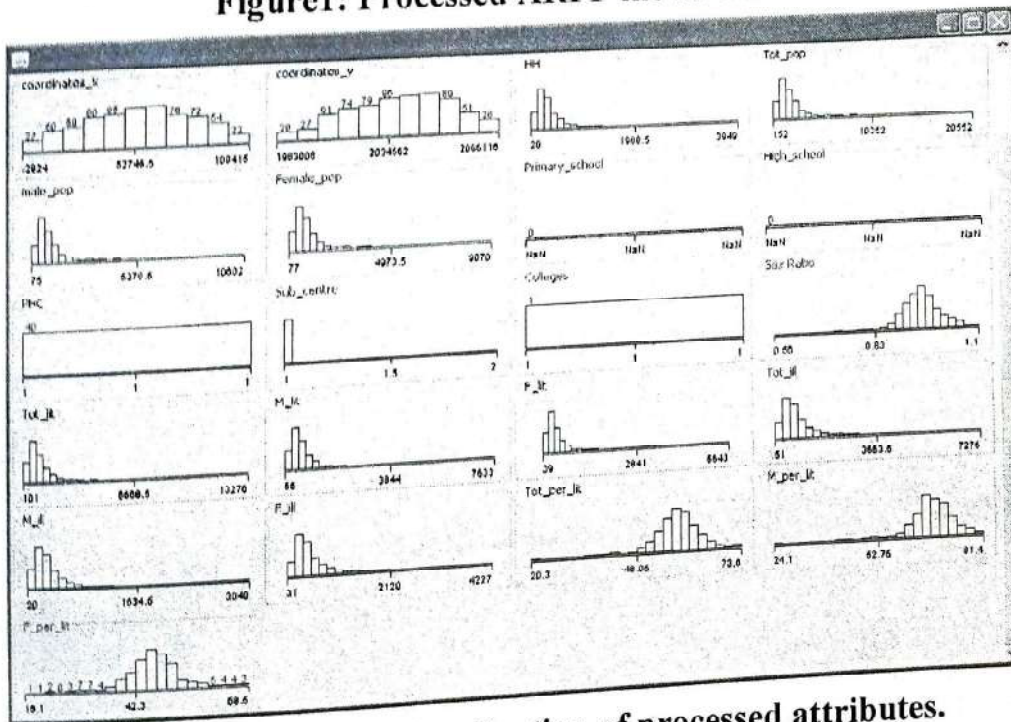

Figure1: Processed ARFF file in WEKA

Figure 2 Graphical visualization of processed attributes.
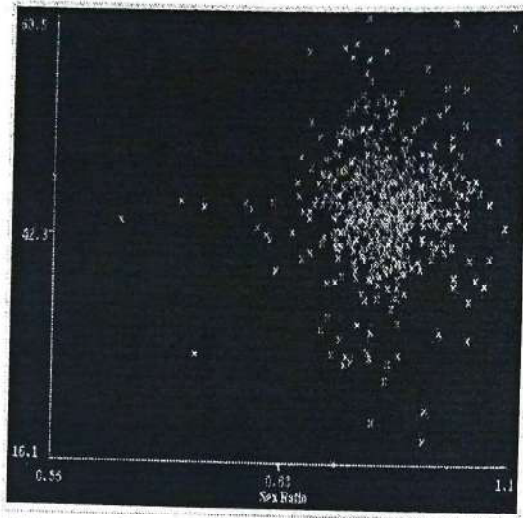
Figure 3. Female literacy and Sex ratio values.   **Figure 4.** Male literacy and Sex ratio values.
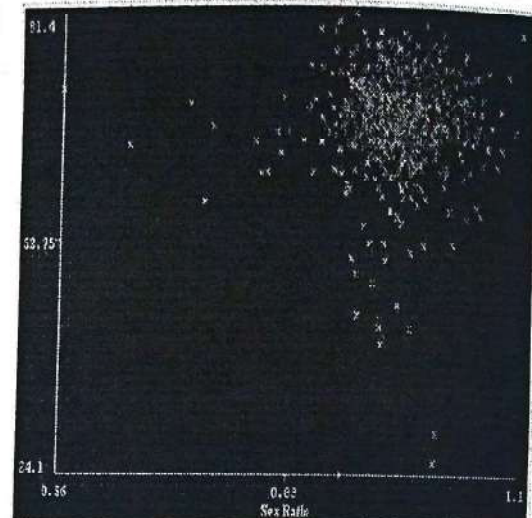
Accordingly we have computed the sex ratio attribute from the given male and female population data. The new attributes like, male_percent_literacy, female_percent_literacy and sex_ratio are compared each other to extract the impact of literacy on gender inequality. The Figure 3 and Figure 4 are the extracted results of sex ratio values with male and female literacy.

On the Y-axis, the female percent literacy values are shown in Figure 3, and the male percent literacy values are shown in Figure 4. By considering both the results, the female percent literacy is poor than the male percent literacy in the district. The sex ratio values are higher in male percent literacy than the female percent literacy. The results are purely showing that the literacy is very much important to manage the gender inequality of any region.

Conclusion

Taking pictures and developing them (or loading them into a computer) has become trivial. Data mining and related technologies have had significant advances, but we have yet to build the equivalent of the point-and-click cameras. This short review of the basic goals of data mining, is to provide, those interested with enough information to see the value of data mining and use it to find nuggets; after all, almost everyone has access to the main ingredient that is needed: *data*.

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SCREENLESS DISPLAY: AN EMERGING TREND IN THE NEAR FUTURE

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ABSTRACT

Technological advancement nowadays is moving to a faster pace. The latest display technology -Touch Screen Display, commonly used in our smart phones and tablet computers will move to a mere history in the coming future. Screenless Display, the emerging new display technology will replace this touch screen environment and will solve the problems at higher level, making life more comfortable. The main aim of the Screenless Display is to display or transmit the information without the help of a screen or the projector. Using this display, we can directly project images onto the human retina, open space and even to the human brain. It avoids the need of high weight hardware and it will provide privacy at a high rate. This paper is intended to give an idea about screenless display, working principle and its types.

Keywords – *Screenless, Visual Image display, Retinal Direct display, Synaptic Interface*

1. Introduction

A display is a computer output surface and projecting mechanism that shows text and often graphic images to the computer user using a cathode ray tube (CRT), liquid crystal

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display (LCD), light-emitting diode, gas plasma, or other image projection technology. The display is usually considered to include the screen or projection surface and the device that produces the information on the screen. The lack of space on screen based displays provides an opportunity for the development of screenless displays. Screenless display is an interactive projection technology developed to solve the problems related to the device miniaturization of the modern communication technologies. As the name indicates it has no screen and it can be defined as a display used to transmit any data such as pictures or videos without the help of screens. Space constraint and portability issues associated with screen-based displays and the need for complete privacy, especially to view confidential information are some of the factors that would drive the screenless display market. However, high cost of this technology is the major restraint for the growth of this market. The fast growing gaming market and the demand for products consuming less power are expected to create a lot of opportunities for the growth of the market. During the year 2013, this display came into progress by the implementation of products like virtual reality headsets, retinal displays and holographic videos.

2. Related Works

The Media Lab at the Massachusetts Institute of Technology is known to be the first inventors of screen-less display. Other companies have made significant breakthroughs as well. By modifying a liquid-crystal display (LCD), the MIT HP Labs in Palo Alto, California used complex physics to make 3-D displays as thin as half a millimeter. The key to creating the HP display is to capture

every angle. This was done by using rapidly spinning mirrors and multiple graphic processors. Since the displays are capable of projecting 3D images to the space, many disadvantages of 2D and screen based displays can be avoided. Displaying feature of it can be thought of as a projector without a movie. Using this excellent technology, one can even make smart phone as a TV. The countdown for the first screenless display has started currently from the month of May 2014 onwards. Screenless Display currently uses Interactive Projection technology with visual display and 3D Projection Technology. The screenless display market has witnessed substantial growth in 2013-2014 and various companies have developed various devices in this field, such as mobile phones for elderly and blind people, bionic contact lenses, virtual reality headsets and holograms. Technological advancements based on consumer preference is a key strategy utilized by Google. The Google glass developed by Google is in high demand across the US. The key players in the global market are Google, Displair, Kapsys, Microsoft Company and Avegant.

3. Screenless Display

Screenless Displays can be defined as a display which helps to display and even transmit any information without the aid of screens. There are several types of screenless display that are under development which will describe as:

- Visual Image display
- Retinal Direct display
- Synaptic Interface

The first category, visual image is defined as the things that can be seen by the human eye. The second category, retinal display – the name itself- indicates the display of image directly onto the retina. The third category synaptic reference means that sending information directly to the human brain.

3.1 Visual Image Display

The visual image is a type of screenless display, which recognizes any type of image or thing with the help of the human eye. The following are few examples of the visual image display: holographic display, virtual reality goggles, heads up display, etc. The working principle of this display states that the light gets reflected by the intermediate object before reaching the retina or the eye. The intermediate object can be a hologram, Liquid Crystal Displays (LCD) or even windows.

Holographic messages that became popular through the 'Star War Film' are now becoming a truthful reality. Holographic Displays allow the display of three dimensional images by using simple components like Helium – Neon Laser, a Lens, an object, mirror and a holographic film. The laser beam used will initially create a plasma environment. When the laser and object beams coincides, a 3D image will be projected. The projected image will appear to be floating in air. Presently, MIT's Media Lab reported a holographic color video display (inexpensive) with the resolution of TV.
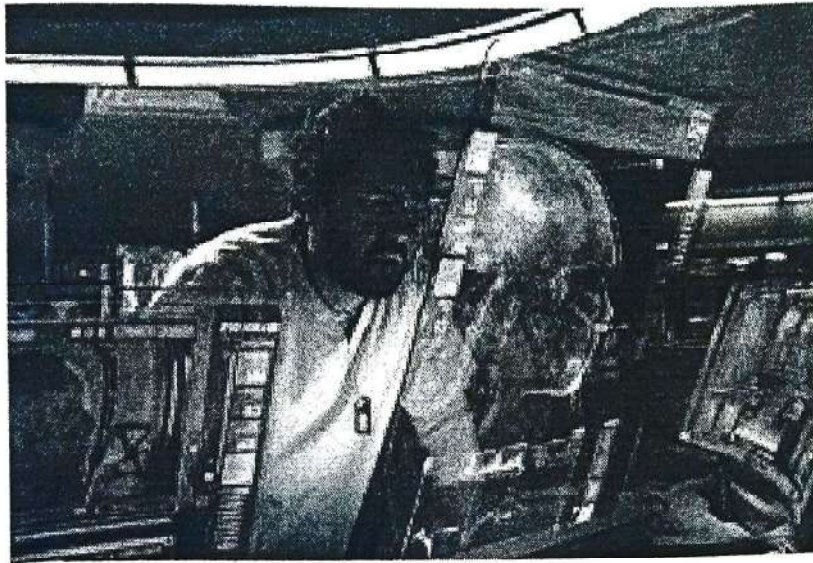
Figure 3.1: Example for holographic display

3.2 Retinal Direct display

Virtual Retinal Display (VRD), a screenless display technology allowing the image directly to be projected on to the retina. In VRD, no real image is produced. It just beams the image to our eye balls directly. The user will feel that the display is floating in the space in front of him. Retinal Scan Display and Retinal Projector are some common popular names of it. Compared to other displays, it uses narrow band color, coherent light and allows short transient light emission. The VRD was initially invented by Kazuo Yoshinaka in 1986. Later work at the Human Interface Technology Lab at University of Washington had brought out a VRD system in 1991. Now VRD is under more research.

The block diagram of the virtual retinal display in fig 3.1 consists of following blocks: photon generation, intensity modulation, beam scanning, optical projection and drive electronics. Photon generation block generates the coherent beam of light; this

photon source makes use of the laser diodes as coherent source with retina display to give diffraction onto the retina of the human eye. The light generated from photon source is intensity modulated. The intensity of the light beam gets modulated to match the intensity of the image.
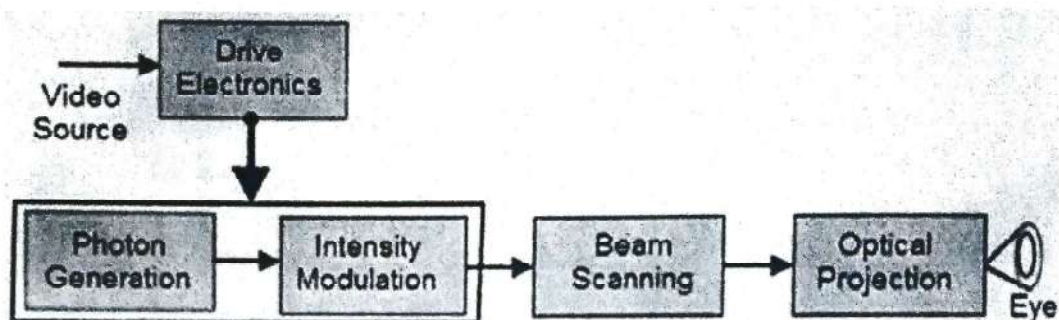
Figure 3.2: block diagram of retinal display

The modulated beam gets scanned by the beam scanning. By using this scanning block, the image is placed onto the retina. In this beam scanner, two types of scanning modes take place: raster mode and vector mode. After the scanning process, optical projection takes place for projecting a spot-like beam onto the retina of the eye. The spot focused on the eye is sketched as an image.

Drive electronics placed on the photon generator and intensity modulator is used for synchronization of the scanner, modulator and coming video signal. These displays are made available in the market by using MEMS technology. This display can be extremely helpful in maintaining the privacy and security of the contents. A person can even control the intensity of display through his voice.
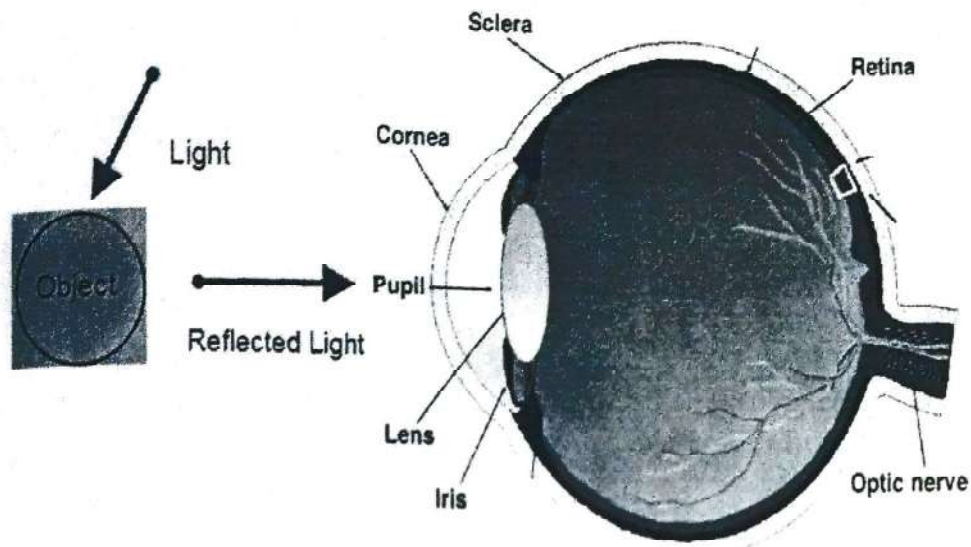
Figure 3.3: How vision works
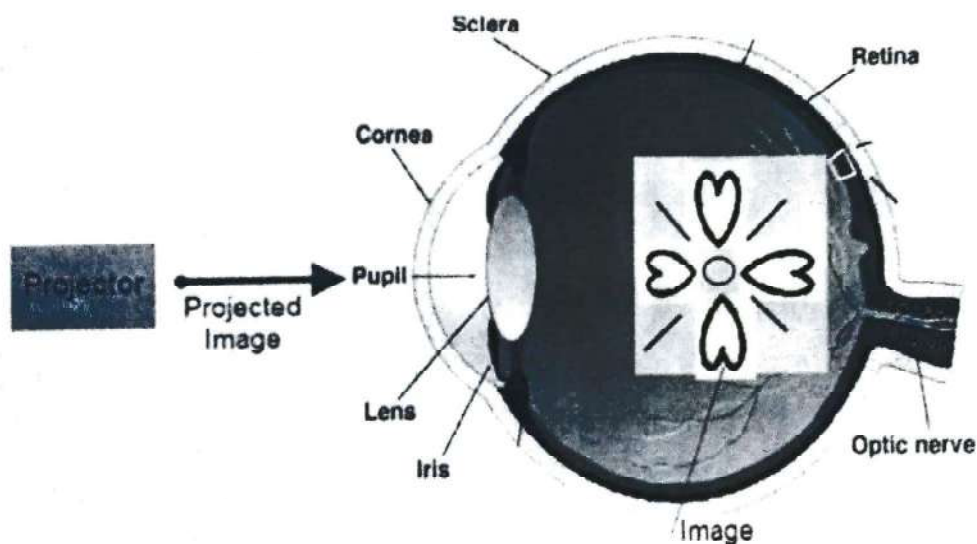
Figure 3.4: Retinal Projection

3.3   Synaptic Interface

Synaptic display is a type of screenless display that does not display an image in free media or onto the retina. It displays by transmitting the signals directly into the brain through the optic nerve. There are no light involved, basically electrical impulses.

This method is tested on horseshoe crabs by recording nerve images. Therefore, furthering the neural code transmitted to the brain by the optic nerve. This display offers the possibility of providing sight for the blind by using implanted electronics to bypass nonfunctional parts of the eye. It can give users the benefit to view images in greater coordination and complexity than the eyes capable of producing. However the method requires more research and development for further production of worldwide application can be implemented.

This type of display does not use light at all. Instead, the information is directly sent to the brain. This technology is the most advanced of all, and is still under great development. Synaptic Interface has not been tested on humans yet but scientists are of the view that it will prove extremely helpful especially in the case of blind people.
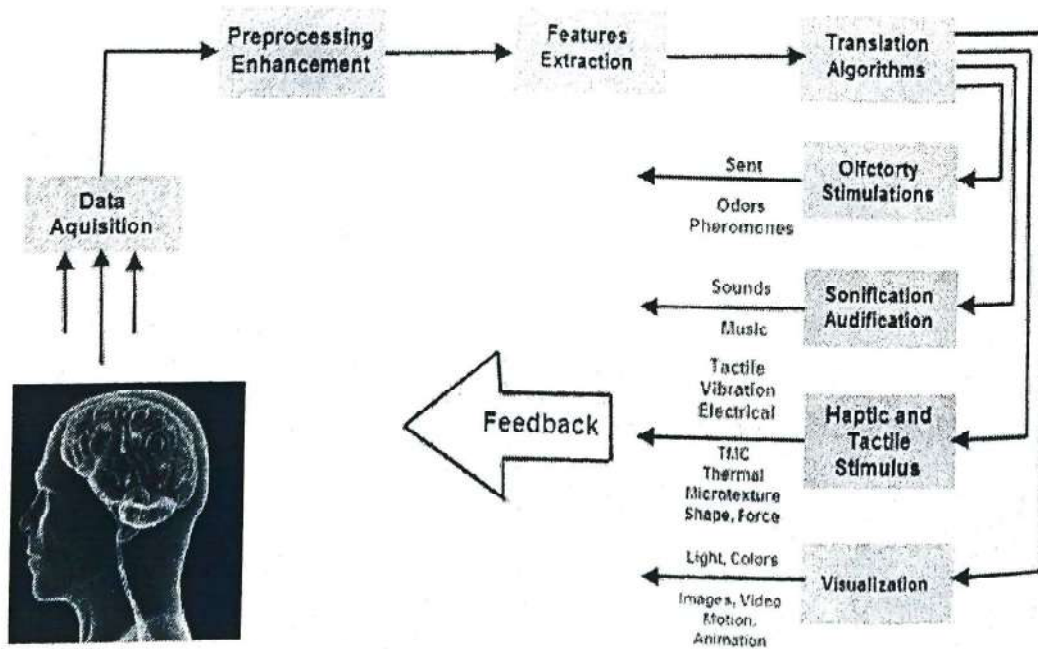
Figure 3.5: Synaptic Interface

Screen-less display has many advantages and it can be used for many beneficial purposes including security systems, secure communications, education, commercial purposes, planning and broadcasts. Although cell phones help us a great deal but we cannot use them for cumbersome tasks- tasks that include a lot of typing- since the keypad and screen are really small, and thus we have to refer back to our laptops for important assignments. However, with the screen-less display in the market, this problem can easily be overcome with a person being able to access information and use the display keyboards for all the important work.

4. Conclusion

This paper has elaborately discussed screenless displays which is one of the most emerging computer technologies and has become a new exciting range for the upcoming generations as a field of the futuristic technology. Due to the ability of having several advantages which are involved in the making, designing, coding of the screenless, this needs plenty of knowledge and process for the development is still under the improvement. These displays are the future that would reach the world of all organizations and institutions by presenting the brighter and efficient and cost effective means of communication, fundamentally revolutionizing the approach to comprehending information. It will going to bring a revolution in the field of displays and will replace the current display technology that is touch-based. And also this screenless display technology promises of cost effective devices which will provide better privacy as compare to the present display devices.

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WIRELESS AD HOC

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ABSTRACT

ad hoc is a Latin phrase meaning "for this". It generally signifies a solution designed for a specific problem or task, non-generalizable, and not intended to be able to be adapted to other purposes. Common examples are organizations, committees, and commissions created at the national or international level for a specific task. In other fields the term may refer, for example, to a military unit created under special circumstances, a tailor-made suit, a handcrafted network protocol, or a purpose-specific equation. ad hoc can also mean makeshift solutions, shifting contexts to create new meanings, inadequate planning, or improvised events. A wireless ad hoc network (WANET) is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically on the basis of network connectivity. In addition to the classic routing, ad hoc networks can use flooding for forwarding data.

Wireless mobile ad hoc networks are self-configuring, dynamic networks in which nodes are free to move. This paper shows the history of the ad-hoc networks and its development and its applications based on its decentralized nature of networks and it shows how the routing is done by mentioning the routing algorithms and how each one works then we move to the advantages and disadvantages of the ad-hoc networks then we go across the protocol stack. Wireless networks lack the complexities of infrastructure setup and administration, enabling devices to create and join networks "on the fly" - anywhere, anytime.

Keywords: *Wireless, Ad Hoc, Network*

Introduction

A wireless ad-hoc network, also known as IBSS - Independent Basic Service Set, is a computer network in which the communication links are wireless. The network is ad-hoc because each node is willing to forward data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. This is in contrast to older network technologies in which some designated nodes, usually with custom hardware and variously known as routers, switches, hubs, and firewalls, perform the task of forwarding the data. Minimal configuration and quick deployment make ad hoc networks suitable for emergency situations like natural or human-induced disasters, military conflicts.

History

The earliest wireless ad-hoc networks were called "packet radio" networks, and were sponsored by Defense Advanced Research Projects Agency (DARPA) in the early 1970s. Bolt, Beranek and Newman Technologies (BBN) and SRI International designed, built, and experimented with these earliest systems. Experimenters included Jerry Burchfield, Robert Kahn, and Ray Tomlinson of later TEN-Extended (TENEX), Internet and email fame. Similar experiments took place in the Ham radio community. It is interesting to note that these early packet radio systems predated the Internet, and indeed were part of the motivation of the original Internet Protocol suite. Later DARPA experiments included the Survivable Radio Network (SURAN) project, which took place in the 1980s. Another third wave of academic activity started in the

mid-1990s with the advent of inexpensive 802.11 radio cards for personal computers. Current wireless ad-hoc networks are designed primarily for military utility.

Application

The decentralized nature of wireless ad-hoc networks makes them suitable for a variety of applications where central nodes can't be relied on and may improve the scalability of networks compared to wireless managed networks, though theoretical and practical limits to the overall capacity of such networks have been identified. Minimal configuration and quick deployment make ad hoc networks suitable for emergency situations like natural disasters or military conflicts. The presence of dynamic and adaptive routing protocols enables ad hoc networks to be formed quickly. Wireless ad-hoc networks can be further classified by their application:

Mobile ad hoc networks (MANET)

A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires.

Vehicular Ad hoc Networks (VANETs)

Vehicular Ad hoc Networks are used for communication between vehicles and roadside equipment. Intelligent vehicular ad hoc networks (InVANETs) are a kind of artificial intelligence that helps vehicles to behave in intelligent manners during vehicle-to-vehicle collisions, accidents.

Smart Phone Ad hoc Networks (SPANs)

Leverage the existing hardware (primarily Bluetooth and Wi-Fi) in commercially available smart phones to create peer-to-peer networks without relying on cellular carrier networks, wireless access points, or traditional network infrastructure.

Internet based mobile ad hoc networks (iMANETs)

Internet based mobile ad hoc networks are ad hoc networks that link mobile nodes and fixed Internet-gateway nodes. One implementation of this is Persistent System's Cloud Relay.

Military / Tactical MANETs

Military / Tactical MANETs are used by military units with emphasis on security, range, and integration with existing systems.

A mobile ad-hoc network (MANET) is an ad-hoc network but an ad-hoc network is not necessarily a MANET.

PROS & CONS

Pros

- No expensive infrastructure must be installed
- Use of unlicensed frequency spectrum
- Quick distribution of information around sender

Cons

- All network entities may be mobile ⇒ very dynamic topology
- Network functions must have high degree of adaptability
- No central entities ⇒ operation in completely distributed manner

Protocol Stack

A major limitation with mobile nodes is that they have high mobility, causing links to be frequently broken and re-established. Moreover, the bandwidth of a wireless channel is also limited, and nodes operate on limited battery power, which will eventually be exhausted. Therefore, the design of a mobile ad hoc network is highly challenging, but this technology has high prospects to be able to manage communication protocols of the future. The cross-layer design deviates from the traditional network design approach in which each layer of the stack would be made to operate independently. The modified transmission power will help that node to dynamically vary its propagation range at the physical layer. This is because the propagation distance is always directionally proportional to transmission power. This information is passed from the physical layer to the network layer so that it can take optimal decisions in routing protocols. A major advantage of this protocol is that it allows access of information between physical layer and top layers (MAC and network layer).

Routing

Proactive Routing

This type of protocols maintains fresh lists of destinations and their routes by periodically distributing routing tables throughout the network. The main disadvantages of such algorithms are:

1. Respective amount of data for maintenance.

2. Slow reaction on restructuring and failures.

Distance Vector Routing

As in a fix net nodes maintain routing tables. Distance-vector protocols are based on calculating the direction and distance to any link in a network. "Direction" usually means the next hop address and the exit interface. "Distance" is a measure of the cost to reach a certain node. The least cost route between any two nodes is the route with minimum distance. Each node maintains a vector (table) of minimum distance to every node. The cost of reaching a destination is calculated using various route metrics. RIP uses the hop count of the destination whereas IGRP takes into account other information such as node delay and available bandwidth.

Reactive Routing

This type of protocol finds a route on demand by flooding the network with Route Request packets. The main disadvantages of such algorithms are:

1.   High latency time in route finding.

2.   Excessive flooding can lead to network clogging.

Flooding

Is a simple routing algorithm in which every incoming packet is sent through every outgoing link except the one it arrived on. Flooding is used in bridging and in systems such as Usenet and peer-to-peer file sharing and as part of some routing protocols, including OSPF, DVMRP, and those used in ad-hoc wireless networks.

Hybrid Routing

This type of protocol combines the advantages of proactive and reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. The choice of one or the other method requires predetermination for typical cases. The main disadvantages of such algorithms are: 1. Advantage depends on number of other nodes activated. 2. Reaction to traffic demand depends on gradient of traffic volume.

Technical Requirements

An ad hoc network is made up of multiple "nodes" connected by "links."

Links are influenced by the node's resources (e.g., transmitter power, computing power and memory) and behavioral properties (e.g., reliability), as well as link properties (e.g. length-of-link and signal loss, interference and noise). Since links can be connected or disconnected at any time, a functioning network must be able to cope with this dynamic restructuring, preferably in a way that is timely, efficient, reliable, robust, and scalable.

The network must allow any two nodes to communicate by relaying the information via other nodes. A "path" is a series of links that connects two nodes. Various routing methods use one or two paths between any two nodes; flooding methods use all or most of the available paths.

Medium – Access Control

In most wireless ad hoc networks, the nodes compete for access to shared wireless medium, often resulting in collisions (interference). Using cooperative wireless communications improves immunity to interference by having the destination node combine self-interference and other-node interference to improve decoding of the desired signal.

Mathematical Models

The traditional model is the random geometric graph.
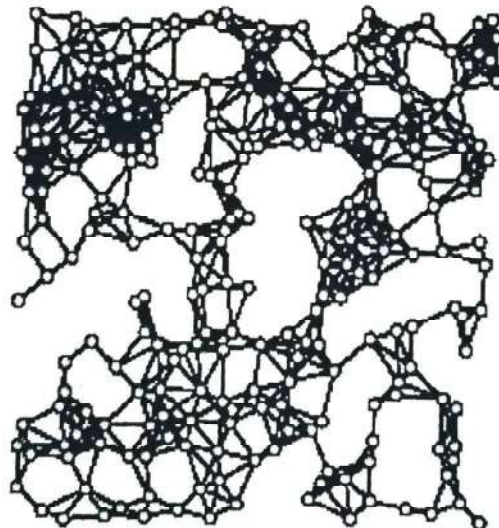
Figure 1. A randomly constructed geometric graph drawn inside a square

These are graph structures consisting of a set of nodes placed according to a point process in some usually bounded subset of the n-dimensional plane, mutually coupled according to a boolean probability mass function of their spatial separation (which may be a step function, see unit disk graphs). One then analyses the group of network observables (such as connectivity the distribution

of centralities or the distribution of node degrees) from a graph-theoretic perspective.

Security

Microsoft does not allow advanced encryption and security protocols for wireless Ad hoc networks on Windows. In fact, the security hole provided by Ad hoc networking is not only the Ad hoc network itself, but the bridge it provides into other networks.

Simulation of Wireless Ad Hoc Network

One key problem in Wireless Ad Hoc networks is foreseeing the variety of possible situations that can occur. As a result, Modeling and Simulation using extensive parameter sweeping and what-if analysis becomes an extremely important paradigm for use in ad hoc networks. Traditional M&S tools include NS2 (and recently NS3), OPNET Modeler and NetSim.

However, these tools focus primarily on the simulation of the entire protocol stack of the system. Although this can be important in the proof-of-concept implementations of systems, the need for a more advanced simulation methodology is always there. Agent-based modeling and simulation offers such a paradigm. Not to be confused with multi-agent systems and intelligent agents, agent-based modeling originated from social sciences, where the goal was to evaluate and view large-scale systems with numerous interacting "AGENT" or components in a wide variety of random situations to observe global phenomena. Unlike traditional AI systems with intelligent agents, agent-based modeling is similar to the real world. Agent-based models are thus effective in modeling bio-

inspired and nature-inspired systems. In these systems, the basic interactions of the components of the system, also called Complex Adaptive System, are simple but result in advanced global phenomena such as emergence.

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DRIVE SHARE

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ABSTRACT

DriveShare is Distributed File System intended to simplify access, retrieval and sharing of files through the network. It being a distributed system will not require a centralized server and can be up with even one of the participating systems online. It will support file permissions and read only settings. Directories can be created and maintained. The user can access his/her files through any computer which is a part of drive share. File access will be transparent to the user. File sharing, commenting and reviewing will be possible. The user starts the system and logs in using username and password. The interface loads up the files belonging to him and shared by others to him. He is allowed to add, modify, read and share files using the interface. The system on being started by the user tries to find and connect to DFS. This makes all the files stored on the system available for use and access. If no other peer is found, it declares itself as the coordinator and subsequent peers will take it as such. The system is involved in updating and synchronizing the various data structures of the DFS.

Index Terms: *Drive Sharing, Distributed File System, DFS.*

Introduction

A distributed file system or network file system is any file system that allows access to files from multiple hosts sharing via a computer network. This makes it possible for multiple users on multiple machines to share files and storage resources. The client nodes do not have direct access to the underlying block storage but interact over the network using a protocol. This makes it possible to restrict access to the file system depending on access lists or capabilities on both the servers and the clients, depending on how the protocol is designed. In contrast, in a shared disk file system all nodes have equal access to the block storage where the file system is located. On these systems the access control must reside on the client. Distributed file systems may include facilities for transparent replication and fault tolerance. That is, when a limited number of nodes in a file system go offline, the system continues to work without any data loss. So in creating DriveShare – A Distributed File System we have gone for system where the entire file is send in response to a query from a primary store computer. The locking granularity is avoided to prevent overhead and complication. The entire file is locked in response to write request if read is not going on. If being read the readers are informed to invalidate.
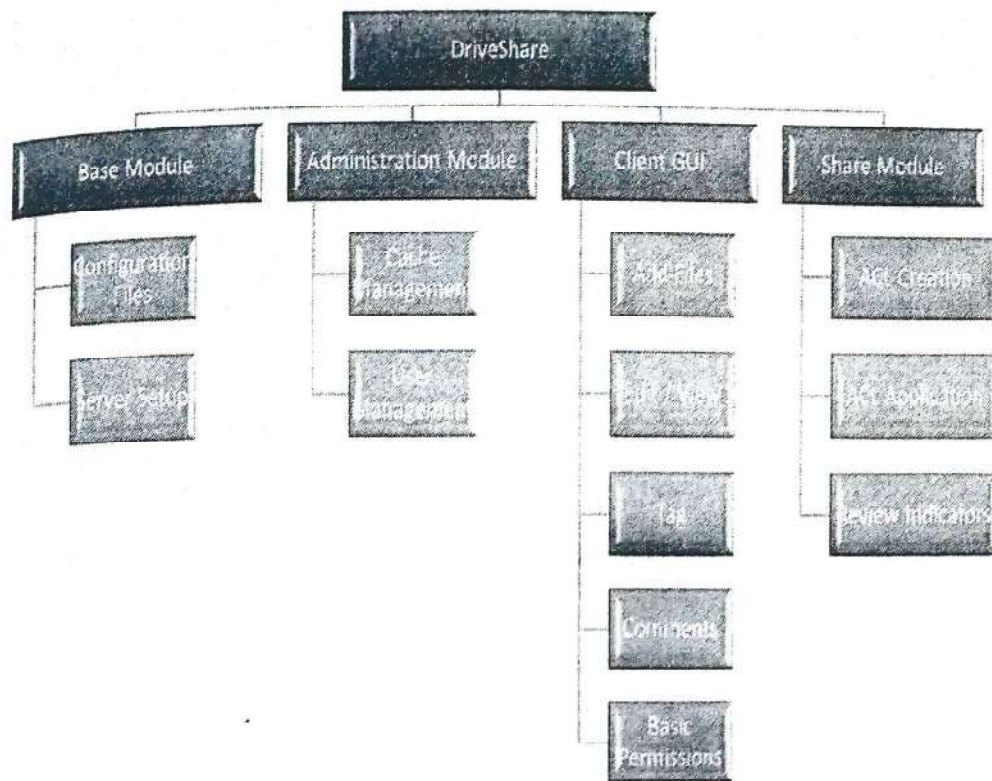
Figure 7. Block Diagram

Networking Concept Used

TCP

The Transmission Control Protocol (TCP) is one of the core protocols of the Internet Protocol Suite. TCP is one of the two original components of the suite, complementing the Internet Protocol (IP) and therefore the entire suite is commonly referred to as TCP/IP. TCP provides the service of exchanging data reliably directly between two network hosts, whereas IP handles addressing and routing message across one or more networks. In particular, TCP provides reliable, ordered delivery of a stream of bytes from a program on one computer to another program on another computer. TCP is the protocol that major Internet applications rely on, such as the World Wide Web, e-mail, and file transfer.

IP

The Internet Protocol (IP) is a protocol used for communicating data across a packet-switched internetwork using the Internet Protocol Suite, also referred to as TCP/IP. IP is the primary protocol in the Internet Layer of the Internet Protocol Suite and has the task of delivering distinguished protocol datagrams (packets) from the source host to the destination host solely based on their addresses. For this purpose the Internet Protocol defines addressing methods and structures for datagram encapsulation. The first major version of addressing structure, now referred to as Internet Protocol Version 4 (IPv4) is still the dominant protocol of the Internet, although the successor, Internet Protocol Version 6 (IPv6) is being deployed actively worldwide.

Distributed Computing

A distributed system consists of multiple autonomous computers that communicate through a computer network. The computers interact with each other in order to achieve a common goal. A computer program that runs in a distributed system is called a distributed program, and distributed programming is the process of writing such programs

Socket

Internet socket or network socket is an endpoint of a bidirectional inter-process communication flow across an Internet Protocol-based computer network, such as the Internet. The term Internet sockets is also used as a name for an application programming interface (API) for the TCP/IP protocol stack, usually provided by the operating system. Internet sockets constitute a

mechanism for delivering incoming data packets to the appropriate application process or thread, based on a combination of local and remote IP addresses and port numbers. Each socket is mapped by the operating system to a communicating application process or thread. A socket address is the combination of an IP address (the location of the computer) and a port (which is mapped to the application program process) into a single identity, much like one end of a telephone connection is the combination of a phone number and a particular extension.

An Internet socket is characterized by a unique combination of the following:

- Local socket address: Local IP address and port number

- Remote socket address: Only for established TCP sockets. As discussed in the Client-Server section below, this is necessary since a TCP server may serve several clients concurrently. The server creates one socket for each client, and these sockets share the same local socket address.

- Protocol: A transport protocol (e.g., TCP, UDP), raw IP, or others. TCP port 53 and UDP port 53 are consequently different, distinct sockets.

Within the operating system and the application that created a socket, the socket is referred to by a unique integer number called socket identifier or socket number. The operating system forwards the payload of incoming IP packets to the corresponding application by extracting the socket address information from the IP and

transport protocol headers and stripping the headers from the application data.

Module introduction

Basic Module:

This module will contain the initial steps to configure a system as a DriveShare system.

a) Configuration files: This section contains functions which access and maintain the configuration files. The files will be maintained in an SQLite database and on disk serialized files

    i. FileDS

    ii. UserDS

    iii. LeaseDS

    iv. LeaseGrantDS

    v. SystemDS

b) Server setup: This section will be responsible for setting up the DriveShare on the target system. It will also create the required configuration files. It will check the ports availability and inform the installer of any conflicts. The cache location will also be set.

Administration Module:

This is module intended for both local and remote administration of the DriveShare system.

c) Cache Management: The administrator can set the cache directory.

d) User Management: The creation and management of users. Users can be normal users or administrators

Client GUI:

This will be the GUI for the client from where he can

- a. Login
- b. Add Files
- c. Edit / View
- d. Tag
- e. Comments
- f. Basic Permissions for his files

Share Module:

This module will implement the sharing of files between various users.

- a) Access Control List (ACL) creation: It will be created according to selections made for each file

- b) ACL application to files

- c) Review Indicators: Comments sharing

Election Algorithm

The election algorithm is used to select the coordinator for the DFS system. It can be started by any peer.

1) A peer detecting non response from the coordinator starts the election process.

2) It sends a broadcast with election message.

3) It collects all the response available within the given timeout period.

4) If none it declares itself coordinator and sends Coordinator message with its ID

5) Else it selects the peer with highest ID including itself

6) Then it sends Coordinator message with its ID

7) A peer on receiving coordinator message records the coordinator
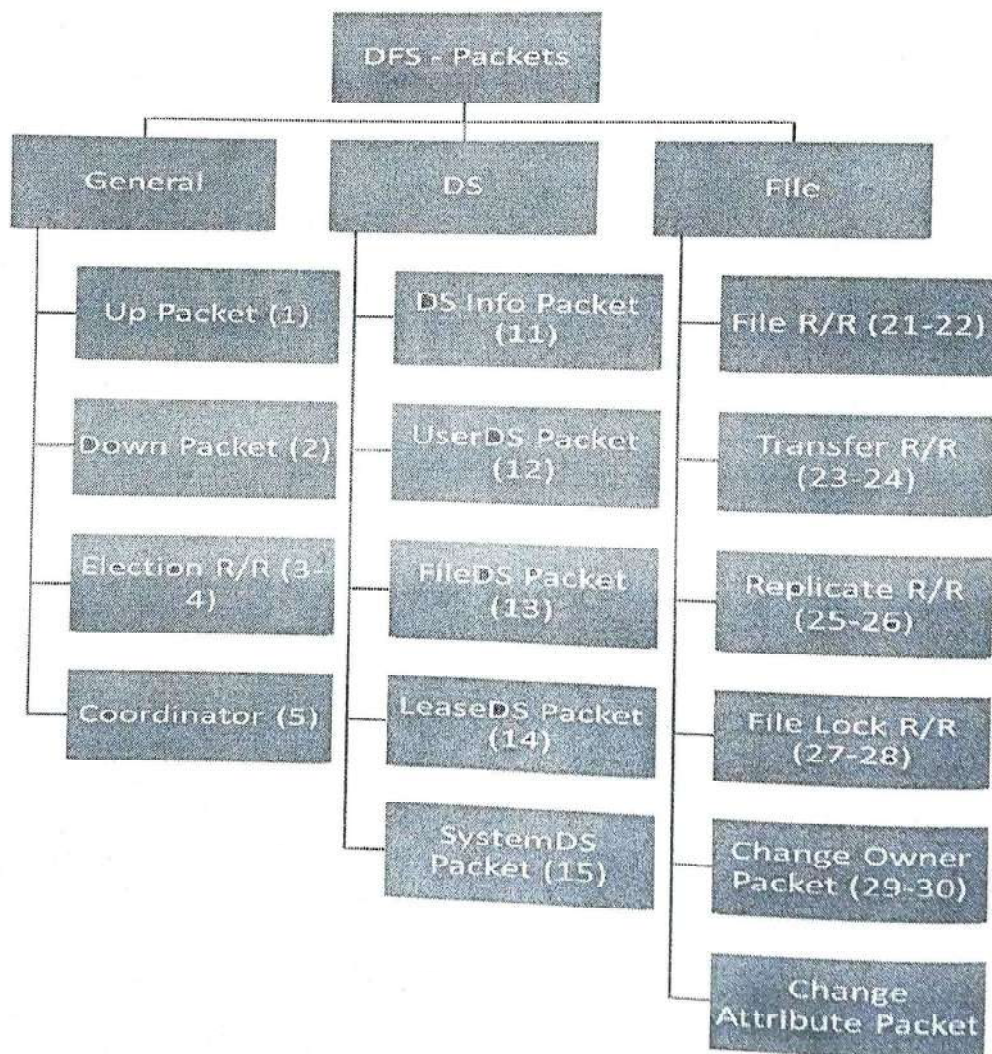
Figure 2. DFS Packets

Advantages

- Increased availability

- No central server

- Replication transparent: The administrator can make copies as needed on different systems

- Increased reliability

- Ability to share file easily

- Easy creation of Access Control List and apply them to files or directories

- Add file to DriveShare

- Ability to attach tags and comments to files

- View the associated tags and comments

- A GUI for the normal user to perform his operations

- Access transparency: The user or administrator can access the system from any system which is a part of DriveShare

- Use of SQLite to maintain configuration files. It is faster than text based configuration files

Disadvantageso Android

- The systems should be online
- The user GUI need some more user friendliness

Conclusion

DriveShare is Distributed File System intended to simplify access, retrieval and sharing of files through the network. It being a distributed system will not require a centralized server and can be up with even one of the participating systems online. It will support file permissions and read only settings. Directories can be created and maintained. The user can access his/her files through any computer which is a part of drive share. File access will be transparent to the user. File sharing, commenting and reviewing will be possible.

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The support system of single women

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Abstract
The Singleton has emerged as a distinct social category in the rapidly changing Kerala society. The present study attempts to show the change from Spinster to Singleton and the generation differentials of single women in Kerala, India. The study also made an attempt to find out the support systems of the single women of Kerala.

The focus of the study is single women of two generations, 225 spinsters and 225 singletons. Single women from three districts- Thiruvanathapuram, Ernakulam and Kozhikode constituted the sample for the study. The different aspects of the singlehood were collected with the help of Interview schedule and the scale developed was used for measuring support systems of the single women. The economic theory of Marx, Women's economic empowerment theory of Blumberg, Dramaturgical model of role theorists, Becker's labelling theory of deviance, Michalo's Multiple-discrepancy theory are the theoretical framework of the study.

The analysis of the study reveals that there is difference between spinsters and singletons in all background variables and dependent variables. The findings of the study shows that the major support systems considered in this study are family, employment, friends, social participation, and leisure. There is significant difference between spinsters and singletons on each sub-section of support system and in each sub-section of support system, singletons have better score showing that they have better support system than the spinsters. The study shows that single women of Kerala have good support system from their family. Majority single women consider friendship as a strong support system to them and in the case of singletons this rate is very high.

Keywords: Single Women, Spinsters, Singletons, Generation Differentials

Introduction
Family and marriage are considered to be the oldest and the most basic and fundamental institutions in the sub-systems of the society. Both are important for the existence and functioning not only of society, but also for the sustenance and continuation of human being. The concept of marriage varies in degree from community to community and nation to nation. According to Horton and Hunt (1964: 206) [13], "Marriage is the approved social pattern, whereby two or more persons establish a family". Marriage as a socially sanctioned union of male and female, is an institution devised by society to sanction the union and mating of male and female for purposes of (a) establishing a household (b) entering into sex relations, (c) procreating and (d) providing care for the offspring.

Singlehood
In ancient time, the unmarried women were severely condemned and had no place in society. Under Roman law, an unmarried woman was considered a burden. That is, 'unmarried status' was not positively accepted by society. Single women were never free from the dominance of male people. In America spinsterhood came to be seen as a sexually as well as socially deviant state. The legacy of single blessedness fostered emphasis on marriage or singlehood as a choice for women in the middle and upper classes (Adams 1976) [1]. Recent years have brought about a great change in the life of women all over the world. This increase in single Americans can be attributed to a number of social and economic trends: the postponement of marriage, the rise in the divorce rate, career break-through for women and the easing of credit discrimination against them and the growing independence of young people from their parents.

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Singlehood in India

Unlike West, in India, an analysis of the position and status of single women during the Vedic times reveals that they enjoyed a high status. A girl in Vedic India waited until she could find the right partner for marriage, failing which she could even decide to remain unmarried. During the post Vedic age the position of single women slowly began to decline. As marriage came to be considered as a goal for women, the chastity of single women was doubted and hence she came to be looked down upon. Manu supported the male's domination and compelled women who stayed in the solitude of temple, to demonstrate their art in public, by dancing before the God and they were converted as 'Devadasis' and Nagarwadhus. One of the most striking changes is the increasing number of people who live on their own. The women of new generation are growing up with a belief that whatever their fate be i.e., be it remaining single, they must be partly or fully self-supporting. The emancipation changed their life style, their roles, their status and life patterns

Singlehood in Kerala

In Kerala society, Singlehood is not a new phenomenon. From ancient times, many girls from Namboothiri families remained single. They were restricted by endogamy. That is, they were allowed to marry only from their on caste. Among the Christians, especially in the catholic families existed a peculiar custom, one daughter remain single for taking the care of old parents and younger ones. These single women helped the head of the family to manage the family administration and financial matters.

Today singleness is not at all incompatible with the ideal of womanhood. The new singletons'- carefree city singles bring in a more positive picture than the old maid spinster. They believe that singlehood will provide more freedom, independence and more life satisfaction than married life. Today a new and positive stereotype is applied for modern single women. A modern singleton is seen as urban, highly educated, relatively young, ambitious, single minded, determined, active and a career woman. By rejecting marriage and children she has made a conscious choice to be single. This study presents the support system of this new global sociological phenomenon of the Twenty first century and traces the generation differentials of single women in two generations – the Spinsters and Singletons.

Review of Literature

Ahuja says that the self-image, self-esteem and adjustment of single women in life depend upon the emotional support they get from different sources. A 'support' is defined as "any object or action that the receiver and / or the giver define as necessary or helpful in maintaining a life-style" (Ahuja 1996:6) [2]. The relationships between individuals are seldom static and essentially dynamic in nature (Hinde 1979) [12]. Communication is the backbone in assessing family relationships and dynamics. Effective and right types of communication bring family members together emotionally and make family functioning more meaningful and sound (Khasgiwala 1993) [20].

Kraisonswasdi (1986) [21] says that the standard of living of a particular family is conditioned by a number of variables, like value system, occupational background, education, income, locality etc. However, the economic factors play very pertinent role in determining the standard of living of the family. Family has monopolized caring, security, sharing,

trust and intimacy. The varied situations generate a different atmosphere and create a varied family picture. These structural aspects have an important bearing on the quality and kind of relationships existing between parents and children; the distribution of rights and duties. How single women should behave towards the family members and society is determined by the conventions and formal definitions of the organization in which she is working/ where she is staying (Hinde 1979) [12].

Rani (1976) [30] states that in past, the family became largely responsible for attending to the mental health and emotional adjustment of single women. But now, the practice of single women living and working in the family is declining. That is, the social structure has completely changed. The importance of relatives for companionship and support has diminished.

Each Individual's life is blossomed with the help of many support systems. In the case of single women also, their life is blossomed with support system like parents, relatives and friends. Ratra (2006) [31] reveals that single women, usually develop a sense of family that differs from others. Friendships are very important to singles. Many of them acquire a social network that provides the kind of emotional and psychological support found among other family types. Singles participate in a variety of groups that provide social support and recreation. Academic activities and free choice activities are the main hobbies of the single women. They are not isolated especially the modern singletons. Thornton (1989) [37], opinioned that singles had a lot of connections with others.

In the view of Stain (1976) [36], the lack of support for single life-styles undercuts the personal and social identity of the never-married contributing to the feelings of guilt and embarrassment, fear of loneliness and psychological weariness from initiating and sustaining a life-style which lacks a supportive ideology in the larger culture.

Kanter's (1978) [19] study of fifty young (24-34 years of age) and of medium socio-economic level never-married women living alone in an urban area found that they were "not relatively isolated." They had networks of individuals who had 'a deep and genuine concern for their well-being' and they "were involved in intimate relations with others". They had created homes for themselves with a comfortable and nurturing atmosphere which pleased them. It gave them a sense of ownership. Even with the change in the social fabric, single women have not given up their culture and values, and still believe and participate in many religious activities, which gives greater emotional support to them and it determines their life satisfaction.

Objective

(1) To identify the support system of single women

Hypothesis

(1) There is generation differential among single women of Kerala with regard to the support system

Clarification of the Concepts

Single women: Single women are those who have crossed the marriageable age (35) and are yet not married. In the present study single women belonging to two generations are studied, that is, 65 to 80 and 35 to 50.

Generation Differentials: According to Developmental theory, the generation differentials are considered as 'generation gap.' In this study, generation differentials mean

a relative difference in the ideas of single women belonging to two generations, that is, single women of the age group of 65 to 80 and 35 to 50.

Spinster: Single women who are not married and do not belong to any religious organizations, and who belong to the age group of 65 to 80 are referred as spinsters.

Singleton: Single women who are not married and do not belong to any religious organizations, and who belong to the age group of 35 to 50, are referred as singletons.

Support System: Support system is a multidimensional construct that consists of all types of supports enjoyed by single women in two generations from other sources.

Age, education, occupation, religion, region and place of living are considered as independent variables. Support system is the dependent variables. The present research work is designed to study the life of single women. So an analytical cum comparative design is adopted. The Universe of the study comprises of unmarried single women. The total sample of the study consists of 450 women selected from the unmarried single women in Thiruvanathapuram, Ernakulam and Calicut districts for getting the socio-cultural and geographical representation of the north, south and central parts of the Kerala, with 225 spinsters and 225 singletons. From each district 75 spinsters and 75 singletons, and thus 150 samples are collected from one district. Because of lack of statistical documents/reports about the single women in Kerala, researcher used snow ball sampling. The Pilot study was conducted in Ernakulam district, as it was easy to get both urban and rural single women. The data collection was mainly based on primary and secondary data. In this present study secondary data was collected from census reports, seminar reports, pamphlets, journals, periodicals, books, newspapers, reports and publications of various associations, and various publications of the central, state and local governments. Primary data is collected from younger and older generation of single women. For collecting the primary data, the researcher developed Interview schedule and three scales as tools. Interview schedule was used to collect all relevant information. One scale was developed for measuring the Support System of single women. A total of 100 single women fifty spinsters and fifty singletons were interviewed for Pre-test. Regarding the interviews, initially it was very difficult to convince the respondents about the purpose of the study. A qualitative cum quantitative approach on data analysis has been adopted. The statistical analysis has been done with the help of Statistical Package for the Social Science (SPSS). The major limitation of the study is the inadequacy of the availability of recorded material, which forced the researcher to use, the Snow ball sampling, which has its own limitation.

Support System

Support system is a multidimensional construct that consists of different types of supports including emotional support, integration, tangible help, and information support (Krausu and Markides 1990) [23]. The human existence depends upon support systems which one begets through inheritance, employment, family, friendship, religion, formal institutional support from outside family and kin network. Informal contacts and frequent interactions help for the development of intimate and close relationships. The degree of closeness of the relationship depends upon the quantity and the quality of the interactions. These interactions lead them to maintain strong support systems. Pearlin and Johnson (1981) [29] have observed that supportive and helping relations between people are not limited to marriage. Unmarried people often establish interpersonal ties that serve as a partial functional alternative to marriage. Cockrum and White (1985) [7] advocate the similar idea. They suggest that supportive family, friends, co-workers and others play an important part in the life and happiness of single adults by validating singlehood as an acceptable adult status. At the same time, a negative concept exists in our society. Schaefer (2001) [33] in his book, 'Sociology' explains that to remain single represents a clear departure from societal expectations. A single adult must confront the inaccurate view that she is always lonely and isolated. He adds that to overcome these societal expectations, singles have formed numerous support groups.

One of the objectives of the present study is to explore the content and quality of support systems of the single women. Relationships are considered the backbone of the support system. Life-long deprivation arising out of singlehood necessitates support system at several levels of existence. To measure the level of support system, a 'Support System scale for Single Women' was developed. The scale dealt with five aspects of single women's life. The major support systems of single women considered in this study are pictured with the help of a diagram, that is, family, friendship, employment, social participation and leisure.
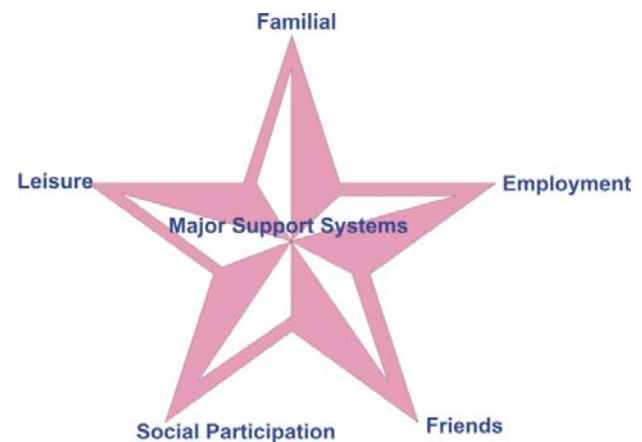
In a society that values individuality and self-fulfillment, the modern single life style can offer certain freedom that older single women may not enjoy. So with regard to support system also generation differentials are studied. The variables in the support system scale for single women are given below:

Familial support is an important variable for measuring the support system of singlehood. It is related to ties with family members, level of support from the family etc. The low score means that 'not so good relationship' with the familial atmosphere. The high score means 'good relationship' with familial atmosphere. In the 'Support System scale for Single Women,' the variable employment support is related to co-operation with co-workers, happiness in the working conditions, social status, mental relaxation, economic freedom etc. The low score indicates employment is not a high support system for single women. High score indicates single women consider employment as a support system. In the 'Support System scale for Single Women' an attempt is

made to measure the relationship tie with friends, financial and mental support from them, their encouragement and level of sharing capacity with friends. The low score indicates the support from friends is not high. Whereas, high score indicates friends are a strong support system.

Social Participation is also considered as a support system and it measures the ability to talk with others, the readiness to participate in social activities, social commitment, social relationship, how far they forget their sorrows because of social relation, social awareness etc. Low score indicates low social participation; high score indicates high social participation. Leisure, the sub-scale, measures how far the single women are interested in leisure activities/games. Indirectly it measures the mental happiness of the individuals. Low score indicates individuals' are not involved in recreational activities where as high score indicates individuals have good participation in leisure activities. The total support system score is divided into three groups equally; high, moderate and low groups. Here high means a score between 220-162, moderate between 161-103 and low between 102-44.

Table 1: Frequency and Mean of the Support system scores of Single women

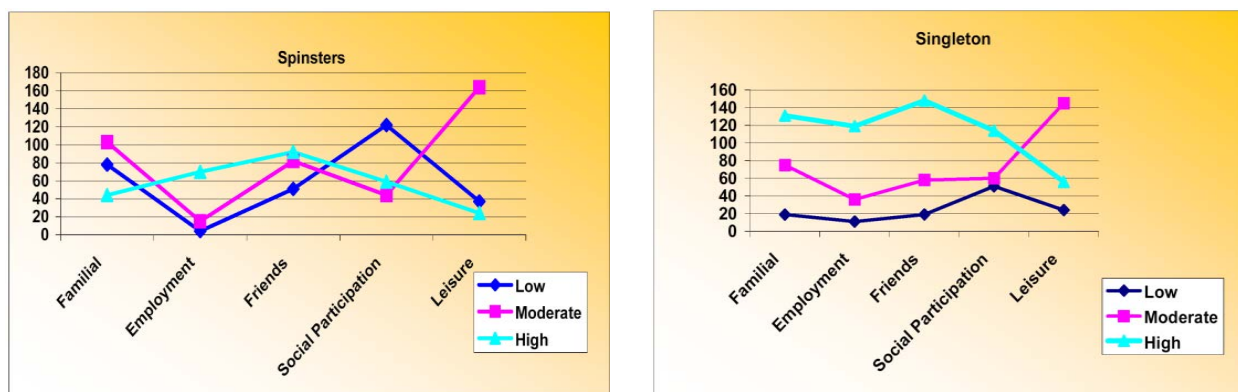| Spinsters							
	High		**Moderate**		**Low**		**Total**	**Mean**
Total	38	16.9	80	35.6	107	47.6	225	114.3
Familial	44	19.6	103	45.8	78	34.7	225	24.4
Employment	70	31.1	15	6.7	4	1.8	225	40.9
Friends	92	40.9	82	36.4	51	22.7	225	29.2
Social Participation	59	26.2	44	19.6	122	54.2	225	23.4
Leisure	24	10.7	164	72.9	37	16.4	225	8.2
Singletons							
Total	104	46.2	83	36.9	38	16.9	225	151.2
Familial	131	58.2	75	33.3	19	8.4	225	33.2
Employment	119	52.9	36	16.0	11	4.9	225	38.9
Friends	148	65.8	58	25.8	19	8.4	225	35.4
Social Participation	114	50.7	60	26.7	51	22.7	225	30.8
Leisure	56	24.9	145	64.4	24	10.7	225	7.4

Fig 1: Support system scores of Single Women

The above table shows that spinsters and singletons differ on the basis of their support system. Out of 225 spinsters, only 16.9 per cent of them have good support system. But 46.2 per cent of singletons enjoy good support system in their life. Obviously it indicates that modern life situations of majority of singletons allow them to establish a close relationship with others, which is not the case with spinsters. To get a further insight into the relationship and its action as the support system each sub system of the support system scale is analysed. Kachru (2006) [18] says that in India the family system does provide some support and so it becomes natural for single women to make use of this support system from family. Many single women live within their family and its barriers, because there are hardly any emotional and economic support structure available outside for them. At the same time, Bhatnagar (1989) [4] indicates single women, as an ideal sister, wants nothing from her brother but she showers her love and kindness to her brother. These studies inspired to make an attempt to find out how far is the family, a support system to the single women of Kerala.

From the table 1 it can be observed that out of 450 respondents, only 21.6 per cent of them belong to low familial support group. Majority of them belong to high and moderate groups. It shows that single women of Kerala have good support system from their family. Findings of the present study are supported by Gordon (1994) [10]. In young age, more emotional support was provided by parents, siblings and friends. This variation may be because of singleton's economic security. Among the high familial support group, majority (74.9 per cent) belongs to singletons group and out of total singletons, 58.2 per cent of them came under high familial support group and only 8.4 per cent singletons belong to low familial support group That is, this percentage difference indicates that there is a significant difference between spinsters and singletons on their familial support.

Roy (2004) [32] in her study indicates that many singles prefer to live with their families. Here, the percentage analysis proved that even now, single women consider family as a great support system in their life and it influenced their total

support systems; especially for singleton. In their case, the parents are alive and they like to live with them but spinster's case is not the same. Compared to spinsters, singletons are more economically independent. That is, if they are economically secure, family members are interested in supporting and caring them. As a part of our culture, even now these single women are enjoying the protection and care of family members.

To Marx (1844), work - the production of goods and services - holds the key to human happiness and fulfillment. Work is the most important primary human activity. He believed that work provided the most important and vital means for man to fulfill his basic needs, his individuality and his humanity. Single women work both for contributing to her family's economy and supporting herself (Tilly and Scott 1978). They also had a feeling that economic independence gives them personal esteem (Darrington *et al.* 2005) [8]. Earlier studies have shown that employment is a strong support system to women as well as single women.

Here, the discussion will be focused on the employment support network consisting of all those people and groups who provide support to the single women. Out of the total single women, 238 (52.88 per cent) of them were found engaged in jobs while among them 8 (3.36 per cent) were self – employed. Study shows that out of these respondents, majority (75.2 per cent) consider employment as a great support system to them. Only 4.2 per cent of them do not consider employment as a support system in their life. It can be generalised that in both generations, majority consider employment as a high support system in their life. Employed singletons number is high compared to spinsters. The favourable familial atmosphere and attitudes of family members allow single women to enjoy their employment and led them to it compared to spinsters. Analysing the motivation to work, the study revealed that in majority of cases single women work or seeks employment because of the need for money but some of the single women do work for non-economic reasons too. Ranjan (1993) supports this opinion and says that most of the unmarried women had strong attachment to their occupation. The main income of the modern singletons is from employment. So, they have certain type of social status and social contacts in the society. This employment gives them certain type of secure feeling in their life and it allows them to look to the future without fear. A general concept existing in our society in connection with single women is that they are isolated and silent personalities of the society. Many social taboos also exist in our society. Smith says, "Single woman is isolated and frustrated and therefore forever incomplete" (Smith 1951:127). But many studies indicate that it is not true. Ball *et al.* (2004) [3] reveals that friends are more supportive and less discriminating of women. A woman generally has a stronger sense of the need for a personal bond than man. Friends play a positive role in the development of single women's support system. Friends are more supportive than parents and relatives. Some feelings cannot be shared with everyone, many a times not even with parents or close relatives. Such feelings can be precisely described as "secrets" of life. Single women have more of such problems, as they have to live an isolated life. Even if they live with their parents or in a joint family, many times they find a big gap in their closeness with the family members. Darrington *et al.* (2005) [8] says that friendships helped to ease the burden of the mental struggles and created a supportive network of individual's who were experiencing

virtually the same thing at the same time. Bott (1971) [6] claims that each individual before marriage has a social network- a number of women with whom they interacts with on a fairly regular basis. But after marriage, these connections will lose its importance. Here, we know, singles can continue these connections life long and their friendship relationships score is always high. Sousa and Lyubomirsky (2001) explain women tend to provide greater and more meaningful support as friend than men. That is, both men and women say their friendships with women are intimate, nurturing and supportive than their friendships with men. Friendship is considered as a strong support system in the life of single women. In modern times their life situations are favourable to establish relationships with friends.

The table (1) shows that out of total single women, 53.3 per cent of them belong to high friendship support group and among them 61.7 per cent of them come under singleton group. Compared to spinsters (22.7 per cent), very few of singletons (8.4 per cent) belong to low friendship support group. From the analysis it can be generalised that majority single women consider friendship as a strong support system and in the case of singletons this rate is very high. The reason is that majority singletons are employed and their job situations led them to high friendship relationship score. The present study is supported by Jethani (1994) [16]. In her study, she found that professionals had more friends and more singletons are employed. She also pointed out in her study that the friendship ties are strong when women are single, marriage weakens such ties. A person likes the company of other persons who are like herself, and with whom secrets and feelings can be shared. Darrington *et al.* (2005) [8] found that most of the single friends were supportive of their friend's single status. Again, she adds that the support from friends often helped singles to counterbalance the pressure they felt from their family and work place. For Shostak (1987) [34] a supportive group of friends are necessary to deal with issues of loneliness among single adults. He note that socialisation with other singles play a critical role in the development of a positive single experience because it allows single adults to share experience; offer emotional support; provide a listening ear for single life discouragement and delights; and share common perceptions of life, love and being single.

Interest in social field is not a new sphere for women, though the magnitude might have increased or decreased with time. Woman manifests desirable and favourable social attitudes which facilitate her acceptance into the group. An assumption existing in our society is that unmarried women are more involved in voluntary organizations than the married ones. Smith (2005) [35] points out that single people actually show more evidence of being socially active than married people. It is these studies that made the researcher to study the social participation support system in the life of single women. The percentage analysis shows that most of the single women consider social participation as a support system in their life. That is, present study reveals that single women have relations with others and they are not isolated and frustrated in the society.

Out of total respondents (450), 38.4 per cent of them consider social participation as highly supportive of them while the same percentage (38.4 per cent) considers it as a low level support. Among the spinsters group, only 26.2 per cent of them belong to high support group but the singleton's (50.7 percent) rate is very high. Contradictory to this, among

the low supportive group, 54.2 per cent of them are spinsters and only 22.7 per cent are singletons. It can be inferred that there is significant difference between spinsters and singletons on their support system level. That is, spinsters do not consider social participation as a strong supportive element in their life. This idea is supported by Anjali Roy. According to Roy (2004) [32] in traditional countries, like India, where social arrangements are less gender-integrated, traditional female ties seem to provide professional elite women with a support system that they lack in more modernized societies.

Leisure is a must in everyone's life to regain the energy lost in work and to maintain a healthy life by avoiding overstrain of self. Havighurst (1970) [11] defines leisure activities as those in which a person may indulge on his own free will either to rest, to amuse himself, to add to his knowledge, to improve his skills without increasing his earning power, or to maintain his voluntary participation in the life of the community. Leisure is a support system to human beings. Haralambos (2004) reveals that family has lost a number of its functions in modern industrial society. In the earlier joint families, each member can recreate within the family atmosphere, which is impossible in the present nuclear families. If they recreate within the family, single women will get a lot of chance to communicate with other family members and can establish close relationship with family members. It will produce more mental satisfaction to them. But in the modern industrialised society, the importance of family ties are decreasing and leisure facilities are not available inside the family. Single women, too, should have leisure activities to relax and to overcome their strains (Jethani 1994) [16]. Leisure is very essential in the life of single women especially for working single women. Now different types of leisure facilities are available outside the family. So singles always participate in these leisure facilities with their close friends. Automatically, these friendship relations become more intimate and closer.

The earlier studies show that leisure activities are an essential support system for single women in their life. So here, an attempt is made to identify how far single women consider this variable in their life as a support system and whether there is any difference between single women of two generations. Out of the total (450) respondents majority consider leisure as only a moderate role to play as support system.

The above percentage analysis shows that there is difference between two generations in the support system. To prove the hypothesis that there is difference in the support system of single women in two generations, the total support system levels of the single women belonging to the two generations were classified and then the Mean and S.D were calculated. The difference between total relationships levels of two generations were tested for significance by finding the Critical Ratio (C.R). The results are shown in the table 7.2 given below. Here the standard deviation is high, so we use Mann-Whitney test for testing the equality of means of Total support system.

Table 2: Mann-Whitney Test on Support System of Single Women

	Generations	
	Spinsters	**Singletons**
Mean	114.25	151.15
SD	41.79	40.29
Critical Ratio	8.76	
'p' value	P<0.001	

The statistical calculations proved that the difference between the spinsters and singletons in the case of their support system is significant. Thus it can be concluded that the two groups differ significantly with respect to the level of support system. So the hypothesis there is generation differentials among single women of Kerala, with regard to their support system is accepted. The finding of the present study is supported by the study of Glan and Weaver (1988). According to them, young people no longer view that they are isolated persons, they have strong support system in their life and they are very happy in their new life style. It can be concluded that compared to spinsters, singleton's support system is too strong and the level of support system is high.

7.1 Factors that Influences the Support system

Above analysis proved that life of single women are enriched by various support systems. The role of these support systems varies depending on their education, employment, income, place of living and religion. That is, the level of support system can vary according to the independent variables. So, a further analysis is made to find out the difference in the role of support systems between the different groups based on these variables.

Education is a great instrument for establishing good relationship with others. It helps to understand others more clearly and builds strong bonds with others. One way ANOVA is used to see whether the spinsters and singletons of different educational standards vary in their support system.

Table 3: One Way ANOVA on Education and Support System of Single Women

Spinsters					
Education	**N***	**Mean**	**SD**	**F value**	**P value**
P.G and other higher studies	90	140.33	40.69	39.625	0.0001**
College education	55	99.91	31.39		
School education	80	94.76	33.33		
Total	225	114.25	41.79		
Singletons					
P.G and other higher studies	190	138.80	38.58	6.467	0.002**
College education	25	126.20	38.88		
School education	10	155.08	39.44		
Total	225	151.15	40.29		

* Indicates number, ** statistically significant

The analysis of the support system Mean Score indicates that there is significant variation in the support system on the basis of their educational background. In the case of spinsters, those single women who have higher education have greatest support as it can be seen from the Mean score (140.33). But in the case of singletons, school educated has high support system compared to higher educated singletons. Miller and Form (1980) present this idea and they have labeled the top professionals as a highly self-conscious group. The top working single women are not only self-conscious but conscious of their 'self-importance'. Their ethno centrism leads them to believe that they have special gifts and attributes not generally shared by the commoners. This makes educated singletons keep a distance from the outsiders.

Employment is a means for livelihood as well as a means to communicate with others. The level of support system can vary according to the employment or unemployment especially with regard to the single women. To find this variation a One Way ANOVA is done.

Table 4: One Way ANOVA on Employment and Support System of Single Women

Spinsters				
Employment level	N*	Mean	SD	F value	P value
Employed/ retired	90	146.73	36.95		
Unemployed	135	92.59	28.84	151.52	0.0001**
Total	225	114.25	41.79		
Singletons				
Employed/ retired	148	166.97	32.42		
Unemployed	77	120.73	36.42	94.611	0.0001**
Total	225	151.15	40.29		

* Indicates Number, ** statistically significant

The support system of both spinsters and singletons of different employed status groups are significantly varying. The observations of the support system Mean score indicate that employed and retired groups have high support system than the unemployed groups.

Income is an important element for establishing good relationship with others. It is considered by all, as a strong variable for varying the level of support system. That is, income also influences the relationship ties of the single women in both generations. The statistical tool, One Way ANOVA is used to see whether the spinsters and singletons of different income group's show variation in their support system.

Table 5: One Way ANOVA on Income level and Support System of Single Women

Spinsters				
Income level	N*	Mean	SD	F value	P value
Very high	9	159.56	45.80		
High	32	155.50	31.57		
Moderate	34	148.32	35.07	1.905	0.136
Low	8	123.88	37.48		
Total	83	147.78	35.82		
Singletons				
Very high	62	177.50	27.14		
High	48	163.60	30.83		
Moderate	30	153.67	39.32	5.01.	0.002**
Low	8	151.25	30.24		
Total	148	166.74	32.53		

* Indicates the Number, ** statistically significant

To both single women group, their support system Mean score is increasing according to their income level. As their economical condition increases, their support system also increases. In the case of spinsters, test is not significant at 0.136 levels and income has not made any variation on support system. Blumberg (1984) [5] argues that as economic independence increases single women's support system level is also increasing.

The natures of community we belong decide the level of support system in the life of single women. Here an attempt is made to find out the variation in the support system level on the basis of place of residence of single women in two generation, with the help of One Way ANOVA.

Table 6: One Way ANOVA on Place of Residence and Support System

Spinsters				
Place of residence	N*	Mean	SD	F value	P value
Rural	87	98.66	35.68		
Urban	138	124.08	42.48	21.561	0.0001**
Total	225	114.25	41.79		
Singletons				
Rural	88	132.68	39.55		
Urban	137	163.01	36.21	34.955	0.0001**
Total	225	151.15	40.29		

* Indicate Number, ** statistically significant

The above One Way ANOVA result shows a significant variation on support system level by the place of residence in both generations. Urban single women have high support system Mean score than the rural single women. The high Mean score of urban single women of both generations shows that urban single women have better support system compared to ruralites.

Religion is an influential element for shaping the behaviour of the individuals. Its rules and regulations mould the structure of the society. Religion gives instructions to establish good relationship with others. It advises people in each and every aspect of their life. So religion is considered as a great instrument in their support system. An attempt is made to find out whether support system level of single women varies according to their religious groups.

Table 7: One Way ANOVA on Religion and Support System of Single Women

Spinsters				
Religions	N	Mean	SD	F value	P value
Hindus	118	110.56	41.32		
Christians	98	119.91	41.21		
Muslims	9	101.00	50.58	1.824	0.164
Total	225	114.25	41.79		
Singletons				
Hindus	105	153.85	38.65		
Christians	86	151.30	41.26		
Muslims	34	142.41	42.73	1.036	0.357
Total	225	151.15	40.29		

There is no significant variation in their support system level on the basis of their religion. It can be concluded that religion is not a strong variable in influencing the level of support system in the life of single women. Even then, the observation of the support system Means score indicate that among the spinsters, Christians have better support system than the other two religious groups. Among singletons, Hindus have better support system compared to Christians and Muslims.

Summary
The human existence depends upon different support systems such as employment, family, friendship, religion etc. The major support systems considered in this study are family, employment, friends, social participation, and leisure. With the help of 'Support System scale for Single Women', it is found that only 16.9 per cent of the spinsters have good support system, while 46.2 per cent of singletons enjoy good support system in their life. There is significant difference between spinsters and singletons on each sub-section of support system and in each sub-section of support system,

singletons have better score showing that they have better support system than the spinsters.

The study shows that single women of Kerala have good support system from their family. The traditional structure of the family system in Kerala is the reason for this fact. Majority (75.2 per cent) single women consider employment as a great support system to them. Only 4.2 per cent of them do not consider employment as a support system in their life. That is, in both generations, majority consider employment as a great support system in their life. Majority single women consider friendship as a strong support system to them and in the case of singletons this rate is very high. Since majority singletons are employed and their job situations lead them to high level of friendship relationships. The analysis of the study shows that most of the single women consider social participation as a support system in their life. Single women have relations with others and they are not isolated and frustrated in the society. Among the spinsters group, only 26.2 per cent of them have high social participation score but in the case of singleton's it is 50.7 per cent. Out of the total respondents, majority consider leisure has only a moderate role to play as support system. Here the rate of singletons is higher than the spinsters. Singletons, who enjoyed high status employment, are interested in leisure activities for relieving their job tensions. One important hypothesis of the study is tested and proved in this chapter. With the help of Mann-Whitney test, which revealed that the level of support system is different in two generations.

With the help of statistical test ANOVA, it is found that the support system varies according to the independent variables, education, employment, place of residence and income. The spinster's income level does not create any variation on their support system.

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A Comparative Study on Life Satisfaction Level of Single Women

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Abstract:
Feminism means movements towards creating a new order of society that ensures women's full self determined life for women. Feminism is a force that is generated out of women's unity. This force led to create new social atmosphere in Kerala society. The singleton has emerged as a distinct social category in the rapidly changing Kerala society. This paper examines the life satisfaction level of the singletons, in Kerala. It focuses on the Life satisfaction is a subjective assessment of the quality of one's life. So an attempt is made in this paper to analyse the life satisfaction level of single women with the help of a ten point scale. It included three aspects- general, social and personal life satisfaction. The result proves that most single women are satisfied with their life. The high expectations of singletons negatively affect their life satisfaction level. The life satisfaction is varying according to their education, employment, income and place of residence. It is found that religion has no influence in the level of life satisfaction of single women. Life satisfaction level of spinsters varies more on the basis of education than singletons. In both generations, higher education reduced their life satisfaction level. The employment, income and place of residence made more variation in singletons life satisfaction compared to spinsters. There is a significant association between stress and life satisfaction of single women and it indicated that high stress lead to high life satisfaction. Single women's support system and life satisfaction are associated and single women, who have high support system, they have high expectations in their life. If they can't fulfill this expectation, their life satisfaction level will decrease. The life satisfaction level of single women on the basis of motivational factors- chance and choice, indicated that there is difference between chance group and choice group in their life satisfaction level and the life satisfaction is always varying according to their motivational factors. High expectations of choice group of single women led them to low level of life satisfaction.

Keywords: Single women, spinster, Singleton and life satisfaction

1. Introduction

The changes in the last few decades are so rapid and far reaching that many thinkers look upon this as a new era in human history. The processes of industrialisation, urbanisation and secularisation have brought about many socio- psychological changes in the attitudes and values of the people. The most striking one is the emancipation of women from their traditional bound ethos challenging the institution of marriage and family.

In Kerala society, Singlehood is not a new phenomenon. From ancient times, many girls from Namboothiri families remained single. They were restricted by endogamy. That is, they were allowed to marry only from their on caste. The eldest son in the family had the right to marry from the same caste. All other Namboothiri males were allowed to establish relation or "sambantham" from other caste people. This prevented many Namboothiri girls the chance of marriage. Keralites never overlooked them but had a sympathetic eye and respect. They were very beautiful, healthy and showed interest in various fields of art and knowledge. Many modern singletons believe that the stereotype of an old maid –spinster is becoming a thing of the past. The single women have emerged as a distinct social category in rapidly changing urban India. We have a number of successful unmarried women who enjoy high status in the fields of various professions, services and social works. Today a new and positive stereotype is applied for modern single women. A modern singleton is seen as urban, highly educated, relatively young, ambitious, single minded, determined, active and a career woman. By rejecting marriage and children she has made a conscious choice to be single. This study presents the emergence of singletons as a new global sociological phenomenon of the Twenty first century and traces the generation differentials of single women in two generations – the Spinsters and Singletons.

2. Methodology

2.1. Objectives
To analyse the intergenerational difference in the level of life satisfaction of single women.

2.2. Hypotheses

The two broad hypotheses that may be formulated are:

(1) There is generation differential among single women of Kerala with regard to Life satisfaction.

(2) The motivational factors-chance or choice determine women and the life satisfaction level of single   women.

2.3. Clarification of the Concepts

2.3.1. Single Women

Single women are those who have crossed the marriageable age (35) and are yet not married. In the present study single women belonging to two generations are studied, that is, 65 to 80 and 35 to 50.

2.3.2. Generation Differentials

According to Developmental theory, the generation differentials are considered as 'generation gap.' In this study, generation differentials mean a relative difference in the ideas of single women belonging to two generations, that is, single women of the age group of 65 to 80 and 35 to 50.

2.3.3. Spinster

Single women who are not married and do not belong to any religious organizations, and who belong to the age group of 65 to 80 are referred as spinsters.

2.3.4. Singleton

Single women who are not married and do not belong to any religious organizations, and who belong to the age group of 35 to 50, are referred as singletons.

2.3.5. Life Satisfaction

It refers to the overall well-being of the single women in two generations and a retrospective evaluation of their satisfaction of life through self-judgments.

Age, education, occupation, religion, region and place of living are considered as independent variables. life satisfaction is the dependent variable. The interplay of these variables are analysed in this article. The present research work is designed to study the life of single women. So an analytical cum comparative design is adopted- discovering, 'what is happening', analysing, 'what has happened', inferring, 'why it is so' and suggesting 'what can be done about it'. The Universe of the study comprises of unmarried single women, not belonging to any religious organisation, of Kerala. The total sample of the study consists of 450 women selected from the unmarried single women in Thiruvanathapuram, Ernakulam and Calicut districts for getting the socio-cultural and geographical representation of the north, south and central parts of the Kerala, with 225 spinsters and 225 singletons. From each district 75 spinsters and 75 singletons, and thus 150 samples are collected from one district. Because of lack of statistical documents/reports about the single women in Kerala, researcher used snowball sampling. The Pilot study was conducted in Ernakulam district, as it was easy to get both urban and rural single women. The data collection was mainly based on primary and secondary data. Secondary data refers to that 'already recorded for some other purpose but used in the particular research project'. In this present study secondary data was collected from census reports, seminar reports, pamphlets, journals, periodicals, books, news papers, reports and publications of various associations, and various publications of the central, state and local governments. Primary data is collected from younger and older generation of single women. For collecting the primary data, the researcher developed Interview schedule and a ten point scale. The major limitation of the study is the inadequacy of the availability of recorded material, which forced the researcher to use, the Snow ball sampling, which has its own limitation.

3. Life Satisfaction

Life satisfaction is considered to be the cognitive or judgmental component of subjective well- being. It manifests itself in confidence, sociability, feeling of competence and happiness. It can be assumed that life satisfaction implies qualities such as positive mental health, good temperament and low alienation. Life satisfaction reflects individual's global assessment of their present quality of life based on personally chosen criteria. Every individual performs a sum total of a variety of roles and the competence and success depends upon how one fulfills all these roles. If the roles are performed according to the expectations of the society, the individual is regarded as a socially competent person. It raises one's own image and enhances the self-esteem as a worthy person. In other words, if the role is not according to the societal norms, the self-image will decrease and he would not be considered as a worthy person. Loewenstein (1981) found that life satisfaction is significantly correlated to factors such as good health, not being lonely, living as couples, having friends and being engaged in work. She adds that life satisfaction level does not vary by sexual needs. Sousa and Lyubomirsky (2001) say that the greater the gender equality within a culture, the greater life satisfaction. The negative attitude of the society and family members always affect unfavorably the level of their life satisfaction. In 'women issues', Misra (1992) reveals that this satisfaction level of single woman depends upon the attitude of society towards them. In general, all the single women agree on the point that the disadvantages of remaining unmarried over-ride the advantages, especially in a country like India. Frijters (2000) viewed that health is a major determinant of life satisfaction and poor health is associated with a decline in latent life satisfaction. Baily and Miller (1998) have related life satisfaction to job satisfaction, interpersonal relationships,

socio-economic status, education, family background, and many other variables. All these relationships indicate that life satisfaction is a multidimensional concept. Warren (2006) in her study "Women" deals with the aspects of retirement for older men and women in Australia. She found that life satisfaction was higher for retired people with a spouse or partner than it was for single retirees. Single women expected to retire at a later age than partnered women.

One of the goals of this study is to analyse the life satisfaction level of the single women. Since life satisfaction is an individual evaluation, the respondents are asked to evaluate themselves on a ten point scale. Here, the term life satisfaction includes personal life satisfaction, social life satisfaction and general life satisfaction levels of single women. It is the retrospective evaluation of life, happiness through self- judgments referring to the overall well being of them. The ten point scale was classified into three degrees, that is, those who evaluate themselves between 21-30 are considered to have high life satisfaction, those who belong to 12-20 as moderate and those who belong to 3-11 as low life satisfaction level. Table below shows the self report of the single women about their life satisfaction level.

	High		Moderate		Low		Total	
Spinsters	**105**	46.7	**80**	35.6	**40**	17.8	**225**	100
	64.0		54.1		29.0		50	
Singletons	**59**	26.2	**68**	30.2	**98**	43.6	**225**	100
	36.0		45.9		71.0		50	
Total	**164**	36.4	**148**	32.9	**138**	30.7	**450**	100
	100		100		100		100	

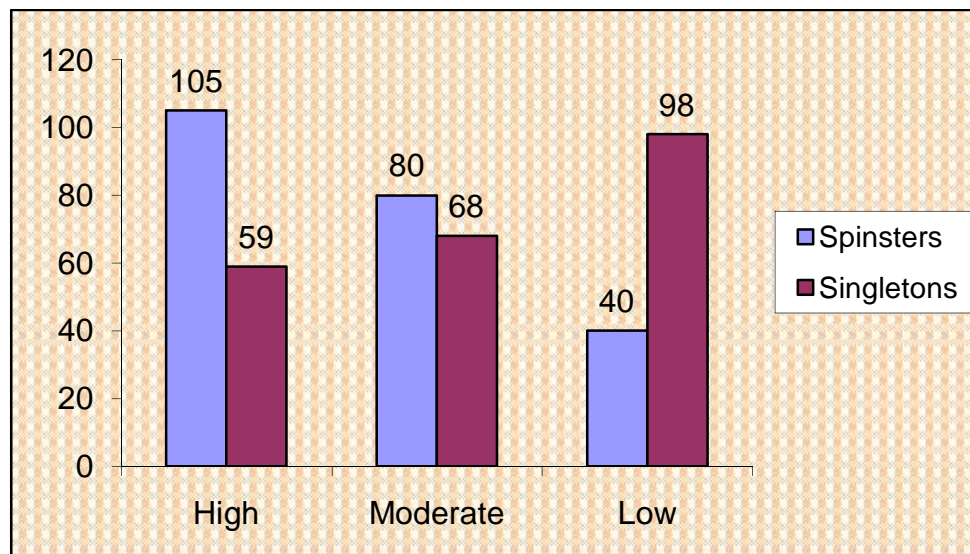*Table 1: Frequency of the Life satisfaction level of Single Women*

Figure 1: Life satisfaction level of Single Women

Out of total respondents (450), 36.4 percent have life satisfaction and only 30.7 percent of single women have low life satisfaction. Spinsters' indicated better life satisfaction and only 17.8 percent come under low life satisfaction. Ratra (2006) says, the popular belief that an old person who has never married will face an unhappy, lonely old age is not true. The present study proves this. But singletons rate of life satisfaction is very low. Present study compels us to analyse why more singleton's come under the low life satisfaction category than spinsters.

In traditional Indian culture, old age is considered as one of the stages of human developments that is highly respected and is authoritative in the family. Elderly people enjoy good respect in the society because of their rich worldly experience. The situation is fast changing because of the effect of rapid industrialisation, modernisation and the changing pattern of family. Sometimes, there is no one to look after them due to different reasons (Gowri *et al.* 2003). This situation may affect the life satisfaction level of spinsters and reduce the level of life satisfaction. But the present study found that singletons are better adjusted, less stressed, highly supportive, but less satisfied with their life. Michalos' Multiple-Discrepancy Theory (1986) is relevant here. According to this theory, satisfaction is determined by one's perception of "how things are" vs. "how they should be". Small discrepancies among these areas result in greater life satisfaction. Large discrepancies among these areas result in smaller life satisfaction. In the case of singletons, they have high expectation and they couldn't reach their expectation. Thus the gap between their expectations and reality is very high. So automatically their life satisfaction level decreases in proportion to their expectation.

To prove this hypothesis, Mann-Whitney Test is used. The Life satisfaction of the single women belonging to the two generations is classified and then the Mean and S.D were calculated. The differences are tested for significance by finding the Critical Ratio (C.R). The result is given in the table 2.

	Generations	
	Spinsters	**Singletons**
Mean	17.94	13.62
SD	6.51	7.01
Critical Ratio	6.61	
'p' value	P<0.001	

Table 2: Mann-Whitney test on Life satisfaction of Single Women

Since the calculated Mean of spinsters is high compared to singletons, it can be said that the life satisfaction level of spinsters is high compared to singletons. The Critical ratio 6.61 is highly significant at 0.001 levels which prove that difference between the singletons and spinsters, with respect to the life satisfaction is significant. The study indicated that the Multiple discrepancy theory is relevant. This study reveals that life satisfaction level is high for spinsters because their gap between the reality and expectation is very low compared to singletons. Thus the hypothesis, there is a significant difference between spinster and singleton on their life satisfaction level is proved.

The discussions about the life satisfaction level of single women in two generations inspire us to analyse the degree of their happiness and the degree of their singlehood enjoyment. To get data for this researcher included some direct questions in the interview schedule.

3.1. Life Satisfaction and Happiness of Single Women

In the book, 'City of God', Varro (2002) reveals that the happiness of people would be one way of measuring the level of life satisfaction. If the person enjoys happiness in life, the life satisfaction level would be very high. The earlier studies pointed out that these two factors are closely related. Trimberger (2005) in his study 'The new single women' found that modern singles are happy with their life and the prospect of remaining single. At the same time, contradictory opinions are also reported by other social scientists. During the time of interview, one of the respondents revealed that an unmarried girl can lead a happy life provided she is employed, because she will be occupied, independent and could not brood over it. The new role has given women a new confidence and freedom. Most of the working women are generally happy because they have a sense of identity instead of being known in other's label. Now society appreciates her for economic contribution or takes note the creative work they do. This is the reason, why working women seem to be happier than non-working. Single women having high life satisfaction is expected to have better adjustment with her life situation and vice- versa. Earlier, in the present study, it was found out that most of the singletons became single mainly for freedom and independence. That is, the spirit of freedom allows them to enjoy more happiness in their life.

The discussions about single women's happiness, reflects that many studies have been done on this subject, but these studies have not related the stage of happiness with life satisfaction. So an attempt is made to assess the influence of happiness on the level of life satisfaction. For this respondents were asked whether they are happy in their state of singlehood. The responses are presented in the table 8.7.

Spinsters							
	High		**Moderate**		**Low**		**Total**
Yes	**25**	53.2	**19**	40.4	**3**	6.4	47 100
	71.4		15.4		4.5		20.9
Somewhat	**8**	15.4	**37**	71.2	**7**	13. 5	52 100
	22.9		30.1		10.4		23.1
No	**2**	1.6	**67**	53.2	**57**	45. 2	126 100
	5.7		54.5		85.1		56.0
Total	**35**	15.6	**123**	54.7	**67**	29.8	225
	100		100		100		100 100
Singletons							
Yes	**88**	68.2	**34**	26.4	**7**	5.4	**129** 100
	88		37.8		20		57.3
Somewhat	**5**	15.2	**25**	75.8	**3**	9.1	**33** 100
	5		27.8		8.6		14.7
No	**7**	11.1	**31**	49.2	**25**	39.7	63 100
	7		34.4		71.4		28.0
Total	**100**	44.4	**90**	40.0	**35**	15.6	**225** 100
	100		100		100		100

Table 3: Life Satisfaction and Happiness of Single Women

The findings of the present study indicate that in both generations, those who enjoyed more happiness in their life have high life satisfaction. The responses reveal that while only 21 percent of the spinsters are happy with their singlehood life, 57 percent of the singletons are happy. Further analysis of the association between state of happiness and life satisfaction shows that 68.2 percent singletons who said they are happy are those who have high life satisfaction. The discussion about the degree of happiness is not

favourable to the findings of the statistical analysis of the life satisfaction level of single women. Here we see a contradiction that singletons are better but in the case of life satisfaction, spinsters are better than singletons. It may be because of unawareness of their life style condition. Other wise, they are not willing to reveal the exact condition of their life. Because of their prejudice, a lot of bias crept into the data which was collected through direct questions from Interview schedule. But life satisfaction scale provides a good picture of the exact satisfactory level. Here they couldn't hide about themselves.

4. Factors that Influence the Life Satisfaction

Life satisfaction depends on the expectations of what one is capable of accomplishing, one's past circumstances, one's ideals, what one feels he deserves, what one minimally requires to be content, and what one ultimately believes. Generally it is believed that the life satisfaction level of single women is based on the whole aspects of their life; their education, employment, income, place of residence, religion and motivational factors. So an attempt is made to find out how far these factors influence the level of life satisfaction of single women.

Every human beings life history indicates that their ideas and attitudes directly influence their life satisfaction level. Education gives not only a modern outlook and rational perspective, but it also liberates women from their invisible enslaved chains. Moreover, education fosters a sense of independence and self-sufficiency in women (Desai 1967). The attitudes and values propagated by education play a significant role in building the personality, individuality and the entire mental makeup of an individual. Education is a means to women for economic security and it allows her to overcome her personality defects. Education help women to empowerment and raise their social status in the society. Education may also provide access to greater occupational and income opportunities, which may additionally influence life satisfaction. It is assumed that educated women enjoy higher status in the society than the uneducated women and based on their educational qualifications the life satisfaction level of the single women may vary. A One Way ANOVA was done to find out the difference between different educational groups and life satisfaction level. The results of the One Way ANOVA is presented in the table No.4.

Spinsters					
Educational Level	**N***	**Mean**	**SD**	**F value**	**P value**
P.G and other higher studies	90	14.30	6.27	34.374	0.0001**
College education	55	18.72	5.70		
School education	80	21.51	5.03		
Total	225	17.94	6.51		
Singletons					
P.G and other higher studies	190	12.27	6.24	28.97	0.0001**
College education	25	20.28	6.59		
School education	10	22.70	6.07		
Total	225	13.62	7.01		

Table 4: One Way ANOVA on Education and Life Satisfaction of Single Women
*indicates number, ** statistically significant at 0.001 level

The statistical analysis shows that different educational qualifications made variations in the level of life satisfaction of single women. The variation is significant but the interesting point that can be mentioned is that the highest mean score in life satisfaction is found among lower educated single women both among spinsters and singletons. The mean score indicates that higher educated groups have lower life satisfaction level. Campbell (1976) conceptualised life satisfaction as the difference between what one wants and what one has – essentially a comparison between reality and the ideal. The distance between these two determine the level of life satisfaction of a person. In the case single women, they have their own desires about ideal life. But the real life is far away from it. For singletons' this gap is too wide. The findings of the present study are supported by Campbell and his colleagues. Lounsbury (2004) in her study 'personality and satisfaction', found that career satisfaction and life satisfaction were significantly correlated. Employment increases the quality and degree of life satisfaction. Single women's sense of self and identity are more strongly tied to their occupational status than it is for ordinary women. "Money and Power" are not still appropriate goals for women in the work place. Instead, creativity and self-fulfillment are considered more appropriate roles in these single women's definitions of themselves as 'career women'. Some single professional women seem satisfied or even ecstatic with their freedom. Carroll (2005) explains interestingly for both men and women the longer the unemployment history the greater the probability of reporting low life satisfaction. So an attempt is made to find out whether life satisfaction varies on the basis of their employment.

Spinsters					
Employed status	N*	Mean	SD	F value	P value
Employed/ retired	90	13.59	6.08	95.424	0.0001**
Unemployed	135	20.85	5.01		
Total	225	17.94	6.51		
Singletons					
Employed/ retired	148	10.51	5.34	137.266	0.0001**
Unemployed	77	19.61	5.88		
Total	225	13.62	7.01		

Table 5: One Way ANOVA on Employment and Life Satisfaction
*indicates number ** statistically significant at 0.001 level

Here the Mean score indicates that unemployed single women have high life satisfaction level than the employed. The reason behind this fact is that the employed single women's expectations are very high and they couldn't achieve their expectations. But in the case of unemployed single women, they do not have much expectation. So the life satisfaction level of the employed single women is lower than the unemployed single women. Another interesting observation is that, compared to spinsters, singletons life satisfaction Mean Score are lower. In contemporary socio-economic structure, income is one of the most important bases of social differentiation and of distribution of power, prestige and privileges in society (Ranjan 1993). Sousa and Lyubomirsky (2001) say that there is a high relationship between life satisfaction level and the income level of individuals. He added that income appears to be a better predictor of life satisfaction than level of education. That is, the economic aspect of the single women actually determined the level of their life satisfaction.

According to Engels and Marx (1848), women employment and economic security would largely free women from economic dependence upon man. Blumberg (1984) argues that the key factor that determines the status of women in the world's societies is their level of economic power. Where women's economic power is high women are able to translate their power into relatively high status. They again say that there is a high relationship between life satisfaction level and the income level of individuals and the poorer singles obtain greater satisfaction from life because the achievement surpasses their expectations of what is attainable. This relationship is a very complicated one. In modern times, women's economic security and self-sufficiency inspire them to become single. A social dictum exists in our society is that single women are a burden to others and their life as malcolony. Economic freedom changed this situation and raised their status. Blumberg again says that single hood is a result of their economic independence and self-sufficiency. That is, income is a strong instrument for influencing the level of life satisfaction. So a One Way ANOVA is used to find out the variation in life satisfaction in relation to their income.

Spinsters					
Income level	N*	Mean	SD	F value	P value
Very High	9	11.88	7.13	9.769	0.0001**
High	32	11.25	4.77		
Moderate	34	13.94	4.69		
Low	8	21.75	4.53		
Total	83	13.43	5.76		
Singletons					
Very High	62	8.56	2.55	16.280	0.0001**
High	48	10.08	4.76		
Moderate	30	12.47	6.69		
Low	8	19.50	5.26		
Total	148	10.44	5.19		

Table 6: One Way ANOVA on Income and Life Satisfaction
*indicates number, ** statistically significant at 0.001 level

The statistical analysis indicates that there is significant variation in the different income groups of single women in two generations. When income level increases, life satisfaction level decrease, and vise versa. That is, the life satisfaction mean score indicate that low income group of single women have high life satisfaction level. In the case of income also Michalo's (1986) theory is very relevant. Here also the gap between the expectation and reality of singleton is very wide. So singletons life satisfaction level is below the spinsters. The attitudes and behaviours of individuals vary according to their society and region. The attitudes of individuals around them determine the single women's level of life satisfaction. . So the level of life satisfaction varies in relation to their place of residence or region. One Way ANOVA is used to see whether the life satisfaction level of spinster and singleton vary according to places of residence.

Spinsters					
Place of residence	N*	Mean	SD	F value	P value
Rural	87	20.34	5.74	20.936	0.0001**
Urban	138	16.43	6.54		
Total	225	17.94	6.51		
Singletons					
Rural	88	17.75	6.88	64.194	0.0001**
Urban	137	10.97	5.71		
Total	225	13.62	7.01		

Table 7: One Way ANOVA on Place of Residence and Life Satisfaction of Single Women
*indicates number, ** statistically significant at 0.001 level

The table indicates that there is difference between single women belonging to different region in their life satisfaction level. Singleton's regional variation is higher than spinsters. The analysis pointed out that the rural singles have high life satisfaction level than the urban single women. Here also it can be observed the relevance of Multiple Discrepancy theory. The living circumstances inspired the urban women to expect more from the life. But they couldn't achieve it. So their life satisfaction level is lesser than their rural counter parts.

In the life of single women religion is a guiding factor. Their life style inspires them to adhere with religious practices and enjoy mental relaxation. A good number of single women spend time in reflection of the Scripture and worship. Ahuja (1996) says that single women may get emotional support by engaging themselves in religious activities or talking to their spiritual friends and it is a good support more than any other source. It is quite natural that older single women are more religious minded than the younger singles. So their religious influence on life satisfaction is very high. Keeping in view the above ideas, researcher tried to find out whether there is any variation in life satisfaction level on the bases of their religion.

Spinsters					
Religions	N*	Mean	SD	F value	P value
Hindus	118	18.26	6.60	2.571	0.079
Christians	98	17.19	6.35		
Muslims	9	22.00	5.98		
Total	225	17.94	6.51		
Singletons					
Hindus	105	13.73	7.05	1.753	0.176
Christians	86	12.72	6.78		
Muslims	34	15.41	7.30		
Total	225	13.62	7.01		

Table 8: One Way ANOVA on Religion and Life Satisfaction of Single Women
* indicates Number

The statistical analysis shows that there is no significant variation on life satisfaction level of single women in both generations on the basis of their religion. The Mean score observes that in both generations, Muslim single women have better life satisfaction than the other two religious groups and the spinsters have better Mean Score than singletons indicating that religion has more influence in the life of spinsters because of their value system attained during their childhood days. Our findings are supported by Sandhya and Jethani. Jethani (1994) pointed out that unmarried women of old age believe more in religious rituals and they become the prime promoters of religious beliefs. They divert their attention from worldly problems by concentrating more on religious activities. Through religion they extended their relationship networks and life satisfaction.

All these analyses prove that there is generation gap in the two category of women. That is, there is difference between spinsters and singletons with regard to their life satisfaction. The life satisfaction varies significantly on the basis of education, employment, income and region. That is when single women are better educated, employed, have good income and are residing in urban area, they have less life satisfaction. Religion is found to be having no role in the life satisfaction level of single women.

5. Life Satisfaction and Adjustment Level of Single Women
Adjustment is the satisfactory relation of an organism to its environment. It is a gradual process in day to day life. Schneiders (1960) in his study 'Personal adjustment and mental health' defined that adjustment is simply an organism's individual, peculiar way of reacting to inner demands. In some instances, this reaction is efficient, satisfying and we say that it is good adjustment. When the reaction is inefficient and unsatisfactory; we call it a bad adjustment. Good adjustment always lead us to life satisfaction. Keeping these ideas in mind, an attempt has been made here to find out the how far adjustments influence the level of life satisfaction.

	High life Satisfaction	Moderate Satisfaction	Low Satisfaction	Total Satisfaction
High adjustment	**16** 10.2	**46** 29.3	**95** 60.5	**157** 100
	9.8	31.1	68.8	34.9
Moderate adjustment	**93** 42.7	**86** 39.4	**39** 17.9	**218** 100
	56.7	58.1	28.3	48.4
Low adjustment	**55** 73.3	**16** 21.3	4 5.3	**75** 100
	33.5	10.8	2.9	16.7
Total adjustment	**164** 36.4	**148** 32.9	**138** 30.7	**450** 100
	100	100	100	100

Table 9: Life Satisfaction and Adjustment
X2 = 139, 42 P<0.001, statistically significant

The chi-square analysis shows that there is association between adjustment and life satisfaction. However, interestingly the percentage analysis shows that while only 10.2 percent of highly adjusted singles have high life satisfaction, 60 percent of them have low life satisfaction. In the case of low adjustment it is otherwise. Seventy three percent low adjusted single women have high life satisfaction. It is because single women are generally adjusted with the life but they are not totally satisfied to their status of singlehood.

6. Life Satisfaction and Stress level of Single Women
It is generally believed that there is an inverse relationship between life satisfaction and stress level of single women. Earlier studies pointed out that stress of the single women is an obstacle for their satisfaction in life. So here, an attempt is made to find out whether stress is an obstacle in the life satisfaction of single women of Kerala.

	High	Moderate	Low	Total
High stress	**25** 55.6	**12** 26.7	**8** 17.8	**45** 100
	15.2	8.1	5.8	10.0
Moderate	**101** 55.5	**56** 30.8	**25** 13.7	**182** 100
	61.6	37.8	18.1	40.4
Low	**38** 17.0	**80** 35.9	**105** 47.1	**223** 100
	23.2	54.1	76.1	49.6
Total	**164** 36.4	**148** 32.9	**138** 30.7	**450** 100
	100	100	100	100

Table 10: Life Satisfaction and Stress
X2 = 86.11, P<0.001, statistically significant

The Chi-square analysis indicates that there is a significant association between life satisfaction and stress. The percentage analysis shows that 55.6 percent of the high stress single women have high life satisfaction and among the low stress single women only 17.0 percent of them have high life satisfaction. Hence stress is a positive catalyst for life satisfaction. Achievement of the life goals raised the single women in the ladder of their life satisfaction. In the case of single women of Kerala, stress is not an obstacle in their life satisfaction. The table shows that high stress need not always lead to low life satisfaction.

7. Life Satisfaction and Support System Level of Single Women
Several studies have examined the relationship between social support and life satisfaction among the single women. Most of these literatures have indicated a positive relationship between social support and life satisfaction. Many studies found that social support was significantly related to life satisfaction. From the earlier studies, we can realise that in a women's life, relationships with others are very crucial for life satisfaction. So an attempt is made to know whether there is any association between single women's life satisfaction and support systems in Kerala.

Support System	High life Satisfaction	Moderate life Satisfaction	Low life Satisfaction	Total
High support system	**16** 11.3	**44** 31.0	**82** 57.7	**142** 100
	9.8	29.7	59.4	31.6
Moderate support system	**50** 30.7	**66** 40.5	**47** 28.8	**163** 100
	30.5	44.6	34.1	36.2
Low support system	**98** 67.6	**38** 26.2	**9** 6.2	**145** 100
	59.8	25.7	6.5	32.2
Total	**164** 36.4	**148** 32.9	**138** 30.7	**450** 100
	100	100	100	100

Table 11: Life Satisfaction and Support System

The Chi-square analysis of the life satisfaction and support system of the single women yields a highly significant value. Here also the inverse relationship between life satisfaction and support system is observed. The percentage analysis indicates that while only 11.3 percent of these who have high support system have high life satisfaction, 57.7 percent of them have only low life satisfaction. It is because single women, who have high support system, have high expectations also in their life. When they can't fulfill this expectation, their life satisfaction level will decrease.

8. Life Satisfaction and Motivational Factor of Single Women
Erikson (1964) says, ability to make ones own decisions and to take responsibility for ones own actions are all implied in independence. Earlier studies pointed out that the motivational factor is a strong element to determine the life satisfaction level. On the basis of this fundamental factor, an attempt is made to examine how the motivational factors influence the life satisfaction of single women of two generations.

	High	Moderate	Low	Total
Spinsters				
By chance	**102** 57.6 97.1	**66** 37.3 82.5	**9** 5.1 22.5	**177** (100) 78.7
By Choice	**3** 6.3 2.9	**14** 29.2 17.5	**31** 64.6 77.5	**48** (100) 21.3
Total	**105** 46.7 100	**80** 35.6 100	**40** 17.8 100	**225** (100) 100
Singletons				
By chance	**57** 57.6 96.6	**36** 36.4 52.9	**6** 6.1 6.1	**99** (100) 44
By Choice	**2** 1.6 3.4	**32** 25.4 47.1	**92** 73.0 93.9	**126** (100) 56
Total	**59** 26.2 100	**68** 30.2 100	**98** 43.6 100	**225** (100) 100

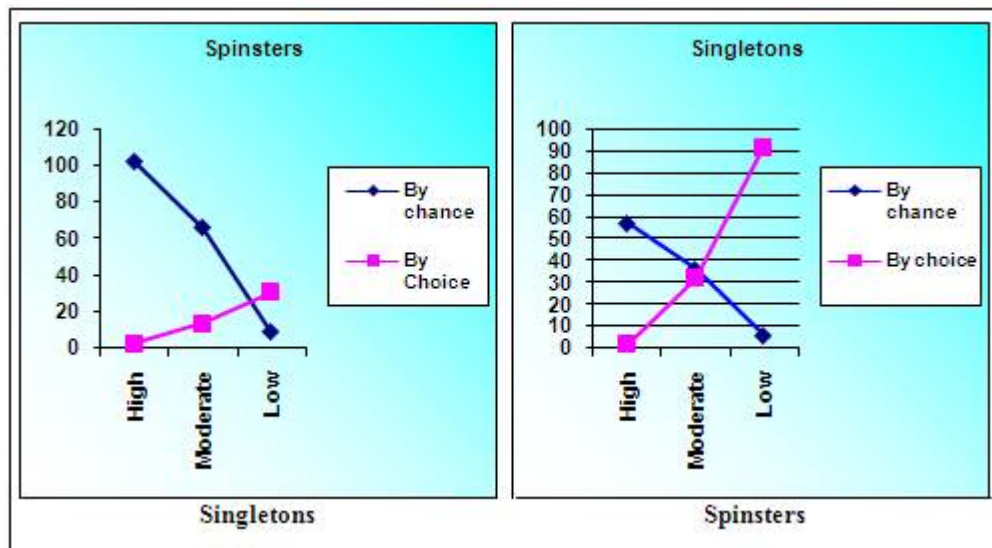*Table 12: Life satisfaction and Motivational factor of the Single Women*

Figure 2: Life satisfaction and Motivational factor of the Single Women.

 In both generations, chance group have high life satisfaction than the choice group. It is noticed that age could not make any difference between the association of motivational factor and life satisfaction. The table shows that even among singletons, who became single by their own choice, life satisfaction is very low compared to those who became single by the chance. The findings of the present study is contradictory to the findings of Kachru. Kachru (2006) revealed that single woman, who by conscious choice has decided to live without a partner, enjoyed their life and there is no bitterness and frustrations in their life. In earlier analysis of life satisfaction the same trend is found. The choice group single women's life satisfaction is very low because their life expectations are high which they could not achieve. But the chance group singles do not have that much expectations in their life. So the gap between the reality and expectations of chance group single women are not too wide. Thus their life satisfaction is high compared to choice group.

One of the hypothesis of the study is that the motivational factors-chance and choice determine the level of life satisfaction of single women in both generations. Before proving the hypothesis an attempt is made to find out the difference between chance group and choice group on their life satisfaction level. The total single women belonging to the two major motivational factors were classified as chance group and choice group. Then the Mean and S.D were calculated. The difference between total life satisfaction levels of two groups were tested for significance by finding the Critical Ratio (C.R). The results are shown in table 8.14. Here the standard deviation is high, so Mann-Whitney test for testing the equality of means of Total support system is applied.

	Motivational Factors	
	Chance Group	Choice Group
Number	276	174
Mean	6.63	3.25
SD	1.94	1.39
Critical Ratio	14.79	
'p' value	P<0.001	

Table 13: Mann-Whitney Test on Life Satisfaction and Motivational factors

The statistical calculations indicate that the difference between the chance group and choice group in the case of their life satisfaction is significant. The Mean Score of the choice group single women life satisfaction level is around half of the Mean Score of life satisfaction level of the chance group single women. It indicates that motivational factors of singlehood are strong to determinants in the level of life satisfaction single women.

A One Way ANOVA is used to find whether the spinsters and singletons of different motivational groups vary in life satisfaction level.

Spinsters					
Motivational factors	N*	Mean	SD	F value	P value
Chance	177	19.97	5.39	124.367	0.0001**
Choice	48	10.48	4.56		
Total	225	17.95	6.51		
Singletons					
Chance	99	19.47	5.91	272.155	0.0001**
Choice	126	9.02	3.51		
Total	225	13.62	7.01		

Table 14: One Way ANOVA on Motivational factors and Life Satisfaction of Single Women
*indicates number, ** statistically significant at 0.001 level

The analysis shows that there is significant variation on life satisfaction level of single women by motivational factors in both generations. In both generations, majority of single women who come under 'chance' group, belongs to high life satisfaction level and those who belong to 'choice' group; their life satisfaction level is low. Motivational factors made variation in life satisfaction to a higher extent in the chance group than in the choice group in both generations. Here also the same trend already found in earlier analysis is seeing, that is, choice group singles have high motivation or ambitions in their life. But as couldn't achieve these goals, their life satisfaction level became very low compared to the chance group. The hypothesis of the study, the motivational factors-chance and choice determine the life satisfaction level of single women has been proved.

9. Conclusion
Life satisfaction is a subjective assessment of the quality of one's life. So an attempt is made in this chapter to analyse the life satisfaction level of single women with the help of a ten point scale. It included three aspects- general, social and personal life satisfaction. The result proves that most single women are satisfied with their life. Only 30.7 percentage of single women have low life satisfaction, spinsters revealed they have better life satisfaction, only 17.8 percent of spinsters come under low life satisfaction section. But 43.6 percentage of singletons revealed that they have low life satisfaction. Singletons' Mean score is also low compared to spinsters. The high expectations of singletons negatively affect their life satisfaction level. The statistical tool, Mann Whitney test proved that the hypothesis, there is a significant difference between spinsters and singletons in their life satisfaction level.
The analysis found that the level of life satisfaction is varying according to their education, employment, income and place of residence. It is found that religion has no influence in the level of life satisfaction of single women. It is found life satisfaction level of spinsters varies more on the basis of education than singletons. In both generations, higher education reduced their life satisfaction level. The employment, income and place of residence made more variation in singletons life satisfaction compared to spinsters. The percentage distribution and Chi-square analysis found that there is significant relationship between the dependent variables adjustment, stress and support system and life satisfaction level of single women. It is found that the adjustment and life satisfaction are highly associated. The study found, the high stress need not always lead them to low life satisfaction. There is a significant association between stress and life satisfaction of single women and it indicated that high stress lead to high life satisfaction. Single

women's support system and life satisfaction are associated and single women, who have high support system, they have high expectations in their life. If they can't fulfill this expectation, their life satisfaction level will decrease.

The analysis of the life satisfaction level of single women on the basis of motivational factors- chance and choice, indicated that there is difference between chance group and choice group in their life satisfaction level and the life satisfaction is always varying according to their motivational factors. With the help of statistical analysis, the hypothesis the motivational factors –chance and choice determines the life satisfaction level of single women has been proved significantly. The findings of the present study pointed out that the Mean score of life satisfaction of the choice group is lesser than the chance group. High expectations of choice group of single women led them to low level of life satisfaction. However, with the help of statistical analysis of ANOVA found that the level of life satisfaction is varying according to their motivational factors-chance and choice.

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An Ab-Initio Study on Conformers of Cyclohexane

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Abstract— **Computational chemistry uses methods of theoretical chemistry, incorporated into efficient computer programs, to calculate the structures and properties of molecules and solids. Ab-initio methods are based entirely on quantum mechanics and basic physical constants. The study was designed to calculate the zero point energy of the conformers of cyclohexane by using geometry optimization method. Compare the energies obtained from optimization methods with the experimental values. Then elicit the effect of different basis sets on the energies of these conformers.**

Keywords — Ab-initio, guassian03, basis sets, zero point energy.

I. INTRODUCTION

Computational chemistry simulates chemical structures and reactions numerically, based in full or in part on the fundamental laws of physics. It allows chemists to study chemical phenomena by running calculations on the computers rather than by examining reactions and compounds experimentally[1]. Computational chemistry is therefore both an independent research area and vital adjunct to experimental studies . Quantum-mechanical methods of treating molecules are classified as Ab-initio or semiempirical. The aim of Ab-initio molecular orbital theory is to predict the properties of atoms and molecules. It is based on the fundamental laws of quantum mechanics . Different mathematical transformations and approximation techniques are necessary to solve the equations that build up this theory.

II. GEOMETRICAL OPTIMIZATION OF CONFORMERS OF CYCLOHEXANE

Geometry optimization methods are used to compute the equilibrium configuration of molecules and solids. Stable states of molecular systems correspond to global and local minima on their potential energy surface[2]. Starting from a non-equilibrium molecular geometry, energy minimization employs the mathematical procedure of optimization to move atoms so as to reduce the net forces (the gradients of potential energy) on the atoms until they become negligible. A well established algorithm of energy minimization can be an efficient tool for molecular structure optimization.

A. *Guassian 03*

Starting from the basic laws of quantum mechanics, Guassian predicts the energies, molecular structures, and vibrational frequencies of molecular systems along with numerous molecular properties derived from these basic computation types. It can be used to study molecules and reactions under a wide range of conditions including both stable species and compounds which are difficult or impossible to observe experimentally such as short-lived intermediates and transition structures.[3]

B. *Basis set effects*

A basis set is the mathematical description of the orbitals within a system used to perform the theoretical calculation.[4] The basis set can be interpreted as restricting each electron to a particular region of space. The basis set is a set of atomic functions used to construct LCAO-MOs. A complete set of basis functions must be used to represent spin orbitals exactly.

C. *Preparing input for Geometry optimization*

The opt keyword in the route section requests a geometry optimization, using the basis set and level of theory specified by the other keywords. In Gaussian, the molecule specification for geometry optimization can be given in any format desired: Cartesian coordinates, z-matrix, mixed coordinates. The geometry optimization job will produce the optimized structure of the system as its output .
Here is the input file for an optimization of chair and boat conformers of cyclohexane .[5]

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Cyclohexane chair form

 # RHF/6-31G(d,p) Opt Freq T

```
X1
X2 1 r1
C5 1 r2 2 ac1
C6 2 r2 1 ac1 3 60.0
C9 1 r2 2 ac1 3 120.0
C10 2 r2 1 ac1 3 180.0
C7 1 r2 2 ac1 3 -120.0
C8 2 r2 1 ac1 3 -60.0
H3 3 r3 1 ah1 2 0.0
H3 3 r3 1 ah2 2 0.0
H5 5 r3 1 ah1 2 0.0
H5 5 r3 1 ah2 2 0.0
H7 7 r3 1 ah1 2 0.0
H7 7 r3 1 ah2 2 0.0
H4 4 r3 2 ah1 1 0.0
H4 4 r3 2 ah2 1 0.0
H6 6 r3 2 ah1 1 0.0
H6 6 r3 2 ah2 1 0.0
H8 8 r3 2 ah1 1 0.0
H8 8 r3 2 ah2 1 0.0
r1=0.5        r2=1.4        r3=1.1
ah1=170.0  ac1=90.0        ah2=90.0
```

Cyclohexane boat form

 # RHF/6-31G(d) Opt Freq T
```
X1
X2 1 1.0
X3 1 1.0 2 90.0
X4 1 1.0 3 90.0 2 180.0
C1 1 r2 2 ac1 3 0.0
C2 1 r2 2 ac2 3 60.0
C3 1 r2 2 ac2 3 120.0
C4 1 r2 2 ac1 3 180.0
C5 1 r2 2 ac2 3 -120.0
C6 1 r2 2 ac2 3 -60.0
H2 6 r3 1 ah1 4 0.0
H3 7 r3 1 ah1 4 0.0
H5 9 r3 1 ah1 4 0.0
H6 10 r3 1 ah1 4 0.0
H2 6 r3 1 ah1 2 0.0
H3 7 r3 1 ah1 2 0.0
H5 9 r3 1 ah1 2 0.0
H6 10 r3 1 ah1 2 0.0
H1 5 r3 1 ah2 2 0.0
H1 5 r3 1 ah3 4 0.0
H4 8 r3 1 ah2 2 0.0
H4 8 r3 1 ah3 4 0.0
r2=1.4    r3=1.1    ac1=60.0   ac2=90.0
 ah1=110.0  ah2=110.0       ah3=140.0
```

The above inputs for the optimizations of chair and boat forms were done by using the basis set 6-31G(d),it's description is that it adds polarization functions to heavy atoms:[6] use for most jobs on up to medium/large sized

systems.(This basis set uses the 6-component type functions). Similarly we use the other basis sets such as 6-31G(d,p) which adds polarization functions to the hydrogen as well: use when the hydrogens are the site of interest and for final accurate energy calculations and the other basis set 6-311G(d,p) which is a triple zeta basis set and it adds extra valence functions(3 sizes of s and p functions)[7].

III   RESULTS AND DISCUSSION

When the optimization converges, it knows that the current structure is the final one, and accordingly ends the calculation at that point. The final structure and summary of conformers of cyclohexane from the output file is given in the following pages. Summary file contains the calculation type, calculation method, basis set, imaginary frequency, dipole moment, and the processing time. Frequencies are also obtained from the output files. Frequency calculations can serve to find out the transition states. Imaginary frequencies are listed in the output of a frequency calculation as negative numbers. By definition, a structure which has n imaginary frequencies is an nth order saddle point. Thus ordinary transition structures are usually characterized by one imaginary frequency since they are first- order saddle points.

The boat conformation is a good deal less stable than the chair conformation. It is believed to lie, not at an energy minimum, but at an energy maximum; it is thus not a conformer, but a transition state between two conformers. Frequency calculations retrieve that boat conformer contains an imaginary frequency and thus it is a transition state. The final structure and summary of conformers of cyclohexane from the output file is given below.

Cyclohexane chair form

Calculation type - FREQ   **Calculation method - RHF**

Basis set - 6-31G(d)   **Imaginary frequency - 0**

Dipolemoment - 0 Debye   **Point group - D$_3$d**

Time   - 1 minutes 14 seconds

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Cyclohexane boat form

Calculation type - FREQ   **Calculation method - RHF**

Basis set – 6-31G(d)   **Imaginary frequency - 1**

Dipolemoment - 0.0272 Debye   **Point group – C$_{2v}$**

Time- 1 minutes 38 seconds

We ran geometry optimizations of cyclohexane conformers using both the 6-31G(d), 6-31G(d,p) and 6-311G(d,p) basis sets in order to determine the effects of zero point energieson the predicted structures.

Table1:- Effects of basis sets on the zero point energy of cyclohexane conformers. (Energies in hartrees/particle)

Different basis sets	Chair form	Boat form
6-31G(d)	-234.025567	-234.013298
6-31G(d,p)	-234.044890	-234.032588
6-311G(d,p)	-234.083368	-234.070943

Table 2:- Comparison of the Zero point energies with experimental values.

Different conformers of cyclohexane	6-31G(d)	6-31G(d,p)	6-311G(d,p)	Experimental value.
Chair form	0	0	0	0
Boat form	7.698Kcal/mol	7.719Kcal/mol	7.796Kcal/mol	6.8 Kcal/mol

Table 3:- Comparison of processing time in conformers of cyclohaxane using different basis sets.

Different basis sets	Chair form	Boat form
6-31G(d)	1 minutes 14 seconds	1 minutes 38 seconds
6-31G(d,p)	2 minutes 55 seconds	3 minutes 40 seconds
6-311G(d,p)	6 minutes 38 seconds	8 minutes 16 seconds

IV CONCLUSION

We conclude that our results from geometry optimizations of cyclohexane conformers agree with the following statements. "In the conformers of cyclohexane the chair being a global minimum (ground state) and the boat conformation is a transition state, allowing the inter conversion between two different twist-boat conformations. Thus the conformations involve following order of stability chair form>boat form." From the effects of basis sets on the energies of cyclohexane conformers we obtained that the minimal basis set 6-31G(d) gives the energy values which are more comparable with the experimental values. And also the other basis sets are more time consuming than 6-31G(d) basis set. 6-31G(d) thus appears to achieve the basis set limit for this model chemistry.

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International Journal of Advanced Research in Biological Sciences

Research Article

Mass Multiplication of *Morinda citrifolia* (Noni): A Highly Potential Medicinal Plant

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Abstract

Noni, *Morinda citrifolia* L. (Rubiaceae), is a small,fruit-bearing, evergreen shrub or tree that now grows throughout the tropics. It is a traditional source of medicine, dye, and food for indigenous peoples, and it recently has been marketed internationally as a dietary supplement. Seed propagation takes more time for germination and also variation in fruits, whereas, stem cuttings can be rooted early and with no variations in fruits. In order to overcome the problem with seeds, vegetative propagation could be tried as potential means of propagation of quality planting stock. Cutting is a method to propagate Noni by the use of detached plant parts which when placed under favourable conditions develop into a complete plant resembling in all characteristics to the parent from which it was taken. A study was conducted at Carmel College Botanical Garden to develop a standard vegetative propagation technique through cuttings. Among the different types (Tip, Semi hard wood and Hard wood cutting) with different number of nodes (2, 3 and 4), Hard wood cuttings with 4 nodes performs better and gives more success percentage and healthy planting material.

Keywords: *Morinda citrifolia,* tip cutting, semi hard wood, hard wood,propagation

Introduction

Noni is a wonder crop expecting our respect to become a commercial orchard crop under cultivation. Noni, commonly – Indian Mulberry and scientifically *Morinda citrifolia* L. belongs to the coffee family Rubiaceae . The production of large number of saplings from the limited elite pedigree tree could be possible within a short period and could meet growing demand by the farmers. The true to the pedigree plants thus produced in the country can enhance the foreign exchange earning capacity.   Though it has greater demand hitherto, no efforts on its propagation have been made owing to its hollow nature of stem. Its domestication is possible only by standardizing the propagation techniques. The Noni seeds have a problem of seed dormancy/hard seed coat (water repellant) thus limiting its commercial cultivation. The primary disadvantage of seed propagation is that it takes more time for germination and also variation in fruits, whereas, stem cuttings can be rooted early

and with no variations in fruits. In order to overcome the problem with seeds, vegetative propagation could be tried as potential means of propagation of quality planting stock. The goal of vegetative propagation is to get the best planting stock with highest genetic quality material (Wright, 1975). For making plants through cuttings, it is essential to know the proper techniques for vegetative propagation of this crop.

Cuttings are the very common, easy and cheapest method of vegetative propagation .Healthy parent plant, part of stem, size of the stem, length of cuttings, number of nodes, rooting media, growing structure are considered to influence success percentage and production of healthy plantlets. In this experiment we mainly considered types of cuttings and number of nodes.

Morinda citrifolia is reputed to have antibacterial, antiviral, antifungal, antitumor, anti tubercular effect,

analgesic activity, immunological activity, mental health and improve high frequency, antihelminthic, analgesic, hypotensive, anti inflammatory, immune enhancing etc., due to its beneficial effects, the fruit juice of *M. citrifolia* is widely distributed throughout the world as nutraceutical dietary supplement. The leaf of this plant is directly used on skin for ulcerations and

for minor infections (Duke, et al., 2002).. The present study is focused on mass multiplication of *Morinda citrifolia* (noni): Here an attempt was made to find out specific type of stem cutting and number of nodes per cutting required for mass multiplication of *Morinda citrifolia* (Noni).

Fig.1 *Morinda citrifolia* **–Habit**

Morinda citrifolia   flowers and fruits

Materials and Methods

In order to find specific type of stem cutting and number of nodes per cutting required, a field experiment was conducted at Carmel College, Mala.

Preparation of cuttings :

Cuttings of 15-20 cm length with uniform pencil thickness were selected and prepared from an ideal

mother plant from Thiruthipuram.. Selected cuttings were carefully prepared by giving a slanting cut (45°) at the bottom to expose more cambial area to absorb more moisture and form roots. Bottom cuts were given just immediate to the nodes and planted in slanting position.

Rooting media and growing condition :

Using a mixture of sand and vermicompost (1:1) raised beds were prepared under 50% shade net with poly tunnels.

Planting of cuttings :

Prepared cuttings were planted at 10-15 cm apart with half portion of cutting inside the soil and taken care that the lower buds were not damaged. The soil was thoroughly pressed around the cuttings and watered regularly to keep it moist.

Experimental design :

Experimental design followed was Completely Randomized Block Design (CRBD). There were nine treatments with three replications. Each treatment was with 30 numbers of cuttings.

Treatment details :

Three different types of cuttings with 3 different node numbers were used. The treatment details are presented in Table 1.

Table 1. Details of treatment

Treatments	Type of cutting	Number of nodes
T1	Tip cutting	2
T2	Tip cutting	3
T3	Tip cutting	4
T4	Semi hard wood	2
T5	Semi hard wood	3
T6	Semi hard wood	4
T7	Hard wood	2
T8	Hard wood	3
T9	Hard wood	4

Results and Discussion

The results on success percentage in relation to type of cuttings and number of nodes revealed significant differences among treatments (Table 1). It was observed that the success percentage was maximum (83%) in T 9 (Hardwood cuttings with 4 nodes) and the minimum (2%) in T 1 (Tip cuttings with 2 nodes). Type of cuttings influenced more effectively than number of nodes.

Table 2. Percentage of success in different treatments

Treatments	Days after planting					Transplanted successfully in polybags (%)
	10	20	30	40	45	
T1	15	10	7	2	2	--
T2	14	13	9	5	3	--
T3	15	13	11	7	4	--
T4	20	14	14	12	10	33
T5	23	20	18	17	16	53
T6	20	18	17	17	17	56
T7	23	21	20	20	20	66
T8	25	24	23	23	23	76
T9	28	26	25	25	25	83

Type of cuttings are influenced by the factors like nutritional status of stem, age of the plant, etc . Hard wood stems with high amount of carbohydrate and less Nitrogen lead to better success. According to Kumar (2000) factors influencing shoot and root growth in cuttings are food supply (ratio of carbohydrate to nitrogen in the stems), age of the plant, type of cuttings and environmental conditions (water, temperature, relative humidity, light and rooting media). Noni is the perennial plant, in which stored energy is more in hard wood stem than in other parts. This is the plant with typical hollow stem, which is weaker and with less cambial tissue wherever the stem is not well matured. Cambium is the primary tissue for the development of vascular tissue and root system. So the hard wood stem is with less hollow and with more cambial tissue when compared to soft wood and tip cuttings. Stored energy is more in hard wood cuttings to enhance shoot sprout and root initiation.

Gill *et al*. (1998) reported that very common type of cutting propagation in perennial plant is hard wood cutting. Hard wood cuttings are prepared from the trees when tissues are fully mature. The shoots of about one year old or more can easily be used for preparing hard woodcuttings. It is now recognized that the nutrition–status of stock plants exerts a strong influence on the development of roots and shoots from the cutting. Cuttings from plants with high C/N ratio produce more roots but feeble shoots as against those containing ample carbohydrate and higher nitrogen that produce fewer roots but stronger shoots. Cuttings from succulent stems with very low carbohydrate and high nitrogen do not succeed (Singh, 2000).The type of stem cutting is arbitrary, but 20 to 40 cm cuttings are manageable and effective in Noni (Nelson, 2003).The results of the above study revealed that the hard wood cuttings with four nodes are the best method to propagate Noni through cuttings. This can be applied at field level for mass multiplication of ideal true to type plants through stem cuttings.

Summary and Conclusion

The fruit juice of *M. citrifolia* L. is in high demand in alternative medicine for various illnesses, such as arthritis, diabetes, high blood pressure, muscle aches and pains, menstrual difficulties, headaches, heart disease, Acquired Immune Deficiency Syndrome (AIDS), cancer, gastric ulcers, sprains, mental depression, senility, poor digestion, atherosclerosis, blood vessel problems and drug addiction.

The Noni seeds have a problem of seed dormancy/hard seed coat (water repellant) thus limiting its commercial cultivation. Seed propagation takes more time for germination and also variation in fruits .The results of the above study revealed that the hard wood cuttings with four nodes are the best method to propagate Noni through cuttings. Hard wood stems with high amount of carbohydrate and less Nitrogen lead to better success. Noni is the perennial plant, in which stored energy is more in hard wood stem than in other parts. Cambium is the primary tissue for the development of vascular tissue and root system. So the hard wood stem is with less hollow and with more cambial tissue when compared to soft wood and tip cuttings. Stored energy is more in hard wood cuttings to enhance shoot sprout and root initiation. Hard wood cuttings can be applied at field level for mass multiplication of ideal true to type plants through stem cuttings.

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RESEARCH ARTICLE

INVITRO PROPAGATION OF *KAEMPFERIA GALANGA* USING RHIZOME

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ARTICLE INFO	ABSTRACT
	A protocol was standardized for the rapid propagation *Kaempferia galanga* using rhizome. The medium used was MS medium with auxin (IAA, IBA) and cytokinin (BA). Of these maximum shoots were produced when cultured with MS medium containing 1.0mg/l BA and 0.1mg/l IAA. Maximum shoots were produced by sub culturing in two weeks of sub culturing in the same medium. Regenerated plants were acclimatized and established on soil with eighty five percent success.

INTRODUCTION

Kaempferia galangal belongs to *Zingiberaceae* family with a common name "kacholam" in Malayalam and "black thorn" in English. It is a rhizomatous medicinal plant, widely used as medicine for its volatile oil and aromatic compounds It is very important because the rhizome is having the carminative, diuretic properties and widely used in manufacturing of medicines for cough, stoppage of nasal, block etc...The common method of reproduction is vegetative reproduction through the rhizomes, but there is susceptibility to disease and slow growth. More than that the demand of this plant is increased day by day and the price is also high. Because of these reasons it is necessary to find another method for the rapid propagation of these plants. *Invitro* propagation is most suitable for this. Rhizomatous plants like ginger, curcuma etc. can be grown by this method so invitropropagation to this plant is also important. A lot of invitropropagation methods were develop for zingiberaceae plants by using rhizome. Khatun *et al.,* 2003, methods of culture initiation and multiple shoot regeneration *Z. officinale* and almost similar protocol is effectively used for *Curcuma* species (Tyagi *et al.,* 2004; Das *et al.,* 2010). A study on in vitro multiplication and rhizome formation for *Z. officinale*. Was conucted uner the effect of of different growth regulators and culture conditions on was studied by Rout *et al.* (2001). A major problem in rhizomatous plants during initiation and successful establishment of aseptic cultures is contamination (Borthakur *et al.,* 1999).

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The time of collection is important regarding the responding percentage and the contamination rate in *invitro* studies of *Zingiber* species. Rainy season, is the most favorable time for initiation of culture because the buds are in actively growing state adventitious shoots developed from 80 % of the explants and rate of contamination was also less. Stanly and Keng 2007 reported in vitro seasonal effect on bud growth in *Z. zerumbet* and *Curcuma zedoaria* and *Curguligo orchioides* (Wala and Jasrai 2003). A widely used as a standard carbon source for plant tissue culture is Sucrose, and different concentrations and different osmotic environments have been used (Das *et al.,* 2010). Reports were there stating that higher concentration of sugar source is ideal for in vitro micro rhizome production in *Z. officinale*. Although explants showed a fair response to individual cytokinins used, the combinations of two regular cytokinins (BA and Kn) were found to be ideal for shoot multiplication. Similar results were found by Anish *et al.* (2008) found out that cytokinins (BA and Kn) were found to be ideal for shoot multiplication. in *Bosenbergia pulcherrima*, a threatened ginger. Genetic purity of in vitro raised plants using proved to be an efficient tool for many plant species (Rout and Das 2002; Hussain *et al.,* 2008). The explants source and mode of regeneration are known to play a major role in determining the presence or absence of variation. Using rhizomatous buds as explants for micropropagation lowers the risk of genetic instability as the organized meristem is generally more resistant to genetic changes that might occur by indirect regeneration (Salvi *et al.,* 2002).

Objectives

In this present work an effort was taken to do the invitropropagation of Kaempferia galanga using rhizome as the

explants. We are also aiming to develop a fast and large scale multiplication of the plant by using the same explants.

MATERIALS AND METHODS

Rhizome explants were collected from the field grown plants from various places of Thrissur District Kerala. They were brought to the laboratory and surface sterilization was performed by excising the rhizome, washing it thoroughly under running water, for 20 minutes, then with Teepol for 20 minutes and again with Bavistine (Fungicide) for 20 minutes and then with distilled water for 10 minutes. Then they were taken to the laminar air flow chamber and treated with .01% $HgCl_2$ for 3 minutes and rinsed with water for 5 times to remove the traces of $HgCl_2$. After surface sterilization the rhizome were trimmed into appropriate size and inoculated in the MS medium for shoot multiplication. The basal medium used was Murasige and Skoog medioum containing all salt and vitamins, 30 g/l sucrose, 8g/l Agar. The media were variously supplemented with Benzyl amine individually and in combination with Indole 3 Acetic Acid (IAA) and Indole- 3 butric acid (IBA). Regenerated micro shoots were placed in rooting medium containing half strength MS supplemented with various concentration of auxins (IAA,IBA) singly for rooting. P^H of the medium was adjusted to 5.7+ 1before adding the agar and autoclaved 1.1 Kg cm^{-2} for 20 minutes at 120^0 C. Cultures were incubated at 25 ± 1 ^{0}C with a photoperiod of 16 hours with photon flux density of about 70 µmol m^{-2} provided with a white fluorescent light.

RESULTS AND DISCUSSION

Shoot proliferation

In order to find out an optimum culture medium for the maximum multiple shoot production from the rhizome of *Kaempferia galanga* a number of experiments were conducted.

Initial stage of inoculation

Shoot proliferation from the rhizomes

Multiple shoot development was there in all combinations of growth hormones but maximum was observed with Ms +1 mg/l BA+0.1 mg/l IAA. Multiple shoots were initiated in four week old culture. Number of shoots per culture was 19.36±1.25 and average length of shoot per culture was 6.35±0.25. Similar effect was reported in Alpinia calcarata by Amin *et al* in 2001. The effect of various concentration of BA on shoot initiation and proliferation was also studied here. Best response for shoot proliferation was in 1.0mg/l BA +0.1mg/l IAA supplemented MS medium almost 96% explants showed shoot proliferation at this concentration. Similar results obtained for ginger and turmeric by Blachandran *et al* (1990) and M.M. Rahman *et al* in *Kaempferia galanga* (2005)

Rooting of shoots

Rooting was induced by placing them in half strength MS medium supplemeted with various concentration of IAA, IBA ranging from 01 -1.0 mg/l. The best performance was for 0.2 mg/l of IBA with 905 root at 6th week. These findings are in agreement with the result obtained by Amin *et al* in 2001 for Alpinia calcarata and Blachandran *et al* (1990) for ginger and turmeric and M.M. Rahman *et al* in *Kaempferia galanga* (2005).
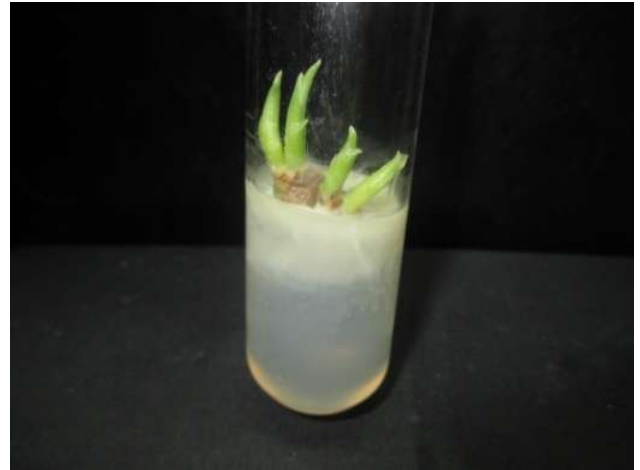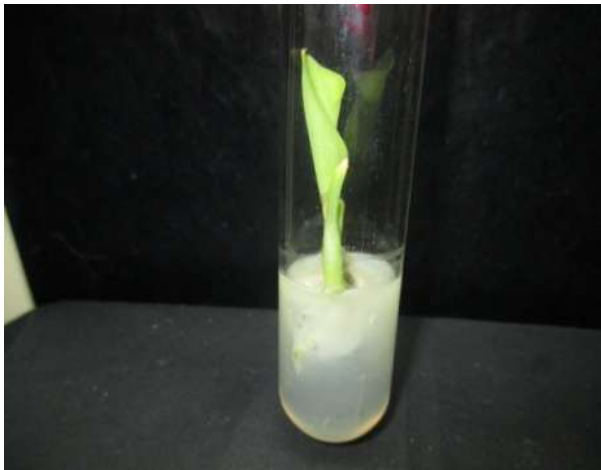
Rooting   Rooted plant in pot

Kaempferia galanga

Establishment under *exvitro* condition

The invitro generated plants were transfered to the soil by making their root agar free by continuous flashing of tap water. Then these plants were slowly transfreerd to ice cream pots containing sand, gareden soil and compost in 1:1:1 ratio. 85% of survival was noticed .

Summary and Conclusion

A protocol was developed for invitro propagation of *Kaempferia galanga* using MS medium for shoot multiplication. The basal medium used was Murashigue and Skoog medium containing all salt and vitamins, 30 g/l sucrose, 8g/l Agar which was were variously supplemented with Benzyl amine individually and in combination with Indole 3 Acetic Acid (IAA) and Indole- 3 butric acid (IBA). Rooting was induced by placing in rooting medium containing half strength MS supplemented with various concentration of auxins (IAA, IBA) singly for rooting. We can conserve the red listed medicinal plant Kaempheria galanga by in vitro propagation method. It is very effective, fast and easy method to produce such plants in mass. For this the rzhizome can be used for the best result and MS medium supplemented with 1.0 mg/l BA and 0.1 mg/l IAA is more suitable to provide large number of multiple shoots.

Aknowlegement

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In vitro Propagation of *Aegle marmelos* through Nodal Explants

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Abstract: *A protocol for micro propagation of bael [Aegle marmelos (L.) Corr.] was developed. The nodal explants of trees were used to initiate cultures. Two cytokinins, viz., 6-benzylaminopurine (BAP) and kinetin (Kn) were used in varied concentration (0.1–2 mg/l) for shoot multiplication. BAP (2 mg/l) was found better than Kn, where a 3-fold increase in the number of shoots was recorded in 4 weeks. A synergistic influence of cytokinin and auxin was also observed in the present study. A combination of 0.5 mg/l BAP and 0.1 mg/l IAA induced the formation of maximum number (4.5) of shoots (2.5 cm). For rooting of in vitro shoots, different auxins, namely, NAA, IAA and IBA (0.1–2 mg/l) were tested. IAA (0.01 mg/l) was found better than NAA and IBA. It was concluded that elite cultivars of bael can be micropropagated, without undergoing callus phase, using the BAP (0.5 mg/l) plus IAA (0.1 mg/l) for shoot multiplication and IAA (0.1 mg/l) for rooting, to produce true-to-type in vitro plants. The in vitro raised plantlets were acclimatized with 60% success.*

Keywords: invitro, explants, sterilization, shooting, bael

1. Introduction

Aegle marmelos is a medicinal plant widely used in Indian system of medicines for many diseases. It belongs to the family rutaceae. It is medium sized tree, commonly known as bael tree. In pharmacology all parts including root is used for many purposes. The fruit pulp marmalosin is a patented drug in India as it is used as laxative and diuretic. In Siddha and Unani, its suggested as a plant of unique healing powers. It also contains number of phytochemicals. In Charaka Samhita, it prescribed that the tender fruits of *Aegle mermelos* with buttermilk is good for diarrhoea. In case of diarrhoea with blood, it is prescribed as tender fruits mixed with jaggery, honey and oil. We find many such references in ancient and in most recent works proving the importance of this red listed tree. This tree has the wonderful capacity to acts as a potent anti-helminthic, hypoglycaemic, cardiac stimulant, anti-diarrhoeal and antiviral agent (Khare, 2004) [18]. All parts of this tree all used as ingredients in many ayurvedic preperations like Bilva Taila, asamoolaarishta, Gangaadharab Choorna, Amritaarishta, Mahaanaaraayana taila, Chyawana praasa, Pushyaarvuga choorna. The root of this tree being the major medicinally useful part, afforestration causes a serious threat for its survival in nature. The timber is good for furniture. Seed and root propagation is very slow and the progeny formed is not uniform also. Conventional methods of propagation are very slow. It is season bound also. So *in vitro* propagation is suitable for rapid multiplication.

2. Review of Literature

This tree is cited as one of the red-listed medicinal species of South India (Ravi kumar & Ved, 2000)[30]. Many workers namely Arya et al, (1981)[5], Arya & Shekhawat (1986)[4] Hossain *et al*, (1993, 1994, 1994a)[9,10] Islam *et al.* (1993, 1994, 1995, 1996a, 1996b)[11], Arumugam & Rao (1996, 2000)[2,3], Ling & Iwamasa (1997)[20], Ajith kumar & Seeni (1998)[1], Islam (2006)[12], Prematilake *et al* (2006)[24],Pranati & Behera (2007)[23], Raghu *et al*, (2007)[27], Das *et al* (2008)[7], Rajesh Pati *et al*, (2008)[28], Neha *et al.* (2010)[22], Rekha Warrier *et al* (2010)[31],

Ramanathan *et al* (2011)[29], Puspasree & Thirunavoukkasu (2011)[26], Kuldeep & Narendra (2011)[19]etc attempted to raise this hardy tree through *in vitro* techniques In the current report, efforts were made to find out, which is the best suitable explant material and best media formulation for rapid clonal propagation of *Aegle marmelos.* Bhajaj (1997)[6], conducted an experiment in this plant and proved that the nodal explants are very in growth and proliferation . Kuldeep & Narendra (2011)[19], explained the importance of the position of nods is important in shoot initiation. Raghu *et al*. (2007)[27], Rajesh Pati *et al*. (2008)[28], also conducted such works. Arya & Shekhawat (1986), Ajithkumar & Seeni (1998), conducted *in vitro* propagation works and stressed the importance of auxin and cytokinine for proliferation. Islam *et al*. (2007), generated callus using different concentrations and combinations of BAP with 2, 4- D, NAA and IBA while culturing node. As per Raghu *et al.* (2007)[7], low concentrations (0.1- 1 mg/L) of BAP and KN phytohormones can induce multiple shoots from nodal segments. Multiple shoots formation was induced by Das et al. (2008) by using combination treatments of BAP + NAA . Neha *et al*. (2010), successfully cultured nodal segment on MS media with many plant growth regulators to attain the multiple shoot-lets. MS medium with different concentrations of BA, KN and GA3 either individually or in combination is better for shoot proliferation in the view of Puspashree *et al*. (2012)[26].

3. Materials and Methods

Plants were selected from different parts of Thrissur District. Explants were selected from healthy twigs collected and cut it as pieces of 10 cm length. Leaf, internode, nodal segments were taken as taken as explants. Explants were washed thoroughly with tap water then by teepol for 10 minutes and then with bavistine and again with distilled water. Then it was taken in to the laminar air flow chamber there it was treated with 0.1% mercuric chloride for 2 minutes and then with distilled water. Then the explants were inoculated in MS medium fortified with Kinetin and IAA(2.0 -1 mg/l) each. Different media concentrations were used. Then they were incubated in

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culture room. Rooting hormones were provided for root initiation. It was ½ strength MS+IBA 10.0 mg/l and IAA 1.0 mg/l.

All these growth regulators were taken in different concentrations of BAP alone in 05t0 3mg/l BAP in 0.5, 1 and 2mg/l concentration along with IAA in 0.1, 0.2, 03, 0.5 mg/L each. We were also evaluated explants for responses. In total, 20 combination treatments were tested for explants establishment purpose. Again Kinetin and IAA combination was there. Kinetin in three concentration (0.5, 1 and 2mg/l) each concentration combined with 0.1, 0.2, 03, 0.5 mg/L concentration of IAA.

Maintenance of cultures: All the cultures were maintained under 12 hr light and 12 hr dark cycle in a culture room at 23 ± 2^0 C with 55 ± 5 % relative humidity. White cool fluorescent lights controlled by a timer were used to provide about 1000 Lux intensity light for obtaining morphogenesis. Cultures were regularly monitored for callusing, direct or indirect differentiation of shoots/roots at regular intervals.

4. Results

Of the different explants used, the nodal explants produced, it was direct morphogenesis in most of the cases, though indirect morphogenesis interfered sometimes in the presence of some strong callus inducing growth regulator. In case of explants like, leaf bits, internode it was indirect morphogenesis, and also poor growth. After 25 days multiple shoot proliferation was noticed in medium. Maximum proliferation was noticed for the nodal explants in medium containing Kinetin 2.0 mg/l +IAA 1.0mg/l. This treatment produced 8.98 micro shoots and maximum leaves/ explants. After shoot formation rooting medium was applied and While more number of roots (2.33 and 2.0), root length (4.8.0and 3.33 cm) were recorded with MS +IBA 10 +IAA 1.0 mg/l. Then they were transferred to the small pots in the green house and after 4 weeks to large field pots.

5. Discussion

Due to low shoot proliferation, basal callusing, vitrification and difficulty in rooting the i*n vitro* propagation of *Aegle marmelos* is a challenging task. Different explants materials were used to test the regeneration potential of each of them following tissue culture methods. Of the various explants used, nodal explants proved to be the best suited material for the fast adventitious plantlets development. Bhajaj (1997)[6], pointed out that the nodal explants are very in growth and proliferation. Kuldeep & Narendra (2011)[19], mentioned that the explants from 4-8th nodal segments are the best ones for the shoot initiation and not the terminal tender ones. Raghu *et al*. (2007)[27], Rajesh Pati *et al.* (2008)[28], also conducted such works. All these result are also in agreement with this work. Arya & Shekhawat (1986)[4], Ajithkumar & Seeni (1998)[1], conducted *in vitro* propagation works and stressed the importance of auxin and cytokinine for proliferation. Islam *et al*. (2007)[13], derived callus to regenerate plantlets using different

concentrations and combinations of BAP with 2, 4- D, NAA and IBA while culturing node. Raghu *et al.* (2007)[27], used low concentrations (0.1- 1 mg/L) of BAP and KN phytohormones to induce multiple shoots development from nodal segments. Multiple shoots formation was induced by Das et al. (2008) by using combination treatments of BAP + NAA and attained about 22.7 multiple shoots. Neha *et al*. (2010)[22], successfully cultured nodal segment on MS media provided a range of plant growth regulators to attain the multiple shoot-lets. According to Puspashree *et al*. (2012)[26] MS medium with different concentrations of BA, KN and GA3 either individually or in combination is better for shoot proliferation.

Rooting hormones were provided for root initiation .It was ½ strength MS+IBA 10.0 mg/l and IAA 1.0 mg/l. After initiation of root, rooted plantlets were successful acclimatized to the *in vivo* conditions following suitable measures. Arya & Shekhawat (1986), Ajithkumar & Seeni (1998), Pranati & Behera (2007), Rajesh Pati et al. (2008), Hossain *etal*. (1994a), Kuldeep & Narendra (2011), Puspasree & Thirunavoukkarasu (2011) etc were also used½ strength MS media supplemented with IBA in different concentrations. From these the results, it appears ½ strength liquid MS medium fortified with different concentrations of IBA and IAA is good for root initiation.

Table1: Growth rate of various explants on different concentrations of growth hormones

Growth regulators	% of explant showing proliferation	No of shoot per culture	Average length of shoot per culture
BAP			
0.5	30	3.1±0.35	1.33±0.32
1.0	32	3.25±0.38	2.11±0.36
1.5	36	3.32±0.62	2.58±0.16
2.0	38	3.75±0.28	3.28±0.24
2.5	38	3.99±0.45	3.64±0.58
3	31	3.02±0.39	3.22±0.14
BAP+IAA			
0.5+0.1	31	3.13±0.54	1.21±0.12
0.5+0.2	35	3.34±0.22	2.22±0.32
0.5+0.3	38	3.36±0.24	2.61±0.34
0.5+0.5	38	3.86±0.06	2.25±0.38
1.0+0.1	41	5.36±1.47	4.41.±0.36
1.0+0.2	42	5.32±0.66	4.46±0.43
1.0+0.3	42	5.26±0.78	4.28±0.82
1.0+0.5	34	4.5±0.48	3.44±0.68
2.0+0.1	32	4.23±0.89	3.22±0.24
2.0+0.2	30	3.16±0.36	2.24±0.38
2.0+0.2	30	3.36±0.62	2.13±0.28
2.0+0.5	28	2.82±0.55	1.89±0.54
KINETIN+IAA			
0.5+0.1	32	3.28±0.38	2.26±0.12
0.5+0.2	32	2.98±0.33	2.49±0.44
0.5+0.3	32	2.69±0.28	2.26±0.42
0.5+0.5	32	2.38±0.44	2.34±0.88
1.0+0.1	34	3.23±0.22	2.50±0.18

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1.0+0.2	34	3.56±0.26	2.78±0.14
1.0+0.3	34	3.58±0.23	2.88±0.16
1.0+0.5	36	3.62±0.18	2.98±0.34
2.0+0.1	**40**	**3.62±0.26**	**3.26±0.24**
2.0+0.2	34	3.16±0.18	3.14±0.24
2.0+0.2	32	2.54±0.22	1.69±0.22
2.0+0.5	28	2.24±0.16	1.98±0.24

6. Conclusion

In conclusion we can say that even though the *in vitro* propagation is a tedious task due to many reasons the successful propagation of *Aegle marmelos* can be achieved through the nodal explants by using MS medium fortified with Kinetin and IAA(2 -1 mg/l) each.

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GC-MS ANALYSIS OF THE LEAVES OF *PUERARIA PHASEOLOIDES* (ROXB.)BENTH.

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ABSTRACT

In this study the composition of ethanol extract of the leaves of *P. phaseoloides* was analysed by GC-MS. Twenty one different compounds were identified and they are mainly the Hyrdocarbons, Sesquiterpenens and fatty acids. The retention times and peak areas of the identified constituents are presented in a table. The six main constituents identified were 2H.1-Benzopyran, 3, 5, 6, 8a- tetrahydro - 2, 5,5, 8a- tetramethyl-, Cis-, 2(4H)- Benzofuranone, 5, 6, 7, 7a-tetrahydro – 4, 4,7a – trimiethyl -, (R)-, 3, 7, 11, 15 – Tetramethyl- 2-hexadecen – 1-01, Oct – 3- ene – 1, 5- diyne, 3- t- butyl – 7, 7- dimethyl, Phytol, Squalene.

Key words: GC-MS, Squalene, Sesquiterpenens and hydrocarbons

Introduction

Pueraria phaseoloides (Roxb. Benth. (Papilionoideae) is Vigorous, deep-rooted, *perennial* twining and *climbinglegume*, slightly woody, and hairy. Its main stems are slender, rooting at the nodes upon contact with moist soil. Young shoots are densely covered with brown hairs. Leaves large, trifoliate, borne on petioles and covered with ascending hairs. Leaflets thin, triangular-ovate, usually very shallowly lobed; lateral leaflets oblique, and wide. Flowers small, mauve to deep purple, borne in scattered pairs in axillary racemes,

about 15-30 cm long, on peduncles about 12.5 cm long. Pod straight, or slightly curved, linear, cylindrical thinly covered with stiff adpressed hairs, turning black when ripe. Seeds, oblong to squarish with rounded corners, brown to brownish black in colour. *P. phaseoloides is* native to Southern China. Naturalised throughout the humid-tropics. The tuberous root can be eaten.

The aim of the study was to investigate the composition of the ethanol extract of the leaves of *Pueraria phaseoloides by GC-MS.*

Materials and Methods

Plant Collection

Fresh leaves of the plant was collected from the river banks of Chalakudy, Thrissur dt, Kerala and the plant name was confirmed by comparing it with the Herbarium specimen in KFRI (Kerala Forest Research Institute). A voucher specimen was submitted in Rapinat Herbarium, Tiruchirappalli.

Extraction

Finely chopped fresh leaves of *Pueraria* were extracted by hot extraction process using a soxhlet extraction device with solvent ethanol, for 72 hrs at a temperature not exceeding the boiling point of the solvent. The filtrates were concentrated in vaccum rotary evaporator at 60°C in order to reduce the volume. The paste like extracts were stored in labeled screw capped bottles and kept in refrigerator at 4°c.

GC/MS Analysis

The extracts were subjected to GC-MS. Gas chromatography-Mass Spectrometry analysis was performed with an Fisons GC-MS

instrument. A Splitless mode was chosen with helium as carrier gas. The column was DBS MS of 30 m in length, 0.25 mm in diameter and 0.25 mm film thickness and μ (1 mg/ml) the active fractions (Substances) dissolved in ethanol was injected in the following conditions, injector temperature, 280°C carrier gas, helenin, Pressure 150 Kpa, Ionisation mode E$^+$ solvent delay (min) 2.00, temperature gradient, 20°C per minute from 100 to 315°C. The analysis was carried out at the Food Analysis Laboratory at Thanjavur, South India.

Result and Discussion

Twenty one different compounds were identified in the ethanol extracts leaves of *Pueraria phaseoloides*. The identification of these constituents was made by the direct comparison of their retention times (RT) and mass spectra fragmentation with those in NIST (National Institute of Standards and Technology) Library, NIST (National Institute of Standards and Technology) Library, and the published literatures. Some of the phytochemical components of ethanol extracts of *Pueraria leaves* are presented in the Table1 showing their Retention Times and Peak areas. In total (21) constituents were identified and the major constituents present in the leaf alone are presented in the Table 2.

Previous phytochemical analysis have reported the presence of various isoflavonoids of highantioxidant properties including daidzin, genistin, tectoridin, and puerarin, in *Pueraria tuberose* [1], [2], [3], [4]. Puerarin, highly abundant in *P.tuberosa*, has hypothermic, spasmolytic, hypotensive, and anti arrhymatic activities [5]. Atherapeutic effect of puerarin on diabetic nephropathy has been

reported [6]. Crude extracts of *P.tuberosa* have contraceptive effects and induce uterine changes in rats [7]. Plant derivatives also demonstrate hypocholesterolemic effects [8]. This is also important in the treatment of alcohol dependency due to inhibition of alcohol transport across the gut membrane [9].

*Pueraria tuberosa*possesses lupinoside which can prevent damage of insulin activity by free fatty acid [10]. The presence of biologically active compounds such as phenols, polyphenols, tannins, alkaloids flavanoids and terpenoids in various plants are known to possess antibacterial activity [11]. The leaves of *Pueraria phaseoloides posses phytol* which have Antimicrobial, Anti-inflammatory, Diuretic and Anticancer effect. Squalene has antibacterial, Antioxidant, Antitumour, cancer preventive, Immunostimulant, Chemo preventive, Lipoxygenase-inhibitor and pesticide activity.

Glycerin an antimicrobial preservative is present. Octonoic acid, is an insecticide and has antimicrobial effect. 2-Furancarboxaldehyde,5-(hydroxyl methyl)- is an antimicrobial preservatve. Asarone is Antipyretic Antispasmodic, Emetic, Fungicide, Mutagenic, Sedative Myorelaxant, tranquilizer, pesticide, cardio depressant, Psycoactive, and Anticonvulsant.

Conclusion

Pueraria tuberosa which seems almost extinct in vast tracts of the Eastern and western Ghats of India. *Pueraria phaseoloides possesses a vast array of valuable compounds and it can be used instead of Pueraria tuberosa. Though Pueraria phaseoloides* is an underutilised species it can be a valuable alternative to much sought after *Pueraria tuberosa.*

Table 1: Some of the GC-MS Constituents of the Leaves of *Pueraria phaseoloides, Ethanol extract*

Serial No.	Retention Time	Name of the Compound	MW	Compound Nature	Peak area%
1	4.13	Glycerin	92	Alcohol	4.63
2	6.22	1- Butanol,3-methyl, formate	116	Alcohol	5.74
3	15.71	2H.1-Benzopyran, 3, 5, 6, 8a-tetrahydro -2, 5,5, 8a- tetramethyl-, Cis-	192	Aromatic Compound	0.13
4	16.67	2(4H)-Benzofuranone, 5, 6, 7, 7a- tetrahydro - 4, 4, 7a- trimethyl -, (R)	180	Aromatic Compound	0.26
5	17.39	Dodecanoic acid	200	Lauric acid	1.09
6	24.39.	3, 7, 11, 15 – Tetramethyl- 2-hexadecen – 1-01	296	Tetrapene alcohol	1.19
7	27.76	Oct- 3- ene-1, 5-diyne, 3- t- butyl - 7, 7- dimethyl	188	Unsaturated hydrocarbon	0.87
8	28.71	Phytol	296	Diterpene	2.75
9	41.02	Squalene	410	Triterpene	3.06

Table 2: Phytochemical Compounds in Leaf alone

1	2H.1-Benzopyran, 3, 5, 6, 8a- tetrahydro -2, 5,5, 8a-tetramethyl-, Cis-
2	2(4H)- Benzofuranone, 5, 6, 7, 7a- tetrahydro - 4, 4, 7a-trimethyl -, (R)-
3	3, 7, 11, 15 – Tetramethyl- 2-hexadecen – 1-01
4	Oct- 3- ene-1, 5-diyne, 3- t- butyl -7, 7- dimethyl
5	Phytol
6	Squalene

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PREPARATION AND CONDUCTIVITY STUDIES OF POLY(P-PHENYLENEDIAZOMETHINE)/POLY (VINYLCHLORIDE) BLENDS

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Introduction

Conducting polymer composites have drawn considerable interest in recent years because of their numerous applications in a variety of areas of electrical and electronic industry[1-3]. In most of these applications, the main concern is to obtain sufficient level of conductivity in the material. Preparation of blends, composites and interpenetrating network has been widely used as an approach to combine electrical conductivity with desirable mechanical strength of polymers[4]. Several attempts have been described to produce conducting polymer composites with better physical properties by either chemically or electrochemically[5-9]. Charge transport mechanism in conducting polymer composites was reported by Radhakrishnan et.al.[10].

The present study involves In-situ polymerization of glyoxal and p-phenylenediamine in different solvents containing different amounts of PVC. The d.c. conductivity and microwave conductivity of each sample was measured. The effect of dopants like $HClO_4$, HCl and I_2 on conductivity was also studied.

Experimental

Materials used

Paraphenylene diamine, Glyoxal hydrate (trimer), Polyviny lchloride, N, N-Dimethyl formamide, Toluene, Tetrahydrofuran, Methanol, Acetone, Hydrochloric acid, Perchloric acid, Iodine, and Carbon tetra chloride.

Synthesis of poly(p-phenylenediazomethine)–Polyvinylchlorideblends

PVC (5g) was dissolved in 50 ml of Tetrahydrofuran. 0.1mole of p-phenylene diamine was added to 300 ml of N,N-dimethylformamide and was dissolved in it by stirring. Then 0.1 mole of glyoxal was added to it and stirred well. The solution of PVC in THF was added to the above reaction mixture and stirred well. Then the temperature of the reaction medium was increased slowly to boiling, with continuous stirring, and was refluxed at the boiling temperature for 4 hours. By that time, the precipitation of the product takes place. It was then allowed to cool to room temperature and then poured into excess of ice-cold water with stirring. It was allowed to settle, filtered, washed with plenty of water until the filtrate was colourless. Then it was washed with methanol, and allowed to dry at room temperature in air for one day. Then the final drying of the sample was done at 70^0C in vacuum.

The same procedure was repeated by varying the amount of PVC. For this, 10 gm of PVC was dissolved in 100ml of THF, 15 gm of PVC was dissolved in 150ml of THF, and 20 gm of PVC was dissolved in 200ml of THF and was added to the reaction mixture containing glyoxal and p-phenylenediamine in DMF.

The dried sample was powdered well, and, pelletized for the density and d.c. conductivity measurements. For the spectral and thermal studies, the sample was extracted with acetone until the extract was colorless, and dried well.

Doping

1g each of the sample was added to 50ml each of 1M HCl solution, 1M $HClO_4$ solution and saturated solution of I_2 in CCl_4 and kept for 24 hours. Then it was filtered, washed with a little amount of acetone and dried at 70^0 C in dynamic vacuum for one hour.

Measurements

IR spectra

Particles of the polymer samples were flattened by means of cold compression between two diamond windows. IR spectra of the samples were recorded with a Biorad UMA 500infrared microscope, which is coupled to a Biorad FTS 6000 spectrometer. Spectra were recorded with a resolution of 4 cm^{-1} co-adding 100 scans.

D.C. conductivity

D.C. conductivity of the pressed pellets was determined by the two-probe technique. The samples were sandwiched between two copper electrodes and a constant voltage (6V) was applied to the sample. The current flowing through the sample was measured using a digital multimeter (APLAB model 1087). The conductivity of the sample was calculated using the equation, $\sigma = t / RA$, where 't' is the thickness of the pellet, 'R' is the resistance of the sample (R = E / I, where 'E' is the applied voltage and 'I' is the resulting current through

the sample), and 'A' is the area of cross section of the pellet ($A = \pi r^2$, where 'r' is the diameter of the pellet).

Density

Density of the pressed pellets were determined using the equation, $D = M/V$, where 'M' is the mass of the pellet and 'V' is the volume of the pellet.

Results and discussion

Figure 1 gives the IR spectrum of the conducting polymer-polyp-phemylenediazomethine- blends with PVC. A broad band existed between 3200 and 2400 cm^{-1}. These bands can be assigned to the $-(N-H_x)-Cl$ strtetching vibration of amine salts. Other spectral bands were due to the conducting polymer. Some more absorption bands can be ascribed to the PVC spectrum. Figure 2 compares the IR spectrum of the conducting polymer with that of the blend. Some of the spectral bands were common in both of the spectra. From these, we can conclude that conducting polymer was incorporated into the PVC matrix.

As the amount of PVC was increased in the blends, the solubility of the polymer was increased. This may be due to the effect of two solvents, THF and DMF, in the reaction medium, or, it may be due to the removal of HCl from PVC by the action of heat during the course of the reaction. The presence of acid was found to increase the solubility of the conducting polymer. In concentrated acids, the polymer was soluble at high temperature. So the processability of the conducting polymer can be improved by making its blends with PVC without any chemical change in the polymer structure.
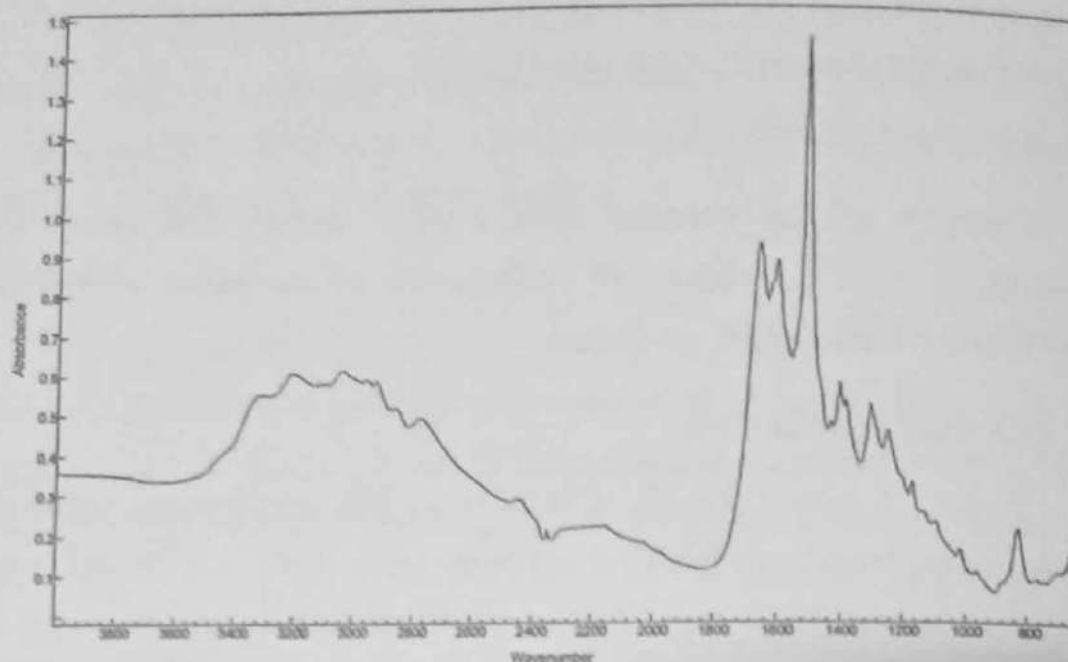
Fig. 1: IR spectrum of the conducting polymer- PVC blend
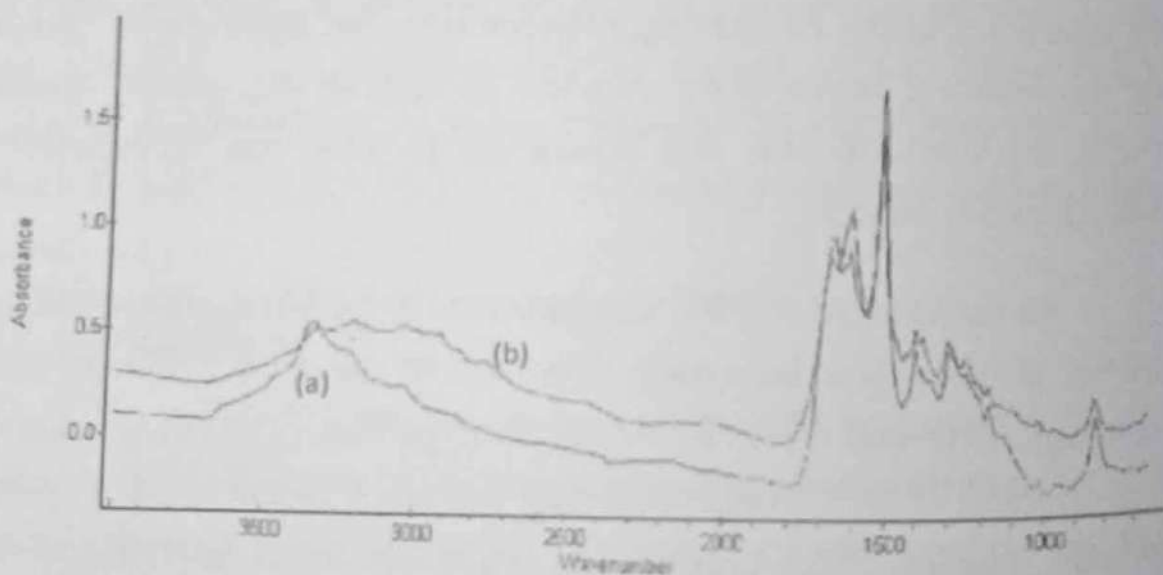
Fig. 2: IR spectra of (a) conducting polymer prepared in DMF and (b) its blend with PVC

Figures 3 and 4 show the IR spectra of the conducting polymer /PVC blends doped with HCl and HClO₄. The absorption peak at

3345 cm^{-1} in the undoped polymer was shifted to a broad band in the region of 3338 and 3360 cm^{-1} in HCl and HClO$_4$ doped samples respectively. The strong peak at 1628 cm^{-1} was characteristic of C=N bond in conjugated polymers. The bands at 1094 and 1084 cm^{-1} were due to the dopant molecules HCl and HClO$_4$. The bands at 1512 and 1425 cm^{-1} showed the benzenoid and quinoid rings attached to N atom. Other bands were same in undoped and doped samples.
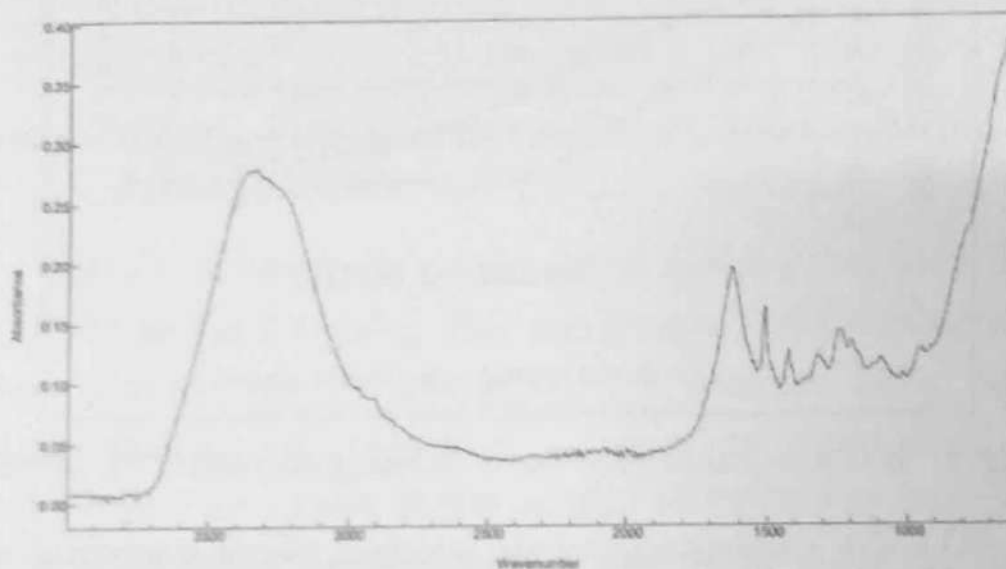
Fig. 3: IR spectrum of the conducting polymer/PVC blendsdoped with HCl

Fig. 4: IR spectrum of the conducting polymer/PVC blend doped with HClO$_4$

D.C. conductivity of the blends of the conducting polymer based on glyoxal, p-phenylene diamine and varying amounts of polyvinyl chloride is shown in the figure5.
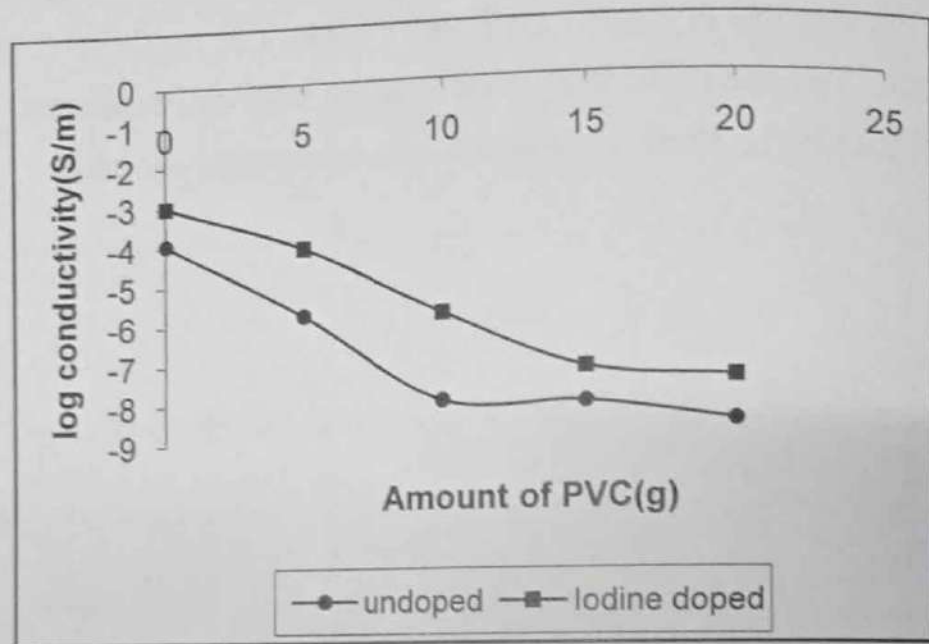
Fig. 5: D.C. Conductivity of the conducting polymer/PVC blends

The d.c. conductivity of the undoped blends decreased with increase in the amount of PVC. It was because, PVC is an insulator and the presence of nonconducting PVC in the composite prevented the free movement of electrons through the conducting polymer chain. Here, the conducting region was separated by a nonconducting region, so that the jumping of electrons from one conducting region to other became difficult. Hence the conductivity was decreased as in the case of polyethylene blends.

The variation in d.c. conductivity of the doped samples with the amount of PVC is given in figure 6.
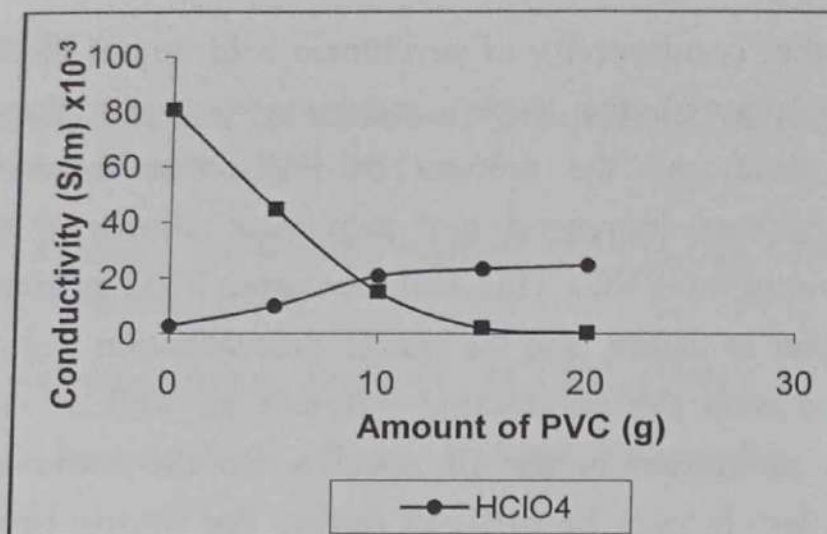
Fig.6: D.C. Conductivity of HCl and HClO$_4$ doped conducting polymer/PVC blends

The d.c. conductivity of the doped samples was more than that of the undoped samples. This was because, after doping, more charge carriers were introduced into the polymer chain, which helped to increase the conductivity. Conductivity of perchloric acid doped samples containing higher amount of PVC were more than that of other doped samples. HClO$_4$ was found to be the better doping agent because, of the large size of ClO$_4^-$ counter ion, which helped to tightly attach the dopant to the polymer chain. Hence the removal of the dopant was difficult. This may be due to the attachment of H$^+$ ions to the N atom of the polymer using the lone pair of electrons to increase the charge delocalization as it is clear from the IR spectra. Conductivity of the I$_2$ doped samples were lower than that of other samples doped with HCl and HClO$_4$. It may be due to the fact that charge delocalization due to iodine on the polymer chain was very low. Also, on drying the samples, the action of heat and vacuum may be removing the iodine easily, compared to acid dopants.

The d.c. conductivity of perchloric acid doped blends were more than that of the pure conducting polymer doped with perchloric acid. As the amount of PVC was increased, d.c. conductivity was increased and remained almost constant at higher amount of PVC. This was because, PVC present in the blend is polar in nature, and the charge delocalization and oxidation takes place with the conducting polymer as well as with PVC molecules as shown in the IR spectra. So the removal of the dopant molecule may be difficult during the drying process and since the charge carriers were not lost, the conductivity was higher for the blends. After a saturation point was reached, the increase in conductivity was negligible because, the amount of insulating region of PVC was increased in the blend.

Conclusions

1) The d.c. conductivity of the undoped conducting polyme blends was lower than the d.c. conductivity of the conducting polymer.

2) The d.c. conductivity of the undoped polymer blends was decreased with increase in the amount of PVC.

3) The d.c. conductivity of the conducting polymer blends was increased on doping with HCl, $HClO_4$ and iodine.

4) The d.c. conductivity of the blends of conducting polymer with PVC doped with HCl and iodine was decreased with increase in the amount of PVC, but it was increased on doping with $HClO_4$ and it remained constant at higher concentration of PVC.

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MAJOR FACTORS LEAD ELDERLY TO OLD AGE HOME

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ABSTRACT

Ancient Indian culture revered elderly and gave them high prestigious position. As a part of industrialization and westernization Indians forgot about their glorious culture and became blind follower of the same. Indians were unable to incorporate their culture to industrialization. Kerala is not an exception to this. Feminization in elderly is more prominent in Kerala. Elderly are considered as waste product by this culture as they have to contribute nothing to economy and put them in old age home. Objective of this study is major factors lead elderly to old age home. The study found out that change in economic structure creates crucial economic problems to elderly which act as the main catalyst to leading them to old age home. Economic problems cause breakage in family relationship which in turn leads to family problems. This acts second leading factor. When they are unable to occupy specified position in family, they are also expelled from society also. Hailing health, psychological problem and religious problem are other leading factors. Religious factors have not much to contribute in this. One of the most dangerous situations explored through this study is among young old have the most complicated economical problems than others.

Introduction

Our ears vibrated severely with spontaneously growing "greying population" and "Feminisation in ageing". In this new era, society work hard to outnumber the elderly with old-age homes as a false part of social security. Of course there are kaleidoscopic changes occur in every moment. This is may be due to as an after effect of industrialization, individualization, modernization etc. These evolutionary changes moulded social being into an introverted isolated person. The glorious position of elderly false steeply. They are considered as waste element of the society and put into 'Recycle bin'- "Old age home". They can impart unavoidable role in society even in their later age. But in fast computerized life nobody have enough time to look after their parents and elders. It is very interesting to identify bounded factors lead them to old age home. For this we have to explore the major factors which lead them to old age home. It is their right to live happily and prestigiously in their later age as this is an age of harvesting. In this context descriptive method was undertaken to explore major factors lead them to old age home. Analysis was based on primary data collected through structured interview schedule. Samples were selected with random sampling method from three districts in Kerala.

As we progress into the twenty-first century, ageing has become increasingly recognised as an important issue facing individuals, families, communities and nations. Increasing age is related to long-term health conditions, higher rates of disability and poorer reported health status. Successful adaptation to this process depends on the interaction of a wide range of events. Population ageing could have profound implications for the economies as well

as societies experiencing a rapid increase in the share of older persons in the total population. However, ageing can also lead to the emergence of social welfare and gender-related issues. The combined effect of these changes could have an impact on economic growth and thereby the welfare of the people. These issues may pull them to old age home.

Many of the changes that occur from aging result from a gradual loss. These losses often begin in early adulthood, but thanks to the ability of our organs to adjust and maintain health, the actual loss is not experienced until it is fairly extensive. Interestingly enough, the majority of these changes are not seen until after age 70. The biggest difference in the rate of aging and organ efficiency lies in the presence of disease and/or the ability of the body to adapt to external stress. There is a wide variation among individuals in the rate of aging and, within the same person, different organ systems age at different rates. Old age is visualised as diminished physical and psychic activity and a plethora of problems. India is not exempted from this. Among Indian states, Kerala has the largest proportion of elderly population and the growth rate among the aged is increasing. Not only aged, but old age homes are also increasing.

Review of Literature

The process of reading, analyzing, evaluating, and summarizing scholarly materials about a specific topic is the review of literature. **Rahul DevBhaswar** in his paper "Population Ageing in India: Demographic and Health Dimentions" presents demographic and health dimensions of ageing population (60 plus) in India and its

major states. Decreased fertility rate and increased life expectancy leads to demographic transition. Asia will have the majority of world's elderly population by the turn of the 20th century. Various indicators such as changes in age structure, sex ratio, rural-urban residence, marital status, support ratio and causes of deaths among the elderly were analyzed for different census years and discussed in detail. According to him population starts ageing in two ways- "bottom-up" and 'top-down". Bottom-up ageing is due to decline in fertility and top-down is due to decline in mortality. Kerala Goa and Haryana are the three states which have the largest proportion of elderly women in India. He states that the feminization of elderly population is very clear. His study shows that the process of population ageing has already started in India .With the decline in fertility and mortality levels, the size of the younger population is shrinking, leading to the ageing of the population. Trend in sex ratios and grater life expectancy of females indicate that feminization of elderly population of non-working age relative to the working age in all the states. His study reveals that Kerala will witness population ageing sooner than other states. Expenses of caring for old and frail relatives with multiple, chronic disabilities and illness is increasing the load for working class. Governmental, non-governmental agencies along with families would require providing the care and support for the increasing number of elderly persons (Bhaswar, 2001).

Satadru Haldar, in his paper, 'Management of health and health related problems of the tribal aged', analyses elderly health and its relation to the social well being. They are vulnerable due to decrease in failing health. Ordinarily the members of their family

are supposed to take care of them. The effect of individualism and fast deterioration of family leads old people to seek the assistance from state. We assumed that the family would take care of their own aged. But even in the villages, there are old people who have become destitute. In modern times many changes have taken place and individualistic as well as competitive life has intruded. The major health problems of elderly are malaria, Muscular pain, Stomach pain, Respiratory problems like Asthma, eye complaints, T.B., Blood pressure, Arthritis, Paralysis etc. Female suffer more than males in visual disability. This happens due to nutritional deficiency in general and Vitamin A deficiency in particular. Elderly females are more prone or willing to accept their way of life in a positive emotional framework. Self assessed health status is an important indicator of quality life during old age. Health condition and economic condition seems to have no relationship with one another as both rich and poor enjoy similar health conditions. Many elderly people find it difficult or impossible to manage such activities as walking outside, bathing washing wearing garments, getting around the house getting in and out of bed and so on. For this they need help from family or nearby kin's. This paper gives the main factors that lead elderly to old age home (Haldar, 2006).

Vijay Prakash Sharma, in his paper, 'Tribal Aging in Jharkhand Health Perspective' analyzed elderly in traditional region. The old have traditionally been honored and respected. Those who neglected their old parents earned social disrespect and were ridiculed .Govt. of Jharkhand in its new health policy-2004 has announced that provisions for care of aged will be made. In 2002-03 Govt. Of Jharkhand reported construction of two old age homes for

elderly. This gave an idea about the involvement of state for the well being of old (Sharma, 2006).

In the article, 'Ageism in Kerala' by **Dr. K. G. Moli** after effect of ageism in Kerala analyzed. According to the author, among the Indian states, Kerala has the largest proportion of elderly population and the growth rate among the aged is increasing higher and higher. Therefore one of the many challenges- facing Kerala is its growing elderly population. The marital status of the older persons is an aspect of family structure that deeply affects their living arrangements, support systems and individual well-being. It also determines the living arrangements of older persons. They constitute a multiple support system for spouses in terms of emotional, financial and social exchanges. In Kerala majority of the elderly females are widows. Among the elders (60+) in 1981, 66% of the women had lost their husbands whereas only 12%of the men lost their wives. Therefore elder women of Kerala are doubly marginalized due to the combined effects of ageing and widowhood. Widowhood is the main factor that influences one's adjustment and mental health. Due to the breakdown of the joint family system, selfishness, lack of adjustment, refusal to compromise and with younger women entering into jobs, the case and attention give to the elderly persons are affected. Majority of the female elderly especially of the rural area are living in poor economic background with no money at their disposal to meet their daily life. This paper gave us information about the leading factors to old age home (Moli, 2004). From these, we can understand elderly female folk exploited greatly. Several gaps are existed within these studies. So a deep research is needed to overcome this.

However, an ongoing criticism of the social scientific study of ageing is that it lacks "theoretical rigor" and tend towards the descriptive. Thus research on ageing being primarily problem-driven rather than theory-driven. Kerala's elderly female folk are heterogeneous group. Major factors lead elderly to old age homes are different. We have to find out those factors which lead them to old age home.

Methodology

In Kerala as per 2001 census, the percentage of 60+ was 10.48 and it is 11.7 per cent in 2011 and is projected to be 15.6 per cent in 2021. The elderly women represent the fastest growing age group in the population of Kerala. The threat of population ageing is more severe in Kerala than the rest of the country. Gender dimension of ageing is very significant in Kerala and female population predominates at all the stages of older ages. Population ageing could have profound implication for the economies as well as the societies. Thus the dependency ratio is greater.

A large number of elderly females are in the status of widowhood, illiterates, non-working and belong to lower and or no income brackets. All these finding leads to the conclusion that the aged females are the vulnerable within vulnerable. Their miserable status makes them to appear more aged than actually what they are. 'World Health Organisation Report 'states that the percentage of the aged women who are 60+is going to be doubled within two decades. But so far no specific study has been done to elevate their status. There will be lesser and lesser people taking care of the elderly as the decades roll by. Traditional life guards of family care

are dwindling due to industrialization, our migration, dual career, female job participation and growing consumerism. All these make the well-being of the elderly, a growing challenge of the 21st century. A significant aspect of challenge comprises the depressed elderly along with society who are unwilling to accept them.

An overview of available studies revealed the fact that the majority of researches concentrated on the problems faced by the elderly women. A study based on the **Major Factors Lead elderly to Old Age Home** has not been done. So the present study" is undertaken with a view to explore information to fill the existing research gap. It is hoped that such a study would be helpful to the policy makers and society.

The scope of study is limited to the elderly women (60 years and above) residing in Kerala. The study on factors which lead them to old age home was being primarily problem-driven. Kerala elderly womankind is a heterogeneous group. They have to face a lot of problems during their existence. So this analysis is based on these problems. A single theory cannot explain all these problems. Various factors deeply intertwined to each of it. Descriptive research design has been adopted for this study. The purpose of this research design is to explore the factors which lead elderly women to old age home and elicit new information about the elderly women residing in old age homes in Kerala.

The objective of this study is to find out major factors lead elderly to old age home. The design uses primary and secondary data. The primary data about the elderly for the study have been collected through structured interview schedule among elderly

women in Kerala. The secondary data are derived from books, journals, reports, newspapers and online media on the subject, 150 samples selected from old age home, Kerala are considered as samples by Simple Random Sampling. Out of 150 samples, 50 samples from Thiruvananthapuram, 50 from Kozhikode and 50 from Thrissur old age home. Data collected through structured interview schedule were analysed with SPSS.

Discussions and Analysis

Table 1: Major Factors lead elderly to old age home

Major leading factors	Number	Total	Per cent
Economical factors	147	150	98
Family factors	144	150	96
Social factors	105	150	70
Health factors	41	150	27
Psychological factors	41	150	27
Religious factors	10	150	7

The above table deals with the major factors which lead elderly to old age home. Researcher finds that 98 percentages of them entered to old age home by their serious economical factors. 96 percentages of the members have family and because of this problem, they lead to Old Age Home. 70 percentages of the members by social factors. Only 27 percentage members have health and psychological factors. One interesting thing noticed here that 7 percentages of the members have religious factors. But the study proved that religion and religious faith is not considered as a great leading factor for them to Old Age Home.

Researcher concluded that vulnerability among the elderly explained by earlier studies proved by the above table. According to several studies in Kerala, around 50 per cent of elderly have some personal income. But the present study disagrees with it. In most of the cases, income earned by elderly is not sufficient to fulfil their daily needs. Thus economic problems become most serious factors for elderly which makes their way to old age home. In this industrialised individualised new millennium family relationship undergoes several changes which lead to breaking up of family relationship. This doubled problems of elderly which lead their way to old age home. Human being is a social animal. So in the process of ageing has an unavoidable role in the process of ageing. Above table indicates the importance of social alienation which makes their life unbearable. Compared to these factors, health and psychological factors are very meagre but significant. Religious factors are not in a considerable amount leading them to old Age Home.

Here economic factors of elderly based on age, education, income, marital status etc. are analysed.

Table 2: Age and Economic factors leading to old age home

Age	Economic factors			Total
	Low	Medium	High	
60-69			$_{38}56\ ^{100}$	56
70-79	$_{50}1\ ^{1.5}$	$_{100}1\ ^{1.5}$	$_{44}64\ ^{97}$	66
>80	$_{50}1\ ^{4}$		$_{18}27\ ^{96}$	28
Total	2	1	147	150

The above table shows that how age with economic factors are related and push them to institutions. Majority elders especially

younger age group enter into institutions, due to economic problems as their major factor compare to senior elderly. Among middle old, 1.5 per cent have low level economic problems for this and 1.5 per cent medium economic factor and 97 per cent have high level economic problems and it push them to institutions. Among oldest old, 4 per cent have low level problems and 96 per cent high level problems. Among members have low economic problems, 50 per cent belong to middle old and 50 per cent oldest old. Among medium category 100 per cent belong to middle old. Among high problem category 38 percent belong to young old, 44 percent medium old and 18 percent oldest old. The study found out that among the youngsters, majority pushed into Old Age Home due to their high economic problems and compare to seniors, youngsters' number is very high. That is, younger age group elderly enter in to institutions because of high economic problems than seniors.

From this researcher pointed out that as the age decreases the problem become more severe in old age home. This indicates the new trend of industrialisation and individualisation percolates to the grass root level. In coming years these trend may increase more prominently. Modernization and westernization put elderly in more complicated condition. Society is facing tremendous changes in economic structure. Elderly female folk are the most negatively influenced by this. They are desperately deteriorated due to this. This tendency unpredictably increased in future also if we didn't take necessary steps to stop this nature.

Table 3: Religion and Economic factors leading to old age home

Religion	Economic factors			Total
	Low	Medium	High	
Hindu			43 63 100	63
Muslim			27 40 100	40
Christians	100 2 4	100 1 2	30 44 94	47
Total	2	1	147	150

In the above table religion and economic problems are analysed. The study pointed out that all Hindus and all Muslims enter into Old Age Home because of high economic problems. Among high problem holders 43 per cent belong to Hindus, 27 per cent belong to Muslims and 30 per cent belong to Christians. Among Christians only 4 per cent belong to low problem category and 2 per cent to middle category. The analysis found out that religion not considered as a factor for pushing them to institutions. One interesting point noticed here that among the all religions, elderly pushed into institutions due to high economic problems than any other factor. That is, religion is not an influencing factor for enter into institutions.

From this it is concluded that any particular religion alone can't load the sin of economic problem. There is any strong tie up of religion and economic problems cannot see. Religious activities not much related to economic activities. In India, for centuries, women have been pushed aside from the path of development in the name of customs, tradition and religion. Lack of progress is due to low public awareness of gender issues, strong traditional practices and values, the caste system and religion- but more because of lack of cooperation from key stakeholders (Ghosh, Ray and Chande, 2002).

Table 4: Caste and Economic factors leading to old age home

Caste	Economic factors			Total
	Low	Medium	High	
General	100 2 [2]	100 1 [1]	76 112 [97]	115
SC			10 15 [100]	15
OBC			14 20 [100]	20
Total	2	1	147	150

In the above table caste and economic problems are analysed. Almost all members except 3 per cent belong to high economical problems group, which lead them to old age home. Out of 150, 2 respondents belong to low level problems group and 1 per cent has medium level problems. One interesting thing noticed here that among the SC and OBC elderly, cent percentage of them enter into Old Age Home because of high economic factors.

From the table, inferred that we cannot blame against a single caste for the pity condition faced by elderly. Several articles call elderly as vulnerable within the vulnerable. This table also verify the same. Age old traditions have a strong bond on its members. This study gives an indication to the breakage of this bondage. Caste exerted tight constraints on women. This control involved two major aspects. One was women's disinheritance from immovable property in the form of land, and their exclusion from the productive economy involving removal from public life to the domestic sphere. The second was the far greater control exercised by men over women's sexuality, imparted through the new law books known as the Smritis. (Gupta, 2001).

Table 5: Education and economic problems leading to old age home

Education	E Low	Economic factors Medium	High	Total
Illiterate			$_{33}$ 49 ^{100}	49
Primary	$_{50}$ 1 ^{1}		$_{61}$ 89 ^{99}	90
Secondary			$_{6}$ 9 ^{100}	9
Degree	$_{50}$ 1 ^{100}			1
>Degree		$_{100}$ 1 ^{100}		1
Total	2	1	147	150

Education and economic problems analysed here and it indicated that both between a inverse relationship. Among high level economic problem holders 33 per cent are illiterate and 61 per cent have primary level education. Only 6 per cent have secondary level education. Among primary levels, 1 per cent has low level problems. 100 per cent degree holders have low level problems, at the same time 100 per cent of the above degree levels have medium problems lead them to institutions.

Researcher points out that educational qualification of the respondents have much importance for leading them to Institution. Our society is a patriarchal type. In this society, women are participating only in supporting jobs which do not pay much. Earlier studies argue that female headed families face huge amount of economical problems. Most of them lie below poverty line. This is proven true through this table. Earlier studies indicate that Kerala female folk unfortunately unable to transfer their educational qualification to increase their economical level.

Table 6: Marital status and Economic factors leading to old age home

Marital status	Economic factors			Total
	Low	Medium	High	
Married			2 3 100	3
Widow	50 1 1	100 1 1	67 98 98	100
Separated			4 6 100	6
Unmarried	50 1 2		27 40 98	41
Total	2	1	147	150

Marital status and economic factors are analysed in above the table. Only among widows 1 per cent lies in low level problem holders and 1 per cent in medium levels. Among unmarried members only 2 per cent lie in low level problem holders and 98 per cent lie in the high level problem holders. 100 per cent separated members have high level problems lead them to institutions. Among the married elderly, 100 percentage enter into institution due to high level economic problems. Among low level problem holders 50 per cent lie under widow category and 50 per cent under unmarried sector. The study found out that widows and unmarried number is very high compare to married. That is, our family system give a chance to live in family to married women.

Through this study, researcher point out that in old age home most of them are unmarried and widows. These two elderly category are not fit to live in society and family. Our family system not supported both. Marital status have very significant role in our society. This is not valuable in this particular atmosphere. Marital status has nothing to do in this particular atmosphere to eliminate them from economic problems. Through this age related marital

status explained. Marital status and economic problems are closely related. The increased number of widow in old age home gives the importance of marital status.

Table 7: Region and Economic factors leading to old age home

Region	Economic factors			Total
	Low	Medium	High	
Rural	100 2 [1]		95 140 [99]	142
Urban		100 1 [13]	5 7 [87]	8
Total	2	1	147	150

Region and economic problems are analysed in the above table. Among the 150 respondents, 140 of them from rural and only 8 from urban area. Among rural elderly 1 per cent come to institution because of low level economic problem and 99 per cent come under in high problem category. Under urban category 87 per cent come to institution by economic problem factor as high 1 and 13 per cent by medium level category.

Researcher points out that rural elderly enter into old age home by complicated economic factors. Earlier studies indicate that rural elderly have more complicated problems than their counter parts residing in urban area. This study also confirms the same. Upon losing their traditional moorings, they seek support and justification in the modern sector of urban society, yet quickly become victims of a consumer oriented world in which everything is commoditised, bought and sold. In this amoral and irreligious realm of society, men have become more powerful than ever before, assuming greater rights of action (Pandey, 2009).Women's access

to land ownership is extremely limited. The majority of rural women depend on agriculture which is major unorganized sector in India. The lack of facilities to acquire skills and unavailability of opportunities to enter other fields has made them desperate and depressed (Subramanyam, 2010). This gives an indication of importance of region in economy. So researcher analysed the importance of region in economic factors of elderly to institution.

Table 8: Income and Economic factors leading to old age home

Income	Economic factors E Low	Medium	High	Total
Nil			98 144 100	144
<500			1.4 2 100	2
500-1000			0.6 1 100	1
1000-2000	50 1 100			1
>2000	50 1 50	100 1 50		2
Total	2	1	147	150

The table shows that there is an inverse relationship between Income and economic factors. One interesting thing noticed here that the three groups of income (nil, <500 and 500-1000) respondents revealed due to their high economic problems, enter into institutions. Among high level problem holders, 98 per cent belong to the elderly do not have any income. 1.4 per cent have income less than rupees 500 only and 0.6 per cent have income rupees 500-1000. Among medium levels have income above rupees 2000. Among low levels problem holders 50 per cent have income rupees 1000-2000. Remaining 50 per cent belong to the category have income greater than rupees 2000.

Researcher points out that surely income has significant role to remedy their economical problems. Majority of the elderly belong to the no income class, due to the absence of income, they have complicated economical problems and these economic problems are considered as the major factor to push them to institutions. Very few have income which not sufficient for their daily living. That group also dipped into Old Age Home. Earlier recorded data's are proven through this. According to United Nations Report, women constitute half of the world's population perform nearly two-third of work hours, receive one tenth of the worlds income and own less than one hundred per cent of the world's property. The low value for female life is the biggest problem (Khan, 2010).

Conclusion

Ageing population and feminisation among elderly are major problems have to face by societyand sociologists. Ageing process is the outcome of advancement in scientific knowledge. But the human being fails to incorporate these advances to society's well being. Otherwise society fails to give enough places for elderly in the natural world. Society alienated elderly and put them in recycle bin-"old age home". Industrialization and westernization lead people to individualization. Individualization devaluate our old ethics. Our revered elderly desperately deteriorated. Objective of this study is major factors lead elderly to old age home. The design uses primary and secondary data. The primary data about the elderly for the study have been collected through structured interview schedule among elderly women in Kerala. The secondary data are derived from books, journals, reports, newspapers and online media on the subject.

150 samples selected from old age homes in Kerala with the help of Simple Random Sampling. Out of 150 samples, 50 samples from Thiruvananthapuram, 50 from Kozhikode and 50 from Thrissur old age homes. Data collected through structured interview schedule were analysed with SPSS.

Major findings of this study are

1) The present study found out that economic and family problems considered as the major factors to push them to institutions.

2) The study found out that among the youngsters, majority pushed into Old Age Home due to their high economic problems and compare to seniors, youngsters' number is very high. That is, younger age group elderly enter in to institutions because of high economic problems than seniors.

3) The analysis found out that religion is not considered as a factor for pushing them to institutions. One interesting point noticed here that among the all religions, elderly pushed into institutions due to high economic problems than any other factor. That is, religion is not an influencing factor for enter into institutions.

4) Researcher found out that we cannot blame against a single caste for the pity condition faced by elderly. One interesting thing noticed here that among the SC and OBC elderly, cent percentage of them enter into Old Age Home because of high economic factors. Several articles call elderly as vulnerable within the vulnerable. Age old traditions have a strong bond on

its members. This study gives an indication to the breakage of this bondage.

5) The study found out that there is an inverse relationship between education and economic problems, which pushed them to institutions. Among the educated elderly nobody have economic problems and this economic problem compel them to institutions. Our society is a patriarchal type. In this society, women are participating only in supporting jobs which do not pay much. Earlier studies argue that female headed families face huge amount of economical problems. Most of them lie below poverty line. This is proven true through this study. Earlier studies indicated that Kerala female folk unfortunately unable to transfer their educational qualification to increase their economical level.

6) The study found out that widows and unmarried number is very high compare to married enter into institutions by economic factor. That is, our family system give a chance to married women, live in family. Marital status have very significant role in our society.

7) Researcher points out that the rate of the rural elderly residing in old age home is very high compare to urban elderly. That is, study found out that rural old people enter into institutions due to their economic factors than urban elderly. Earlier studies indicated that rural elderly have more complicated economic problems than their counter parts residing in urban area. This study also confirms the same. Upon losing their traditional moorings, they seek support and justification in the

modern sector of urban society, yet quickly become victims of a consumer oriented world in which everything is commoditised, bought and sold. In this amoral realm of rural society, men have become more powerful than ever before.

8) The study found out that there is an inverse relationship between Income and economic factors. Researcher points out that surely income has significant role to remedy their economical problems. Majority of the elderly belong to the no income class, due to the absence of income, they have complicated economical problems and these economic problems are considered as the major factor to push them to institutions. Very few have income which not sufficient for their daily living. That group also dipped into Old Age Home.

9) Researcher points out that surely income has significant role to remedy their economical problems. Majority of the elderly belong to the no income class. Due to the absence of income they have complicated economical problems. Very few have income which not sufficient for their daily living. Earlier recorded data's are proven through this. This indicates the seriousness of the problem.

Suggestions

1) Make awareness among elderly and society about their significant role have to play in old age.

2) Take necessary steps to increase their economical status.

3) Make our family bonds more strong enough to protect our elderly.

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THE EDIBLE ART IN *SALT N' PEPPER*

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Food and drink figure into our everyday lives in a number of ways. Food has become a subject of art, continually inspiring artists and writers. Functionally, food is "a substance taken to maintain life and growth" (Oxford Dictionary 291). Aesthetically, it is a sensory experience, a form of beauty not tainted by violence (http://food andwineaesthetics.com/category/art-and-food-2/). Culturally, it "is a many- splendoured thing, central to biological and social life" (Counihan and Van Esterik 1).

Eating and drinking bear symbolic, aesthetic, spiritual, economic, cultural and social values. Food belongs simultaneously to the world of aesthetics, economics and culture. Food as an object of aesthetic experience appeals to our senses. We describe it in terms of its visual presentation and sensual composition. It is very difficult to disentangle food from its web of production, distribution, and consumption. Economics tries to find answers to the "who?" questions: who farms, who trades, who eats, who cooks, who manages waste, who profits, and so on. Food is central to religious traditions throughout the world. Religions typically prescribe which food should be eaten and which should be avoided; they assign significance to food production, preparation, and consumption; and they connect

dietary regimentation with moral conduct and spiritual salvation. Food and culture define one another. Food preparation and consumption are bound to the beliefs, practices, and laws of nations and cultures.

Food has become a recipe for success in Malayalam cinema. The New Wave Kitchen opens with Aashiq Abu's *Salt N' Pepper* (2011) and the trend continues in Anwar Rasheed's *Ustad Hotel* (2012). More and more movies in the food genre are being produced in Malayalam film industry. Food has a special relevance and makes its presence practically everywhere in these movies. The films weave into their narratives the love for well-cooked food and food turns out to be a strong base connecting various stories.

This paper attempts to interpret the images of food in the movie *Salt N' Pepper*. The objective is to look at the presentation of food as an aesthetic object, a contextualized object and a marker of identity. The social and cultural functions of food are also examined.

Salt N' Pepper (2011), directed by Aashiq Abu brings into its canvas a world signified by food or rather food becomes a real sign and in this process juxtaposes the questions "eat to live" or "live to eat". The ingredients and flavours, techniques of preparation, utensils used, all form a part of the system of differences in signification. The film discusses food as a code to create and share meanings with others.

Food appears throughout the movie as a subject of aesthetic judgement. The decorative use of food appeals to the viewer's senses. Vivid scenes of food preparations and consumption are consistently shown. The tagline of the film is *Oru Dosa Undakkiya Katha* ("The story born out of a Dosa") and the subtitle is "Somethin's cooking".

The title song *Chempaavu Punnellin Choro* composed by Rafeeq Ahamad is a visual fiesta featuring Kerala cuisine. Images of brown *unniyappams*, multi coloured halwas, yellow jelabis, crispy banana chips, big dosas, *mulakaracha meen curry*, *palada pradhaman* and hot *mulamkutti puttu* filled the screen. Colours, flavours, textures, aromas and the sounds of cooking enhance the experience of tasting and eating.

The movie identifies the many food spaces right from *thattu kada* and tea stalls to popular hotels in Kerala, the different occasions like festivals, marriages where food is cooked and served and the best combinations like dosa-chutney, *kappa-meen curry*, *puttu-.kadala* and *uppum mulakum*.

Food is inextricably intertwined with the emotions of the characters and is rarely shown without food or references to food. Kalidasan falls in love with Maya as she rings him to order "Thattil Kutti Dosa". Babu's culinary skills made him the cook of Kalidasan. He is from Kottarakara and is good in making *unniyappam*. Everyone enjoys Maya's banana fries. Manu stares at Meenakshi, with the froth of a hot coffee over his upper lip. Balakrishnan, an officer at an excavation site, explains the impact of a steaming hot tea, after a terribly drunken night. And the lecherous technician who's after Maya at work, always has something to chew.

The consciousnesses of the characters are interpreted in terms of food. The involvement in food preparation becomes a conscious strategy to come in terms with the sense of loss. *Salt N' Pepper* employs food preparation as a narrative strategy to tell stories, to evoke memories and to represent the desires of the body. Maya is

indulging in culinary activities in memory of her dead mother. She brings her mother back to life through cooking. Here food permits the return to the past and becomes a space for realization of the absent. The absences are given a presence through food. Food acts as a metaphor in depicting multilayered relationship. Kalidasan tells Maya the secrets of baking a multi-layered cake known as Joan's Rainbow cake, made by a French soldier's wife as the Second World War raged on, when she anxiously waited for her husband. The sequence of baking the cake is saturated with love. The cake ascertains romance. Thus food locates the dislocated. Each meal cooked is a realization, a recollection and a relocation.

The film includes within its purview not only the enjoying of food but also the dislike towards food. Kalidasan cannot enjoy the food prepared by Babu when his mind is tensed. Manu calls the drink (enjoyed by Kalidasan and Babu) *koora rum*. Mujeeb's tea is mocked as *oola chaya*. The movie has many scenes of eating food in the presence of good company. Food has provided a fruitful site for understanding social relations, family and kinship.

The meanings and significance of food extend far beyond its nutritive function. Roland Barthes in his essay "Toward a Psychosociology of Contemporary Food Consumption" defines food:

For what is food? It is not only a collection of products that can be used for statistical or nutritional studies. It is also at the same time, a system of communication, a body of images, a protocol of usages, situations and behaviour. (21)

The cooked meals on the table brings in memories. Nostalgia is a form of selective memory, history without errors enabling us to

enjoy the past without guilt. The contemporary culinarians in the movie are longing for a return to the old days. Rather than a return to the past, the contemporary fascination with food traditions is a reinterpretation and recontextualization of the past with an eye toward a better tasting future.

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COMPARATIVE STUDY OF TWO SELECTED PTERIDOPHYES OF CARMEL COLLEGE CAMPUS

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ABSTRACT

In this present study we attempted to depict the variations and similarities of two selected pteridophytes of varying habitats from our campus namely Pteridium and Ceratopteris by studying morphological, anatomical and palynological studies. The study points towards the fact that each pteridophyte is specially adapted to its own habitat by morphological, anatomical and palynological features.

Key words: *Ceratopteris, Pteridium, Palynology, habitat.*

Introduction

Pteridophytes are a group of higher cryptogams possessing a well developed vascular system, hence also called vascular cryptogams. The name pteridophyta was originally assigned to this assemblage of plants by Hackel because of the presence of pinnate or feather like leaves. In the plant kingdom, pteridophytes occupy as a position between bryophytes and gymnosperms.

Most of living members are terrestrial and prefer to grow in cool and shady places while some are xerophytic, eg: *Selaginella rupesrtis*. Many pteridophytes are found on aquatic conditions, eg: *Marsilea, Salvinia, Azolla, Ceratopteris* etc. Four particular types of

habitats that pteridophytes are found in are (i) most shady forests (ii) crevices in rock surfaces specially when sheltered from the fall of sunlight (iii) acid wetlands including swamps and bogs, and (iv) tropical trees bearing many epiphytic species. Pteridophytes are mostly herbaceous, and rarely climbers (eg: *Lygodium*) and trees (eg. *Schizae, cyathea*). Tree ferns are found in the Himalayas. Adult plant is a sporophyte. The plant body is differentiated into root, stem and leaves. In most general gametophyte or prothallus is simple, green and heart – shaped. Life cycle is with typical heteromorphic alternation of generations.

The classification of pteridophyta has always been arbitrary and unsatisfactory. Different schemes have been proposed by different authors at different times. Pteridophytes divided under 4 divisions. Psilophyta, Lycophyta, sphenophyta, filicophyta; psilophyta included psilophytes, Lycophyta include lycopods, sphenophyta includes horsetails and filicophyta includes ferns.

Economic Importance of Pteridophytes

Food Plants: Some pteridophytes are widely used as a source of food and fodder.

Biological fertilizer: It is commonly called mosquito fern *Azolla* plants are used as biological fertilizer in the rice fields of many countries.

Landscape plants: Several ferns are grown in horticulture as landscape plants, for cut foliage and as house plants. Eg:-*Nephrolepis enaltata, Asplenium nidus.*

Removal of heavy metals: Some ferns like *Pteris vittata*, are found to be useful in the removal of heavy metals, especially arsenic, from the soil.

Ornamental pteridophytes: The beauty of the leaves of several pteriophytes makes them the most sought after plants for lawns, green houses and gardens.

Ecological indicators: Equisetum is an indicator of gold and some other minerals in the soil.

Medicinal value of pteridophytes: Many pteridophytic plants are used for treating several human aliments such as gastro intestinal problems including stomach ache, peptic ulcers, diarrhea and dysentery etc. *Ceratopteris thalictroides* fresh juice of leaves stops bleeding of wounds skin diseases. *Pteridium aquilinum* a) fronds and rhizomes – antiheliminthic astringent b) infusin of plants, urine flow etc..

Review of Literature

Even after the period of over 130 years, the works on pteridophytes were standing as the classical works and are being extensively referred by Pteridologists in India and South East Asia, not only in taxonomy but also for morphology, anatomy and palyonology. Several studies were there in the field of Pteridophytes. Bhutta *etal* in 1987 made a modified technique to study the xylem of plant organ. Carlequest *etal* in 2001 studied about structural, ecological and evolutionary significance of vessels in ferns. Murtaza made morpho palynological studies on climbing fern *Lygodium japonicum* in 2004. Again Murtaza *etal* made

another study onanatomical and palynological studies in some filicales was made in the year 2006. A clear cut view on preserved *Woodwardia* was made by Pig *etal* in 2001. Stewart in 1957 studied about fern and fern allies of Western Pakistan. H.Schneider made a study of endemic fern genus in 2004.R. Tryon *etal*. Al-Sheri *etal* give an illustrated description of *Sellaginella imbricata* from Saudi Arabia in 2009. Bhutta in 1973 studied about germinating spores of pteridophyta. Prantl in 1881 made a study on morphology of Schizean ferns. Palynological study on some species of *Asplenium* by Gamal *etal*.Morphopalynological and anatomical studies on fan fern *schizaea dichotoma* (l.) Smith from Neelum valley, Azad Kashmir was made by Ghulam Murtaza in 2008. Daniels, R. E. In 1985 Studied the growth of Pteridium aquilinum. Williams and Foley, in 1976 seasonal variations in the carbohydrate content of bracken fern. Singh in 1963 made anatomical and ecological studies of some ferns of Mussorie. Chandler in 1905 studied the arrangements of vascular strands of leptosporangiate ferns. Donsellarin 1969 made a study on distribution and ecology of *Ceratopteris* in Surinam.Johnsoninin1961 studied the genus *Ceratopteris* in Malaya.Lloyd in 1973conducted a study on sexual and vegetative reproduction in Hawaiian *Ceratopteris thalictroides*. McGrath *etal* assessed gene copy number in the homosporous ferns Ceratopteris *thalictroides* and *C. richardii* (Parkeriaceae) by restriction fragment length polymorphims. The importance of spore morphology in relation to the plant taxonomy and evolution has been understood since the time high resolutions of microscope revealed the extraordinary architecture of the spore wall surfaces. These advancement in optical technology and in microtechniques, have

served enormously have served enormously in gaining an understanding of the spore wall structure, sculpture and their development, to the benefit of phylogenetic morphologists working in the ferns

Materials and Methods

In this study we examined 2 pteridophytes one of terrestrial and other of aquatic habitat (namely *Pteridum* and *Ceratopteris* respectively) and studied the morphological anatomical and palynological features to make a clear cut view on similarities and differences of these two.

For this study we collected the plant from our College campus and took into the lab and made detailed morphological studies and after that thin anatomical studies were made by taking cross section of various plant parts, the sections were stained in saffranine and mounted in glycerin and examined under compound microscope. For palynological studies we practiced by acetolysis, from the result we made the conclusion.

Result

Pteridium

Kingdom	:	Plantae
Division	:	Pteridophyta
Class	:	Pteridopsida
Order	:	Dennstaedtiales
Family	:	Dennstaedtiacea
Genus	:	Pteridium

Pteridium is commonly known as "Eagle fern" occurring in temperate and subtropical regions in both hemispheres. The extreme lightness of its spores has led to its global distribution.

It is a herbaceous perennial plant deciduous in winter the large roughly triangular fronds are produced singly, arising upwards from an underground rhizome and grow 13cm tall the main stem or stipe is upto I cm diameter at the base it readily colonize undisturbed areas.

Economic Uses

[1] *Pteridium* have been considered edible by many cultures throughout history and are still commonly used today as a foodstuff. Both fronds and rhizomes have been used to brew beer and the rhizome starch has been used as a substitute for arrowroot. Bread can be made out of dried and powdered rhizomes alone or with other flours. It was traditionally used for animal bedding, which later broke down to a rich mulch which could be used as fertilizer. When used by gardeners as a winter mulch it has been shown to reduce the loss of potassium and nitrogen and to lower soil P^H. Other uses were a packing material for products such as earthenware, as a fuel, as a form of thatch. The ash was used for degreasing woolen cloth.

Morphology

Rhizome

(i) Long type:- They arise from the parent axis and grow in the same direction thus penetrating deep in soil. They have longer internodes and to not bear leaves.

(ii) Intermediate:- After their origin from the parent axis they grow obliquely upwards for some distance and then run horizontally. They do not bear leaves.

(iii) Short:- They also grow obliquely upwards and then run horizontally a little below the soil surface. They bear leaves and have short internodes.

Branches of varying length that fall within the range of these 3 type have also been reported. The profusely branched rhizome presents a complicated system of branching and affords an efficient anchorage to the species it is profusely covered with mlticellular hairs, the scales are absent.

The young plant has an unbranched creeping rhizome with 4-10 alternating leaves. It grows under the soil and soon bifurcates dichotomously into 2 equal dichotomies. Each dichotomous branch bears a leaf near its point of origin from the main axis both these branches grow deep into the soil and bear leaves that are arranged in a spiral manner. The axis continues to branch dichotomously but there dichotomies are an equal. The shorter branch bears a leaf it appears short and stumpy so that at maturity it look like a bud at the base of leaf these are remanded is Short shoots. The longer dichotomous branch is regarded long shoot.

Petiole

Petiole is present which is for bearing pinnae. Length of petiole may vary. The young plants bear leaves on the main axis but as the plants grow older the leaves seem to be restricted to the short and thick branches. The older portions of rhizome are beset with bases of old leaves and hair. They arise on the upper side of

the rhizome and are borne in an alternate manner. They arise at an appreciable distance from each other and are circinately coiled when young. A mature leaf may vary in length from 2-12 feet. It is tripinnately compound and has a distinct petiole that is as long as the pinnately divided lamina. The portion of the petiole that extends into the lamina is called the rachis the lower branches of the rachis are longer and gradually decrease in length towards the apex so as to give a deltoid or a conical appearance to the laminar portion.

The pinnules are traversed by a large and prominent mid- rib from which arise lateral veins. The veins run obliquely upwards and the furcate pinnules are firm and rough to touch,sub coriaceous. The petioles are covered with unbranched and multicellular hair.

Sporophylls and Sori

Every leaf in *Pteridium* is a potential sporophyll as there is no segregation of reproductive and vegetative leaves. The ultimate segments of the lamina or the pinnules bear sporangia on their margin. The sporangia develop on marginal receptacles and one grouped in a continuous on a confluent and a linear type of sours. It is also called a coenosorus. As a matter of fact numerous smaller sori occur so close to each other that they lose their identity and appear as one long sorus disposed along the two lateral margins of the fertile pinnales. Sori linear, continuous, situated just inside the inrolled margins; pseudo-indusium continuous.Sorri contains many sporangia which are club shaped.

Spore

Spore numerous inside the sporangia.

Anatomy

Petiole

The petiole is simple in structure. It remains surrounded by a layer of epidermis which is being followed by sclerenchymatous hypodermis and the rest of the inner portion of petiole is being filled by parenchymatous ground tissue. Many vascular bundles are arranged in outer and inner rings. Xylem is surrounded by phloem. Epidermis is single layered and it covered by cuticle. Ramenta arise from some of the epidermal cells.

Pinnule

A T.S through the pinnule reveals that the internal structure is similar to that of a bifacial leaf. These are the usual two layers of epidermis with stomata restricted to the lower epidermis.

In between the two epidermal layer is the mesophyll tissue which is clearly distinguishable into palisade parenchyma and the spongy parenchyma. The cells of this layer contain abundant chloroplasts. The spongy zone is made up of numerous loosely arranged and lobed parenchymatous cells. They enclose small and large intercellular space and contain chloroplast the palisade is absent in region of the veins where the cells are compactly arranged so as to give strength to this region.

The vascular bundle is spherical in shape and is surrounded by a distinct endodermal layer. It may be concentric or collateral.

Sporphyll

A vertical section of the sorus reveals that the receptacle is traversed by a vascular strand that runs underneath the sporangia

and connects the free end of the veins. The sorus is protected by two flaps that grow a little to cover the sporangia from Lower end. The upper indusial flap is formed end the upper indusial flap is formed by the reflexed margin of the pinnule and in well developed. The lower industrial flap is true indusium when the upper flap is a false indusium because it is simply a margin of the pinnule and not a specially developed structure. The lower on the free indusium is not well developed and is a thin sheet at tissue made up of a single layer of thin walled cells.

Sporangium

Sporangium is club shaped with stalk. Many sporangium is present and it has stomium annulus etc. It is homosporous also.

Spore

Globose trilete spores are there with exine and intine.

Ceratopteris

Introduction

Kingdom   -   Plantae
Division   -   Pteridophyta
Class   -   Pteridopsida
Order   -   Polypodiales
Family   -   Pteridaceae
Subfamily   -   Ceratopteridoideae
Genus   -   Ceratopteris

Ceratopteris is the only genus among homosporous ferns that in exclusively aquatic. It is pan tropical and classified in the

ceratopteridoideace subfamily, of the pterodaceae. Erect aquatic or sub aquatic ferns of moderate size. Rhizome short, fleshy, horizontal and ascending to erect, loosely rooted in the mud. Floating, radial, dictyostelic with numerous meristele and medullary strands, young parts bearing thin, ovulate, cordate, clathrate scaler. Fronds stipulate, the stripes fleshy with numerous longitudinal air canals, abaxially sounded and ribbed, adaxially flattened, vascular bundles in a peripheral ring, one with each rib and several smaller medullary strands, lamina dimorphic sterile frond spreading, 2-3 pinnatified with broad membranous leaves, venation reticulate without induced free vein lets, fertile fronds erect, longer, narrower and more divided then the sterile, the lobes strongly curved to completely cover the adaxial surface, venation longitudinal branching at the bases of the lobes. Sporangia Solitary, Scattered Along The Veins, Exinduciate But Protected By The Continuous Reflexed Margin Of The Lamina, Large, Short – Stalked, Annular Broad, Irregular, Of 30-70 Thickened Cells, Or Lacking, Containing 16 To 32 Spores. Spores Large Frile, Ribbed With Irregular Long Meshes.

Economic Use

It Is A Fairly Popular Aquarium Plant, Often Sold Under The Name "Water Spirit". It May Be Grown As An Emerged (Floating) Plant Or As An Immersed Plant Rooted In The Substrate. The Most Common Species In Aquarium Use. Plants Of This Genus Have Also Been Used For Food, As A Green, With Common Name "Water Lettuce". However, It Is Now Known That These Ferns Are Also Carcinogenic If Ingested.

Morphology
Leaves

The Leaves Are Dimorphic. The Sterile Leaves Are Spreading With The Broad Lamina, Which Is Two Or Four Times Divided Pinnate Or Trifoliate. Fertile Leaves Are Erect And Are Divided Into Narrow Segments. 2-3 Pinnafied With Broad Membranous Leaves, Venation Reticulate Without Included Free Vein Lets

Petiole

The Stem Is Small And Fleshy With Leaves On Its Upper Surface And Whorls Of Adventitious Roots At Its Base. In Young Condition They Shows Circinate Vernation

Morphology of Sporphyll

The sporangia are sub sessile and leptosporangiate in development. They extend linearly forming two parallel rows on either side of narrow leaf, and are protected by inrolled leaf margin. The young sporphyte is protostelic.

Sporngium: Linerra sporangium with false inducium. Inducium is formed by rolling of leaf margins. Coenosorus also.

Spore

Many spores which are trilete, with mesh like carvings on the surface.

Anatomy
Petiole

The petiole is simple in structure. Epidermis is single layered. Its cells have heavily cutinized outer wall. The cortex is differentiated

into outer chlorenchymatous and inner sclerenchymatous regions. Chlorophylls are embedded in aerenchyma, it has a polycyclic dictyostele.

Spore

Spore trilete, ribbed with irregular long meshes spore are alike but germinate to produce gametophytes of two morphologies. All spore are a kind.

Comparison between *Pteridium* and *Ceratopteris*.

Similarities

	Pteridium	Ceratopteris
Leaves	Pinnate	Pinnate
Meristele	Present	Present
Spore	Homosporus	Homosporus
Number of spores	Numerous spores	Numerous spores
Vegetative reproduction	By spores	By spores
Uses	Freshly edible	Freshly edible
Life cycle	Alteration generation (heteromorphy)	Alteration of generation (hetromorphic)

Differences

	Pteridium	Ceratopteris
Rhizome	With special type of branching	No such branching
Leaves	Homophyllous	Heterophyllous
Inducium	True inducium present	False inducium
Spore	Trilete spores without meshes	Trilete spores with meshes
Anatomy	Without air spaces	With large air spaces

Discussion

According to Carlquist in 2001 vessel presence and degree of specialization in Pteridium vessels may bear a relationship to the wide ecological tolerances of the genus. Bhutta in 1987 stated that the xylem of pteridophytes are related to its living habitats. Murtaza 2009 also reported that the structure, shape etc of pteridophytes are also related with their living patterns. Gamal studied that morphoanatomical and palynological features of Schizea dichotomous is suitable for its habiat and life pattern. As per our study also there is variation in morhoanatomical and palynological features of the selected ferns of the study in accordance with the living conditions. These are certain adaptation for their life.

Summary and Conclusion

In this present study we examined to depict the variations and similarities of two selected pteridophytes of varying habitats from our campus namely *Pteridium* and *Ceratopteris* by studying morphological anatomical and palynological studies. The study points towards the fact that each pteridophyte is specially adapted to its own habitat by morphological, anatomical and palynological features.

Inspite of many similarities there are differences between the two different ferns of different habitats. There are so many differences which help them to lead a comfortable life of their own in their native places. They have their own morphological, anatomical and palynological adaptation suitable for their habitat and life cycle.
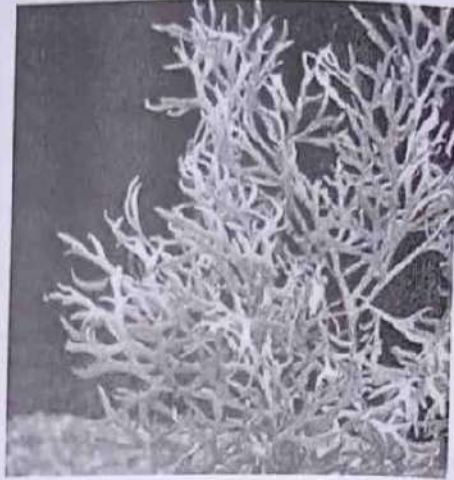
Ceratopteris

Ceratopteris petiole T.S.
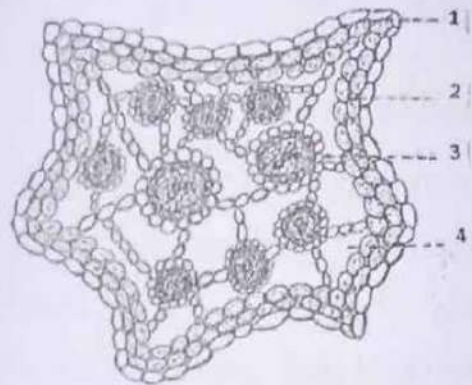
1.Epidermis 2. Hypodermis 3. Vascular bundles 4. Air space

Ceratopteris Fertile sporophyll T.S.
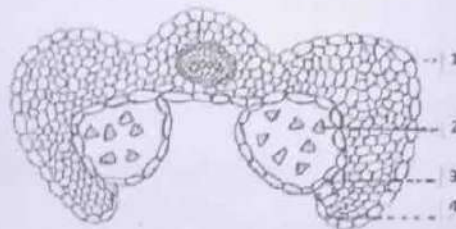
1. Epidermis 2. Sporangium 3. Spore 4. Indusium

Ceratopteris spore

Pteridium

Pteridium petiole T.S
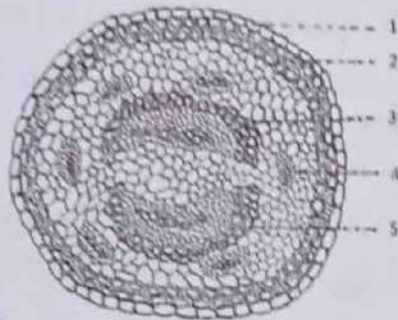
1. Epidermis 2. Hypodermis 3.Sclerenchyma patch 4. Outer vascular bundle 5. Inner vascular bundle

Pteridium sporophyll T.S.
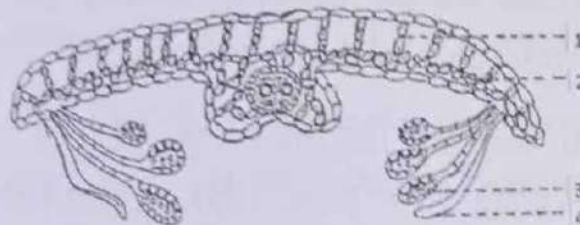
1. Palisade 2. Spongy tissue 3. Sporangium 4. indusium

Pteridium spore

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न्यायमूर्ति वी. आर. कृष्णय्यर

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भारतीय विधि - न्याय व्यवस्था की नीति ज्वाला जस्टिस वी आर कृष्णय्यर का स्वर्गवास हुआ। विधि व्यवस्था को मानवता के साथ जोड़नेवाले आप साधारण आदमी के पक्षघर होकर जीवन भर सामाजिक न्यायकर्ता के रुप में कार्य करता रहा। अच्चतम न्यायालय में न्यायाधीश के रुप में पैंतीस वर्षों तक वे कार्यरत रहे। अपने को जीवन के विविध क्षेत्रों में कार्यकुशल स्थापित किया। सुप्रसिद्ध नयाय - कर्ता, जन - प्रतिनिधि, समाज सेवी के रुप में आप महान कर्मयोगी स्थापित हुए। समाज कल्याण ही उस मनुष्य - स्नेही का एकमात्र लक्ष्य रहा। जीवन की भीड़भाड़ में उपेक्षित आम जनता के पहरेदार बनकर वे काम करते रहे। विधि - नयाय व्यवस्था को साधारण जनता से ज़ोड़ने का महत्वपूर्ण प्रयास आपने ही पहली बार किया था। अपने विरुद्ध जो भी विचार विमर्श हुए थे, उनके प्रति सहिष्णुता के साथ अटल होकर, धीरोदात्त बनकर अपने कर्मक्षेत्र में कृष्णय्यर आगे बढ़ते रहे। केरलीय समाज में आप विशेष रुप में हस्तक्षेप करके लोगों का ध्यान आकर्षित किया था। बिना कोई पूर्वानुमान से वे समाजिक क्रियाकलापों का आलोचना किया करते थे। उनके विचार विमर्शें में तीव्रता और सामाजिक दायित्व उभरकर सामने आते हैं। प्रसिद्ध वकील एफ.एस नरिमान उनके संबन्ध में ऐसा कहा था कि, "When the justice krishna Iyer speaks the nation listens" सर्वोच्च न्यायालय और उच्च न्यायालय में वे न्यायाधीश रहे। विधि व्यवस्था को नये रुप में ठयाख्यायित करने का जो परिश्रम उन्होंने किया था, ज्यादा सराहनीय है। देशभर में उनके प्रस्तावों पर चर्चायें हुआ था। सौ साल की सार्थक जीवन बिताने के बाद, अब वे अपने कर्मपथ से हमेशा के लिए जा चुके हैं।

एडवोकेट वि.वी रामय्यर और नारायणी अम्माल के सुपुत्र बनकर आपका जन्म उन्नीस सौ पन्द्रह (1915) नवंबर को केरल के पालघाट जिला में शेखरीपुरम गाँव में हुआ था। तमिलनाडु के अण्णामलै विश्वविघालय से बि.ए और मद्रास विश्वविघालय से बि.एल की उपाधि प्राप्त की। इसके बाद अपने पिताजी की तरह वे भी मलबार, दक्षिण कानरा और कूर्ग के अदालतों में वकालत करने लगे। वामपंथी विचारों से आप बेहद प्रभावित थे। साम्यवादी विचारधारा के सहयात्री होने पर भी वे आस्थावादी रहे। आप सच्चे ईश्वर भक्त थे। वामपंथी कार्यकर्ताओं की वकालत भी करते थे। लोग ब्यार से उन्हें स्वामी पुकारते थे। उन्नीस सौ बावन में (1952) कण्णुर जिला के कुतुपरम्बु से स्वतंत्र उम्मीदवार के रुप में मद्रास विधानसभा के चुनाव में चयनित हुआ। उन्नीस सौ सत्तावन (1957) के चुनाव में तलश्शेरी से वामपंथी स्वतंत्र उम्मीदवार बनकर प्रथम विधानसभा में सदस्य बने। इ.एम.एस नंपूतिरिप्पाडु के नेतृत्व में केरल के सर्वप्रथम मंत्रिमंडल में विधि मंत्री बन गये। समाज - कल्याण, बिजली, गृह कार्य आदि विभागों का कार्य - संभालन भी आपने किया था। उन्नीस सौ अड़सठ (1968) से तीन साल तक वे केरल

के उच्च न्यायालय के न्यायाधीश रहा। उन्नीस सौ तिहत्तर (1973) में ' लो कम्मीशन' का सदस्य बनकर अपना कर्मक्षेत्र दिल्ली बना लिया था। उन्नीस सौ तिहत्तर (1973) मैं आप सर्वोच्च न्यायालय के न्यायाधीश बने और साढ़े सात वर्ष तक नीति देवता का संरक्षणकार्य करता रहा।

केरलीय समाज के लिए उनका योगदान सराहनीय हैं। भु- स्वामित्व से संबन्धित क्रान्तिकारी नियमों के कार्यकर्ता के रुप में आपका नाम प्रथम में आता है। अनेक सिंचाई योजनाओं का प्रारंभ भी, मंत्री बनकर उन्हें ही किया था। उन्नीस सौ उनसठ (1959) में जब विधानसभा का विघडन हुआ वे फिर उच्च न्यायालय के कर्मयोगी बन गये। 'लो कम्मीशन' की सदस्य बनकर आपने आम आदमी की परिरक्षण केलिए नियमों को नये रुप में लागु करने की कारवाइयाँ की थी।

प्रगतिशील और परिवर्तनशील विचारों को उन्होंने न्याय - प्रस्तावों में अपनाया था। जब कभी न्यायपालिका अपना कर्तव्य भूलकर पथभ्रष्ट होने लगा था, आप स्वंय मशाल लेके उसे अपने पथ दिखाया था। न्यायपालिका का विचार विमर्श आप समय - समय पर किया करते थे। अदालती कारनामों का विचार - विमर्श करते समय उन्हें कभी भी न्यायालय - अवमान का भय नहीं हुआ। सही लगने पर वे अपनी राय निर्भोक होकर प्रकट करता रहा। कानून की व्याख्या उन्होंने अनुच्छेदों के धरातल पर मात्र नहीं किया था। मानव प्रेम ही उनकी मुख्य मुद्दा रहा। आम जनता को नीति देवता से जोड़ने का भरसक प्रयास आप करते रहे। लोकहित के लिए मुक्दमेबाजी करने की आवश्यकता पर उन्होंने जोर दिया। उच्चतम न्यायालय में न्यायाधीश रहकर वे अपने नाम को भारतीय इतिहास में सुवर्णाक्षरों से जोड दिया था। उनके न्याय - प्रस्ताव संपुर्ण भारत का ध्यान आकर्षित करता रहा। भूतपूर्व प्रधानमंत्री श्रीमती इंदिरागाँधी से जुडे इलाहाबाद उच्चन्यायालय के अभिनिर्णय पर उच्चतम न्यायालय के न्यायाधीश के रुप में इंदिरागाँधीजी की सदस्यता रद करने का जो न्यायिक निर्णय उन्होंने लिया था बहुचर्चोत रहा। यह निर्णय देश में आपातकाल की घोषणा के लिए कारण बना था। इसी तरह के अनेक महत्वपुर्ण प्रस्ताव उनके द्वारा किये गये। 'रत्लम नगरपालिका केस' के दौरान उन्होंने नगरपालिकाओं की कर्तव्यों पर विशेष रुप की बातें प्रस्तुत की। उच्चतम न्यायालय में कर्मरत होते समय आप सात सौ तक के गंभीर और महत्वपुर्ण न्याय प्रस्तावों को भारतीय समाज के सामने रखा था। मौलिक अधिकारों को नई परिप्रेक्षय में देखने का और भारतीय संविधान की पुर्नब्याख्या करने का कार्य भी आपने ही किया था। 'लोकअप् उत्पीड़न' को रोकने के लिए डि.के बसु केस के संबन्ध में जो ग्यारह अनुदेश उनके द्वारा रखे गये थे, ज्यादा सराहनीय रहा। जेल - कैदियों के संबन्ध में जो निर्णय लिया गया, महत्वपुर्ण स्थापित हुआ। कैदियों को भी अपना संवैधानिक अधिकार है। उन्हें हथकड़ी पहनकर जेल में नहीं रखना चाहिए। व्यक्तिगत स्वतंत्रता का संरक्षण करना कानूनी व्यवस्था का दायित्व है। कानून और संविधान की आधारशिला मानवता से बने हुई होना चाहिए। एक बार कान्सर रोगी सेब्यर का मुकदमा उनके सामने आये। वह बेंक कर्ज चुकाने में परास्त हो गया था। कृष्णय्यर ने विधि - प्रस्ताव करते समय पूछा कि, मैं सेब्यर से कर्ज चुकाकर इसे मृत्यू के लिए छोड दूँ या इनके हाथ में जो पैसा है, उसके संबल इसे इलाज केलिए भेज दुँ? मनुष्य स्नेही कृष्णाय्यर के जीवन में इस तरह की कई उदाहरण हम देख सकते हैं।

समाजिक विकास के अनुरुप इस्लाम - धर्मो नियमों में फेरबदल लाने का विनम्र सुझ्झाव भी

ऊन्होंने रख लिया था। उनके व्यंग्यपूर्ण आलोचनात्मक वक्तव्यों के लिए कई उदाहरण प्राप्त हैं। एक बार उच्च न्यायालय को छुट्टी देकर कुछ न्यायाधीशों ने क्रिकेट देखने गया था, तब उन्होंने व्यंग्य रूप में कहा था कि क्रिकेट कोई 'जुडीष्यल गेम' नहीं हैं। न्यायपालिका की आलोचना करने में वह कभी हिचकते नहीं थे।

उनकी भाषा में अभूतपूर्व प्रवाह था। उनकी काव्यमयी भाषा न्याय - प्रस्तावों को ओर भी सुन्दर और गंभीर बनाया। अंग्रेज़ी भाषा में उनका ज्ञान अपार था। विधि प्रस्तावों से जुड़कर जो भाषाई प्रयोग किये गये, आक्सफोर्ड कोश में भी स्थान प्राप्त कर चुके हैं। हिन्दी भाषा के प्रति भी उसका विशेष ब्यार था। वे हिन्दी भाषा की हितैषी थे। केरल के हिन्दी प्रचार - प्रसार संस्थाओं से उनका विशेष संबन्ध रहा।

'Wandering in many worlds' आपकी आत्मकथात्मक रचना है। सौ से अधिक कृतियाँ और कई आलेखों की रचना उन्होंने की हैं। इसमें ज्यादातर विधी कानून संबन्धी हैं। न्यायालय से सेवनिवृत होने पर भी वे समाजसेवी रहा। संपूर्ण मानवकुल की उन्नति उनका लक्ष्य था। भारतीय समाज के समस्त दैनिक किया - कलापों में आप अपनी अन्तिम दिनों तक विचारात्मक, ओजपूर्ण वक्तव्य प्रकट करता रहा। जनता आपकी राय जानने को बेहद इच्छुक थे। उनका निधन भारतीय नियम व्यवस्था को भारी नष्ट पहुँचा दिया है। भारतीय नीति व्यवस्था के मानवीय मुख का अस्त हो गया है। नीति व्यवस्था को मार्ग दर्शने केलिए आपकी वादों की प्रज्वलित ज्योति हमेशा वहाँ जलते रहेंगे। मानवता के उपासक एंव विधि - वेता जस्टिस वि.आर कृष्णय्यर को सादर प्रणाम और श्रद्धांजलियाँ।

NATURE, NURTURE AND NATION IN MAGGI ADVERTISEMENTS

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Recently, several Indian states including Kerala banned Nestlé's Maggi instant noodles sale. Food Safety and Standards Authority of India (FSSAI) banned all nine approved variants of Maggi instant noodles along with oats masala noodles suggesting them unsafe and hazardous for human consumption. Besides Nepal, Maggi noodles has also been withdrawn in five African nations - Kenya, Uganda, Tanzania, Rwanda and South Sudan by a super-market chain after a complaint by the Consumer Federation of Kenya. It was revealed later that the United States Food and Drug Administration (FDA) had refused import of the noodles in January 2015 on grounds similar to the reasons for ban in India. FSSAI has identified three problems with Maggi. Lead levels in Maggi noodles are higher than the permissible quantity and they contain MSG. They have done misleading labeling of products and released their product oats masala noodles without approval.

Nestlé has been reprimanded earlier for its advertising for not adhering to marketing regulations in developed countries and making misleading claims in developing countries. In October 2008, Nestlé mistakenly aired an advertisement intended for Bangladeshi Television on British TV. The commercial made false claims that the noodles would "help to build strong muscles, bone and hair". The British Advertising Standards Authority said that the

advertisementdid not abide by the new European Union Consumer Protection Legislation, by which advertisers have to give proof of health claims.

Nestlé introduced Maggi 2 Minute Noodles in India in 1982 when the only place to get noodles was Chinese restaurants. Its success in India is closely connected with the country's first indigenous soap opera *Hum Log* which began its telecast on 07 July 1984. Doordarshan entered into a contract with Food Specialties Limited, the Indian subsidiary of Nestlé to sponsor the production of the serial in return for the rights to nationally advertise its product - Maggi 2 Minute Noodles – during, before and after each episode. Maggi's launch in the total advertisement slots of just 5 minutes during the breaks of serial which ran for over 156 episodes helped the product to establish a brand identity as snack food across the country. This reached to sixty million viewers across India in 1984-85. There was a huge hike in the national sales figures for the product after the company's sponsorship of *Hum Log*. The sales for Maggi noodles "increased from none in 1982 to 1,600 tons in 1983, 4,200 tons in 1985, 10,000 tons in 1990 and 15,000 tons in 1998." (Qtd. in Kumar, 33) In a little while, the Food Specialties Limited campaign for Maggi noodles became a textbook example of how a company could advertise and market new consumer products on Indian television. Till ban, they have enjoyed 90% of the instant noodles market in India and claimed India to be Maggi's largest market for instant noodles in the world. Due to ban, Nestlé India's shares at the Stock Exchange fell. The biggest worry for the Swiss Company is the loss of popular trust in the Maggi brand which they have built through misleading advertisements in India.

The present study analyses selected advertisements of Maggi 2 Minute Noodles which made it the third staple Indian food after wheat and rice. Maggi commercials paved the way for changing lifestyles and eating habits of Indian consumers. The increasing purchasing power of the growing middle class too helped the growth of Maggi noodles sales in India. With 29 states and 7 union territories; 23 constitutionally recognized languages and hundreds of dialects; and social, cultural, religious, economical, political and ideological differences, a very inexpensive food supplement unanimously won the hearts of millions. However remote a village is, one will come across with Maggi 2 Minute Noodles. This has been the intrusion value of Maggi commercials. Strong brand identity has been created through celebrity branding, covert advertising and customer-generated advertising. Eye-catching displays of Maggi noodles at local stores boost the sales. The iconic yellow packaging together with the pictorial representation of noodles with added vegetables helped to reinforce the health factor. Ads of Maggi *Chota* pack of 50 gm worth Rs 5/- attracted the first time customers and Cuppa Mania grabbed the attention of mobile population and young professionals. Thus Maggi became the most preferred snack of new generation.

Ad analyzing is important to understand its intended meaning and impact. Maggi ads claim to have higher consumer interest and brand recall. In its earliest ads, the brand popularized the image of the "Maggi Mom." These were directed against the nurturing sentiments of the traditional Indian mother who cared for her children as well as the modern working woman who find it very difficult to cook time-consuming food. Magi ads thus became guilt-

inducing commercials. The embedded message in the ads induced in them a sense of guilt when they paid no heed to the product, which is advertised as good for their children. There was never a dull moment in these ads. The kids presented in them are endearing, appealing, good-looking and happy and therefore, role models for children. But they were hungry for a quick hot snack which was nothing but Maggi 2 Minute Noodles. Their enthusiastic voice "Maggi, Maggi, Maggi" seemed to echo in the psyche of viewers. Sound effects, music as well as visuals were lively and alluring. Children were fond of Maggi. Mothers loved making Maggi for it took only "2 Minutes" to cook. Nestlé insistently promoted Maggi with taglines such as "Mummy *Bookh Lagi Hei*" (Mummy I'm hungry), *Bas* 2 Minute (Just 2 minutes) and so on. These Maggi kids have all grown up to become young professionals, college students, young fathers and mothers to sustain the sentiments. The copy of the ad itself actually blends in to the background. The captivating slogan "Mummy I'm hungry" then reinforces this in an equally vague manner. Through numerous schemes of free samples and gifts on return of empty packs, Maggi conquered the hearts of the masses.

If we try to analyze the visual and textual components, elements and techniques of following ads featuring Madhuri Dikshit, some points are to be noted.

Fig. 1

Fig. 3

Fig. 3

Fig. 4

First of all, these ads were part of series of ads featuring the same model Madhuri Dikshit, just like ads featuring cute and bubbly Preity Zinta. They promote more than just products, namely images of beauty and success. They define beauty and success as "white and thin" like these Bollywood actors, promoting not only unhealthy and unrealistic images of beauty but class divisions based on racial priority. The message, in short, is that only North Indian fair women are successful just like the Western white female. We are exposed to these commercials every day, but we hardly ever realize their true impact on us. They can persuade us to buy Maggi even if we do not need, and desire a lifestyle that we would not necessarily agree with. They keep us informed of the latest products available, even if they do not get approval from FSSAI like Maggi Oats *Masala* Noodles.

The ads featuring Madhuri Dikshit are overwhelmingly yellow and red. Not only are the model's clothing and the typeface, but also the background is yellow and red. The model is a successful actor as well as mother in yellow and red T-shirt with number 7 written. She holds a red bowl full of yellow noodles in the first 3 ads and a red ball in the last advertisement. With her ardent look and smiling face, she seems to ask on-lookers to have a taste of yummy noodles. The celebrity is foregrounded especially in fig. 3 and celebrating people is in the background. The stereotypical assumption of caring mother with happy children is reinforced. The message creates unrealistic expectations amongst people.

The fast music and lyrics of Maggi commercials with alliteration and definitions of life are always joyful, funny and exciting just as in the ad of Maggi Oats *Masala* Noodles: "Come on, come on, oh let's get the morning oats, start the day in a healthy way, come on, move on….." Though the product has not got approval, the celebrity Madhuri Dikshit moving in accordance with the captivating music compels the viewers to buy the product. As a high profile celebrity, Madhuri Dikshit assures the credibility of the product and immediately generates the interest of prospective consumers. An everyday woman off the street has not been chosen to endorse this particular product. If used as a model, Oats *Masala* Noodles would not have sold half so well. Madhuri Dikshit's appearance with her hairstyle, outfit and make-up contributes to the advertiser's message.

The language and typeface used appeal to our emotion. The symbolic written text on the advertisement is in the signature font of

Maggi. Through this symbolic sign, the font is immediately recognized and associated with the brand through a process of signification with the signature font being the signifier and the brand being the signified. The catchy phrases "HEALTHY BREAKFAST BECOMES MORE ENJOYABLE" and "GOODNESS OF FIBRE OF 3 ROTIS" mislead readers. Giving Maggi 2 Minute Noodles, mothers can relax for they are giving healthy and enjoyable breakfast. Maggi presented as a good hot snack in the earlier ads, is now being presented as healthy breakfast with "GOODNESS OF CALCIUM AND PROTEIN! SHARE YOUR GOODNESS," so that you can have them for your lunch or supper. These are "THINGS THAT SHOULD BE WITH US FOREVER." They do not worry about other food. Here is an instant food which can give the taste and nutrients of real roti/rice/oats/ vegetable/ chicken which can make her family healthy and happy without going for the real one. It is a tasty, lip-smacking, "Xtra-delicious" supplement for time-consuming and delicious food. The implication is that Maggi can make everything possible for your family for they are "SPREADING *KHUSIYAN* FOR MORE THAN 3 DECADES." A decade ago, they declared, "In the last 20 years we have asked for just 2 minutes of your time" acknowledging the consumers' valuable time.

Fig. 5
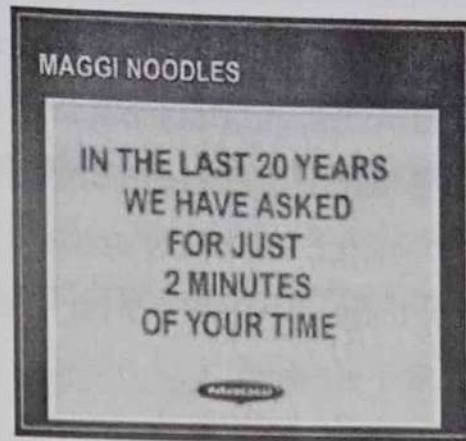
Fig. 6
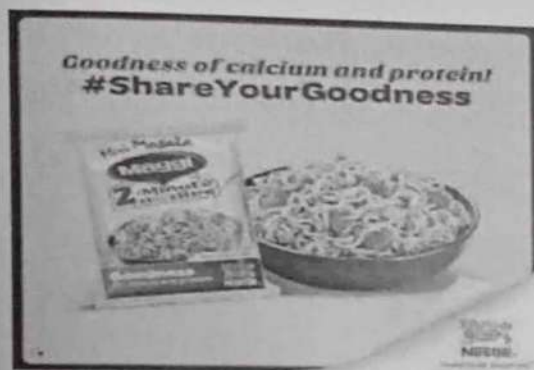
Fig. 7

Fig. 8

Fig. 9

Maggi ads without much ado arouse certain ideas and associations in our minds. For example, when we see the iconic figure, Amitabh Bachan featuring in their ads dressed in a formal suit but with an informal attitude and conversation, standing upright, we associate him with authority, education and success.

These ads seem to tell its readers on the product's lifestyle benefits and how the product made his life better. The launch of "Me and Meri Maggi" Campaign enabled customers to share their experience with Maggi and thus creating a nostalgic mood by letting them share their moments with Maggi. Maggie Recipe Challenge too attracted viewers.
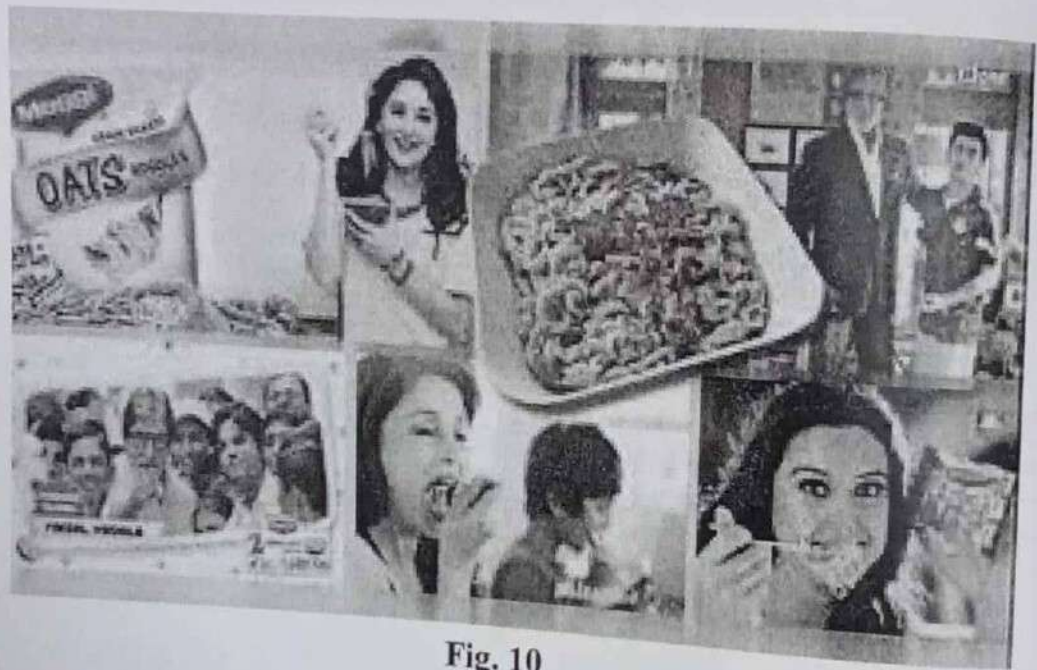
Fig. 10

The multinational company Nestlé intentionally has not given its name in the foreground, instead the brand name in yellow typeface in red background is given. This is to give the impression that Maggi is MADE IN INDIA. Maggi introduced flavours specifically tailored to the Indian market predominantly *masala* in "authentic Indian flavor." This spice sachet has become a popular seasoning in its own right. Masala flavour is the leading flavour in instant noodles in India followed by chicken, vegetable and tomato flavour. "*Meri* Masala," "New *Meri* Masala," "Taste *Bhi* Health *Bhi*," "Spreading *Khusiyan* for more than 3 Decades" and "Grain

Shakti Veg *Atta*" are some instances of *Hinglish* catchy phrases that give the product a sense of oneness, sharing and togetherness combined with patriotic image. The ad gives the impression that Veg *Atta* Noodles are healthier as they are made up of whole wheat grain flour instead of *maida*, the refined wheat and of course, it contains real vegetables.

The logo of Nestlé Company in fig. 11 with the image of a happy family of endearing birds living in a warm, cozy nest symbolically claim to offer consumers family, shelter and warmth under one umbrella. The tagline "Good Food, Good Life" offers healthy life by having healthy food given by Nestlé. The irony is that by devouring Maggi noodles with added MSG and excessive lead, the regular consumers find refuge in hospitals. The written text includes portmanteau words made by Nestlé like "Nutri-licious." This is a combination of "nutritious" and "delicious." The first part of this new word ultimately turns out to be unhealthy whereas the second has come true because of added MSG which causes cancer and the like. Fig.12 too gives the same impression. In this way, the straightforward message of what is being said is contradicted by something as seemingly innocent as the typeface. Just like the child character in fig. 13, the customer in fig. 14 is greedily devouring noodles from a wayside local fast food MAGGI POINT and he represents the typical Indian attitude to Maggi noodles.

Fig.11
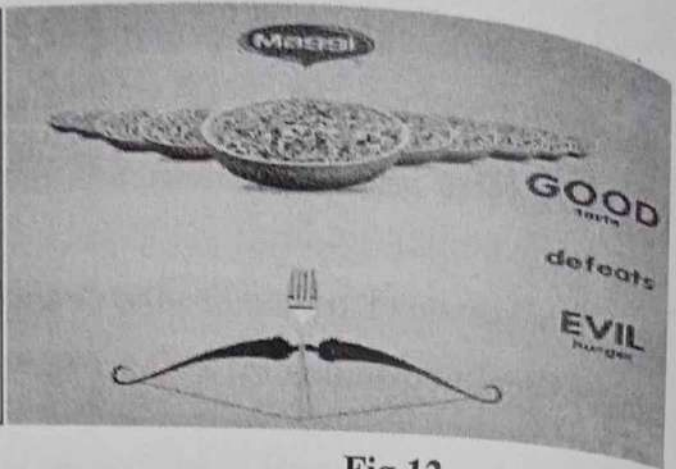
Fig.12

Fig.13
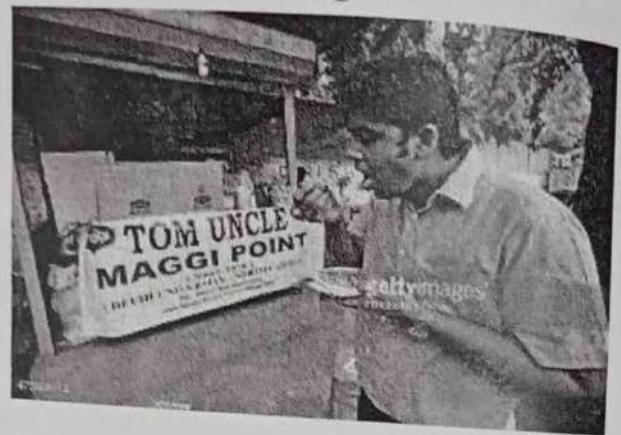
Fig.14

The advent of Maggi by Nestlé can be viewed as an example for globalization. It is the "global flow of cultural products and practices." (Nayar, 178) Maggi's dramatic entry in the 1980-s initiated a variety of neocolonialism in India. The commercialization of Doordarshan by Maggi paved the way for Nestlé ultimately taking over the local markets thus superimposing homogenous cosmopolitanism with their cultural artifact. They created a national identity of instant food through a sense of collective unity making the native Indians to freely accept and assimilate them. This nation as a myth unites people under one umbrella who "even lives supposedly in the larger cause of the nation" forgetting their denied culture (Nayar, 177). It's an assertion by the global company how it would make life easier or more comfortable for their target audience.

Tools of neocolonialism - comforts and pleasures - are being offered by multinational companies like Nestlé in return for their monopoly in our economic, cultural, social, political and psychological environments. This is a fleeting phenomenon. This has marginalized some people who still believe in the goodness and sharing of traditional Indian food in favour of a majority who loves instant food and junk food culture which is projected as "national culture." It is not physical slavery for the neocolonised, but psychological slavery. Their willful acceptance of the stereotype "Maggi Mom" created by the dominant culture leads to this perpetual psychological bondage. They are said to be happy and healthy and enjoying physical freedom. This "freedom" is not freedom in the true sense. The false images of them are propagated by the dominant culture of neocolonisers. "The myth of the nation does not always retain its hold" (Nayar, 177). The temporary ban over Maggi products, in one way or other, is the local resistance to elite global culture.

No one can disagree with A.S.J. Tessimond when he makes a strong case against advertising in his poem, "Attack on the Ad-Man:"

> This trumpeter of nothingness, employed
> To keep our reason dull and null and void.
> This man of wind and froth and flux will sell
> The wares of any who reward him well.
> Praising whatever he is paid to praise.
> He hunts for ever-newer, smarter ways
> To make the gilt seem gold; the shoddy, silk:
> To cheat us legally: to bluff and bilk
> By methods which no jury can prevent
> Because the law's not broken, only bent.

Tessimond makes advertisers out to be inconsistent, unpredictable, crafty, shrewd and prepared to compromise with the truth. This is true when multinational companies like Nestlé fool people by giving misleading labeling of products in their advertisements.

Media texts such as advertisements, in this rat-race global world, aim to convey meaning at a single glance. It is the selection and combination of different signs and techniques that allow them to convey meaning through ads. The connotations that these signs have and what the readers/viewers/listeners decide form different types of signs. These tools allow brands like Maggi with celebrities to combine, to create a naturalized myth of the product such as "Maggi 2 Minute Noodles will make you healthy and happy". In one way or the other, it creates false needs and kindles our materialistic attitude. These media texts exploit our emotions suggesting that submission to these products is the only way to happiness and thus paving way for neocolonialism. We as a 'nation' become a colony from the perspective of globalised and consumerist world which manipulates and changes our social values and attitudes.

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ONLINE RETAIL MANAGEMENT BASED ON AUTONOMIC PRINCIPLES

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ABSTRACT

The ever increasing complexity of computing systems will cross the borders of human capabilities, leading to systems that are too complex to be administrated by human beings. System administrators will no longer be able to install, configure, maintain and optimize these computing systems of the future. The solution to this problem is developing a technology that allows computing systems to manage themselves. This solution is referred to as autonomic computing. In today's economic scenario, Online Retail Systems are gaining prominence and day by day increasing in size, leading to complexities difficult to be managed by human beings. Parallel developments in study of buying behaviors based on various techniques like data mining, decision trees, neural networks etc are gaining significant practical ground, which also increases the complexity to be managed. The basic idea is lay foundation for creation of autonomic systems based on the outputs from behavioral study, inventory management, etc to autonomically handle management of display, inventory predictions etc. The efficiencies achieved should in turn results in higher revenue as well as profits. Paper titles Online Retail Management Based on Autonomic principlesdeals with the development of taxonomy, a model framework for - autonomic online retail management and related standards. It will also delve into the theoretical background of specific techniques, which can be applied in this scenario.

Index Terms: Autonomic, retail, retail management, autonomic computing

Introduction

In this paper, online retail systems were identified as to explore the possibilities of applying autonomous principles to simplify the day to day management of complex systems. An underlying objective of this paper is also simplification of such concepts and their application. The visionary objective of this project is to set an initial footstep in exploring the vast possibilities such an approach opens up. The system interacts mainly with two types of users – the normal user for retail activities and admin users for control activities. The interactions of normal users are stored in event logs. Also, events which require immediate response are handled by the navigational event's module. The policy manager is responsible for providing temporary as well as long term responses. The inputs to the policy manager are the events, and the policy definitions. The admin user can intervene in the complete cycle by providing new inputs and also new policy definitions as well as parameter values. The system consists of multiple smaller managers, which will take care of the day to day tasks. The initial model plans to examine the following managers:

Associative Manager: Takes care of associative rules for product sales in the initial version. In future, it could also take care of associative behaviors emerging from navigational events.

Demographic Manager: Demographic patterns have a very big influence on navigational and buying behavior. Careful analysis, storage and use of these values can better the user experience and also the buying potential considerably.

Discount Manager: Any retail system is governed by a set of discounting policies, which varies from season to season and also with administrative inputs.

New Product Manager: Defines the values of new products coming into the system.

Associative Manager

The associative manager tries to find associations between elements and make use of this to effectively control the navigational behavior.

Fig. 1: Associative Manager

Suggest Associative Behaviour

Associative behavior is suggested in multiple ways:

- Data Mining Analysis
- Statistical analysis
- Random Association

Execute

Next step is to execute the behaviors defined in the planning step and measure the monitor the responses. In case of online retail,

the display characteristics will vary and the effects are registered. This could be in the form of products displayed, product associations displayed etc.

Record Navigational Behaviour

The navigational behavior is primarily captured in log file. The astTECSlog table described in the database section is the key to recording of this navigational behavior.

Analyse Navigational Behaviour

Navigational behavior is analyzed mainly in two ways:

- Data Mining Analysis
- Statistical Analysis

Demographic Manager

Demographic or demographic profile is a term used in marketing and broadcasting, to describe a demographic grouping or a market segment. This typically involves age bands, social class bands and gender. This manager deals with the demographic patterns, item ranking and display according to the patterns.

Fig. 2: Demographic Manager

Suggest Demographic Patterns

The system starts with selling of open source software online. The company size and revenue of the customer is a very important criteria in segmenting this type of customers.

Execute Demographic suggestions

The navigational behavior is being controlled by the demographic group in which the customer is grouped. In prominent places, the category of products suiting his demographic profile will be displayed. In less prominent places, other choices are displayed. This type of display behavior is beneficial for both customer and the site owner.

Record Navigational Behavior

The navigational behavior is primarily captured in log file. The astTECSlog table described in the database section is the key to the recording of this navigational behavior.

Analyze Navigational Behavior

The navigational behavior is analyzed to see, if the customer is behaving rationally corresponding to his demographic profile. In case, he varies very much from the normal behavior, his rating is changed in the upward/downward direction.

New Product Manager

Most of the policy managers have the initial value suggestions for their own modules. Anyhow, certain default values has to be allocated for each of these modules to start being active. The initial values for each of the modules are defined and also any level of

initialization is done by this module.

Initial Category

Initial Demography

Initial Ranking
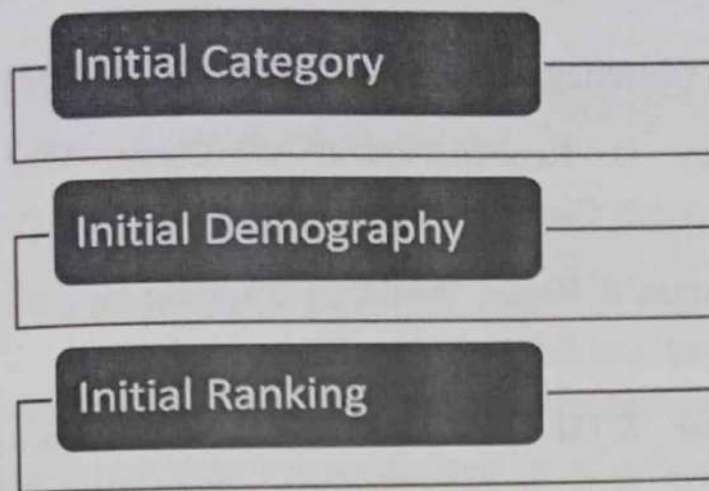
Fig. 3: New Product Manager

Conclusion

Even after a decade of the launch of the Autonomous system manifesto, though we have a good understanding of what autonomic systems should look like, are nowhere near developing and deploying such systems on a wide scale. This paper attempted to apply autonomic principles to the very dynamic area of online retail management.

Acknowledgment

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MALAYALEE BEGGARS - A DILEMMA FOR KERALA SOCIETY

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Associated with the problems of poverty and unemployment is the problemof beggary which is a social problem of great magnitude and grave concern indeveloping countries. Begging is a problem for society in as much as a largenumber of beggars means non utilization of available human resources and dragupon the existing resources of the society. According to a recent survey by DelhiSchool of Social Work there has been a phenomenal increase in the numbersof beggars in India. The biggest problem lies in the changing attitude towards beggars. Giving alms to the needy was built into the social fabric. But the recenttrend in Kerala shows a different picture of beggary, the one which made thepeople to beg without any hesitation.

Methodology

Statement of the problem

Beggary may be regarded as one of the myriad ways in which social deviation manifests itself primarily in a backward or what is now designated as developing economy. Beggary is a major social problem in India. Beggary is a symptom of personal as well as social disorganization. Begging has become a profession in the modern society. It is most profitable business which no needs

investment and hard work. This profitable nature of Beggary encourages healthy people to beg. Normally Keralites are considered to be more prestigious. But now the trend has changed to beg anything at any cost. According to the informal studies conducted by the child line officials in Kerala, a whopping Rs.42 crores of money per year is dumped down the drains, by way of giving alms to beggars, who throng the towns of god's on country. In the capital of Kerala some 800 beggars collect a measly sum of Rs.9 crores per year. Malayalee beggars - a dilemma for Kerala society is a modest attempt to investigate the various aspects of the life of malayalee beggars.

Objective of the Study

To analyze the recent trends among malayalee Beggars in rural areas.

Variables

In this study the researcher used the independent variables like age, sex,category, religion and education and the dependent variables are income,mode of beggary, willing to work etc

Sampling Method; Convenience or accidental sampling.

This is a non probability sampling. It means selecting sample units in a just 'hit and miss' fashion, that means,interviewing people whom we happen to meet.

Tools of Data Collection; Interview schedule.

Limitations of the Study

Absence of openness of the respondents.

Analysis

Beggars are mainly the wandering people and they never stay in their home. But in the case of Kerala, beggars mainly stay in their own family.

The following tables reveals the new trends among malayalee beggars Distribution of respondents based on staying in family

Yes	No	Total
29	11	40
72.5%	27.5%	100%

The majority respondents live with family. Most of the family members support their 'profession'. But they have less interest to contact with their relatives. 55% of the respondents revealed that they had been doing this for more than 10 years. Only 10% of respondents were locals and others from the different districts in Kerala.

Sex wise distribution & Area of beggary

Area / Sex	Market and Bus stand	Rural area	Shops	Total
Male	3(12.5%)	17(70.8%)	4(16.6%)	24(100%)
female	0	8(50%)	8(50%)	16(100%)
Total	3(7.5%)	25(62.5%)	12(30%)	40(100%)

63% beggars were concentrated on rural areas. 30% of them concentrated different shops and others in market and bus stand. They consider the rural places are more comfortable because of the economic benefits and these places are less restricted areas. 80% beggars spent all days for beggary and rest of them were part time beggars.

Mode of beggary

Sl.No	Mode of beggary	Number of respondents
1	With instrumental support	4(10%)
2	Exhibiting wounds	20(50%)
3	Printed matters	7(17.5%)
4	Asking alms	9(22.5%)
Total		40(100%)

Several mode of beggary that adopted by the beggars were found out by the researcher. Disabled beggars adopted the mode of exhibiting their disabilities. Some able bodied persons and aged beggars were distributing the printed materials explaining their tragedies and miserable experiences and asks alms and receives the things like money,cloths,food etc

Savings

Yes	No	total
12	28	40
30%	70%	100%

70%of the respondents have no personal savings. Most of them merely spend their money. They were not aware of personal savings.

Sex and Causes of beggary

causes / sex	Economical	Biological	Other reasons	Total
male	14(58.3%)	8(33%)	2(8.3%)	24(60%)
female	10(62.5%)	3(18.75%)	3(18.75%)	16(40%)
total	24(60%)	11(27.5%)	5(12.5%)	40(100%)

60% of respondents were of the opinion that the main cause behind beggary is economical. 27.5% of respondents said that they accept beggary as a way of livelihood due to biological reasons. Other reasons mainly due to education of chidren, marriage of daughters, treatment of family members etc.

Beggars and their Deviant habits

Deviant habits / Category	Use of tobacco Or pan chewing	Smoking	Drug abuse	total
Child beggars	2	---	---	2(7.14%)
Able bodied	3	2	1	6(21.4%)
disabled	4	1	6	11(39.8%)
others	---	6	3	9(32.1%)
Total	9(32.14%)	9(32.14%)	10(35.71%)	28(100%)

Around 35% respondents have drinking habits. And 32% of the respondents have smoking habits and rest of them have pan chewing or tobacco chewing habits. These deviant habits make them economically backward and socially dreadful. Among the respondents who have deviant habits are 28 (70%).36% are alcohol addicts. In the alcohol addicts a majority of 60 % are disabled beggars. Among the tobacco using respondents above 20%are child beggars.

The following table shows the various sources of food for beggars.
Source of food and Category

Source of food / Category	Hotels	Self cooking	Beggary	Total
Child beggars	2 (50%)	---	2 (50%)	4 (100%)
Able bodied	4 (57.22%)	1 (14.2%)	2 (28.57%)	7 (100%)
disabled	11 (55%)	3 (15%)	6 (30%)	20 (100%)
others	5 (55%)	2 (22.22%)	2 (22.22%)	9 (100%)
Total	22 (55%)	6 (15%)	12 (30%)	40 (100%)

This table shows that there were various sources to get food for beggers.55% of the respondents said that they buy food from small tea shops. 30% of them were received food by beggary and rest of them prepare themselves. Type of food varied from one to another.55% of respondents having rice and others take chapathi, uppuma etc.

Kerala is the big tourism state in the country. Many tourists not only from different parts of our country but also many foreigners are used to visit Kerala normally. A person who avoid to work and wants to earn their livings in easy way are adapting to begging. In Kerala, the beggars are increasing daily in order to earn money from the foreign and other tourists. Kerala being a well educated state, increasing of beggary will be shameful act on the government. So Government should take an immediate action to stop beggary.

Literacy and Willingness to work

Literacy / Willingness to work	Willing	Not willing	Total
Literate	15 (100%)	---	15 (100%)
Illiterate	6 (24%)	19 (76%)	25 (100%)
Total	2 (52.5%)	19 (47.5%)	40 (100%)

This table reveals that out of total respondents 25 of them are illiterate.19% of the illiterate respondents are not ready to work.15 respondents were lliterate and all of them are ready to work. This shows that illiteracy is one of the important factors for their laziness. These lazy people have no interest to get rid from beggary.

Major Findings

- Majority of them(70%) were accepted beggary as a profession

- 73% stay in family

- Main source of income is beggary

- No personal savings (73%)

- Some have mobile phone (18%)

- Spend their money for daily livelihood

- Daily income(above 200) encourages to continue this profession

- Creation of public opinion and collection funds by new methods

- Income generating vocational training should be provided

- To create more rehabilitation centers

- Uniform Law in all states

Conclusion

In Kerala, malayalee beggars are a great dilemma because it is a situation that requires a choice between options that are equally unfavorable or mutually exclusive. Actually they are an agony and headache for the nation. Their savagery nature and indignity create distress to them. They have no entry to the main stream of the society. But we never imprecate them. So we need foresight for their future in all our plannings.

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- Reasons are economical (60%), social (12.5%) and biological (27.5%)

- Able bodied consider this as a profitable business

- Rural areas (63%)very comfortable places for beggary

- Deviant habits like using pan and tobacco chewing (32.14%), smoking (32.14%), drug abuses (35.71%)

- A problem to the society

- People considered them as public nuisance

- Illiterate beggars (76%) do not ready to work, showing their laziness

- Don't want change situations

- Social conditions favour beggary

- No idea(63%) about prohibition act of beggary

- Rural people more charitable towards beggars

- Exploit the favourable condition

- Not a simple problem

- Need social legislations and welfare programmes

Suggestions

- Comprehensive social security measures

- Counteracting the influence of poverty

- Care of orphans and handicapped

PRO-OXIDANT ACTIVITY OF TiO$_2$ ON WEATHERING AND BIODEGRADATION OF LLDPE-PVA BLENDS

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ABSTRACT

In this work we have investigated the effect of titanium dioxide and vegetable oil either acting alone or in combination on the degradation behaviour of LLDPE/PVA blends. The weathering performance of two commercial crystalline forms of TiO$_2$ (rutile and anatase) in commercial polyethylene in the absence as well as presence of vegetable oil is also examined. The extent of degradation was then monitored by physical property measurements, FTIR spectra and scanning electron micrographs.

Key words: *Weathering, Biodegradation, Polyethylene, Pro-oxidant*

1   Introduction

Due to favourable characteristics such as inexpensiveness, nontoxicity, stability and high photoactivity, TiO$_2$ has become an excellent choice for a photocatalyst [1,2]. As photocatalysts, rutile and anatase phases of TiO$_2$ have also been investigated. TiO$_2$ in polyolefins has been studied extensively because of its wide use [3-5].   Polyethylene is a material used in large amounts for packaging because of its relatively low cost, versatile properties including high tensile strength, elongation at break, good barrier properties against water-borne organisms, higher energy effectiveness, light weight and good water resistance [6]. Polyethylene of enhanced

environmental degradability is prepared by blending with biodegradable additives, photo-initiators or by copolymerization. Incorporation of pro-oxidant additives is a promising step to overcome the environmental degradation by polyethylene films. Pro-oxidants accelerate photo oxidation and consequent polymer chain cleavage rendering the product more susceptible to biodegradation.

In this work the pro-oxidant activity of TiO_2 in the weathering of biodegradable LLDPE-PVA blend is investigated in the presence as well as absence of vegetable oil. The degradation due to weathering was monitored by various techniques like physical property measurements, FTIR spectroscopy, and scanning electron microscope (SEM) for surface morphology. Biodegradation of the weathered samples were then carried out in marine benthic environments using *Vibrio species*.

2   Experimental

2.1   Materials

General purpose film grade LLDPE (LL20FS010) used in this study was supplied by Reliance Industries Ltd, Mumbai, India. It has a melt-flow index of 1g/10min at 190^0C and 2.16kg load. The density of the LLDPE sample is $0.920g/cm^3$. Hot water soluble polyvinyl alcohol used in this study was industrial grade obtained from Rolex Chemical Industries, Mumbai. Molecular formula is $(C_4H_{10}O)_n$; viscosity at 4% concentration in water at 20^0C is 3mPa.s. TiO_2 was purchased from M/S Travancore Titanium Products, Thiruvananthapuram.

2.2   Sample preparation

Blending was carried out at 185^0C in a Thermo HAAKE Polylab internal mixer equipped with a pair of roller rotors. The rotor speed

was maintained at 50rpm. Varying amounts of commercial rutile and anatase forms of TiO_2 (0.25%-1% w/w) were added to LLDPE-PVA blends during mixing. Blends containing different proportions of LLDPE, PVA and metal oxides were compression molded into sheets to form thin films. Molded samples, cut into strips according to ASTM D882, were used for all the tests. The details of film samples prepared along with their designation are presented in Table 1. LLDPE-PVA (L0 = LLDPE containing 10% PVA) blends containing glycerol alone have been designated as F and those containing both glycerol and vegetable oil as FV. Samples containing additionally anatase and rutile have been designated as FVA and FVR respectively, the numerical suffix indicating the % concentration of the oxide additive.

L10 + Glycerol = F
L10 + Glycerol + Veg. Oil = FV
L10 + Glycerol + Veg. Oil + Rutile = FVR
L10 + Glycerol + Veg. Oil + Anatase = FVA
L10 + Glycerol + Rutile = FR
L10 + Glycerol + Anatase = FA

Table 1: Details of formulations and their sample designation

Sample designation	LLDPE (g)	PVA (g)	Glycerol (g)	Vegetable oil (g)	TiO$_2$ (g)
F	45	4.5	0.675	—	—
FV	45	4.5	0.675	0.45	—
FVA-0.25	45	4.5	0.675	0.45	0.1125
FVA-0.50	45	4.5	0.675	0.45	0.225
FVA-0.75	45	4.5	0.675	0.45	0.3375
FVA-1	45	4.5	0.675	0.45	0.45
FA-0.50	45	4.5	0.675		0.225
FVR-0.25	45	4.5	0.675	0.45	0.1125
FVR-0.50	45	4.5	0.675	0.45	0.225
FVR-0.75	45	4.5	0.675	0.45	0.3375
FVR-1	45	4.5	0.675	0.45	0.45
FR-0.50	45	4.5	0.675		0.225

2.3 Natural weathering procedure

Polyethylene films were mounted on racks at an angle of 30-45^0 facing the south direction as per ASTM D 1435-99 [9]. These experiments were started in the month of May 2010 in Kochi (Kerala, India) and continued for 600 hours. Samples after weathering were retrieved at regular intervals of 120, 240, 360, 480, and 600 hours, respectively, to evaluate the effect of weathering time on degradation. Average relative humidity in the atmosphere was 70% and the average temperature was 33^{0}C. The weathered samples were then subjected to biodegradation studies.

2.4 Biodegradation in culture medium

Biodegradation of the samples were carried out using a consortium consisting of four PVA degrading *Vibrio sp.* isolated from benthic marine environment, according to ASTM D 5247–92. Bacterial cultures isolated from sediment samples collected from different locations of Cochin back waters and Mangalavanam mangroves, identified as genus *Vibrio* and maintained in the culture collections of Microbial Genetic Lab, *Dept. of Biotechnology, Cochin University of Science and Technology* were utilized in this study.

2.5 Evaluation of extent of degradation

Samples with a gauge length of 100 mm and width of 10 mm were cut from the films for tensile strength measurements as per ASTM 882-85. Six samples were tested for each experiment and the average value was taken. Structural changes upon exposure were investigated using FTIR spectroscopy. FTIR spectra were recorded at regular intervals using a Thermo Nicolet (Avatar 370) spectrophotometer in the spectral region between 4000 and 400cm^{-1}.

For each sample a total of 32 scans were averaged at a resolution of 4 cm^{-1}. Scanning electron microscopy was performed on the samples before and after degradation to investigate the changes in the morphology due to weathering. Sample surfaces were sputtered with gold using usual techniques and then analyzed in a JEOL (JSM-6390LV) electron microscope.

3 Results and Discussion

3.1 Mechanical Properties

The mechanism of the transition metal catalyzed degradation of PE has been described in the literature as a free radical chain mechanism proceeding from the formation of hydro peroxides along the polymer backbone through reaction of the polymer with molecular oxygen [8,9]. Figures 1 & 2 represent the effect of exposure time on the tensile strength of LLDPE-PVA blends containing anatase and rutile after weathering and biodegradation.
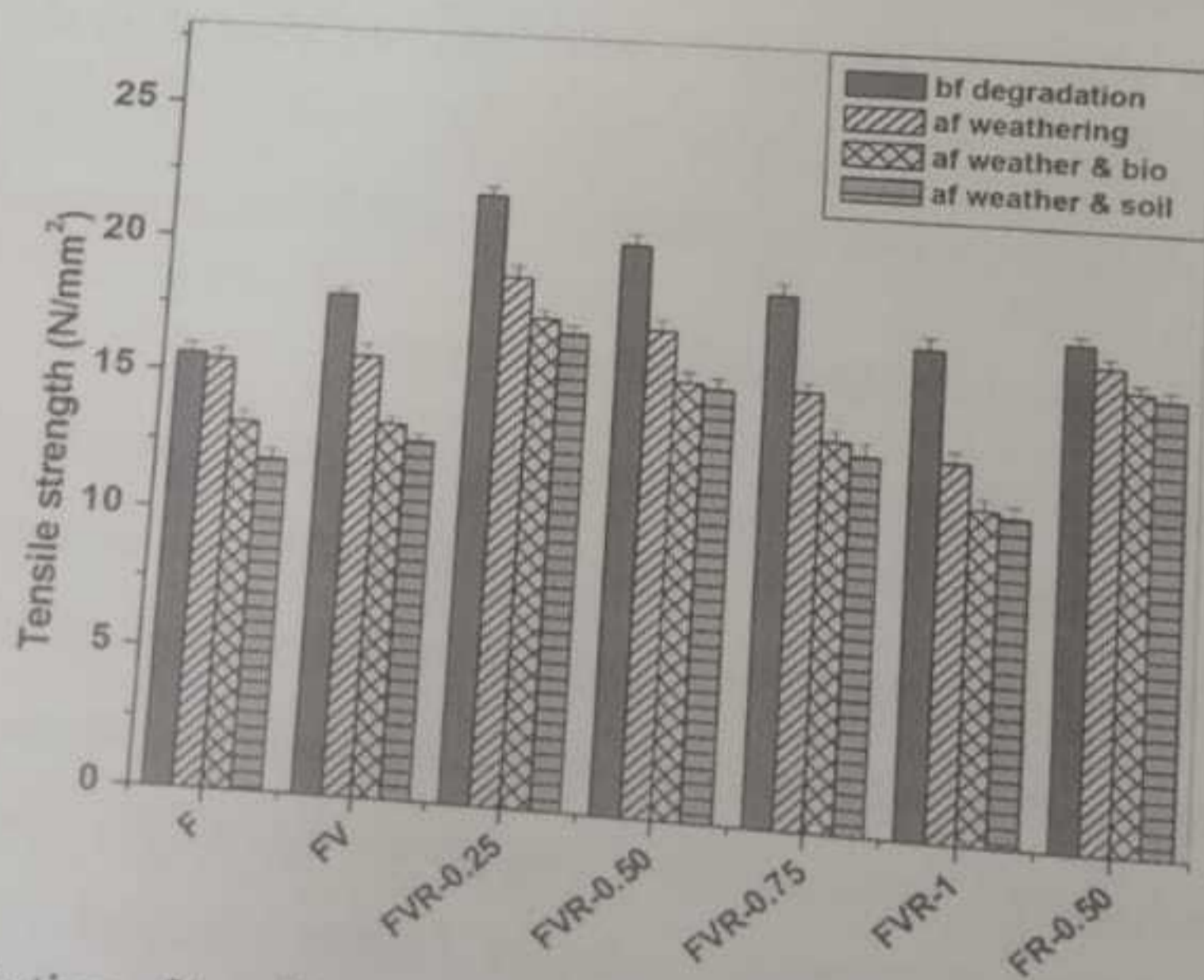
Fig.1: Variation of tensile strength of blends with the addition of varying amounts of commercial rutile
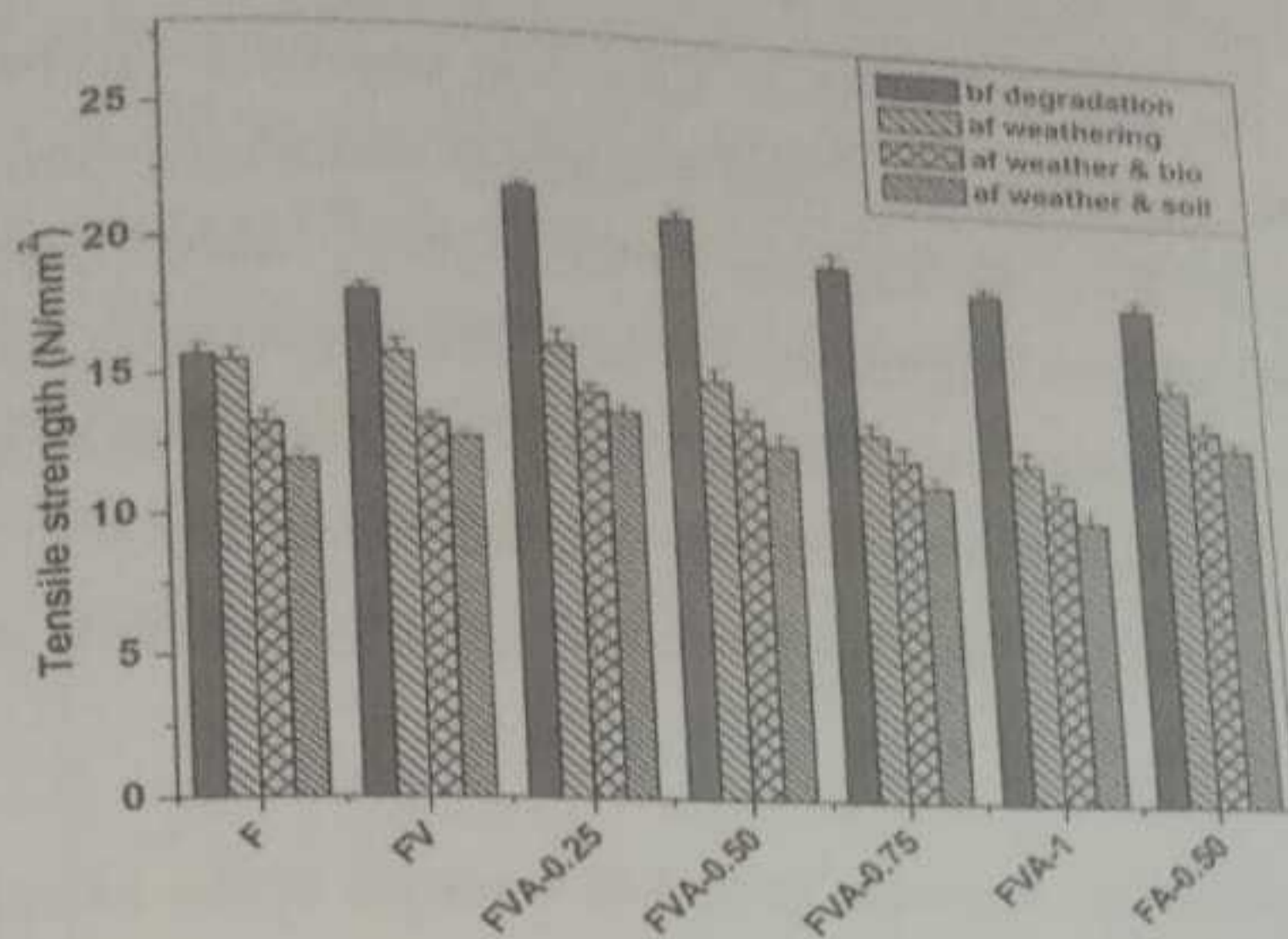
Fig.2: Variation of tensile strength of blends with the addition of varying amounts of commercial anatase

On weathering of the blends containing only TiO$_2$, reduction in tensile properties was observed in the case of samples containing both rutile and anatase. For the case of 0.50% of TiO$_2$ only, the tensile strength decreased by 4.28% for samples containing rutile (FR-0.50) and 16.42% for anatase (FA-0.50) after 600 hours of weathering. Although both forms of TiO$_2$ (rutile and anatase) played a significant role in promoting the photo-oxidative degradation of LLDPE films the decrease is greatest in the case of samples containing anatase pigment.

The samples containing a mixture of vegetable oil and TiO$_2$ showed considerable decrease in tensile strength during outdoor exposure. The stiffness and brittleness of the materials increased considerably within a month of exposure time. We can see that there is a continued decrease in tensile strength after biodegradation and soil degradation also. This effect is also more in the case of samples containing both TiO$_2$ and vegetable oil.

For the case of 0.50% of TiO_2 and vegetable oil, the tensile strength decreased by 15.03% for samples containing rutile (FVR-0.50) and 28.36% for anatase (FVA-0.50) which means that vegetable oil played a significant role in the degradation of LLDPE . Vegetable oil undergoes auto-oxidation by which free radicals are generated. These, in turn, initiate oxidation of LLDPE. The % decrease in tensile strength of the blends after weathering is shown in Table 2.

Table 2: Percentage decrease in tensile strength of the samples after weathering

Sample designation	Tensile strength (N/mm^2)		
	Before weathering	After weathering	% decrease
F	15.63	15.45	1.15
FV	18.03	15.79	12.42
FVR-0.25	21.97	18.98	13.61
FVR-0.50	20.42	17.35	15.03
FVR-0.75	18.89	15.45	18.21
FVR-1	17.25	13.27	23.07
FR-0.50	17.74	16.98	4.28
FVA-0.25	22.04	16.25	26.27
FVA-0.50	21.19	15.18	28.36
FVA-0.75	19.67	13.45	31.62
FVA-1	18.90	12.54	33.65
FA-0.50	18.63	15.57	16.42
FVN-0.25	21.5	14.32	33.39
FVN-0.50	21.9	13.6	37.89
FVN-0.75	21.1	12.9	38.86
FVN-1	22.3	12.4	44.39
FN-0.50	21.2	16.43	22.5

3.2 FTIR Studies

The FTIR spectrum of LLDPE/PVA blends (F) containing 0.50% of anatase (A) and rutile (R) before and after 600 hours of weathering in the presence as well as absence of vegetable oil are shown in Figure 3 to 6 respectively
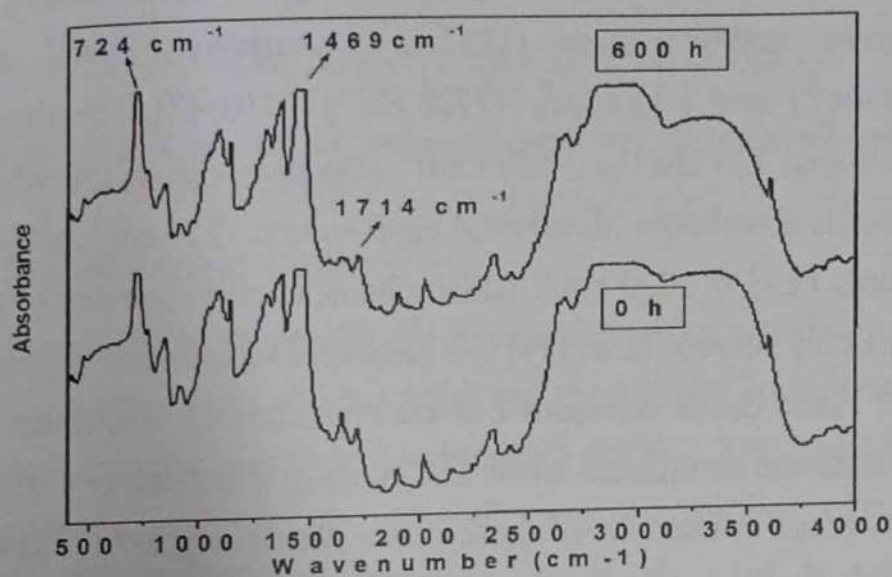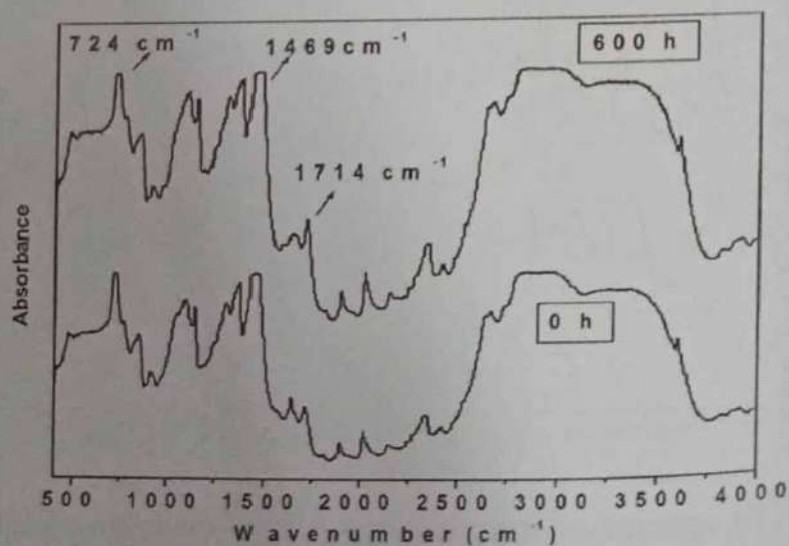

Fig. 3: FTIR spectra of samples containing 0.50% of rutile only
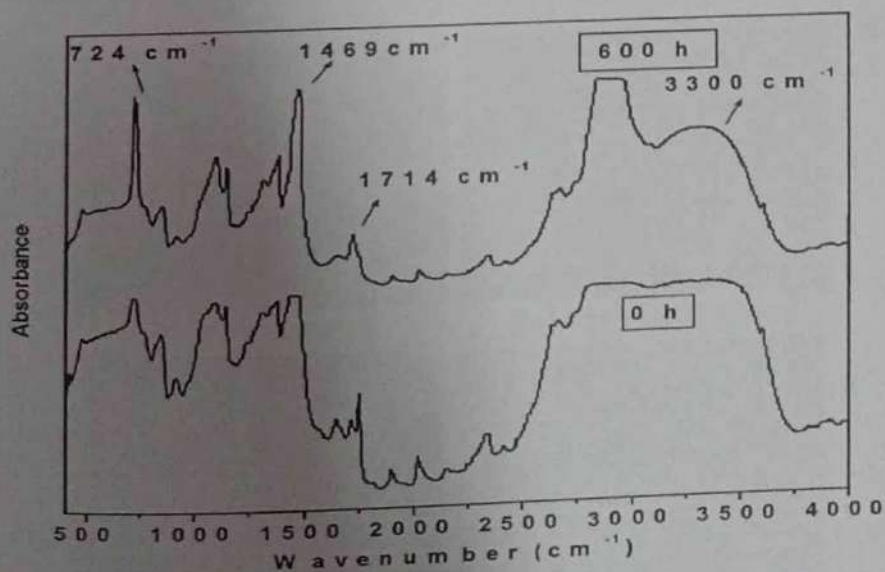
Fig. 4: FTIR spectra of samples containing vegetable oil and 0.50% of rutile

From the figures it can be seen that the absorption band around1714 cm^{-1} which can be assigned to the C=O stretching vibration of a keto group, grows in intensity with extended outdoor exposure. A broadening of the band at this point indicates the formation of more than one oxidation product. Hence these carbonyl bands can be assigned to C=O stretching vibrations arising from aldehydes and/or esters (1733cm^{-1}), carboxylic acid groups (1700 cm^{-1}) and γ-lactones (1780 cm^{-1}) [10–13]. The absorption band around 720 cm^{-1} and 1469 cm^{-1} also increases in intensity. The ratio of the absorbance of carbonyl band around 1714 cm^{-1} and internal thickness band at 2020 cm^{-1}, which characterize the degree of photo-oxidation of polyethylene, [14] has been used to calculate the carbonyl index. These bands correspond to the characteristic absorption of the crystalline and amorphous bands and bending vibrations of C-H bonds. The increase in intensity of these peaks was owing to the fracture of the polyethylene chain in degradable environments. Increase in intensity is maximum in the case samples containing both anatase and vegetable oil.

Fig. 5: FTIR spectra of samples containing 0.50% of anatase only
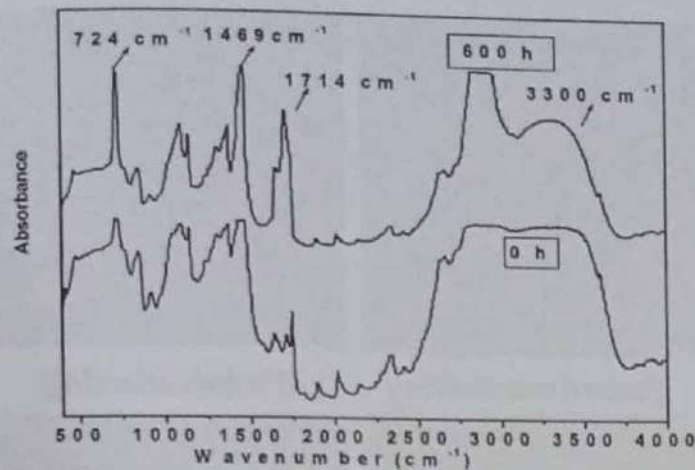
Fig.6: FTIR spectra of samples containing vegetable oil and 0.50% of anatase

3.3 Morphological Studies

The SEM micrographs of the samples after weathering are shown in figures 7-10. After weathering, the samples containing pro-oxidants appear to have numerous cracks. On subsequent biodegradation cavities are seen all over the surface indicating microbial activity. This is especially so in the case of samples containing anatase and vegetable oil.
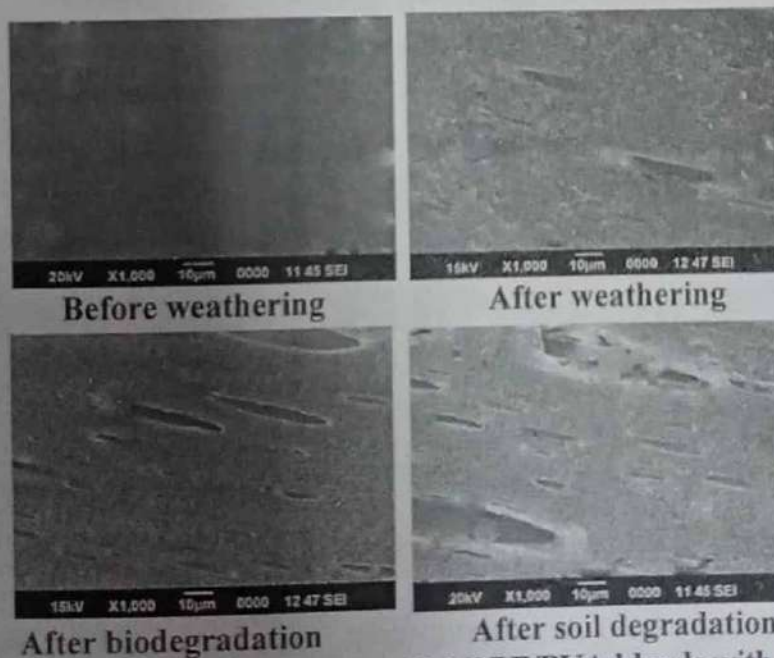

Before weathering   After weathering

After biodegradation   After soil degradation

Fig. 7 Scanning electron micrographs of LLDPE/PVA blends with rutile only

Before weathering

After weathering

After biodegradation

After soil degradation
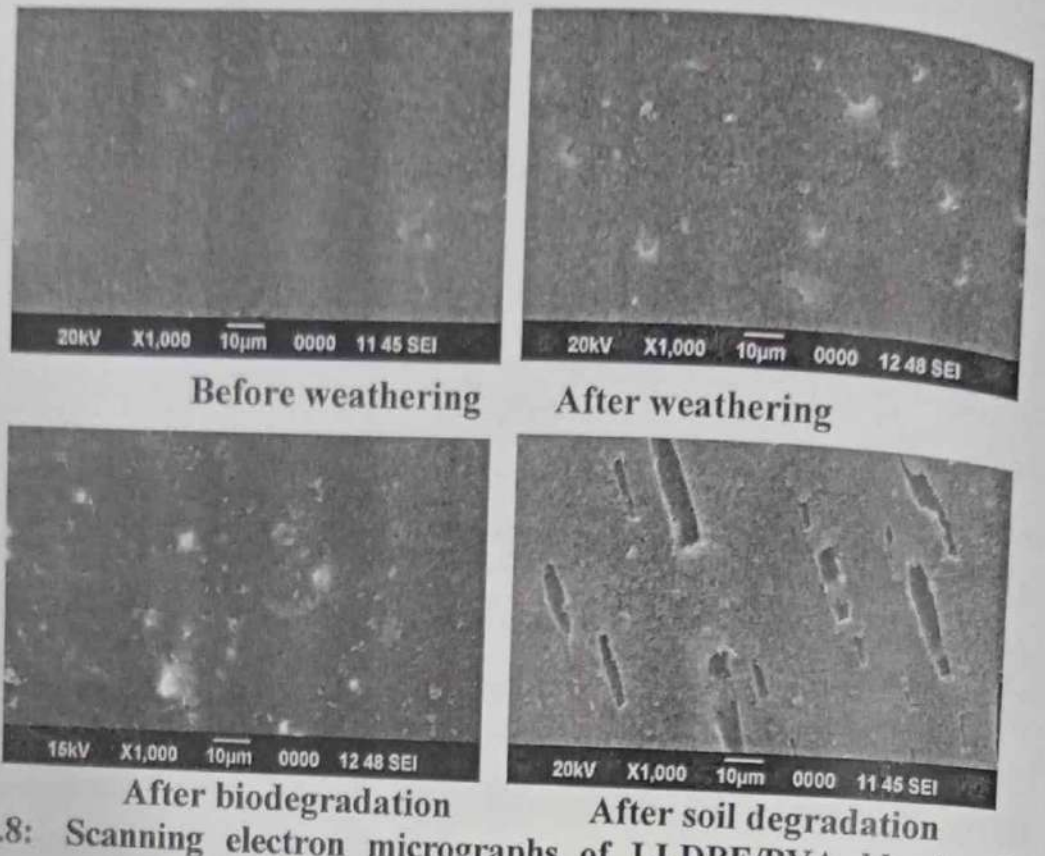
Fig.8: Scanning electron micrographs of LLDPE/PVA blends with rutile and vegetable oil

Before weathering

After weathering

After biodegradation

After soil degradation
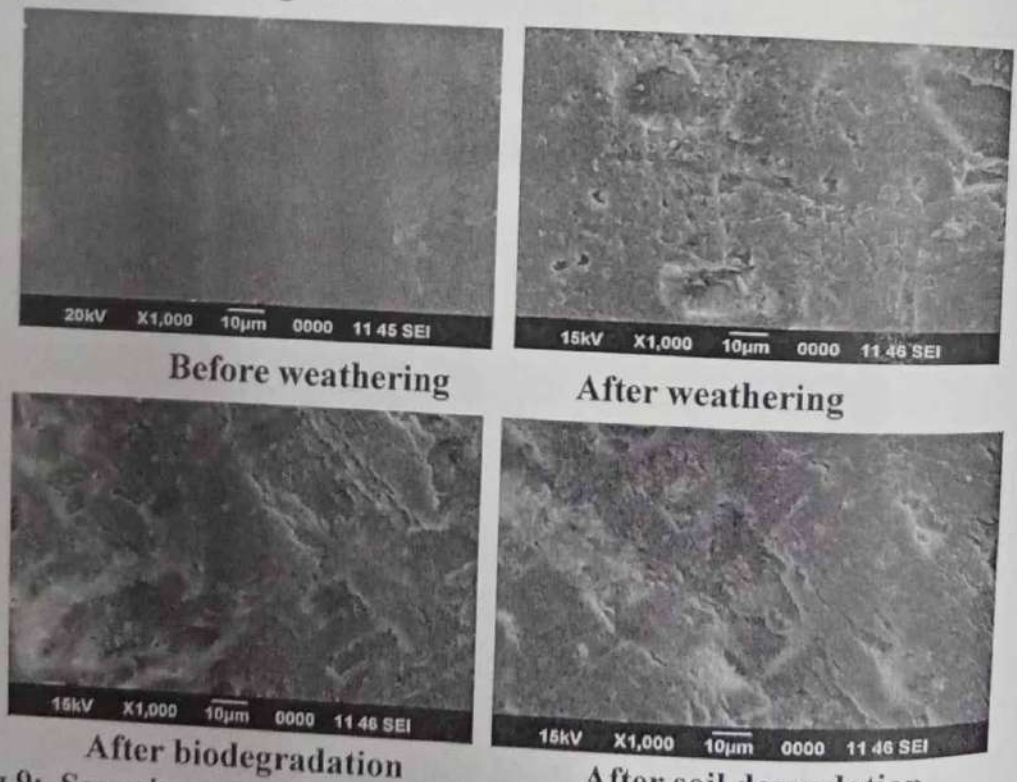
Fig.9: Scanning electron micrographs of LLDPE/PVA blends with anatase only

Before weathering   After weathering

After biodegradation   After soil degradation
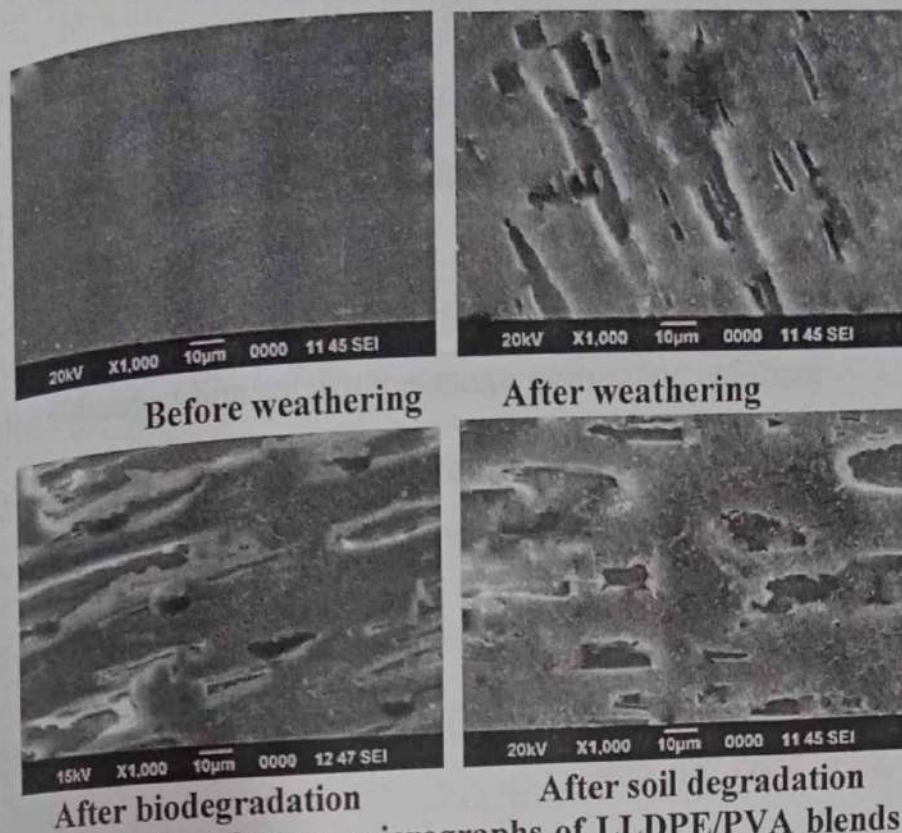
Fig. 10: Scanning electron micrographs of LLDPE/PVA blends with anatase and vegetable oil

Examination of the micrographs shows numerous holes in the film which scatter light and cause whitening. This indicates that in the vicinity of the titania the polymer gets totally degraded to water and carbon dioxide or other volatile substances. Loss of pigment particles from degraded polymers containing titania has been attributed to erosion of the polymer due to photocatalysis [15].

4   Conclusions

- The incorporation of TiO_2 as the key pro-degradant has increased the rate weathering

- Vegetable oil is also capable of accelerating the oxidation of LLDPE/PVA blends during weathering.

- A greater extent of oxidation was observed during weathering, primarily due to TiO$_2$, in the case of compositions containing a combination of TiO$_2$ and vegetable oil.

- The pro-oxidant activity is maximum in the case of samples containing anatase particles and vegetable oil.

- The pores seen in scanning electron micrographs are an indication of degradation

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STUDY OF ANGIOSPERM VEGETATION DURING SUMMER SEASON IN A SELECTED WETLAND AT MALA, THRISSUR DISTRICT

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ABSRACT

A study was conducted to find out the diversity of angiosperm vegetation during summer season in the selected wetland at Mala, Thrissur. For this several field trips were conducted in this area and materials collected for identification. A toatal number of 36 taxa comes under 18 families were recorded. Out of these families poaceae shows more number of plants with 8 species. A RED listed plant Lindernia crustacean, member of scrophulariaceae wasalso identified.

Key words: angiosperm, vegetation, wetland

Introduction

Wetlands are amongst the Earth's most productive ecosystems. They have been described as 'the kidneys of the landscape', because of the functions they perform in the hydrological and chemical cycles, and 'biological supermarkets' because of the extensive food webs and rich biodiversity they support (Bush 2005). Wetland systems directly support millions of people and provide goods and services to the world outside the wetland. People use the wetland soils for agriculture they catch wetland fish to eat they cut wetland trees for timber and fuel wood and wetland reeds to make mats and to thatch roofs. Direct use may also take the form of recreation, such as bird watching or sailing, or scientific study. Peat soils have preserved ancient remains of people and track ways which are of great interest to archeologists.Wetlands are some of the most spectacular, most

beautiful, tranquil place on earth. It is one of the most undervalued ecosystems but provide a range of vital services. Wetlands are one of the kidneys of earth. It absorbs heavy rain releasing water gradually so, flooding is reduced and helps to store water and increase underground water level (Dennis 2001).

Wetland is one of the world's most important environment assets, containing a disproportionately high number of plant and animal species compared to other areas of the world.Many of our endangered plants and animal species depend to totally on wetland and they specially adapted to live in wet places. Wetlands are highly useful to us in many ways, significantly to global economy in terms of water supply, fisheries, agriculture etc.As water moves into a wetland the flow rate decreases allowing particles to settle out. Plant surface provide for filtration, absorption of solids and add oxygen to the water growing plants remove nutrients and play a cleansing role that protect the downstream environment (Schuyt 2004).

Materials and Methods

The study area is a selected wetland in Mala, Thrissur Dist.It is an area possesses lots of angiosperms. An extensive field survey of the study area was carried out from Febuary 2015 to May 2015 for listing the plants.Most of the wetland area was covered with grasses. Colleceted specimens were identified with the help of Flora of the Presidency of Madras [1],[2]&[3],The Flora of Tamil Nadu, India, Flwering plants of Thrissur Forests[15],Biodiversity documentation for Kerala. part 6:Flowering plants [16].

Results & Discussion

There is no studies carried out on wetland Angiosperm diversity in Thrissur District. Besides frequent field visits and observations, many

wetland angiosperms could be identified. Different varieties of angiosperms can be seen in this area.Lindernia crustacean is a RED listed plant is also seen in this area. Monocots are most prominent than dicots. Most prominent plant species seen in this area are from the Poaceae family.The present study records 36 taxa comprising 31 genera of 18 families of flowering plants. In which more diversity is seen in the family poaceae. The details of identified plants are given below:-

Table 1

Name of the plant	Family
Lindernia rotundifolia (L.)Alston	Scrophulariaceae
Lindernia crustacean (L.)F.Muell.	Scrophulariaceae
Fimbristylis miliacea [L.]Vahl.	Cyperaceae
Fimbristylis ferugiana [L.]Vahl.	Cyperaceae
Ludwigia adscendens [L.]Hara.	Onagraceae
Ludwigia parvifolia Roxb.	Onagraceae
Mullugo oppositifolia L.	Isoaceae
Eragrostis amabilis (L.)Hook&Arnott	Poaceae
Cyperus haspan L.	Cyperaceae
Alternanthera philoxeroides(Mart.)Griseb	Amaranthaceae
Leptochloa chinensis L.	Poaceae
Oldenlandia corimbosa L.	Rubiaceae
Allopteropsis cimicina	Poaceae
Panicum repens	Poaceae
Echinochloa crus-gulli	Poaceae
Echinochloa stagnina	Poaceae
Sacciolepis interrupta	Poaceae
Hygrophilla schullii	Acanthaceae
Rotala rotundifolia	Lythraceae
Paspalum scrobiculatum	Poaceae
Centella asiatica	Apiaceae
Colocasia esculenta	Araceae
Eichornia crassipes	Pontederiaceae
Acorus calamus	Acoraceae
Nymphaea stellata	Nymphaeceae
Nymphoides indica	Menyanthaceae
Nymphoides hydrophylla	Menyanthaceae
Cabomba caroliana	Cabombaceae
Limnophilla aquatic Rox.	Scrophulariaceae
Ipomea aquatica	Convolvulaceae
Utricularia aurea Lour.	Lentibulariaceae
Eleocharis palustris (L)Roem.&Schult	Cyperaceae
Bacopa monnieri (L)Pennel.	Plantaginaceae
Eclipta alba L.	Asteraceae
Pandanus fascicularis Lam.	Pandanaceae
Cyperus pangorei Rottb.	Cyperaceae

Table 2: These identified plants were treated as family wise

Family	Number of plants
Scrophulariaceae	3
Poaceae	8
Cyperaceae	4
Onagraceae	2
Isoaceae	1
Amaranthaceae	1
Rubiaceae	1
Lythraceae	1
Apiaceae	1
Araceae	1
Pontederaceae	1
Acoraceae	1
Menyanthaceae	2
Nymphaeaceae	1
Cabombaceae	1
Convolvulaceae	1
Lentibulariaceae	1
Acanthaceae	1

The above observations shows a vast varieties of angiosperms seen in this small wetland area. From these observations it is very clear that the family poaceae is most prominent in this area. Diversity of Cyperaceae members are less, compared with poaceae but the number is not less than that of poaceae. Other families are almost equally distributed in the area of study.

Summary and Conclusion

As a result of this study a vast varieties of angiosperm plants could be identified with in this small area of study. These results reveal that the wetlands are the treasures of plant kingdom. From the collected plants eight of them form the family poaceae, this is the most prominent family in this area. Four members each from the families cyperaceae and scrophulariaceae. Lindernia crustacean is a member of

scrophulariaceae and is a RED listed plant.All the other families almost equally distributed in this area. The other identified families are onagraceae, isoaceae, amaranthaceae, rubiaceae, acanthaceae, lythraceae, apiaceae, araceae, pontederaceae, acoraceae, nymphaeaceae, menyanthaceae, cabombaceae, convolvulaceae and lentibulariaceae. A wetland is an area with large diversity,and also have great role in protecting the life on earth.So it is a need to conserve it as a treasure.

Acknowledgement

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Paspalum scrobiculatum	Poaceae
Centella asiatica	Apiaceae
Colocasia esculenta	Araceae
Eichornia crassipes	Pontederiaceae
Acorus calamus	Acoraceae
Nymphaea stellata	Nymphaeceae
Nymphoides indica	Menyanthaceae
Nymphoides hydrophylla	Menyanthaceae
Cabomba caroliana	Cabombaceae
Limnophilla aquatic Rox.	Scrophulariaceae
Ipomea aquatica	Convolvulaceae
Utricularia aurea Lour.	Lentibulariaceae
Eleocharis palustris (L)Roem.&Schult	Cyperaceae
Bacopa monnieri (L)Pennel.	Plantaginaceae
Eclipta alba L.	Asteraceae
Pandanus fascicularis Lam.	Pandanaceae
Cyperus pangorei Rottb.	Cyperaceae

Table 2: These identified plants were treated as family wise

Family	Number of plants
Scrophulariaceae	3
Poaceae	8
Cyperaceae	4
Onagraceae	2
Isoaceae	1
Amaranthaceae	1
Rubiaceae	1
Lythraceae	1
Apiaceae	1
Araceae	1
Pontederaceae	1
Acoraceae	1
Menyanthaceae	2
Nymphaeaceae	1
Cabombaceae	1
Convolvulaceae	1
Lentibulariaceae	1
Acanthaceae	1

The above observations shows a vast varieties of angiosperms seen in this small wetland area. From these observations it is very clear that the family poaceae is most prominent in this area. Diversity of Cyperaceae members are less, compared with poaceae but the number is not less than that of poaceae. Other families are almost equally distributed in the area of study.

Summary and Conclusion

As a result of this study a vast varieties of angiosperm plants could be identified with in this small area of study. These results reveal that the wetlands are the treasures of plant kingdom. From the collected plants eight of them form the family poaceae, this is the most prominent family in this area. Four members each from the families cyperaceae and scrophulariaceae. Lindernia crustacean is a member of

scrophulariaceae and is a RED listed plant.All the other families almost equally distributed in this area. The other identified families are onagraceae, isoaceae, amaranthaceae, rubiaceae, acanthaceae, lythraceae, apiaceae, araceae, pontederaceae, acoraceae, nymphaeaceae, menyanthaceae, cabombaceae, convolvulaceae and lentibulariaceae. A wetland is an area with large diversity,and also have great role in protecting the life on earth.So it is a need to conserve it as a treasure.

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EMERGING TREND OF E-COMMERCE IN INDIA

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Electronic commerce is presently an indispensable ingredient of India's trade facilitation policy. As a symbol of globalization, e-commerce represents the cutting edge of success in this digital age and it has changed and is still changing the way business is conducted around the world. The commercialization of the internet has driven electronic commerce to become one of the most capable channels for inter-organizational business processes.

E-Commerce consists primarily of the distributing, buying, selling, marketing and servicing of products or services over electronic system such as the Internet and other computer networks. It can involve electronic funds transfer, supply chain management, e-marketing, online marketing, electronic data interchange (EDI) and automated data collection system. It typically uses electronic communication technology such as the Internet, extranets, e-mail, e-books, data bases and mobile phones.

History of E-Commerce

History of e-commerce provides us important details about how electronic commerce began to be used as a popular online mean of economic exchange.

[1] Electronic Data Interchange (EDI) :-

EDI is the crucial phase in the history of e-commerce. It is invented in 1960's and provided with a "set of standards" that

enabled, the big business firms to indulge in a sort of beneficial electronic transactions.

[2] Mosaic Web-Browser :-

The next important phase is the development of mosaic web-browser in 1992. This web browser was soon given the form of a browser which could be down-loaded and was named as Netscape.

[3] Other Important Developments :-

The development and adaptation of DSL and Red Hat Linux respectively, again benefited the process of online business transactions. The year 2000, saw a major merger between AOL and time Warner which marked another important step towards the development of e-commerce.

[4] Present Status of E-Commerce :-

The Worldwide popularity of internet has resulted in the development and over whelming acceptance of e-commerce. It provides with a rich online transaction experience.

## Functions of Electronic Commerce

The four functions of e-commerce

1) Communication
2) Process management
3) Service management
4) Transaction capabilities

|	
Communication Function	• Aimed at the delivery of information and/or documents to facilitate business transactions. e.g. E-mail
Process Management	• Covers the automation & improvements of Business processes e.g. Networking two Computers together.
Service Management	• Application of Technology tom improve the quality of service .e.g. Federal express website- to tracks shipments
Transaction Capabilities	

Features of E-Commerce

1) No Geographical Boundaries

2) Improved market and product analysis

3) Low transaction cost.

4) Better presentation of goods.

5) Comparison is possible.

6) World wide availability.

7) Reduced paper work.

8) Quick order processing.

9) Improved customer interaction.

10) Equal opportunity to all.

Overall Internet Users

Overall internet users
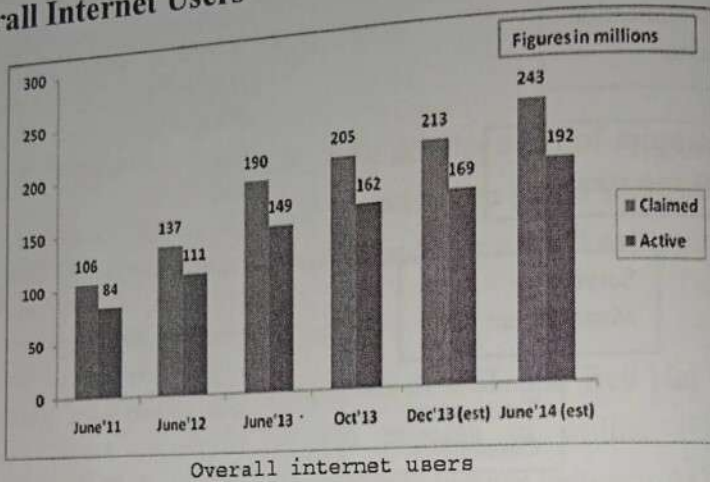
The number of active overall internet users shows an increase from 84 millions to 192 millions. It shows more than 200% increase in the no. of overall internet users.
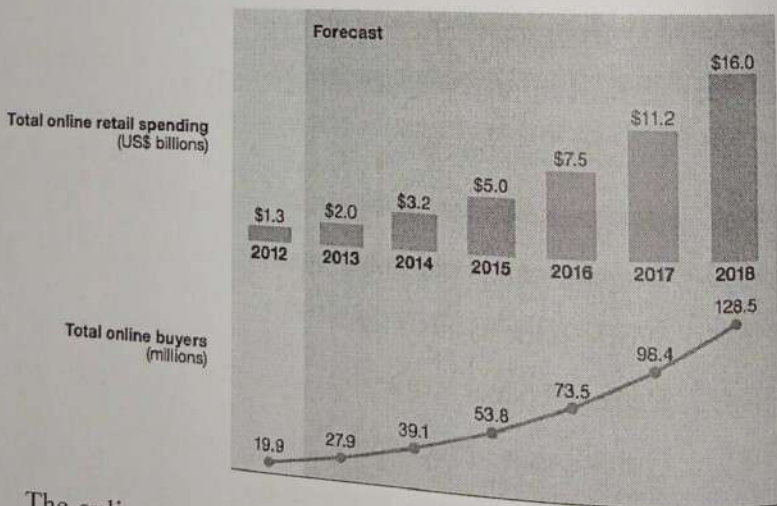
The online retail spending in India shows high growth rate in the year 2012 it was only $1.3 billions and it was $5.0 in the year 2015 and expect a growth of $16.0 billions in the succeeding years.

The total no. of total online buyers also shows Growth. There is only 19.9 million buyers in the year 2012, it was increased to 53.8 million in 2015.
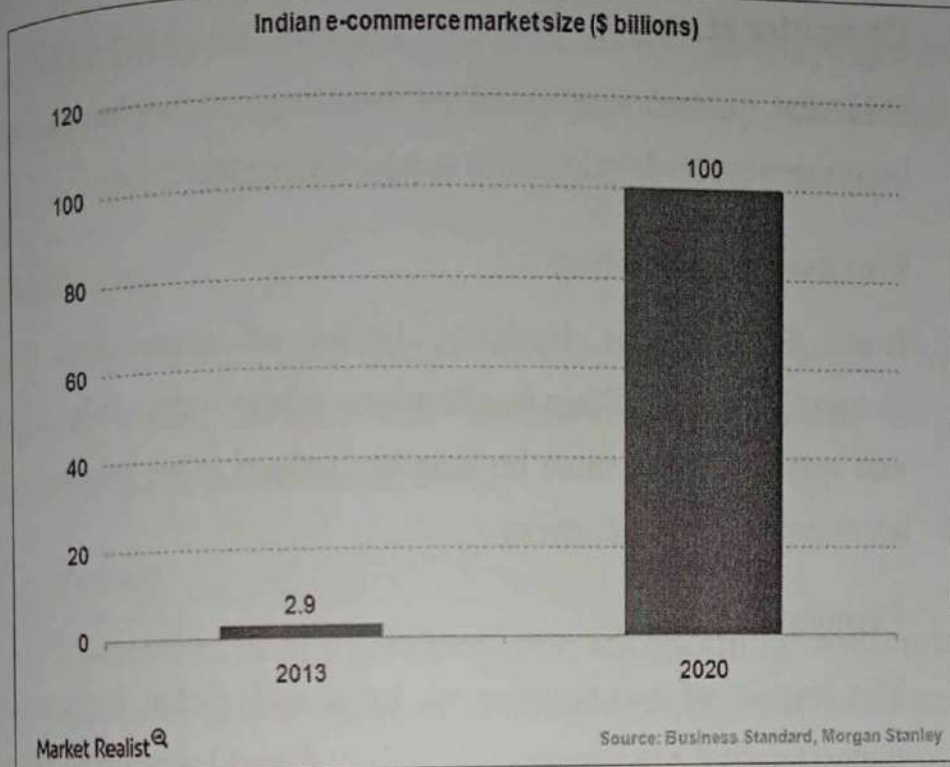
The market size of Indian E-commerce was 2.9 billions in 2013 and it was expected that it should be increased to $100 billion in the year 2020.

Impacts, Challenges and Limitations of E -Commerce

Impacts

E-Commerce have impact on many areas of business and disciplines of business management they are

1. **Marketing:-**

   It impacts particularly in direct marketing Telemarketing with the advances in telephone finally developed in to e- marketing

sprawning 'ECRM' (Customer Relationship Management) data mining and the like by creating new channels for direct sales and promotion.

2. **Computer sciences**

Different networking and computing technologies and languages were developed to support e-commerce.

3. **Finance & accounting**

Items like on-line banking; issues of transaction cost; accounting and auditing implications where 'intangible' assets and human capital must be tangibly valued in an increasingly knowledge based economy.

4. **Economies :-**

The impact of e-commerce on local and global economies; understanding the concepts of a digital and knowledge based economy and how this fits in to economic theory.

5. **Production & Operations Management (Manufacturing) :-**

Web based enterprise resource planning system (ERP) can be used to forward orders directly to production floor within seconds, thus cutting production cycle times up to 50% especially when manufacturing plants, Engineers and Designers are located in different countries.

6. **Management Information Systems(MIS):-**

MIS analysis, designs and implements e-business systems within an organization.

Human Resource Management(HRM)

7. HRM takes care of online recruiting.

Business Law and Ethics

8. The Different and legal ethical issues such as copy right laws, privacy of customer Information, legality of electronic contracts etc have arisen as a result of e-commerce.

Challenges

E-Commerce posed many threats because of its being what is popularly called faceless and borderless. The following are the issues related to e-commerce.

1. Privacy

Privacy has been significant issue of concern for both current and prospective e-commerce customers. Privacy consists of not being interfered with, having the power to exclude; individual privacy is a moral right.

2. Security

The Internet offers unprecedented ease of access to a vast array of goods and services. The rapidly expanding arena of "click and mortar" and the largely unregulated Cyberspace medium have however prompted concerns about both privacy and data security.

3. Disintermediation

This is a means of eliminating the intermediary such as retailers, wholesalers etc by setting up a website to sell directly to customers. For Example downloading of Music.

Limitations

- Credit card security is a serious issue if vulnerable
- Extensive database and Technical knowledge and experience required.
- Customer apprehension about online credit card orders.
- Constantly changing technology may leave slow business behind.

Conclusion

E-commerce is one of the biggest thing that has taken the business by a storm. It is creating an entire new economy, which has huge potential and is fundamentally changing the way businesses are done. It has advantages for both buyers as well as sellers and this win-win situation is at the core of its phenomenal rise.

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THE FOOL'S WISDOM: A RE-VISIONING OF CLASSIC NOVELS THROUGH SUFI PERSPECTIVE

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The archetype of holy fool or wise fool depicts the process of self search and discovery of man. Caricatures of physical humor always communicate well from culture to culture. The folk figure Mulla Nasruddin in folk tales, Miguel Cervantes' Don Quixote in *Don Quixote*, Fyodor Dostoevsky's Prince Myshkin in *The Idiot* and Mark Twain's Jim in The *Adventures of Huckleberry Finn* are such archetypes of wise fools that illustrate self- search or self-discovery.

Sufism has pervaded the creation of these characters. Sufi stylistic and thematic devices are quite relevant in the postmodern literary context. Modern and post modern writers have adapted traditional Sufi narrative methods like the fragmentary picaresque narrative and self reflective parables to enhance the human perception of life and universe. These techniques force and challenge the reader to travel through a road not taken. These structures prompt questioning, auditory imaging, visualizing and encourage personal associations and enhance creative manipulation. Nasruddin, Quixote, Jim and Prince Myshkin thus become Sufi constructs who carry their message across frontiers.

Human experience is uniquely different and essentially the same. The archetype of holy fool or wise fool depicts the process of

self search and discovery of man. They become creative vehicles to examine the layers of human soul and to warn humanity that we are running out of time unless we work to develop ourselves. Caricatures of physical humor always communicate well from culture to culture and so Mulla stories has travelled around for thousands of years from India in East to Spain in the West and eventually found its way into Cervantes' classic *Don Quixote*.

The above characters are instances of raw human experiences who embrace life with gusto and heroism. We find similar postmodern characters in the works of Samuel Beckett, James Joyce etc. These characters lack emotionalism. Sufis claim that sentimentalism and emotionalism is a barrier for the accurate view of life. Nasruddin, Quixote, Jim and Prince Myshkin thus become Sufi constructs who carry their message across frontiers.

These figures are not mere entertainers, but wise men who satirize our own follies. The paper highlights the relevance of an in-depth and wider study of Sufism as a literature-relevant-strata rather than a stereotyped religious branch. It also anticipates to emphasize the importance of humor in creating insights.

Spiritual traditions have always influenced our cultural and literary traditions. Sufi tales, jokes, poems and jokes are a source of intense delight and self reflection. Sufi literature strives to transcend the boundaries of self not wanting to anchor writing into an identity. The meaning of a Sufi tale comes through contemplation, ignoring the analytical approach and process of memorizing.

Humor, joking and jesting had been means of entertainment and tools for thinking over the depths of life from ancient

literature especially Sufi literature. Use of irony, allegory, short and long anecdotes, comedy, satire and farce provoke crudest practical joke to elegant witticism. The caricatures like Mulla and Quixote provide an illustrative criticism of life and literature. They lead to a process what we can call "apprehension" rather than "comprehension".

The divine idiot is a hybrid concept which grows out of the crossings of numerous discursive currents and traditions, both secular and non-secular, none of which are themselves utterly monolithic or unified: the history of Christian Saints; the philosopher fools of ancient Rome; the professional fool tradition, traceable back to the courts of the Egyptian pharaohs and the Mexican Aztecs who may have believed that the physically deformed and/or mentally handicapped possessed supernatural powers of magic and healing; the secular fool imagery which developed out of Renaissance Humanism, and, related to this, traditions of courtly and/or royal fool imagery, as that which informs Shakespearean tragedies such as *Hamlet* and *King Lear*; the natural and/or rural divine idiot of Romanticism, such as that represented by Dostoevsky's Prince Myshkin in *The Idiot* and Wordsworth's *Idiot Boy*; and the folkloric and oral narratives of African-American tradition and Native- American tribal cultures.

As embodied connections between the imaginary and history, the metaphysical and the material, the spiritual and the social, the transcendental and the ordinary, holy fools reflect a hope of redemptive powers that science, rationalism, modernity, and consumerism have not eradicated from cultural memory or popular

consciousness. Holy foolishness thus testifies to a longing for redemption via the particulars of the worldly imagination

For Sufis, Mulla Nasruddin becomes a process of self discovery that makes one pause and re-evaluate ones values and logic system in physical and metaphysical plane. Mulla ushers in a new paradigm of thought and existence in the existential dilemma posed by the modern world. Like Mulla, Don Quixote is also the social and spiritual conscience of his community. Both travel widely and their wise foolishness is a tool for thinking over the depth of things. Each of their stories is a lesson in logic. The magic of those parables are relevant as of now as it was then, which impels one to take this topic as an object of deeper study.

The Mulla stories especially vary in interpretation even to the same person at different times. It is this metaphysical content that distinguishes these stories from other jokes and parables. They evoke a distancing effect, comfort and escape from the existential dilemmas of the postmodern world. They offer us a new way of thought and wisdom different from the strictly rational approach. The approach here is a more practical one that comes from immediate experience of life than from books.

The name "sufism" simply means "wisdom" and a Sufi teacher works first with story, metaphor, poetry, spiritual practice or music, in order to get beyond and behind the blocks that the conscious mind puts up. Sufi stories may express humorous, sad or mixed emotions, but generally they are not moralistic, nor is there one particular point to get, as one would in a joke or riddle. The

stories may have many layers, and the most obvious ones often give way to the more subtle only with time and experience.

On the whole, whether condensed or not, Sufi teaching stories sufficiently disorient the reader's rational faculties so that a potential channel for discerning the story's wisdom can be established. Doris Lessing does this in many of her later narratives, including *The Memoirs of a Survivor, Briefing for a Descent into Hell*, The Sufi teaching story aims to shake the audience's existing worldview to such a point that one stops looking at the world through any single lens.

Doris Lessing's direct quotes and simulation of them, in her novels would suggest that she takes them seriously and gives them her full attention, in turn requiring our full attention and effort at, understanding her own stories that resemble Nasrudin's in spirit. Sufi jokes mock the ultimate inadequacy of logic. The collection of Idries Shah offers best of Mulla Nasruddin stories. For example, the Hodja demonstrates the interconnectedness in life when, while walking along a deserted street in the night, he sees a troop of horsemen coming toward him. Frightened out of his wits, he jumps over a wall and finds himself in a graveyard. The horsemen follow him and see the Hodja cowering with fear. "What are you doing there?" they ask him, and the Hodja replies, "It is more complicated than you assume! You see, *I* am here because of you; and you, *you* are here because of *me.*"(124)

The tradition of divine idiocy expresses a paradox: if the wisdom of the world is but folly to God, and if God's own foolishness is the one true, divine wisdom, then the worldly must

renounce all worldly wisdom in order to become truly wise. One must become, by an act of will, a fool. Divine idiocy is thus a form of repudiation: one repudiates the vainglorious wisdom of the world and cultivates the childlike trust and spiritual naiveté which is a defining mark of perfection

While in Russian culture the divine idiot has remained a central figure of spiritual life and of magical possibility in folklore, in the U.S. s/he carries a deeply secular significance whose roots reach back to the enlightenment and to American romanticism. The American idiot is a natural legislator who represents instinctual rather than institutional law. One finds such images and stories of divine idiots in American literature, folklore, popular culture and mass media. These images and narratives often relate the problem of an enlightened individual's relation to an imagined majority that neither recognizes nor values his gifts.

They examine the situation of a character who lives outside the conventional moral frames and institutional structures which regulate American society. They express extreme hopefulness with regard to the social contract on which national identity is based, yet they also reveal the inherent contradictions of that contract. The American idiot is thus an important spiritual expression of radical disunities, or an imaginative world of radical, even irreconcilable contradictions in American moral, pragmatic life. The American idiot is part saint and part madman, part prophet and part con-man, part healer and part lunatic.

Dostoevsky's Prince Myshkin in *The Idiot* may indeed represent the social and philosophical problems inherent in the

Christian ideal of goodness. However, the American Idiot symbolized by Jim in *Huckleberry Finn* represents the contradictions inherent in our utopian ideals of equality, democracy, and freedom, our well ordered manufacturing of social consensus and social consciousness at the cost of revolution.

Approaching the study of American literature and popular culture through the figure of the holy fool can help us learn more about widespread perceptions of religion and the role that religion plays in the organization of everyday life.

Like Huckleberry Finn and Holden Caulfield, idiot boys reject the complacency and dullness of formal educational and religious institutions. They live according to simple truths drawn from natural law, a native intelligence. In Dostoevsky's *The Idiot* even Prince Myshkin, in the end, returns to the company of children upon failing to manage the complexities of the adult world. "The soul is healed by being with children."(525)

Jim, despite his innocence, is able to teach Huckleberry Finn a lesson about natural morality. He achieves this only through his elemental humbleness, modesty, and kindness. Like Huck, Jim is childlike, but the fact that he is a grown man, morally abused by the slavery system, suggests that he is stronger spiritually and closer to divine truth than the "free" white men who Huck and Jim encounter on land, men who constantly lie, steal, and kill for money and revenge. Idiot characters, in such cases, bring to light the contradictions of an economy driven by racism.

The American idiot represents worldly possibilities of transcendence for a people who share no common origin, religion,

or relation to the divine, and he must represent the problems of democratic embodiment for a pluralistic society where, ostensibly, no "body" is privileged above any other. In *The Adventures of Huckleberry Finn* Tom says, "I reckon I got to light out for the Territory ahead of the rest, because Aunt Sally she's going to adopt me and sivilize me, and I can't stand it. I been there before."(323)

Prince Myshkin's innocence, his total sincerity, fearlessness, humility, and lack of self-interest sets him apart from other people, Dostoevsky's dialectical conception of *The Idiot* was to create a novel that would explore the theme of unlimited idealism with unlimited sensualism. In *The Idiot*, extreme idealism is embodied by the idealistic Myshkin, -a positively beautiful individual, according to Dostoevsky's plan for the novel. The author explores the capacity for the co-existence of good and evil within the charismatic personality, the struggle of greatness and fiendishness, divinity and destruction. For Dostoevsky, the problem was a distinctly religious one, a problem that extended to questions about Christian imagery in world literature and the spiritual depth of the Russian people.

Quixotic tales parallel the tales of Mulla Nasruddin, as an example of the essence of Menippean satire in its most basic form, as they are humorous vignettes poking fun at pieces of cultural issues by way of dialogue between the main protagonist and at least one other individual. They provide a twist or a new way at looking at an issue, generally provoking laughter at the same time. It treats social constructs or beliefs with a humorous tone or playful manner. Don Quixote says, "The ability to reason the un-reason which has

afflicted by reason saps my ability to reason, so that I complain with good reason of your infinite loveliness."(13)

Mullah is often a figure of ridicule, yet very cunning, and the stories make fun of despotic rulers and of religious orthodoxy. And yes, Mulla would have understood about the windmills and the giants. For the Mulla, like Don Quixote, often saw the world rather differently. Did he not once throw yeast into a lake to turn it into yoghurt? Did he not once ride his donkey facing backwards? One day Nasruddin was riding his donkey facing towards the back. To people's queries on this unusual gesture he said that it's not that he was sitting on the donkey backwards, he was just interested in where he has been coming from more than where he was going to.

In the world that we live in, akin now in some respects to those autocratic worlds in which only the fool could get away with telling Truth to Power; Cervantes, has the answer - humor, and an understanding of history which is not idealized, but aware of complexities, and aware of Power can save us.

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COLONIAL REFLECTIONS AND MODERN WOMEN: INTROSPECTING 'MEENAKSHI'

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The colonialist, who inherited the enormously old and systematic western scheme of knowledge, about the east called the orient, viewed what they found here as primitive and superstitious in contradiction to their civilized and scientific west. Their criteria of assessment and mode of representation of native life were preconceived and distorted beyond recognition1. To them, the native life was uncivilized and barbarous that desperately needed reforms. And education in western knowledge was the primary step they prescribed for reforming the colonial societies.

The intellectuals in 19th century India adopted an idealized view off the state system based on liberal principles, most of them accepted and even welcomed British rule as divine dispensation2. That Britain in the first half of the 19th century represented the most advanced polity and economy in the world and it was accepted that British rule was the chosen instrument leading India to the path of political and economic modernisation. Their values, notions, clothing, behaviour and ways of life were pictured as superior features of modern life by facilitating the circulation of literary creations embodying practices of modernity.

The western values were soon internalised by native writers who began to reproduce them. CheruvalathuChathu Nair's 'Meenakshi'3

is a good example of this. This novel reproduces western values as superior leading to social progress. It carried the message of progress and reform as defined by the west.

In habits, rationality, dress, games, furniture, nature of dwellings and other major as well as minor aspects of the general social life, the natives began to mimic the westerners. Replacement of such traditional practices, which according to the western understanding impeded progress. Thus centuries of colonial domination created new habits and tastes. Victorian morality, which was the term used to denote the distillation of the moral views of people living at the time of Queen Victoria's reign (1837-1901). Which was become the moral climate of the United Kingdom throught the 19th century. Due to the prominence of the British Empire, in the sphere of colonialism many of these values were spread across the world.

In, India also colonial perceptions were framed in accordance with this Victorian morality. Colonial modernity comes with its own critique of native custom and tradition, and all that was solid in the intellectual and cultural matrix of the elite seems to melt in to the air 4. And in accordance with the colonial perception family and culture were restructured and the system of polygamy and the sambandham system of marriagewere looked down. The reformswere eager to stop them. The spread of English education has been a powerful element in the social movement.

The English educated had a western perspective towards family and kinship and naturally they wanted to do away with the system of inheritance the mother and welcomed the one through the father. Certain leaders found it a disguise to follow the matrilineal system

because there was no identity of the father. Those who viewed society through the victorian morality found it a disgrace to have no certainty of the father. They also wantedlegality for some customs and regulations of marriage.

Meenakshi was written in 1890's, which was a period marked for colonial expansion and its cultural dominance. Thus Meenakshi along with so many other literary works also portrays social elements of a colonized society. Meenakshi is a story about the life of nairs 5. Meenakshi, the heroin of the novel pictured as a member of nair family. Heroin's high qualities of character, romance and fulfilment of her romance became the central theme of the novel. Along with this theme there was depicted another major character called Kochammalu, who was figured as person just opposite to Meenakshi. Kochammalu maintaining a sambandham relation with a malayalee Brahmin (Embranthiri). While maintaining this malayalee Brahmin as her sambandham she maintained conjungal relationship with several people, who were the members of feudal aristocracy of that region. Kochammalu was following age oldcustoms and was enjoying the conjugal freedom accorded to a nair lady in those times. But the novelist with avision of victorian morality takes a judgemental position and has made a moralistic judgment denigrading the character of Kochammalu. And at the end Kochammalu was transforming herself to a new women i.e. with the expectable women identity put forwarded in accordance with the victorian moral code.

By creating these two binary characters the novelist actually tried to project the acceptable female identity. Norms and expectations

which define male and female natures and behaviour. Thus gender is a social construct. Gender is a feature of social construct. And these gender identity is internalized and does becomes a dimension of women's identities. The development process in childhood and beyond is not merely a process of internalization. It is also a process of individualization. Thus, women's identities are both gendered and individualized. Identities are individualised. Individualisations will not entirely her own choice 6. This individualisation does not fully protect women's capacities. Women identities are gendered in patriarchal cultures does impede women's ability to function as self-determining agents7.

Patriarchal societies fashioning as women with bodily self-discipline and fantasies are of internalised oppression. And these imaginaries available to women that would be the bonds of internalized oppression.

These imageries actually would be the bonds of internalized oppression. Identities are individualized. But how gender marks a woman's identity will not be entirely her own choice. Gender works its way in to identity in ways that we may not be conscious of and in ways that we may not be able to change.

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SOLUTION FOR MIXED DATA CLUSTERING IN DATA MINING

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ABSTRACT

Clustering is process in data mining which align objects which have a high degree of similarity in the same group. The real world data is a combination of both numeric and nominal data. The major problem of existing mixed data clustering is, it undergoes much iteration which will reduce the performance and increase the complexities regarding the storage space. Here I introduce an integrated framework using Frequent Pattern based framework for Mixed data Clustering (FPMC) algorithm, to cluster mixed data by performing a one-time clustering along with attribute reduction. This algorithm comes under divide and conquer paradigm, with three phases, namely crack, transformation and merging. The outcome of this clustering will provide a reliable answer when we are in a trouble with mixed datasets.

Keywords: Frequent Pattern Analysis, Clustering, Normalization, Sum of Squared Error, FPMC

Introduction

Clustering is the process of identifying the classes of objects with similar characteristics and features. Clustering segregates the similarities and differences in the database. It form groups of related

data called as either classes or clusters. Apart from classification, clustering is an un-supervised learning method to uncover the causal structures and patterns of a given dataset. It is also called as automatic classification in the sense, data objects can be treated as an implicit class. The distinct advantage is that, it can automatically find the groupings. The methods for clustering are mainly divided into following categories: 1-Partitioning, 2-Hierarchical, 3-Density based, 4-Grid-based methods. First, partitioning method is a popular heuristic method which improves the segregation by moving the objects from one group to another by a local optimum approach. The techniques comes under this methods are K-means and K-medoids. Second, hierarchical method breaks down the data objects to various levels of hierarchies. Two Hierarchical approaches are agglomerative and divisive. The agglomerative approach builds the hierarchies in a bottom up fashion and divisive approach does the same in the top down. Third, density based method finds a solution for the difficulty in finding arbitrary shaped clusters. The clusters are grown on the basis of density to solve the issue. The high density area is called as clusters, whereas the sparse areas are used to differentiate the clusters. Fourth, grid-based method is one of the high speed clustering methods which divides the object space into a number of cells that form a grid structure. The processing time depends upon cells in each dimension of the quantized space [1]. Most clustering algorithms focus on numerical data clustering. But real data set contains mixed data types which are commonly numerical, categorical or binary. As the categorical data cannot be ordered as numerical, need of finding a solution algorithm to cluster mixed data is high.

In this paper, I propose FPMC, an efficient algorithm for mixed data clustering. FPMC performs clustering after crack, transformation and merge phase. In crack phase, the total data set is divided into nominal and numerical packs. Then the processing is in the transformation phase where frequent patterns are mined to extract frequency-token which are numerical substitutes to nominal values. Attribute reduction is achieved by converting 'n' number of nominal attributes to a single numerical attribute. Merge phase combines the output of transformation phase and numerical attributes which will undergo normalization before any numerical clustering algorithm is applied.

Proposed System

In this paper, I propose, FPMC algorithm to cluster mixed data by avoiding the need to cluster many times which reduce the performance. The FPMC algorithm replaces the nominal attributes with the count of frequent pattern that occur in the data set.

The FPMC algorithm uses Apriori as it is the backbone to do mixed data clustering. Apriori algorithm is chosen because to its easiness in implementation and simplicity in data structure. Apriori algorithm is suitable for large data sets. This algorithm first separates the total data set into nominal and numerical in the FPMC crack stage, after replacement of missing values. The crack stage produces two results one is nominal and other numerical pack. The nominal pack undergoes FPMC transformation where frequent pattern analysis is done to obtain a frequency -token value. This value is obtained by analyzing the nominal pack with the frequent patterns derived from Apriori analysis by evaluating Equation (1).

Let $P_1, P_2,.... P_n$ be the frequent patterns obtained after Apriori analysis.

$$RS_{value} = \{P_i, \text{ Count++; flag=Valid;} \quad or \quad !P_i, \text{ flag=Valid; }\}...(1)$$

P_i represent i^{th} frequent pattern we consider and RS_{value} is the result of row wise scan. If a match is found, i.e. $RS_{value} = P_i$, increment the count and mark the row as valid. Else mark it as invalid. Then the merging of numeric and frequency-token attribute takes place, followed by normalization.

The normalization is a process in which all attributes are given an equal weight, this is particularly useful for distance measures while used in clustering. The three main types of normalization techniques available are min-max, z-score and decimal scaling normalization. Min-max normalization is the process of altering the original data into a specified range in a linear fashion. For mapping a v value, of an attribute A from range [minA, maxA] to a new range [new_minA, new_maxA], the computation is given by Equation(2).

$$\frac{v - min_A}{max_A - min_A} \frac{(new\_max_A - new\_min_A) + new\_min_A}{} ....(2)$$

where 'v' is the new value in the required range.

Z-score normalisation is based on mean and median, it is also called as zero mean normalization. The formula is given in Equation (3).

$$\frac{d' = d - mean\ (P)}{std(P)} .... (3)$$

where mean(p) = sum of the all attribute values of P and Std(P)=Standard deviation of all values of P. Decimal-scale normalization is based on the decimal point movement depending on the absolute values of the attributes. The formula is given below in Equation (4).

$$\text{Max } (\, |d| \,) < 1.[5] \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (4)$$

Z-score normalisation is used in the FPMC algorithm as it maintains the range and dispersion of the data set i.e. Standard deviation/variance. After normalization an efficient numerical clustering algorithm is applied. The process flow of FPMC algorithm is given below in Fig. 1.
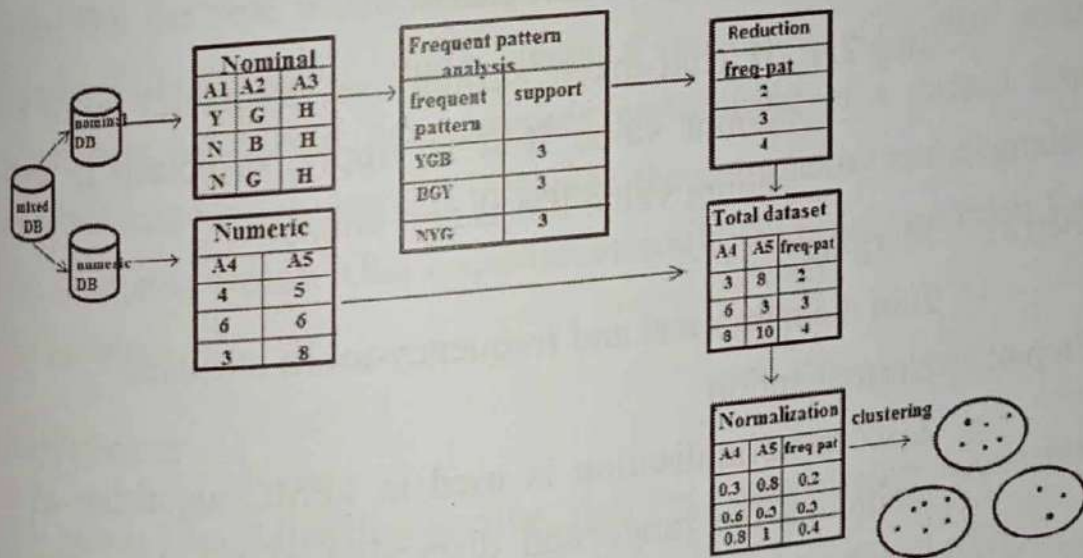
Fig. 1: FPMC flow of execution

Step1:   Partitioning

After the replacement of missing values from the dataset it is divided into numerical and nominal packs.

Step2:   Transformation.

> Step 2.1: Frequent patterns are generated using Apriori.
>
> Step 2.2: Perform row wise scan on the nominal attributes and execute the operations in *Equation* (1) for All instances. After the row wise scanning of entire dataset, we get the value for frequency-token. For the first frequency pattern i.e. P_1 go to Step 2.3 otherwise Step 2.4.
>
> Step 2.3: Set frequency-token attribute as count value for all rows marked as valid. And also store a copy of count to init-token.
>
> Step 2.4: If (init-token <count) set frequency-token as count value if it is empty, orreplace it with count value if it is non-empty.

Step 3:   Merging

> Join the numerical and frequency-token attribute.

Step 4:   Normalization

> Z-score normalisation is used in FPMC algorithm as it maintains the range and dispersion of the data set i.e. Standard deviation/variance.

Step 5:   Clustering

> Perform any numerical clustering algorithm

Step 6:   Validation of the results

SSE is used as evaluation criteria for FPMC algorithm. The Sum of squared error for each data point is the distance to the nearest cluster. The clustering produces good results with small

value for SSE with minimum number of clusters. Equation (5) gives the formula for SSE calculation where m_i represent the mean of the cluster and x the data point C the cluster.

$$SSE = \sum_{i=1}^{K} \sum_{x \in C_i} dist^2(m_i, x) \quad \dots\dots\dots\dots\dots\dots\dots\dots(5)$$

Conclusion

The main objective of clustering is to group similar instances of a data set. The grouping of instances is made on the basis of similarity measures. Even though there are many distance measures available, most of them are applied either on numeric or nominal data. But the real world data are usually mixed in nature. So we cannot directly apply these distance measures. For that most algorithms for mixed data requires partitioning of a dataset into nominal and numeric which increases the complexity and degrades the clustering result. This Experiment could find out a solution for the problem.

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BIOINFORMATICS – IN HUMAN

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ABSTRACT

Rapid advances in bio informatics are providing new hopes to patients of life threatening diseases. Genechips will be able to screen heart attack and diabetics years before patients develop symptoms. In near future, patients will go to a doctor's clinic with lab-on-a-chip devices. The device will in form the doctor in rea ltime if the patient's ailment will respond to a drug based on his DNA. These will help doctors diagnose life-threatening illness faster, eliminating expensive, time-consuming or deals like biopsies and sigmoidoscopies. Genechips re classify diseases based on their under lying molecular signals, rather than mis leading surface symptoms. The chip would also confirm the patient's identity and even establish paternity.

Keywords – *Bioinformatics, Nucleus, DNA*

1. Introduction

Bio informatics is an inter disciplinary research area. It is a fusion of computing, biotechnology and biological sciences. Bioinformatics is poised to one of the most prodigious growth areas in the next to decades. Being the interface between the most rapidly advancing fields of biological and computational sciences, it is immense in scope and vast in applications.

Bioinformatics is the study of biological information as it passes from its storage site in the genome to the various gene products in the cell. Bio informatics involves the creation and computational technologies for problems in molecular biology. As such, it deals with methods for storing, retrieving and analyzing biological data, such as nuclei acid (DNA/RNA) and protein sequence, structures, functions, path ways and interactions. The science of Bio informatics, which is the melding of molecular biology with computer science, is essential to the use of genomic information in understanding human diseases and in the identification of new molecular targets of drug discovery. New discoveries are being made in the field of genomics, an area of study which looks at the DNA sequence of anorganism inorder to determine which genes code for beneficial traits and which genes are involved in inherited diseases.

2. Human Electronics

The nucleus is the most obvious organelle in the human cell. With in the nucleus is the DNA responsible for providing the cell with its unique characteristics. The DNA is similar in every cell of the body, but depending on the specific cell type; some genes may be turned on or off-that is why a liver cell is different from a muscle cell, and a muscle cell is different from a fat cell. About 99.9% of the sequence is identical between any two people. But because the small percentage of DNA that differs can relate to an individual's disease. Scientists are comparing sequence using DNA chips from healthy people and those from patients with a specific disease to help identify genetic targets for drug discovery information about

genetic variation can help to predict which patients are likely to benefit from specific drugs.

The most significant and the biggest application of DNA chips is the use of DNA micro arrays for expression profiling. In expressions profiling the chip controls how different part soft hegenes turned on or off to create certain types of cells. If the gene is expressed in one way, it may result in normal muscle, for instance. If it is expressed in another way, it may result in a tumor. By comparing these different expressions, researchers hope to discover ways to predict and perhaps to prevent diseases.
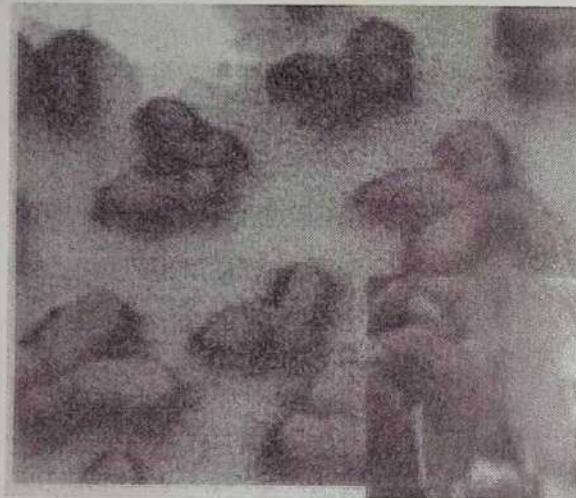
Fig 1: DNA

Electronic circuit can be incorporated in the chip to detect various states of DNA. DNA carries an electric charge. That charge can be read on the chip, just like cells on a memory array. This DNA chip would like to diagnose life-threatening bacterial infections.

In DNA the medium is a chain of two units (phosphate & ribose), and the most easily recognizable message is provided by a sequence of letters (bases) attached to the chain. The DNA has two

sequences of letters wrapped in the form of a double helix. The DNA has two sequences of letters wrapped around each other in the form of a double helix. One is the complement of other, so that the sequence of one string (strand) can be inferred from the sequence of other. The DNA sequence of bases encodes 20 amino acids. Under instructions received from DNA, amino acids join together in the same order as they are encoded in DNA to form proteins. Chains of amino acids, which fold in complicated ways, play a major role in determining how we interact with the environment.

Genomic information is revolutionizing life sciences. The quest for understanding how genetic factors contribute to human disease is gathering speed. The 46 human chromosomes house almost three billion base pairs of DNA that contain 30,000 to 40,000 protein-coding genes. Using bio informatics findout how genes contribute to diseases that have a complex pattern of inheritance, such as diabetics, asthma, and mental illness. No one gene can tell whether a person has a disease or not. A number of genes may make a subtle contribution to a person's susceptibility to a disease. Gene may also affect how a person reacts to the environment. As the entire human genome is too big a sequence on its own, sequencing and reading a genome demand heavy computational resources.

Bioinformatics is largely, although not exclusively, a computer-based discipline. Computers are important in bioinformatics for two reasons:

First, many bioinformatics problems require the same task to be repeated millions of times.

For example, comparing a new sequence to every other sequence stored in a database or comparing a group of sequences systematically to determine evolutionary relationships. In such cases, the ability of computers to process information and test alternative solutions rapidly is indispensable.

Second, computers are required for their problem-solving power. Typical problems that might be addressed using bioinformatics could include solving the folding pathways of protein given its amino acid sequence, or deducing a biochemical pathway given a collection of RNA expression profiles. Computers can help with such problems, but it is important to note that expert input and robust original data are also required.
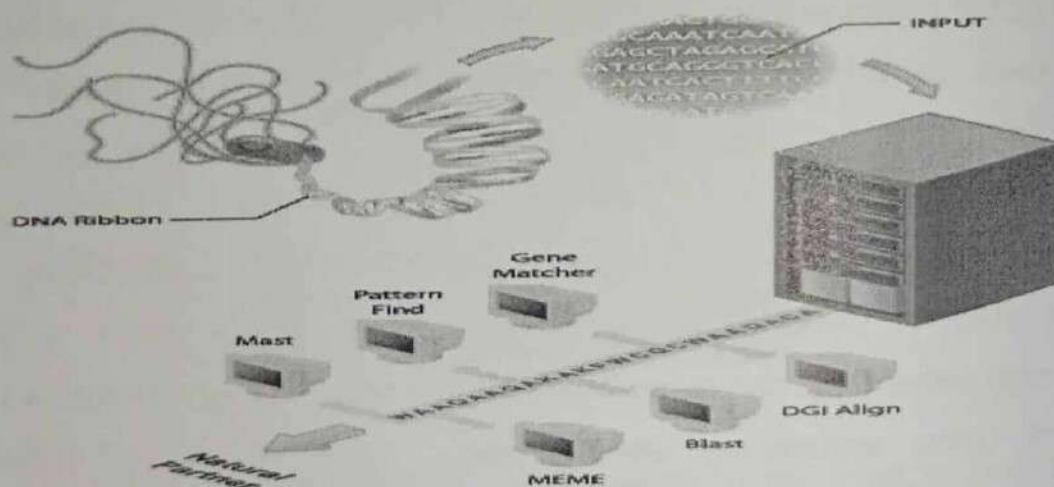
Fig. 2: Involvement of computers

We start with an overview of the sources of information: these may be divided into raw DNA sequences, protein sequences, macromolecular structures, genome sequences, and other whole genome data. Raw DNA sequences are strings of the four baseletters comprising genes, each typically 1,000 bases long. The

GenBank repository of nucleic acid sequences currently holds a total of 9.5 billion bases in 8.2 million entries (all database figures as of August 2000). At the next level are protein sequences comprising strings of 20 amino acid-letters. At present there are about 300,000 known protein sequences.
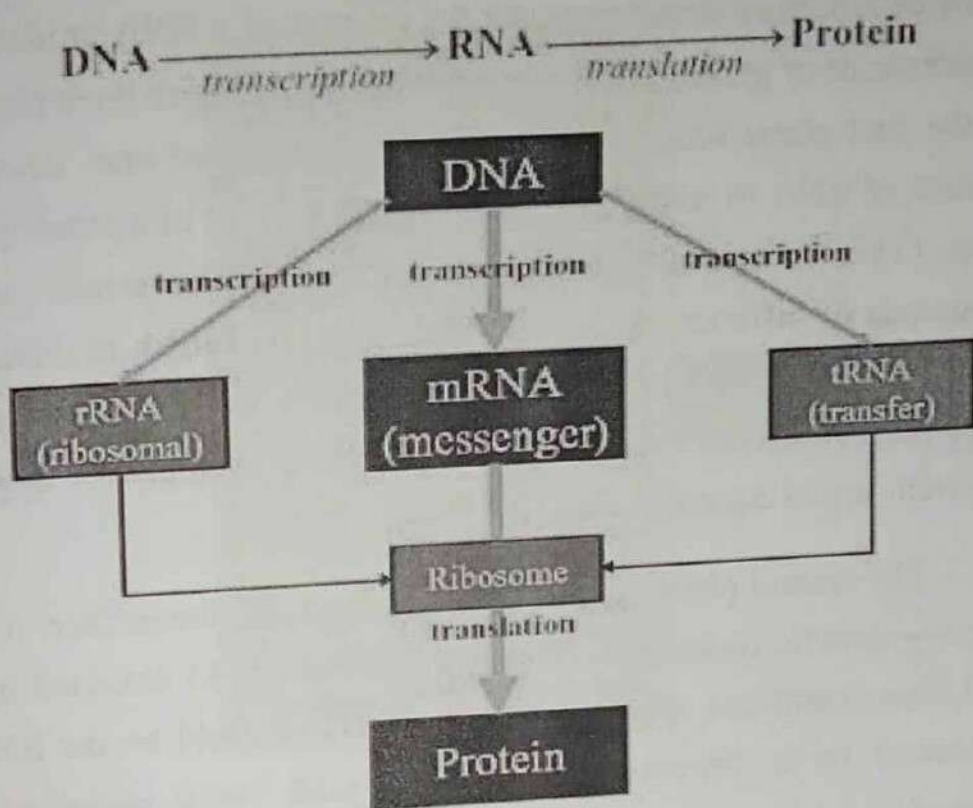
3. Gene Expression

DNA ——————— $\xrightarrow{\text{transcription}}$ RNA ——————— $\xrightarrow{\text{translation}}$ Protein

DNA

transcription   transcription   transcription

rRNA (ribosomal)   mRNA (messenger)   tRNA (transfer)

Ribosome

translation

Protein

Fig. 3: Gene Expression

mRNA encodes the genetic information as copied from the DNA molecules. Transcription is the process in which DNA is copied into an RNA molecule. The resulting linear molecule is an mRNA transcript. tRNA molecules develop a well-defined three-dimensional structure which is critical in the creation of proteins. Translation is the process in which the nucleotide base sequence

of the processed mRNA is used to order and join the amino acids into a protein with the help of ribosomes and tRNA. The 3D structure of proteins is mainly determines by X-ray crystallography and by nyclear magnetic resonance (NMR). It is time consuming and costly.

A powerful new tool available in biology is microarrays. They allow determining simultaneously the amount of mRNA production of thousands of genes. Microarray experiments require three phases. In the first phase one places thousands of different one- stranded chunks of RNA in minuscule wells on the surface of a small glass chip. (This task is not unlike that done by a jet printer using thousands of different colors and placing each of them in different spots of a surface.) The chunks correspond to the RNA known to have been generated bya givengene. The 2D coordinates of each of the wells are of course known.

The second phase consists of spreading—on the surface of the glass— genetic material (again one-stranded RNA) obtained by a cell experiment one wishes to perform. Those could be the RNAs produced by a diseased cell, or by a cell being subjected to starvation, high temperature, etc. The RNA alreadyin the glass chip combines with the RNA produced by the cell one wishes to study. The degree of combined material obtained by complementing nucleotides is an indicator of how much RNA is being expressed by each one of the genes of the cell being studied.

The third phase consists of using a laser scanner connected to a computer. The apparatus measures the amount of combined material in each chip well and determines the degree of gene

expression—a real number—for each of the genes originally placed on the chip. Microarray data is becoming available in huge amounts. A problem with this data is that it is noisy and its interpretation is difficult. Microarrays are becoming invaluable for biologists studying how genes interact with each other. This is crucial in understanding disease mechanisms.
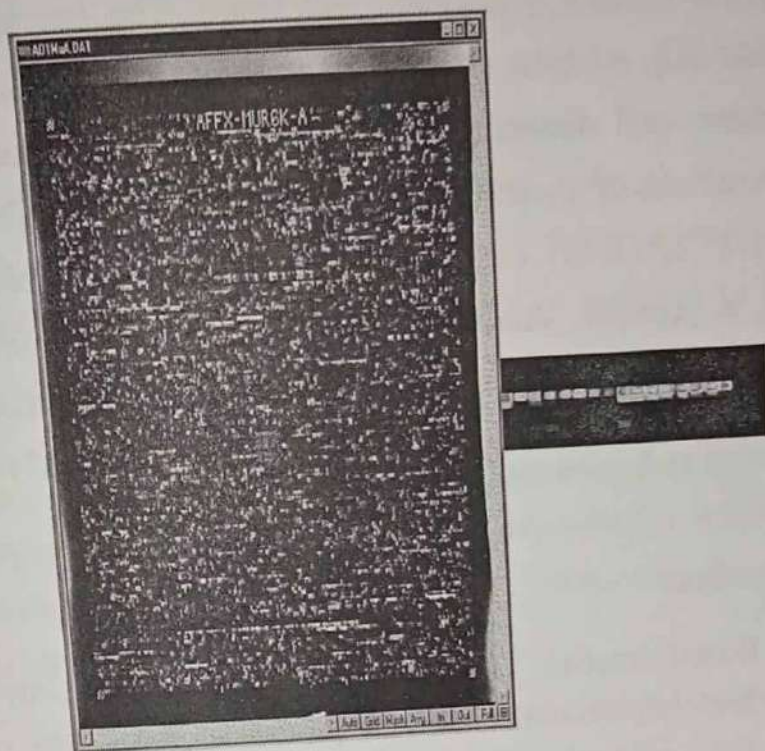

Fig. 4: Microarray

The most significant and the biggest application of DNA chips is the use of DNA microarrays for expression profiling. In expressions profiling the chip controls how different parts of the genes turned on or off to create certain types of cells. If the gene is expressed in one way, it may result in normal muscle, for instance. If it is expressed in another way, it may result in a tumor. By comparing these different expressions, researchers hope to discover ways to predict and perhaps to prevent diseases.

4. Conclusion

DNA is the genetic material of organism. It contains all the information needed for the development and existence of an organism. The DNA molecule is formed of two long poly nucleo tidechains which are spirally coiled on each other forming a double helix. Thusithas the form of spirally twisted ladder. DNA is a molecule made from sugar, phosphate and bases. The basesare guanine (G), cytosine (C), adenine (A) and thiamine (T). Adenine pairs only with Thiamine and Guanine pairs only with Cytosine. The various combinations of these bases make up with DNA. That is; AAGCT, CCAGT, TACGGT etc. An infinite number of combinations of these bases is possible. And then the gene is a sequence of DNA that represents a fundamental unit of heredity. Human genome consists of approximately 30,000 genes, containing approximately 3 billion base pairs.

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CLOUD COMPUTING

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ABSTRACT

Cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. The cloud is just a metaphor for the Internet. It is basically an Internet-based network made up of large numbers of servers - mostly based on open standards, modular and inexpensive. Clouds contain vast amounts of information and provide a variety of services to large numbers of people. The benefits of cloud computing are Reduced Data Leakage, Decrease evidence acquisition time, they eliminate or reduce service downtime, they Forensic readiness, they Decrease evidence transfer time The main factor to be discussed is security of cloud computing, which is a risk factor involved in major computing fields.

For it to be considered "cloud computing," you need to access your data or your programs over the Internet, or at the very least, have that data synchronized with other information over the Web. In a big business, you may know all there is to know about what's on the other side of the connection; as an individual user, you may never have any idea what kind of massive data-processing is happening on the other end. The end result is the same: with an online connection, cloud computing can be done anywhere, anytime.

Keywords: cloud computing, SaaS, cloud, private cloud, cloud security, public cloud, benefits of cloud computing

Introduction

When you store your photos online instead of on your home computer, or use webmail or a social networking site, you are using a "cloud computing" service. If you are an organization, and you want to use, for example, an online invoicing service instead of updating the in-house one you have been using for many years, that online invoicing service is a "cloud computing" service.

Cloud computing refers to the delivery of computing resources over the Internet. Instead of keeping data on your own hard drive or updating applications for your needs, you use a service over the Internet, at another location, to store your information or use its applications. Doing so may give rise to certain privacy implications.

Cloud computing is the delivery of computing services over the Internet. Cloud services allow individuals and businesses to use software and hardware that are managed by third parties at remote locations. Examples of cloud services include online file storage, social networking sites, webmail, and online business applications. The cloud computing model allows access to information and computer resources from anywhere that a network connection is available. Cloud computing provides a shared pool of resources, including data storage space, networks, computer processing power, and specialized corporate and user applications.

What is a Cloud computing?

The term "cloud", as used in this white paper, appears to have its origins in network diagrams that represented the internet, or

various parts of it, as schematic clouds. "Cloud computing" was coined for what happens when applications and services are moved into the internet "cloud." Cloud computing is not something that suddenly appeared overnight; in some form it may trace back to a time when computer systems remotely time-shared computing resources and applications. More currently though, cloud computing refers to the many different types of services and applications being delivered in the internet cloud, and the fact that, in many cases, the devices used to access these services and applications do not require any special applications.

- Cloud computing is Internet- ("CLOUD-") based development and use of computer technology ("COMPUTING")

- Cloud computing is a general term for anything that involves delivering hosted services over the Internet.

- It is used to describe both a platform and type of application.

- Cloud computing also describes applications that are extended to be accessible through the Internet.

- These cloud applications use large data centers and powerful servers that host Web applications and Web services.

- Anyone with a suitable Internet connection and a standard browser can access a cloud application.
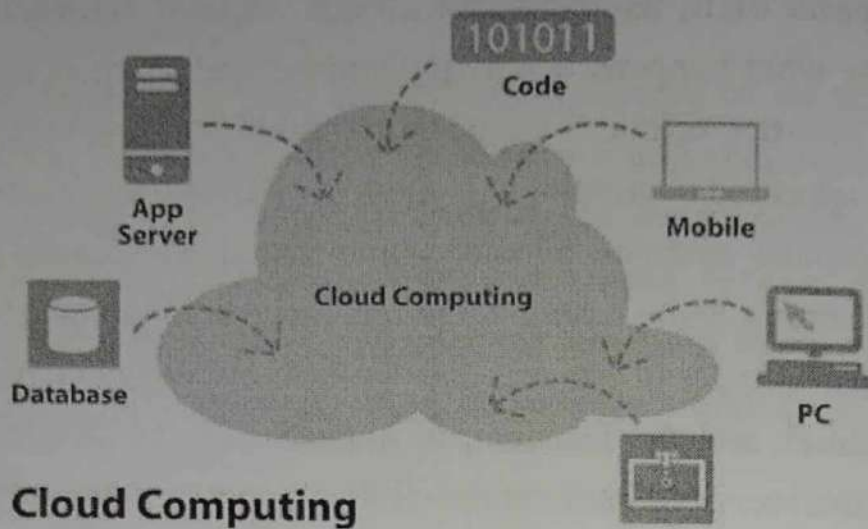
based services, with a common depiction in network diagrams as a cloud outline.

The underlying concept dates back to 1960 when John McCarthy opined that "computation may someday be organized as a public utility"; indeed it shares characteristics with service bureaus which date back to the 1960s. The term cloud had already come into commercial use in the early 1990s to refer to large ATM networks.

By the turn of the 21st century, the term "cloud computing" had started to appear, although most of the focus at this time was on Software as a service (SaaS).

In 1999, Salesforce.com was established by Marc Benioff, Parker Harris, and his fellows. They applied many technologies of consumer web sites like Google and Yahoo! to business applications. They also provided the concept of "On demand" and "SaaS" with their real business and successful customers. The key for SaaS is being customizable by customer alone or with a small amount of help. Flexibility and speed for application development have been drastically welcomed and accepted by business users.

IBM extended these concepts in 2001, as detailed in the Autonomic Computing Manifesto -- which described advanced automation techniques such as self-monitoring, self-healing, self-configuring, and self-optimizing in the management of complex IT systems with heterogeneous storage, servers, applications, networks, security mechanisms, and other system elements that can be virtualized across an enterprise.

Cloud Computing

User of the cloud only care about the service or information they are accessing - be it from their PCs, mobile devices, or anything else connected to the Internet - not about the underlying details of how the cloud works."

History

The Cloud is a metaphor for the Internet, derived from its common depiction in network diagrams (or more generally components which are managed by others) as a cloud outline.

The underlying concept dates back to 1960 when John McCarthy opined that "computation may someday be organized as a public utility" (indeed it shares characteristics with service bureaus which date back to the 1960s) and the term The Cloud was already in commercial use around the turn of the 21st century. Cloud computing solutions had started to appear on the market, though most of the focus at this time was on Software as a service.

The Cloud is a term with a long history in telephony, which has in the past decade, been adopted as a metaphor for internet

Amazon.com played a key role in the development of cloud computing by modernizing their data centers after the dot-com bubble and, having found that the new cloud architecture resulted in significant internal efficiency improvements, providing access to their systems by way of Amazon Web Services in 2005 on a utility computing basis.

2007 saw increased activity, including Goggle, IBM and a number of universities embarking on a large scale cloud computing research project, around the time the term started gaining popularity in the mainstream press.

In 2008, there was a glut of active parties in the increasingly popular field of Cloud Computing. Today, Cloud Computing generates over 10.3 million matches on Google. The scope of Cloud Computing grew from simple infrastructure services such as storage and calculation resources to include applications. However, this meant that forerunners such as application service providing and Software as a Service would also henceforth be included under the designation of Cloud Computing.

At the bottom of these developments was the eventual shifting of IT services away from local computers to the Internet or, generally speaking, in networks. Eventually, Cloud Computing realized an idea that had already been hit upon by Sun Microsystems long before the Cloud Computing hype: The network will be the computer.

Architecture
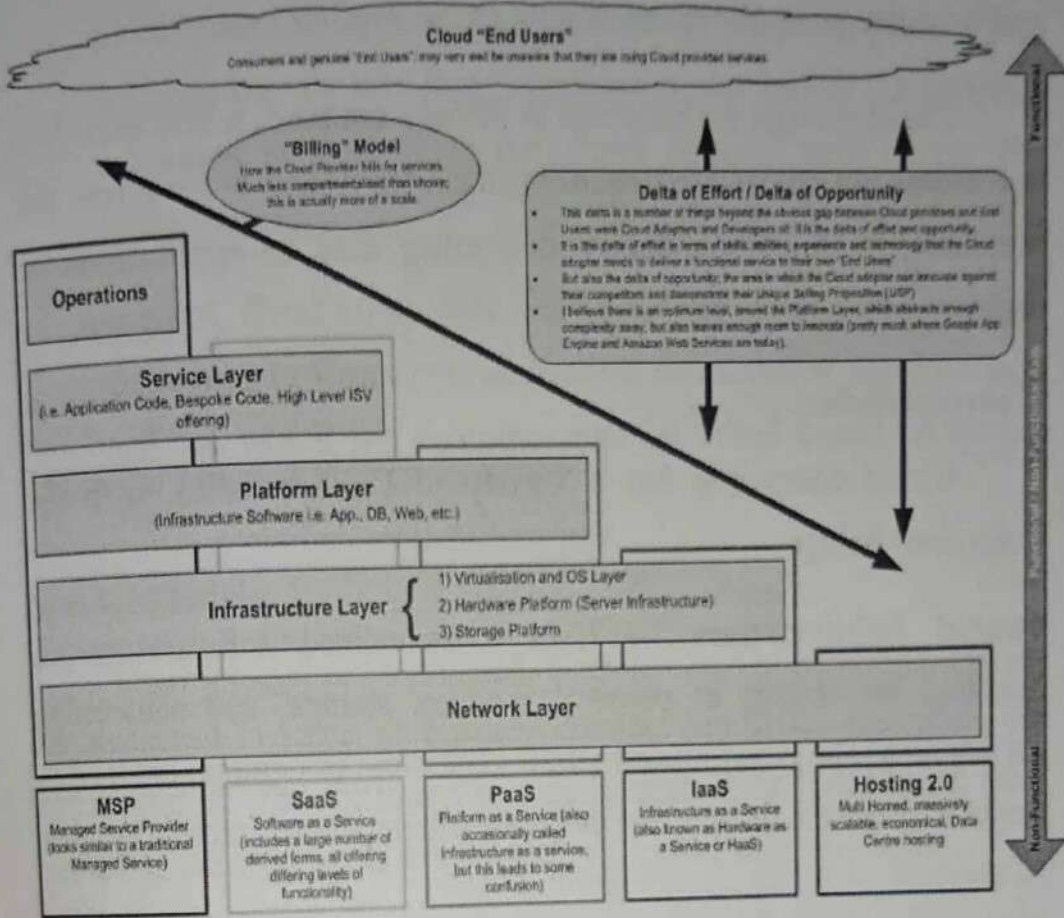
Cloud architecture, the systems architecture of the software systems involved in the delivery of cloud computing, comprises hardware and software designed by a cloud architect who typically works for a cloud integrator. It typically involves multiple cloud components communicating with each other over application programming interfaces, usually web services.

This closely resembles the UNIX philosophy of having multiple programs doing one thing well and working together over universal interfaces. Complexity is controlled and the resulting systems are more manageable than their monolithic counterparts.

Cloud architecture extends to the client, where web browsers and/or software applications access cloud applications.

Cloud storage architecture is loosely coupled, where metadata operations are centralized enabling the data nodes to scale into the hundreds, each independently delivering data to applications or user.

Characteristics

Cloud computing has a variety of characteristics, with the main ones being:

Shared Infrastructure — Uses a virtualized software model, enabling the sharing of physical services, storage, and networking capabilities. The cloud infrastructure, regardless of deployment model, seeks to make the most of the available infrastructure across a number of users.

- **Dynamic Provisioning** — Allows for the provision of services based on current demand requirements. This is done automatically using software automation, enabling the expansion and contraction of service capability, as needed. This dynamic scaling needs to be done while maintaining high levels of reliability and security.

- **Network Access** — Needs to be accessed across the internet from a broad range of devices such as PCs, laptops, and mobile devices, using standards-based APIs (for example, ones based on HTTP). Deployments of services in the cloud include everything from using business applications to the latest application on the newest smart phones.

- **Managed Metering** — Uses metering for managing and optimizing the service and to provide reporting and billing information. In this way, consumers are billed for services according to how much they have actually used during the billing period.

In short, cloud computing allows for the sharing and scalable deployment of services, as needed, from almost any location, and for which the customer can be billed based on actual usage.

Service Models

Once a cloud is established, how its cloud computing services are deployed in terms of business models can differ depending on requirements. The primary service models being deployed (see Figure 1) are commonly known as:

- **Software as a Service (SaaS)** — Consumers purchase the ability to access and use an application or service that is hosted in the cloud. A benchmark example of this is Salesforce.com, as discussed previously, where necessary information for the interaction between the consumer and the service is hosted as part of the service in the cloud.

Also, Microsoft is expanding its involvement in this area, and as part of the cloud computing option for Microsoft Office 2010, its Office Web Apps are available to Office volume licensing customers and Office Web App subscriptions through its cloud-based Online Services.

- **Platform as a Service (PaaS)** — Consumers purchase access to the platforms, enabling them to deploy their own software and applications in the cloud. The operating systems and network access are not managed by the consumer, and there might be constraints as to which applications can be deployed.

- **Infrastructure as a Service (IaaS)** — Consumers control and manage the systems in terms of the operating systems, applications, storage, and network connectivity, but do not themselves control the cloud infrastructure.

Also known are the various subsets of these models that may be related to a particular industry or market. Communications as a Service (CaaS) is one such subset model used to describe hosted IP telephony services. Along with the move to CaaS is a shift to more IP-centric communications and more SIP trunking deployments. With IP and SIP in place, it can be as easy to have the PBX in the cloud as it is to have it on the premise. In this context, CaaS could be seen as a subset of SaaS.
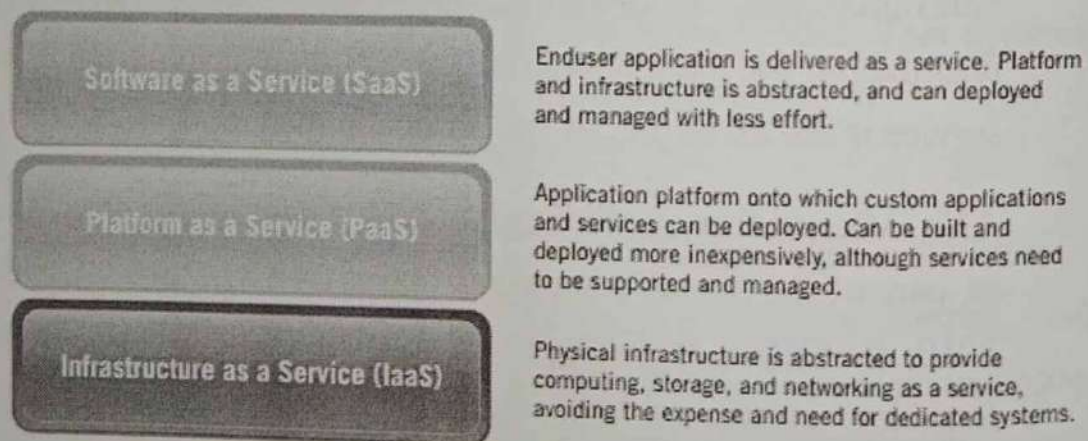

Software as a Service (SaaS)	Enduser application is delivered as a service. Platform and infrastructure is abstracted, and can deployed and managed with less effort.
Platform as a Service (PaaS)	Application platform onto which custom applications and services can be deployed. Can be built and deployed more inexpensively, although services need to be supported and managed.
Infrastructure as a Service (IaaS)	Physical infrastructure is abstracted to provide computing, storage, and networking as a service, avoiding the expense and need for dedicated systems.

Figure 1. Service Model Types

Deployment Models

Deploying cloud computing can differ depending on requirements, and the following four deployment models have been identified, each with specific characteristics that support the needs of the services and users of the clouds in particular ways (see Figure 2).

- **Private Cloud** — The cloud infrastructure has been deployed, and is maintained and operated for a specific organization. The operation may be in-house or with a third party on the premises.

- **Community Cloud** —The cloud infrastructure is shared among a number of organizations with similar interests and requirements.
  This may help limit the capital expenditure costs for its establishment as the costs are shared among the organizations. The operation may be in-house or with a third party on the premises.

- **Public Cloud** —The cloud infrastructure is available to the public on a commercial basis by a cloud service provider. This enables a consumer to develop and deploy a service in the cloud with very little financial outlay compared to the capital expenditure requirements normally associated with other deployment options.

- **Hybrid Cloud** —The cloud infrastructure consists of a number of clouds of any type, but the clouds have the ability

through their interfaces to allow data and/or applications to be moved from one cloud to another. This can be a combination of private and public clouds that support the requirement to retain some data in an organization, and also the need to offer services in the cloud.
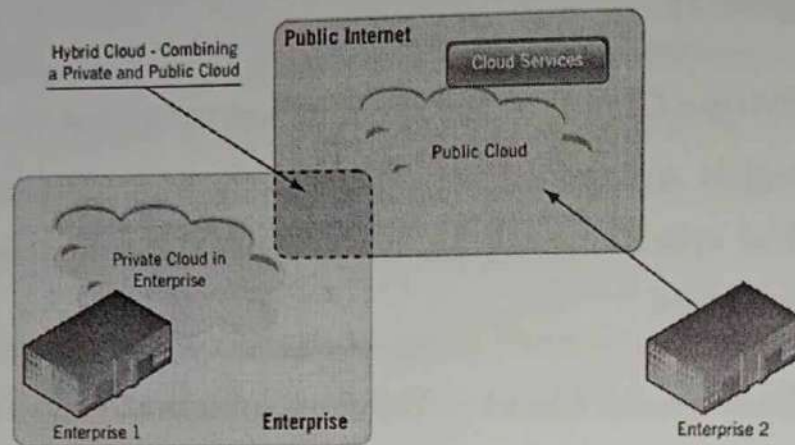

Figure 2. Public, Private, and Hybrid Cloud Deployment Example

Benefits

The following are some of the possible benefits for those who offer cloud computing-based services and applications:

- **Cost Savings** — Companies can reduce their capital expenditures and use operational expenditures for increasing their computing capabilities. This is a lower barrier to entry and also requires fewer in-house IT resources to provide system support.

- **Scalability/Flexibility** — Companies can start with a small deployment and grow to a large deployment fairly rapidly, and then scale back if necessary. Also, the flexibility of cloud computing allows companies to use extra resources at peak times, enabling them to satisfy consumer demands.

- **Reliability** — Services using multiple redundant sites can support business continuity and disaster recovery.

- **Maintenance** — Cloud service providers do the system maintenance, and access is through APIs that do not require application installations onto PCs, thus further reducing maintenance requirements.

- **Mobile Accessible** — Mobile workers have increased productivity due to systems accessible in an infrastructure available from anywhere.
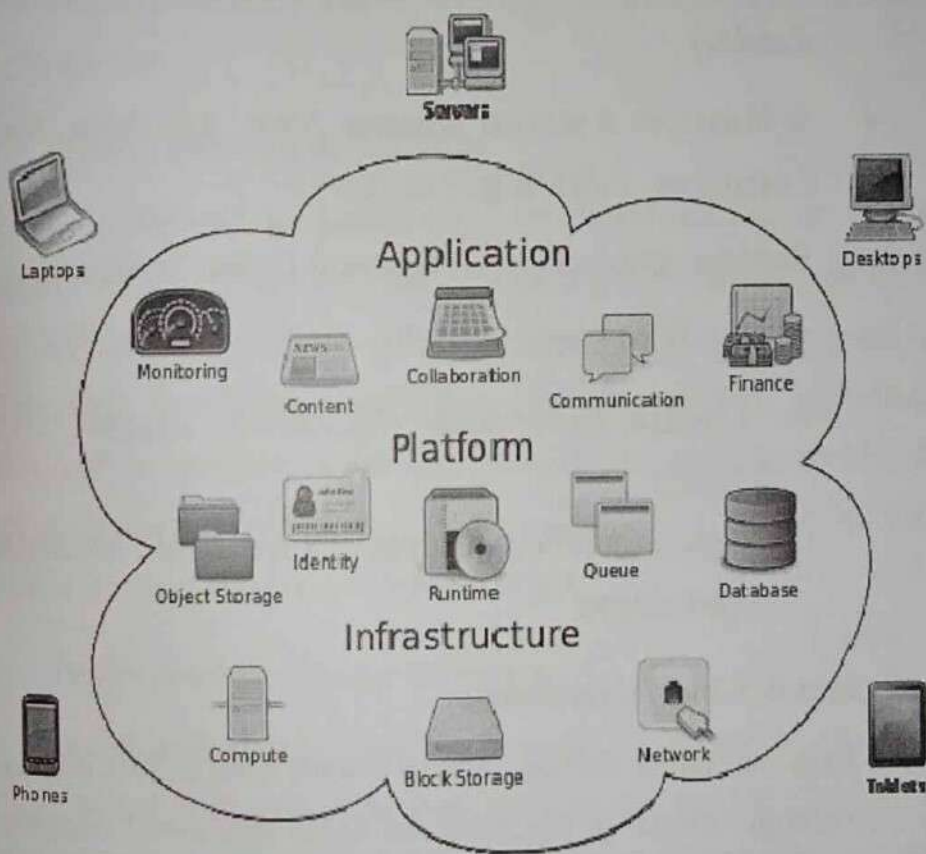
Cloud Computing

Application

A cloud application leverages cloud computing in software architecture, often eliminating the need to install and run the application on the customer's own computer, thus alleviating the burden of software maintenance, ongoing operation, and support. For example:

- Peer-to-peer / volunteer computing (BOINC, Skype)

- Web applications (Webmail, Facebook, Twitter, YouTube, Yammer)

- Security as a service (MessageLabs, Purewire, ScanSafe, Zscaler)

- Software as a service (Google Apps, Salesforce, Nivio, Learn.com, Zoho, BigGyan.com)

- Software plus services (Microsoft Online Services)

- Storage [Distributed]

  o Content distribution (BitTorrent, Amazon Cloud Front)

  o Synchronisation (Dropbox, Live Mesh, SpiderOak, ZumoDrive

Challenges of Cloud Computing

Cloud computing challenges have always been there. Companies are increasingly aware of the business value that cloud computing brings and are taking steps towards transition to the cloud. A smooth transition entails a thorough understanding of the benefits as well as challenges involved. Like any new technology, the adoption

of cloud computing is not free from issues. Some of the most important challenges are as follows.

1.   **Security and Privacy**

The main challenge to cloud computing is how it addresses the security and privacy concerns of businesses thinking of adopting it. The fact that the valuable enterprise data will reside outside the corporate firewall raises serious concerns. Hacking and various attacks to cloud infrastructure would affect multiple clients even if only one site is attacked. These risks can be mitigated by using security applications, encrypted file systems, data loss software, and buying security hardware to track unusual behavior across servers.

2.   **Service Delivery and Billing**

It is difficult to assess the costs involved due to the on-demand nature of the services. Budgeting and assessment of the cost will be very difficult unless the provider has some good and comparable benchmarks to offer. The service-level agreements (SLAs) of the provider are not adequate to guarantee the availability and scalability. Businesses will be reluctant to switch to cloud without a strong service quality guarantee.

3.   **Interoperability and Portability**

Businesses should have the leverage of migrating in and out of the cloud and switching providers whenever they want, and there should be no lock-in period. Cloud computing services should have the capability to integrate smoothly with the on-premise IT.

4. Reliability and Availability

Cloud providers still lack round-the-clock service; this results in frequent outages. It is important to monitor the service being provided using internal or third-party tools. It is vital to have plans to supervise usage, SLAs, performance, robustness, and business dependency of these services.

5. Performance and Bandwidth Cost

Businesses can save money on hardware but they have to spend more for the bandwidth. This can be a low cost for smaller applications but can be significantly high for the data-intensive applications. Delivering intensive and complex data over the network requires sufficient bandwidth. Because of this, many businesses are waiting for a reduced cost before switching to the cloud.

All these challenges should not be considered as road blocks in the pursuit of cloud computing. It is rather important to give serious consideration to these issues and the possible ways out before adopting the technology.

Security

Organizations use the Cloud in a variety of different service models (SaaS, PaaS, and IaaS) and deployment models (Private, Public, Hybrid, and Community). There is a number of security issues/concerns associated with cloud computing but these issues fall into two broad categories: security issues faced by cloud providers (organizations providing software-, platform-, or infrastructure-as-a-service via the cloud) and security issues faced by their customers (companies or organizations who host

applications or store data on the cloud). The responsibility goes both ways, however: the provider must ensure that their infrastructure is secure and that their clients' data and applications are protected while the user must take measures to fortify their application and use strong passwords and authentication measures.

In order to conserve resources, cut costs, and maintain efficiency, Cloud Service Providers often store more than one customer's data on the same server. As a result, there is a chance that one user's private data can be viewed by other users (possibly even competitors). To handle such sensitive situations, cloud service providers should ensure proper data isolation and logical storage segregation.

The extensive use of virtualization in implementing cloud infrastructure brings unique security concerns for customers or tenants of a public cloud service. Virtualization alters the relationship between the OS and underlying hardware - be it computing, storage or even networking. This introduces an additional layer - virtualization - that itself must be properly configured, managed and secured. Specific concerns include the potential to compromise the virtualization software, or "hypervisor". While these concerns are largely theoretical, they do exist.

Conclusion

Cloud Computing is in a period of strong growth, but this technology is still has some issues of security and somewhat it is immature. Government Technology Research Alliance (GTRA) research showed that the most common concern about implementing

Cloud Computing technology was security. We are all aware, country like India faced problems like digital divide and off course very low internet bandwidth. So, benefit of new technology can be reached to limited area of educational area.

But definitely, over a period of time Cloud Computing will become the most promising technology in next few years.

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ESTIMATION PROCEDURES FOR CURRENT STATUS COMPETING RISKS DATA IN PRESENCE OF COVARIATES

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ABSTRACT

In survival studies, current status censoring occurs when each individual in the study is observed only once at a random monitoring time and the information whether the event of interest has happened or not before the monitoring time is only available. Competing risks data with current status censoring frequently arise from cross sectional studies in demography, epidemiology and reliability studies when objects are exposed to multiple risks of failure. In the present paper, we propose a semi parametric regression model based on sub survival functions for the analysis of current status competing risks data. The asymptotic properties of the estimators are discussed.

Key Words: *Competing risks data, Current status censoring, Regression models, Sub survival functions.*

1.   Introduction

In the analysis of medical or industrial data, the term competing risks refer to the situations in which a patient (object) is exposed to two or more causes of death (failure), but its eventual failure can be attributed to exactly one of these causes of failure. Examples for competing risks data in different scenarios can be found in Hudgens et al. (2001) and Sankaran et al. (2015) among

many others. Consider the general competing risks set up with k causes of failure. Let $T > 0$ be the lifetime variable and $C \in \{1,2,...,k\}$ be the cause of failure for an individual. The analysis of competing risks data is carried out using any one of the following three formulations;

(i) Cause specific hazard rate function $\left(\lambda_j(t) \right)$ formulations, where

$$\lambda_j(t) = \lim_{\Delta t \to 0} \frac{P\left(t \le T < t + \Delta t, C = j \mid T \ge t\right)}{\Delta t} \quad j = 1,2,...,k \qquad (1.1)$$

(ii) Cause specific sub distribution function $\left(F_j(t) \right)$ formulations (or cumulative incidence functions), where

$$F_j(t) = P\left(T \le t, C = j\right) \quad j = 1,2,...,k \qquad (1.2)$$

and

(iii) Cause specific sub survival functions $\left(S_j(t) \right)$ formulations, where

$$S_j(t) = \exp\left(-\Lambda_j(t)\right) \quad j = 1,2,...,k. \qquad (1.3)$$

Crowder (2001), Kalbfleisch and Prentice (2002) and Lawless (2003) provide review of literature on competing risks analysis using (1.1) and (1.2). We can note that, even though $S_j(t)$ are not the survival functions of any observable random variables they possess the mathematical properties of continuous survival functions hence known as survivor like function.

In survival studies, current status censoring or interval censoring case I occurs if each patient is observed only once at a

random monitoring time and only the information whether the event of interest has happened or not before the monitoring time is available. One could refer to Banerjee and Wellner (2005) and Koul and Aggarwal (2008) among many others for diverse applications of current status data. Jewell et al. (2003) studied the data on the menopausal history of 2423 women in the context of the current status competing risks set up. Covariates or explanatory variables are used in survival studies to represent the heterogeneity in the population of lifetimes. The well-known Cox proportional hazards (PH) model is employed for the regression analysis of current status data (Diamond et al., 1986 and Sun, 2006).

Current status data with competing risks in the presence of covariates arise naturally from cross sectional studies with several causes of failure. For example, consider the data on clinical trials for cancer diagnosis discussed in Hudgens et al. (2001). In the present paper we consider the estimation of sub survival functions of current status competing risks data in presence of covariates which is not discussed abundantly in literature. We follow the approach used in Haung (1996) and Sun (2006) in the analysis of noncompeting risks set up. The text is organized as follows. In Section 2, we propose a semi parametric regression model based on sub survival functions for the analysis of current status competing risks data. An estimation procedure for baseline sub survival functions and regression parameters is derived and the asymptotic properties of the estimators are discussed. Finally Section 3 summarizes major conclusions of the study.

2. Estimation

In this section, we propose a regression model based on sub survival functions for the analysis of current status competing risks data. The asymptotic properties of the estimators of regression parameters and sub survival functions are discussed. A test statistic based on cause specific hazard rate functions is derived to compare the effect of different causes on lifetimes.

We consider the general competing risks set up with k causes of failure. Under current status censoring scheme, each patient (object) is observed only once at a single random monitoring time $U \in R_+ = (0, \infty)$. The lifetime T remain unobserved and we only observe the 'current status' of the individual at time U (whether it has failed or not before time U) along with the corresponding covariate X. For the patients observed to be relapsed before time U, we also observe the corresponding cause of failure $C \in \{1, 2, ..., k\}$. We assume that the monitoring time U is independent of both T and C and the censoring is non-informative. In addition, it is presumed that a patient (object) cannot fail from two or more causes at the same time and the cause of failure is readily available for relapsed patients. Note that the monitoring times of all patients (objects) need not be distinct. Thus for each individual we observe the vector $(U, \delta, C\delta, X)$, where δ is the indicator variable which take the value 1, if the individual is relapsed before time U and 0 otherwise.

To study the effect of the covariate on the lifetime, we propose a semi parametric regression model given by

$$S_j(t;X) = S_{0j}(t)^{\exp(\beta_j'X)} \qquad j = 1,2,\ldots,k \tag{2.1}$$

where $S_j(t;X)$ is the sub survival function in presence of the covariate vector X for cause j, $S_{0j}(t)$ is the baseline survival function which is common to all patients, β_j is the $p \times 1$ vector of regression parameters for cause j. When β_j is a zero vector for some j, then the covariate does not influence failure due to cause j. We first consider estimation of the sub survival function when the lifetimes are subjected to current status censoring. The study consists of n subjects which may fail due to any of the possible k causes. Let $(U_i, \delta_i, C_i\delta_i, X_i)$; $i = 1,2,\ldots,n$, be i.i.d. copies of $(U, \delta, C\delta, X)$. To estimate $S_{0j}(t)$ and β_j we follow the maximum likelihood approach given in Sun (2006). The complete likelihood of the observed data is given by

$$L = \prod_{j=1}^{k} L_j(\beta_j, S_{0j}) \tag{2.2}$$

In terms of $S_{0j}(t)$ and β_j, $L_j(\beta_j, S_{0j})$ the likelihood function corresponding to cause j is given by

$$L_j(\beta_j, S_{0j}) = \prod_{i=1}^{n} S_{0j}(U_i)^{(1-\delta_{ij})\exp(X_i'\beta_j)} \left\{ 1 - (S_{0j}(U_i))^{\exp(X_i'\beta_j)} \right\}^{\delta_{ij}} \tag{2.3}$$

with δ_{ij} as the indicator function which takes the value 1 if the ith individual observed at U_i found relapsed due to cause j, and 0 otherwise.

The problem reduces to the maximization of $L_j\left(\beta_j, S_{0j}\right)$ over all non increasing step functions with jumps only at U_i's for $S_{0j}(.)$.

Let $0 < s_1 < .... < s_m$ be the ordered distinct time points of $\{U\}_{i=1}^n$. Then $S_{0j}(.)$ takes the form

$$S_{0j}(t) = \prod_{p:s_p \leq t} \exp\left(-\alpha_{pj}\right) \qquad j = 1, 2, ..., k \tag{2.4}$$

where $\alpha_j = \left(\alpha_{1j}, ..., \alpha_{mj}\right)'$ are unknown parameters. Now, the log likelihood of (2.3) can be written as

$$l_j\left(\beta_j, \alpha_j\right) = \sum_{i=1}^n \left\{ \delta_{ij} \log\left[1 - \prod_{pi} e^{-\exp\left(\alpha_{pj} + X_i'\beta_j\right)}\right] - \sum_{pi}\left(1 - \delta_{ij}\right) e^{\left(\alpha_{pj} + X_i'\beta_j\right)} \right\} \tag{2.5}$$

where $\prod_{pi}$ and $\sum_{pi}$ represent the product and summation over $\{p; s_p \leq U_i\}$ respectively. Define R_p as the set of individuals with monitoring time $U_i = s_p$ and D_{pj} as the set of individuals with monitoring tine $U_i = s_p$ and found to be relapsed due to cause j.

Also define $a_{pj} = \sum_{p=1}^p \exp\left(\alpha_{pj}'\right)$ for $p = 1, 2, ..., m$ and $j = 1, 2, ..., k$.

Then the likelihood function (2.5) can be re written as

$$l_j\left(\beta_j, \alpha_j\right) = \sum_{p=1}^m \left\{ \sum_{i \in D_{pj}} \log\left[\frac{1 - e^{-a_{pj}\exp\left(X_i'\beta_j\right)}}{e^{-a_{pj}\exp\left(X_i'\beta_j\right)}}\right] - a_{pj} \sum_{i \in R_p} \exp\left(X_i'\beta_j\right) \right\} \tag{2.6}$$

Equation (2.6) can be maximized using Newton Raphson algorithm to get the estimates of β_j's and α_{pj}'s for $p=1,2,...,m$ and $j=1,2,...,k$. The estimator of $S_{0j}(.)$ for $j=1,2,...,k$ is obtained from (2.4) and by exploiting (2.1) we can also estimate $S_j(t;X)$, $j=1,2,...,k$ at any given covariate level $X=x_0$.

Now our interest focuses on the asymptotic properties of the estimators. Following Haung (1996) and Sun (2006), we prove asymptotic normality and consistency of the estimators. Assume following conditions;

(a) There exists an x_0 such that the covariate X has $P\left[|X| \le x_0\right]=1$

(b) For any $\beta_j \ne \beta_{j0}$ the probability $P\left\{\beta_j'X \ne \beta_{j0}'X\right\}>0$ for

   $j=1,2,....,k$

(c) The support of the censoring time U is an interval
   $I(U)=\left[l_c,u_c\right]$ and $0 \le l_c \le u_c \le \tau_{S_{0j}}$ for $j=1,2,....,k$ with

   $S_{0j}(0)=1$ and $\tau_{S_{0j}} = \sup\left\{t:S_{0j}(t)=0\right\}$.

The Fisher information for β_j is given by

$$I(\beta_j) = E\left\{P_j(U,X)\left[X - \frac{E\left(XP_j(U,X)|U\right)}{E\left(P_j(U,X)|U\right)}\right]^{\otimes 2}\right\}$$

where $a^{\otimes 2} = a'a$ for any $a \in R^d$ and

$$P_j(U,X) = \exp\left(-S_{0j}(.)\right)^2(U|X)O_j(U|X) \text{ and}$$

$$O_j(U|X) = E\left[Q_j^2(\delta, u, x)|U = u, X = x\right] = \frac{S_{0j}(u|x)}{1 - S_{0j}(u|x)}, \text{where}$$

$$Q_j(\delta_j, u, x) = \delta \frac{S_{0j}(u|x)}{1 - S_{0j}(u|x)} - (1 - \delta_j).$$

Consistency: Under the above regularity conditions (a) to (c), from Huang (1996,Theorem 3.2, page 547), we have

$$\hat{\beta}_j \to \beta_j \quad \text{a.s for } j = 1, 2, \dots, k$$

In particular if the distribution function $G(U)$ of U_i's is discrete, then

$$\hat{S}_{0j}(t) \to S_{0j}(t) \text{ for } j = 1, 2, \dots, k$$

almost surely at all mass points of G as $n \to \infty$ and if $G(U)$ is continuous as $n \to \infty$, one has

$$\sup_{0 \le t < \infty} \left| \hat{S}_{0j}(t) - S_{0j}(t) \right| \to 0 \text{ for } j = 1, 2, \dots, k$$

almost surely.

Rate of convergence: Under the assumptions (a) to (c), the rate convergence rate of these estimators is given by

$$d\left((\hat{\beta}_j, \hat{S}_{0j}), (\beta_j, S_{0j})\right) = O_p\left(n^{-\frac{1}{3}}\right) \text{ for } j = 1, 2, \dots, k$$

The overall rate of convergence is governed by the rate of convergence of $\hat{S}_{0j}$. The convergence rate of the estimates are shown to be $n^{1/3}$ which is slower than the usual convergence rate

$\sqrt{n}$, but which is similar to the convergence rate of distribution function of NPMLE of current status data which is studied by Gorenboom and Wellner (1992).

Asymptotic normality: Suppose that β_j is an interior point in the finite dimensional parameter space Θ. Suppose that the assumptions (a) to (c) are satisfied. Then

$$\sqrt{n}\left(\hat{\beta}_j - \beta_j\right) = I\left(\beta_j\right)^{-1} \sqrt{n} P_n l_{\beta_j^*}(m) + o_p(1) \to_d N\left(0, I\left(\beta_j\right)^{-1}\right)$$

where P_n is the empirical measure of the triplet $\left(\delta_{ij}, U_i, X_i\right)$ and $i = 1, 2, \ldots, n; j = 1, 2, \ldots, k$, $l_{\beta_j^*}(m)$ is the efficient score function given by

$$l_{\beta_j^*}(m) = \exp\left(\beta_j' X\right) Q_j\left(\delta_j, u, x\right) \exp\left(-S_{0j}(u)\right)\left\{x - \frac{E\left[X \exp\left(2\beta_j' X\right) O_j\left(U|X\right)|U = u\right]}{E\left[\exp\left(2\beta_j' X\right) O_j\left(U|X\right)|U = u\right]}\right\}$$

and $I\left(\beta_j\right)$ is the information for β_j for $j = 1, 2, \ldots, k$ where m is a point on the parameter space.

Thus, it follows that the distribution function of the monitoring time U_i's, $G\left(U_i\right)$ has bounded support $I_U = \left[\tau_0, \tau_1\right]$ with $\tau_0 > 0$. Furthermore, $S_{0j}(.), j = 1, 2, \ldots, k$ should have strictly positive and continuous density on I_U. Under these assumptions

$$\sqrt{n}\left(\hat{\beta}_j - \beta_j\right) \to N\left(0, \Sigma_j^{-1}\right)$$

where Σ_j is the information matrix for β_j. The result from Huang (1996) also shows that $\hat{\beta}_j$ is also asymptotically efficient since its asymptotic variance achieves information lower bound.

3. Conclusion

In the present paper, we propose a semiparametric regression model based on sub survival functions for the analysis of current status competing risks data. The estimators of baseline sub survival functions and regression parameters were derived and asymptotic properties of the estimators were discussed.

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SEED VIABILITY AND GERMINATION STUDIES IN *MORINDA CITRIFOLIA*: A POTENTIAL MEDICINAL PLANT

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ABSTRACT

At present market, we got a lots of products prepared from Morindacitrifolia - Noni plants. The studies are going on about the plant and many scientists already discovered a lot of medicinal properties of the plant. Morinda has been heavily promoted for a wide range of uses; including arthritis, atherosclerosis, bladder infections, boils, burns, cancer, chronic fatigue syndrome, circulatory weakness, colds, cold sores, congestion, constipation, diabetes, drug addiction, eye inflammations, fever, fractures, gastric ulcers, gingivitis, headaches, heart disease, hypertension, immune weakness, indigestion, intestinal parasites, kidney disease, malaria, menstrual cramps and irregularities, mouth sores, respiratory disorders, ringworm, sinusitis, sprains, stroke, skin inflammation and wounds. Morinda is reputed to have antibacterial, antiviral, antifungal, antitumor, anti tubercular effect, analgesic activity, immunological activity, mental health and improve high frequency, antihelminthic, analgesic, hypotensive, anti inflammatory, immune enhancing etc., Present study reveals that the seeds showed 50% of viability in Tetrazolium test. The result of the present study showed that all the germination method tested result was nil within the stipulated time. The germination of noni seeds is a very difficult task and this reveals that further studies are needed for their germination process.

Key words: *Morindacitrifolia.seed viability, seed germination*

Introduction

Plants are the reservoirs of a large number of imperative organic compounds and they have long been used as the sources of medicines. Dependence onplants is prevalent in developing countries where the traditional herbal medicine plays a major role in health care and in the treatment of many infectious diseases. The rural population of a country is more disposed to traditional ways of treatment because of its easy availability and cheaper cost. Herbal therapies although still an unwritten science is well established in some cultures and tradition and have become a way of treatment in almost 80% of the people in rural areas, especially those in Asia, Latin America andAfrica.Among the medicinal plants discovered bythe ancestors of Polynesians, Noni (*Morindacitrifolia*) is one of the important traditional folk medicinal plants that have been used for over 2000 years in Polynesia. It has been reported to have a broad range of therapeutic andnutritional value. Of the 12 most common plantsthey brought, Noni was the second most popular plant used in herbal remedies to treat various common diseases and to maintain overall goodhealth (Krauss, 1993).The fruit of this plant has been used as food, drink, medicine, colorful dye, cosmetics purpose and has a high demand in medicines for different kinds of illnesses like diabetes, high blood pressure, AIDS, arthritis, cancer, gastric ulcer, sprains, mental depression, senility, poor digestion, atherosclerosis, blood vessel problem etc., Its root, leaves, stem, bark, flowers and fruits are recorded as herbal remedies for different diseases(Wang et al ., 2012).

Morindacitrifolia is reputed to have antibacterial, antiviral, antifungal, antitumor, anti tubercular effect, analgesic activity,

immunological activity, mental health and improve high frequency, antihelminthic, analgesic, hypotensive, anti inflammatory, immune enhancing etc., Due to its beneficial effects, the fruit juice of *M. citrifolia*is widely distributed throughout the world as nutraceutical dietary supplement. The leaf of this plant is directly used on skin for ulcerations and for minor infections (Duke, et al., 2002). Morinda has been heavily promoted for a wide range of uses; including arthritis, atherosclerosis, bladder infections, boils, burns, cancer, chronic fatigue syndrome, circulatory weakness, colds, cold sores, congestion, constipation, diabetes, drug addiction, eye inflammations, fever, fractures, gastric ulcers, gingivitis, headaches, heart disease, hypertension, immune weakness, indigestion, intestinal parasites, kidney disease, malaria, menstrual cramps and irregularities, mouth sores, respiratory disorders, ringworm, sinusitis, sprains, stroke, skin inflammation and wounds (Elkins,1997). The primary indigenous use of this plant is leaves as a topical treatment for wound healing. Several animal studies suggest noni may have anti-cancer (McClatchey 2002), immune enhancing and pain-relieving properties (Hiramatsu T, 1993). Most recently Takashima et al. 2007 demonstrated the medicinal uses of new constituents isolated from noni leaves and used traditionally to promote wound healing.

Therefore, one of the challenges in recent years has been to process fruit juice so as to make a more modern drug from a traditional product. Day by day the market value of this plant increases and the acceptability of this also increases. So in a parallel view the propagation of this plant is also important. The fruit is a multiple fruit and it posses many seeds. So we think it is a good propagation method through seeds. But in the natural

environment the ratio between the number of seeds and germination of seeds shows a great variation through field study. This encourage us to took this problem as our work for study.

Objectives of the present study

- Study the nutritional and medicinal properties of *Morindacitrifolia*
- Testing the seed viability
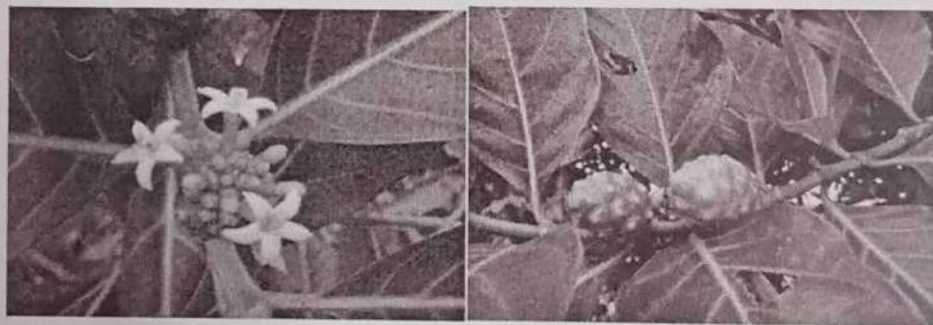- Study seed germination methods

Fig.1: *Morindacitrifolia* Habit

Materials and Methods

During this period of our work we had visited the study area on the months December, January, and March. Our study area was at *ThiruthipuraminErnakulam*district. On December itself we collected the twigs with Leaves, flowers and fruits for our study. It brought to laboratory studied the taxonomic and floral characters. The seeds were separated from the ripened fruits and dried in natural conditions. These dried seeds were used to our study. Some

of the seeds were seen as papery so as to more clarification, we done viability test. For that we took 400 seeds and checked the viability using Tetrazollium test.

Seed Viability Test

Tetrazolium test

This method determines the percentage of the viable seeds, which may be expected to germinate. The chemical 2, 3, 5 Triphenyltetrazolium chloride, tetrazilium chloride in short, is colourless, but it develops intense red colour when it is reduced by living cells. This phenomenon is used to determine the percentage of viable seeds in a seed sample. Seeds are soaked in tape water over night and are split longitudinally with the help of scalpel so that a portion of the embryo is attached with each half of the seed. One half of each seed is placed in a petri dish and covered with 1% aqueous solution tetrazolium chloride for 4 hours. The seeds are then washed with tape water and number of seeds inwhich the embryo is stained red is determined. The percentage of viable seeds is computed as follows

$$\text{Viable seeds} = = \frac{No.half\ seeds\ stained\ red}{Total\ no.of\ half\ seeds} \times 100 : \frac{230}{400} \times 100 = 57.5\%$$

Seed Germination Studies

Mechanical methods

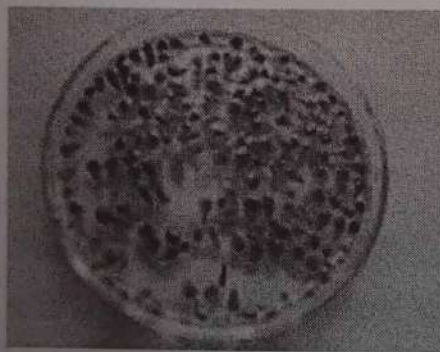1. **Scarification using sand paper**
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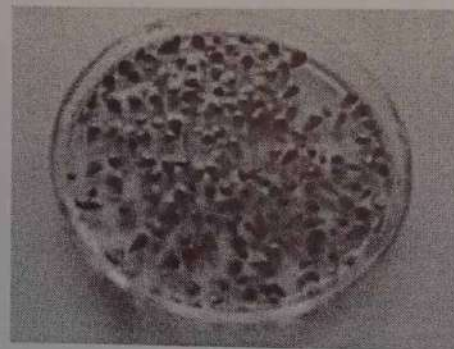
2. Making cut on seed coat

By making cut on the seed coat may helps to sprout out the seedling easily.Noni seeds can be clipped using an ordinary fingernail clipper to create an opening in the tough seed coat, so that water and air may enter and contact the embryo. This clipping can increase the germination percentage and also reduce the time required for germination from several months to only 4 weeks or more .Seeds clipped using fingernail clipper and sowed in sand.
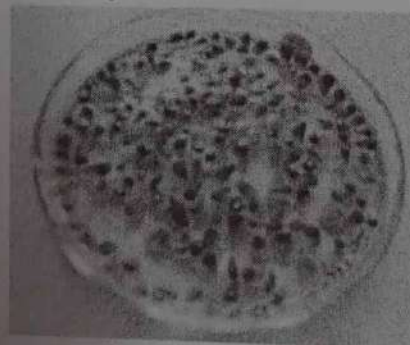
Acid treatment

Acid treatment is one of the method for germination studies. For that the number of seeds were treated in Hcl in different concentrations such as 90%,80% and 70% and all the seeds were potted.

a)70% HClb)   b) 80% HCl

c)   90% HCl

Fig. 4: Noni seeds treated with HCl

Results and Discussion

Seed viability Test

Morindacitrifolia seeds showed 50% of viability in tetrazolium test. The tetrazolium method is faster than germination test and does not require a controlled environment, which is necessary for germination test. In addition, it is relatively cheaper than germination test. But it cannot be applied to all species particularly to those species that have very small seeds and embryos because splitting and examination of such seeds tedious.

Seed germination

The result of the present study showed that all of the above cases the germination result was nil within the stipulated time .Dormancy is a condition where seed will not germinate even when the environmental conditions (water, temperature and aeration) are permissive for germination (Hartmann, 2002). In nature, different kinds of primary dormancy have evolved to aid in survival of species by programming the time of germination at a particular favorable period in the annual cycle (Alwater, 1980). Seed dormancy is an evolutionary adaptation to delay germination after the seed has been shed from the plant. Seed with physical dormancy fail to germinate because the seed will be impermeable to water (Hartmann, 2002). Physical dormancy is most often caused by a modification of seed covering, especially the outer integument layer of the seed that may become hard, fibrous and mucilagenous during dehydration and ripening. Noni seeds can require from 2-6 months germinating without treatment. When seeds are clipped and placed under optimum germination conditions, the time required for seed

germination can be reduced to 4-6 weeks. (Scot C. Nelson 2003). Germination time for scarified noni seeds is 2-120 days depending up on the temperature , environment and variety of genotype. Noni seeds can germinate in conditions rangining from deep shade to full sun, warm, moist and light conditions are beneficial for optimal germination ((Scot C. Nelson 2003). Temperature during germination of noni seeds isperhaps the most critical factor, aside from moisture. At lower temperatures, more time is required for germination. Noni has an extremely wide range of environmental tolerances and is robust enough to germinate in nature under very harsh conditions.

From these studies it is easy to understand that the germination of noni seeds is a very difficult task and this reveals that further studies are needed for their germination process.

Summary and Conclution

From our studies it is easy to understand that *Morindacitrifolia* seeds showed 50% of viability in tetrazolium test. The germination of noni seeds is a very difficult task and this reveals that further studies are needed for their germination process. The fruit juice of *M. citrifolia* L. is in high demand in alternative medicine for variousillnesses, such as arthritis, diabetes, high blood pressure, muscle aches and pains, menstrualdifficulties, headaches, heart disease, Acquired Immune Deficiency Syndrome (AIDS), cancer, gastric ulcers, sprains, mental depression, senility, poor digestion, atherosclerosis, blood vessel problems and drug addiction. The nutritive and medicinal values of the *Morinda*spp. have been clearly established with the research outcome that was completed in different laboratories in abroad. In India, the awareness on the importance of

Noni has just come with the public and also with the scientific community. Hopefully furthermore useful and vital information will be emerged out of theresearch activities initiated on this wonder tree, Noni. Seed germination and commercial rapid seedling production in large scale would be essential for making many wonderful drugsfrom nonifor health care.

Reference

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SEED VIABILITY AND GERMINATION STUDIES IN *MORINDA CITRIFOLIA*: A POTENTIAL MEDICINAL PLANT

Sr. Kochuthressia K. P and Sr. Jaseentha M.O.

Assistant Professor, Department of Botany, Carmel College, Mala
seenakochuthressia@yahoo.co.in

ABSTRACT

At present market, we got a lots of products prepared from Morindacitrifolia - Noni plants. The studies are going on about the plant and many scientists already discovered a lot of medicinal properties of the plant. Morinda has been heavily promoted for a wide range of uses; including arthritis, atherosclerosis, bladder infections, boils, burns, cancer, chronic fatigue syndrome, circulatory weakness, colds, cold sores, congestion, constipation, diabetes, drug addiction, eye inflammations, fever, fractures, gastric ulcers, gingivitis, headaches, heart disease, hypertension, immune weakness, indigestion, intestinal parasites, kidney disease, malaria, menstrual cramps and irregularities, mouth sores, respiratory disorders, ringworm, sinusitis, sprains, stroke, skin inflammation and wounds. Morindais reputed to have antibacterial, antiviral, antifungal, antitumor, anti tubercular effect, analgesic activity, immunological activity, mental health and improve high frequency, antihelminthic, analgesic, hypotensive, anti inflammatory, immune enhancing etc., Present study reveals that the seeds showed 50% of viability in Tetrazolium test. The result of the present study showed that all the germination method tested result was nil within the stipulated time. The germination of noni seeds is a very difficult task and this reveals that further studies are needed for their germination process.

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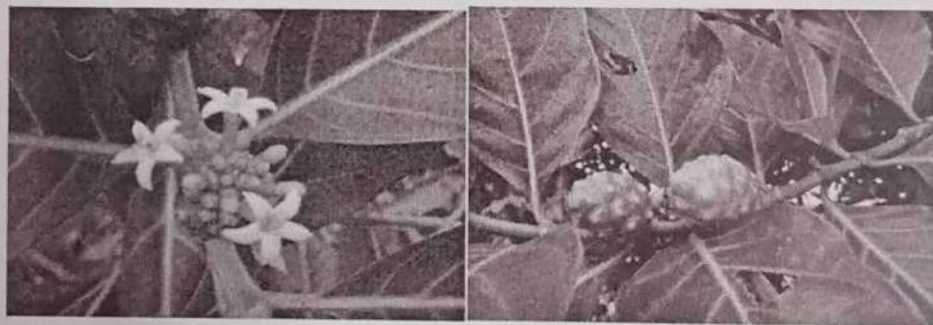- Study seed germination methods

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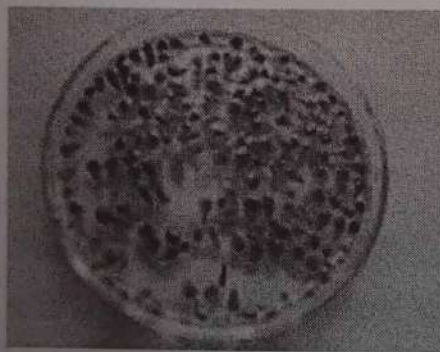1. **Scarification using sand paper**
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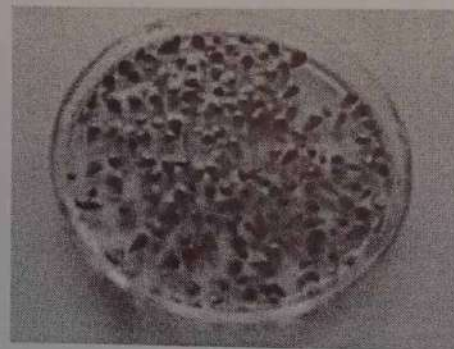
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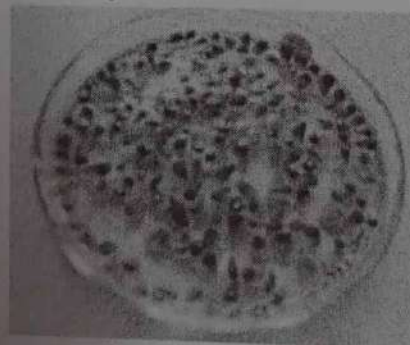
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