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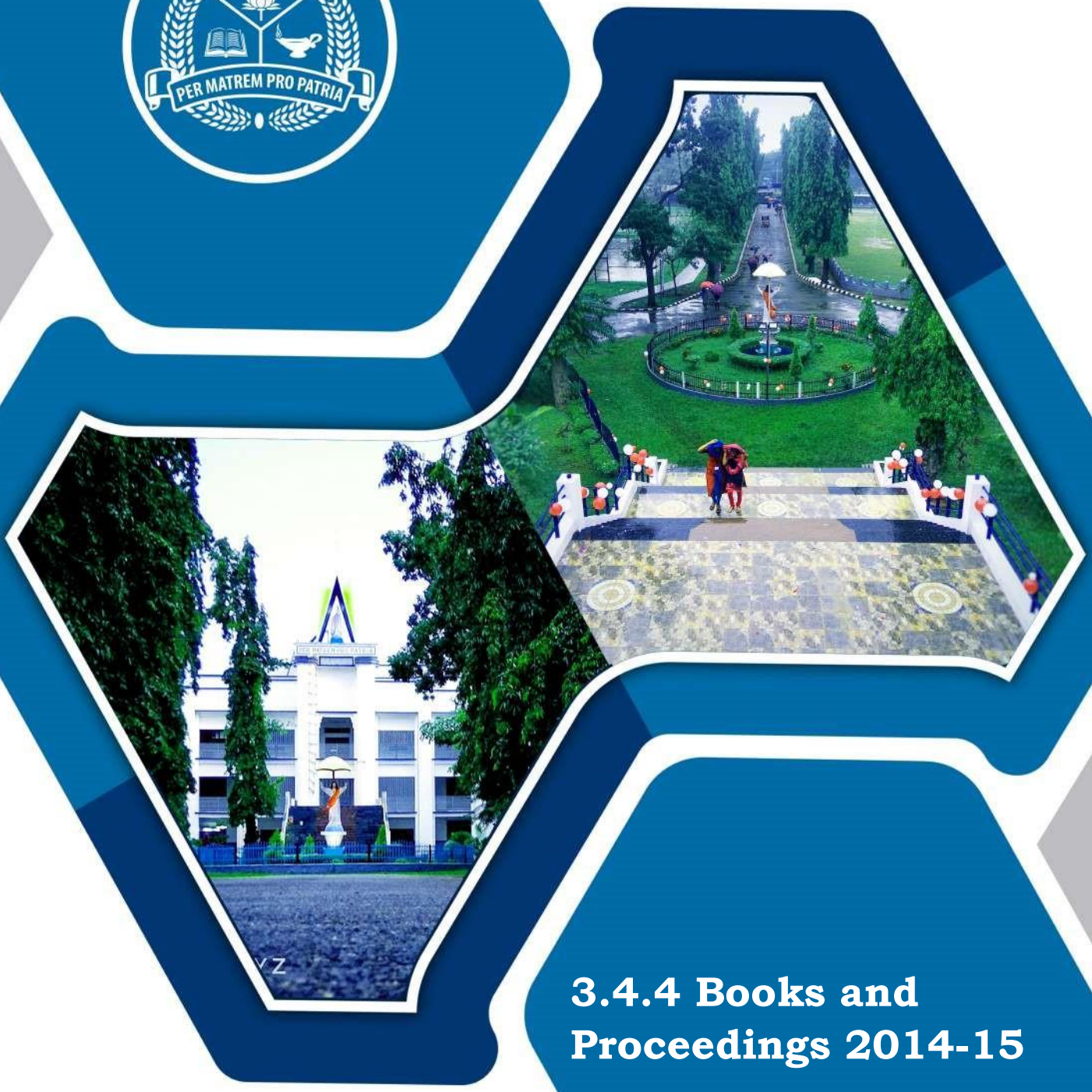

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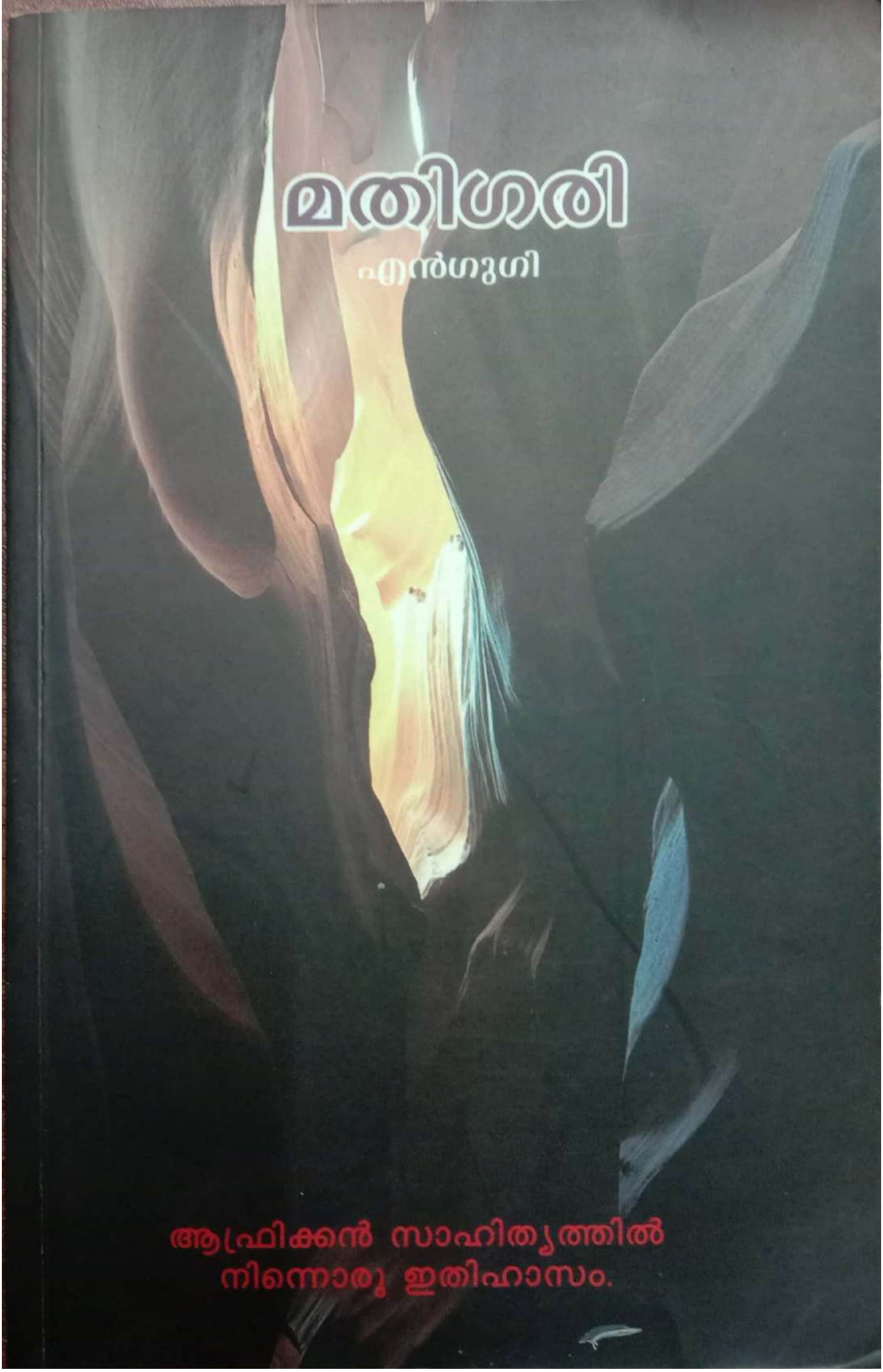

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മതിഗരി

ഗികുയുവിൽനിന്ന് ഇംഗ്ലീഷിലേക്ക് തർജ്ജമ ചെയ്തത്
വാങ്ഗി വാ ഗോറോ

മൊഴിമാറ്റം
ഡോ.സുപ്രിയ എം

ഗ്രാംഷി ബുക്സ്
കൊല്ലം-1

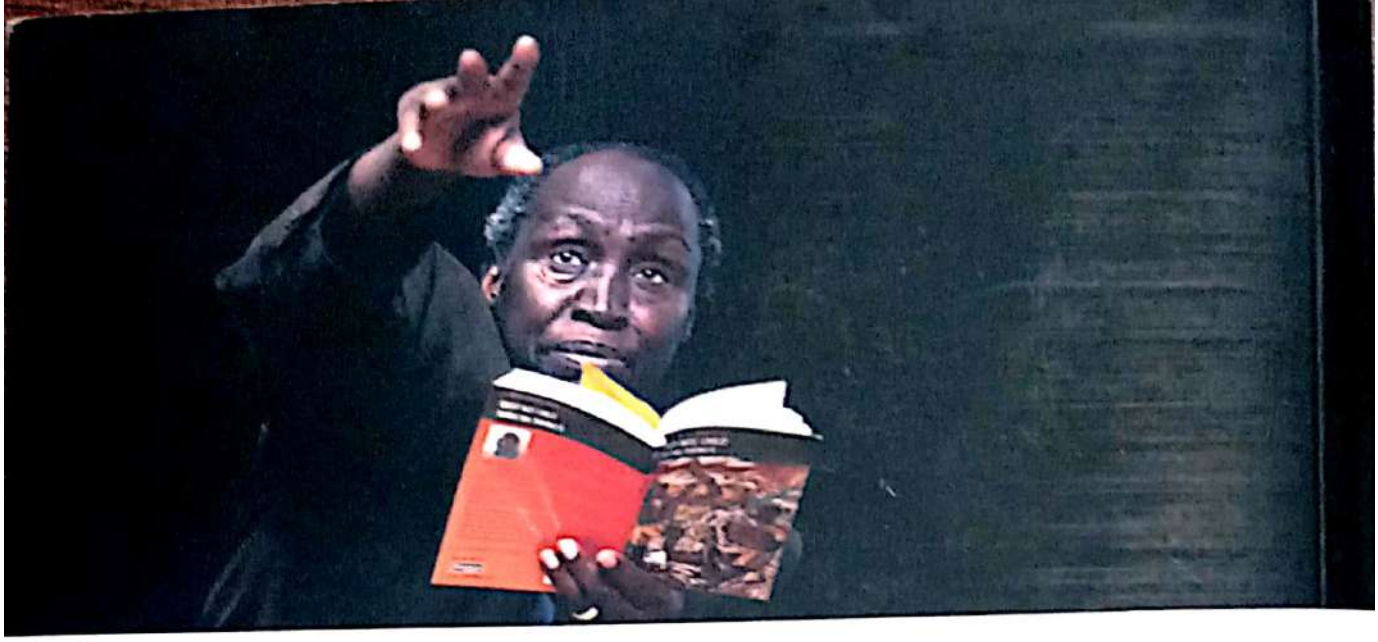
ഉള്ളടക്കം

ഇംഗ്ലീഷ് പതിപ്പിനുള്ള കുറിപ്പ്

ഈ നോവൽ ഭാഗികമായി ആസ്പദമാക്കിയിരിക്കുന്നത് ഒരു നാടൻ കഥയിലാണ്. തന്നെ ഗ്രസിച്ച ഒരു പ്രത്യേകതരം രോഗത്തിന് പ്രതിവിധി തേടി അലയുന്ന ഒരു മനുഷ്യനെക്കുറിച്ചുള്ള കഥ. തന്റെ രോഗം ഭേദമാക്കാൻ കഴിവുള്ള എൻഡീറോ എന്ന വൃദ്ധനെപ്പറ്റി അയാളറിയുന്നു. എന്നാൽ എങ്ങനെ ആ വൃദ്ധന്റെ അരികിൽ എത്തിപ്പെടാം എന്നയാൾക്കറിയില്ല. വൃദ്ധനെ അന്വേഷിച്ചുകൊണ്ടുള്ള ഒരു യാത്ര അയാൾ ആരംഭിക്കുന്നു. വഴിമദ്ധ്യേ അയാൾ പലരേയും കണ്ടുമുട്ടുന്നു. അവരോടെല്ലാം തന്നെ എൻഡീറോ എന്ന വൃദ്ധനെക്കുറിച്ചുള്ള വിവരണം ഒരു ഗാനരൂപത്തിലാണ് അയാൾ നൽകുന്നത്.

എൻഡീറോ എന്ന വൃദ്ധന്റെ
വാസസ്ഥലം പറഞ്ഞുതന്നാലും
അയാളുടെ കാലടിയൊച്ചയിൽ കേട്ടിടാം
കിലുകിലുക്കത്തിന്റെ താളം
എങ്ങും മുഴങ്ങുന്നു മണിനാദം
എൻഡീറോ.....എൻഡീറോ.

മറ്റുള്ളവരുടെ സഹായത്തോടെ അയാൾ ലക്ഷ്യസ്ഥാനത്ത് എത്തിച്ചേരുകയും അയാളുടെ രോഗം ഭേദമാവുകയും ചെയ്യുന്നു. വളരെ ലളിതമായ ഈ കഥ ഏതെങ്കിലും സ്ഥലകാലങ്ങളിൽ പരിമിതപ്പെടുത്താൻ സാധിക്കുന്നതല്ല. 'അന്വേഷണം' എന്ന മുഖ്യ ഘടകത്തിന്റെ കാവ്യാത്മകമായ പുനഃപ്രസ്താവനയാണ് ആ ഗാനശകലത്തിലൂടെ സാക്ഷാത്കരിക്കുന്നതെങ്കിൽ, രോഗശാന്തി തേടിയലയുന്ന മനുഷ്യന്റെ വ്യഗ്രതയാണ് കഥയുടെ അനിശ്ചിതത്വത്തിന്റെ ഘടകം. ഒരിക്കൽപോലും കഥയിൽ പ്രത്യക്ഷപ്പെടാത്ത



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മതിഗരി

എൻഗുഗി

ആരാണീ മതിഗരി ഒരു ചെറുപ്പക്കാരനോ വൃദ്ധനോ മനുഷ്യനോ നിയതിയോ അയാൾ ജീവിച്ചിരിപ്പുണ്ടോ അതോ മൃതിയടഞ്ഞോ.....അതുമല്ലെങ്കിൽ അയാൾ ക്രിസ്തുവിന്റെ പുനർജന്മമാണോ.....ആ പേരില്ലാ ദേശത്തെ ജനങ്ങളുടെ മനസ്സിൽ ഉയർന്നുവന്ന ചോദ്യങ്ങൾ ഇതൊക്കെയായിരുന്നു. ഒരു സുപ്രഭാതത്തിൽ മലഞ്ചരുവിൽ പ്രത്യക്ഷപ്പെട്ട അയാൾ സ്വാതന്ത്ര്യത്തിന് വേണ്ടി പോരാടിക്കൊണ്ടിരുന്നു. വിചിത്രമായ അവകാശവാദങ്ങൾ അയാൾ ഉന്നയിച്ചു. മതിഗരി തന്റെ കുടുംബത്തെത്തേടി അലയുകയായിരുന്നു. സ്വന്തം വീട് പുതുക്കി പണിത് ശാന്തവും സുന്ദരവുമായ ഒരു ജീവിതം കെട്ടിപ്പടുക്കുന്നതിനുള്ള വ്യഗ്രതയിലായിരുന്നു അയാൾ. എന്നാൽ കുടിയിറക്കപ്പെട്ട അവസ്ഥയിൽ തന്റെ ജനങ്ങളെ കണ്ടുമുട്ടുമ്പോൾ, അഴിമതിയും ദുരിതവും ഭീതിയും കൊടികുത്തിവാഴുന്ന തന്റെ രാജ്യത്തെ ദുരവസ്ഥ കാണുമ്പോൾ മതിഗരിയുടെ അന്വേഷണം സത്യവും നീതിയും തേടിയുള്ള പ്രയാണമായി മാറുന്നു. സ്വാതന്ത്ര്യസമരം പുനരുദ്ധരിക്കാൻ അമാനുഷിക കഴിവുള്ള ഒരാൾ ആവിർഭവിച്ചിരിക്കുന്നു എന്ന വാർത്ത എങ്ങും പടർന്നു പിടിക്കുന്നു. വാക്ചാതുരികൊണ്ടു മാത്രം ശത്രുവിനെകീഴ്പെടുത്താൻ സാധിക്കില്ല എന്ന അവബോധം മതിഗരിയിൽ ഉളവാകുമ്പോൾ നോവൽ അതിന്റെ ഉദ്വേഗജനകമായ പരമകാഷ്ഠയിലേക്ക് നീങ്ങുന്നു. തന്റെ ദേശത്തിന് പരമമായ സ്വാതന്ത്ര്യം ലഭ്യമാകാൻ ആയുധബലം തന്നെ സ്വീകരിക്കാൻ മതിഗരി പ്രതിജ്ഞയെടുക്കുന്നു. കാവ്യാത്മകവും ഹാസ്യാത്മകവുമായി പറഞ്ഞു വരുന്ന മതിഗരിയുടെ കഥ സ്വാതന്ത്ര്യാനന്തര ആഫ്രിക്കൻ സമൂഹത്തിലെ മാനുഷികമൂല്യങ്ങളുടെ വിശ്വാസ വഞ്ചനയുടെ ശക്തമായ ആക്ഷേപ ചിത്രവുമാകുന്നു.

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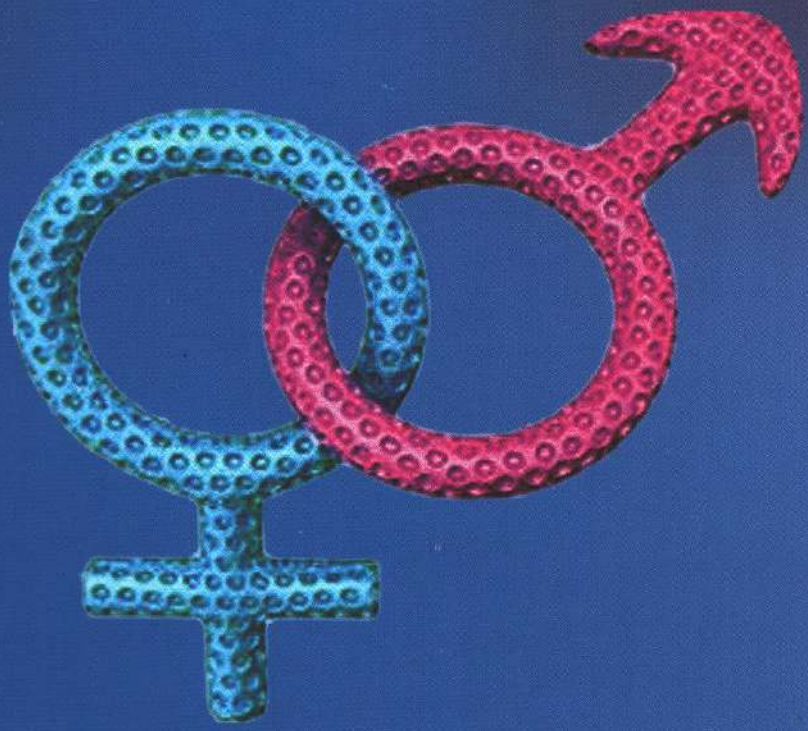

A HAND BOOK ON HUMAN HEALTH AND SEX EDUCATION

FIRST DEGREE PROGRAMME
V SEMESTER
OPEN COURSE IN ZOOLOGY

SHERLY WILLIAMS E
JESSY NETTO
RAZEENA KARIM L

A HAND BOOK ON

HUMAN HEALTH AND SEX EDUCATION

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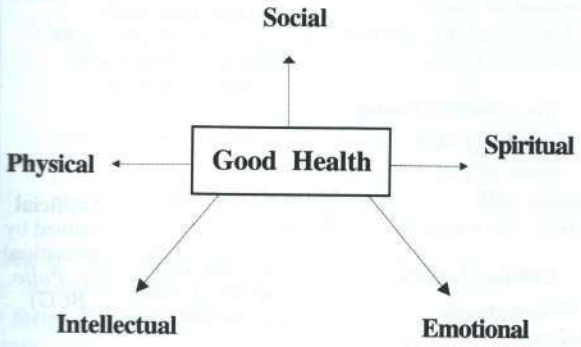
Contents

Deficit/Hyperactivity Disorder (ADHD); Conduct Disorder; Oppositional Defiant Disorder; Separation Anxiety Disorder

- **Prevention of Mental Illness:** Strategies for Prevention and Possible Interventions (Improving Nutrition, Improving Housing, Reducing the Harm from Addictive Substances, Reduced smoking and use of other substances during Pregnancy, Home-based Interventions, Reducing Child Abuse and Neglect, Dealing with Family Disruption; Intervening at the Workplace
- **Alcoholism:** Types of Alcoholic Beverages, Addiction to Alcohol; Effects of Alcohol Consumption - Effect on the Family, Alcohol de-addiction/Rehabilitation Programme
- **Tobacco Addiction and Deadiction:** Chemicals in Tobacco Smoke; Action of Nicotine; Effects of using Tobacco, Tobacco Addiction, Tobacco Deaddiction
- **Lifestyle Diseases:** Causes of Lifestyle Diseases; Prevention of Lifestyle Diseases
- **Community Health;** Major Community Health Services; Prevention and Control of Communicable Diseases; Maternity and Child Health and Family Planning; Health Education
- **Spiritual Health:** Improvement of Spiritual Health
- **Yoga and Meditation:** Importance of Yoga in Stress Management; Who can do Yoga? Yoga Therapy; Yoga Practices; Benefits of Meditation

I
HUMAN HEALTH

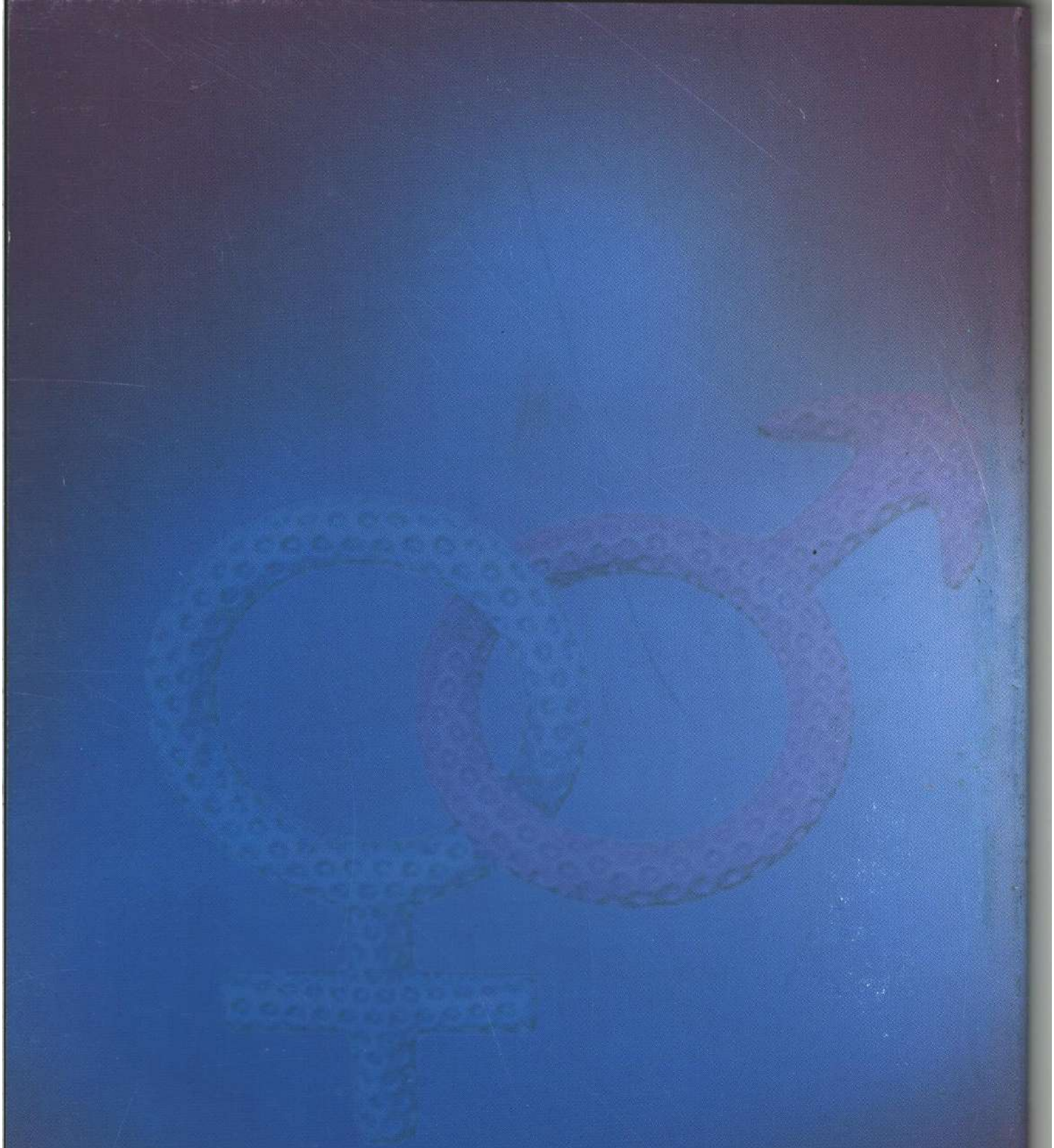
- It is defined as a state of complete Physical, Mental and Social well being and not merely the absence of disease (WHO, 1946). Good health and wellness are interdependent on five dimensions.



Health Awareness

Health Awareness is important for maintaining good health conditions that directly depends on the general well being of a human. Health Awareness can be conducted through

The Mass media
Awareness among the people
Incorporated in School and College syllabus
Health activities by concerned organisations
Health Club



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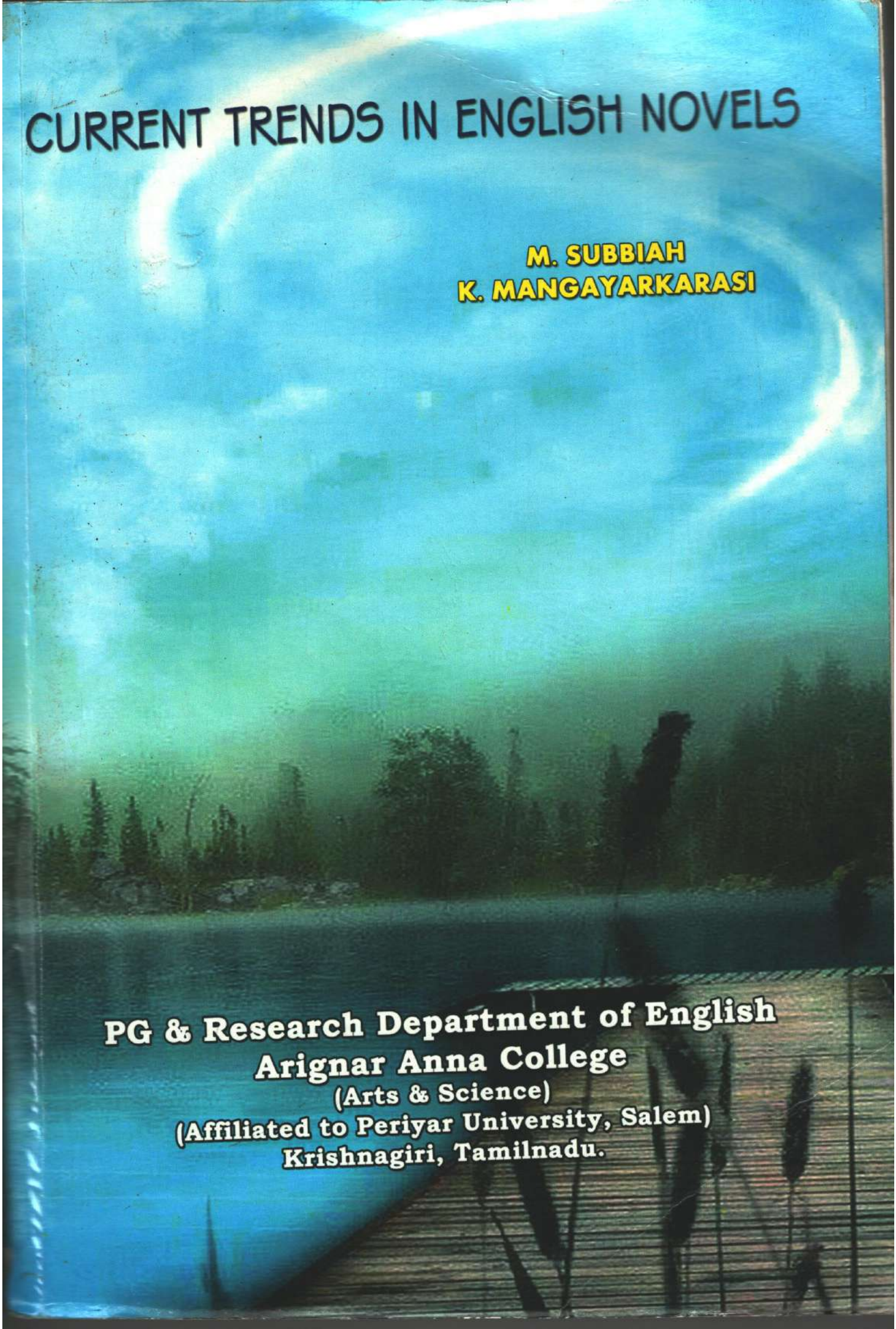
CURRENT TRENDS IN ENGLISH NOVELS

M. SUBBIAH
K. MANGAYARKARASI



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aackrrishnagiri@yahoo.in

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On behalf of the department of English, the Organising Com expresses profound gratitude to the Management for their permission enabled us to conduct a one day National Seminar on 28th March 2014.

Current Trends in English Novels, which in turn, paved the way publication of selected papers.

We would like to acknowledge the benevolent gestures of our hono Principal Dr. M. Subbiah for his constant support and guidance regardi publication of this book.

I record my sincere thankfulness to our beloved Pr Dr.M.SUBBIAH for his constant and continuous help in making this sem success and also in bringing out two volumes of scholarly papers amalgamation of intellectual pursuit. I search for words to exhibit my and gratitude to the Chair Person, Management Members, Principal, Fac Non-Teaching Staff and Students of our college for their whole h cooperation in making this seminar a grand success.

We would like to acknowledge our chair person Dr. T. Banumat her scintillating blessing and messages. Our gratitude is due for the contri of various articles published in this edition.

We must also thank the contributors of the well-researched pap "Current Trends in English Novels", without whose support it would no had its genesis.

essentially an age of unrest, doubts, turmoils and so on. The sociological, psychological, and intellectual climate of the present times has undergone a thorough transformation. In the last two decades of the twentieth century (1980-2000) an increasing number of Third World writers emigrated to the west and chose to write in English language. The style and content of their writings had been greatly influenced by the extent to which they had been able to identify and adapt to their new surroundings. Those who felt alienated in their country tended to write about people and events which were typical of their country of origin and were anxious to infuse Indian local colour in their writings. However, those who were able to identify with their new host country were blessed with a bi-cultural perception which enabled them to write from a wider and more exciting angle.

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CONTENTS

REDEFINING THE CULTURAL PARADIGM: A STUDY OF CROSS-CULTURAL PERSPECTIVES IN SUNETRA GUPTA'S MEMORIES OF RAIN

JAYA SUNNY

The current literary scenario, which has been nurtured on the fruits of migration and globalization, has generated a vast output of writing which effectively demonstrates the significance of culture in determining the contingency and contractedness of all identity. Sunetra Gupta's maiden novel, *Memories of Rain,* offers itself as a study of the extent of potential acculturation, selective biculturalism, the sense of alienation in the adopted culture, and the ultimate black hole-like grip of the native culture, which one cannot just shrug off and which is almost pre-destined to end in a cultural impasse.

Cultural identification as reflected in *Memories of Rain* is a slippery and problematic concept. Gupta points out that her characters are not really representative of a particular culture and essentially explore various issues that cut across geographical boundaries. Characters caught in the clash of two cultural worlds constantly producing and reproducing themselves anew. To many immigrants the search for identity results in the search for a radically different set of values that would inspire and guide them in the proper direction. It is at this turning point that they start lamenting the fragmentation of trusted traditions and start reinterpreting the age-old cultural values of 'home' which lay embedded in their personality. We find characters exploring the nuances of their feeling and struggling to reconcile the seemingly disparate personae within them.

The Indian woman who emigrates to the West, for reasons professional or personal, often encounters problems related to her cultural dissonance. Sunetra Gupta offers a fresh outlook into the female reality, articulating a variety of experiences through the emerging new consciousness of the protagonist. The singularity of Gupta's novel lies in her heroine, Moni, who struggles to maintain a precarious optimum between the two. The image of woman projected in the canvas of Indian English fiction is complex and multi-faceted – woman as mother and protector, woman as the chaste suffering wife, woman as charmer or seductress, woman as the primal force or 'Shakti', protecting the good and destroying evil. Women were forced to suffer stoically, accepting the fact that she

was inferior to man in a male-dominated Indian society. Ideas and tabo etched into her mind right from her childhood so firmly that she perpetuated the idea that the husband was far superior to her (whateve shortcomings), and that her sole responsibility was to be obedient to him his needs and ensure his well-being.Through the centuries, the Indian wo a silent suffering, sacrificing existence, striving to hold the family togeth face of blatant spousal neglect and abuse. Similarly, Moni, once the pa daughter of middle-class Bengali parents, has now to accommodate her hu mistress into her life, even into her household, ". . . there is dignity in her in the excruciating grief of her untranslated songs." (17)

As in innumerable other concepts, other radical changes hav discerned between the eastern and western perception of the sublime important relationship between man and woman, especially within the in of marriage. Concepts relating to love, marriage and sex are somewh 'liberal' from the western outlook extra – marital affairs, jilting and separa matters of small consequence to the 'liberated' and 'refined' western m Thus in the novel, Antony not only pursues his affair with Anna with casualness, he expects his wife, Moni, to accept it with the same matte approach.

As a woman whose sensibility has been etched in the inhabiting and sexual roles assigned to her by the patriarchal Indian society, Mo herself completely incapable of freeing herself completely from the sha the mother culture, as it is deeply rooted in her consciousness. She therefore, at crossroads, caught between tradition and modernity. We find much wronged immigrant wife dealing with her memories of contemplating her status within the despicable love triangle that has bec life, and imagining a possible solution by her impending departure. Her the naive culture's grip on her is emphasized by her reluctance, to sub parents to the shame and grief that accompany a married daughters retur parental abode, in a culture which deemed it perhaps, the greatest curse befall a parent, "And now she will go back to them, bring to them a ne that of a daughter returned, a daughter rejected, a daughter spurned"(32) we find Moni, the docile Indian housewife, functioning as a cultural careta under ever increasing pressure to sustain Indian traditions abroad. In the

she becomes the epitome of Indian womanhood and wifehood, enshrining the qualities of obedience, patience and loyalty.

However, Moni is not the only one who suffers the backlash of the cultural jigsaw of an intercultural marriage. Antony is also victimized, though to a much lesser degree. As a rule, the male counterpart in an inter-racial marriage usually adapts better because he decrees the norms and avails himself of 'alternatives' should he at any point feel disillusioned. He, who had been enchanted by Moni's exotic beauty amid the wretched slums of Calcutta, is unable to sustain his passion for her upon their return to London.

> ". . . a deep intellectual void was eating away at his wonder, his, he could not tell her of what he wrote on the typewriter into the early hours of the morning, his frustration remained dammed within him. (82)

For her part, Moni wonders whether she had been arrested in her development, remained passive by crossing the seas to an unfamiliar land, where, "despite her half-finished honors degree in English, she could not find the right words, the right expressions to voice her opinions, to participate but in the most banal of conversations" (14). She longs to be part of his world, yet she feels detached and unable to merge with her new surroundings, she is part of another world. And among the indifferent streets of London once the city of her dreams, which, upon her setting foot on English soil, had remained stately and aloof and she had longed for the "one large sea of mud and dung" that was Calcutta.

Thus, we perceive the whole novel as being woven, first and foremost on the fabric of the eternal clash of cultures. Moni is portrayed as a character who struggles to cope with the rival pulls of tradition and modernity in her search for identity, independence, fulfilment and selfhood. The process of acculturation is a complicated jigsaw. Even when biculturalism or multiculturalism does take place, it is selective. There are always those areas of the mother culture which cling on to the immigrant as natural as body odour, which, though they may be temporarily swept away by the fragrance of acculturation, will ultimately re-emerge, subjecting the character to a 'culture shock' or disillusionment and yearning for home.

As Moni undergoes cultural, geographical and emotional displacem experiences 'displacement' or 'resettlement', the hybrid evolving sens There is something lost in the transition, and something gained. A d judicious balance would mean adjustment or assimilation. In this connect may take note of Salman Rushdie's statement in *Imaginary Homeland* identity is at once plural and partial, we straddle two cultures". (15)

Discernable is a movement away from the culturally inscribe towards the development of an individual personality shaped by a c milieu. Seeking a home in a new land, Moni finds herself without moor product of a dual culture, she is unsure of her status in relation to the mair and also in relation to her adopted culture. Submerged at the core of existence in London lies the haunting presence of India, and the ang personal loss it represents. This longing for home is powerfully conveyed the continuous evocation of Tagore's rain-laden, nostalgic verses. constantly struggles to make two continents meet in her daily life. She deeply honest insight into the mind of a woman trying to balance the di halves of her existence. She nurses the desire to formulate an identity of h The identity is caught between two worlds, a divided consciousness tha from a western education and the culture and traditions of the Bengal of Ra Sangeet. Little wonder then that Moni must continually plot for hers 'it cultural routes' through the nostalgic reminiscences, which also help in fo relationship between the past, the present and the future. This state of livi between' also provides the terrain for elaborating strategies of selfhood to the growth of a new identity as it is possible for the subject to be rema remodeled in new and innovative ways.

Hence, culture is regarded as intermingled manifold, as a means by w new hybrid identity is negotiated, bringing the resources of the past to bea life in the present. This conglomeration of different lifestyles endows upon the wisdom to realize that all systems of knowledge, all views of the wo never totalizing, whole or pure, but incomplete, muddled and hybrid. To live alien land may well evoke the pain of loss and of not being firmly rooted secure place, but also to live in a world of immense possibility, wi realization and acceptance that new knowledge and ways of seeing c constructed out of the myriad combination of new experiences.

Dr. M. Subbiah, a leading scholar, and a critic, is a Principal at Arignar Anna (Arts & Science) College, Krishnagiri – 635 001 Tamil Nadu. He began his career in teaching in 1977. He did his Doctoral Degree in Madurai Kamaraj University, Madurai, as a Part-time Scholar. His keen interest in research has made him publish more than 70 research articles and presented papers in more than 110 Seminars, Conferences and Workshops all over the world. He has received 35 Degrees from various Universities in different fields. He has more than 38 years of academic experience in English language and literature. He has completed a DIPLOMA IN INTER RELIGIOUS DIALOGUE – a unique diploma course offered only in MK University and not elsewhere in TamilNadu. He has guided more than 11 M. Phil. Scholars. Two National level Seminars have been conducted by him. He has delivered a number of guest lectures and acted as a resource person in various universities and colleges. He is a Life Member in Indian Political Science Association, Life Member in Academy of Public Affairs, Life Member in Applied Linguistics Forum, Life Member in South India American Studies Network.

Dr. K. Mangayarkarasi, Head and Associate Professor of English is a scholar, got her Doctoral Degree from Bharathidasan University, Trichy. She has attended several International, National and state level conferences and seminars. Presently, she is a teaching faculty and Research Guide in Research Department of English , Arignar Anna (Arts & Science) College, Krishnagiri – 635 001. Her keen interest in research has made her publish and present more than 30 research articles.

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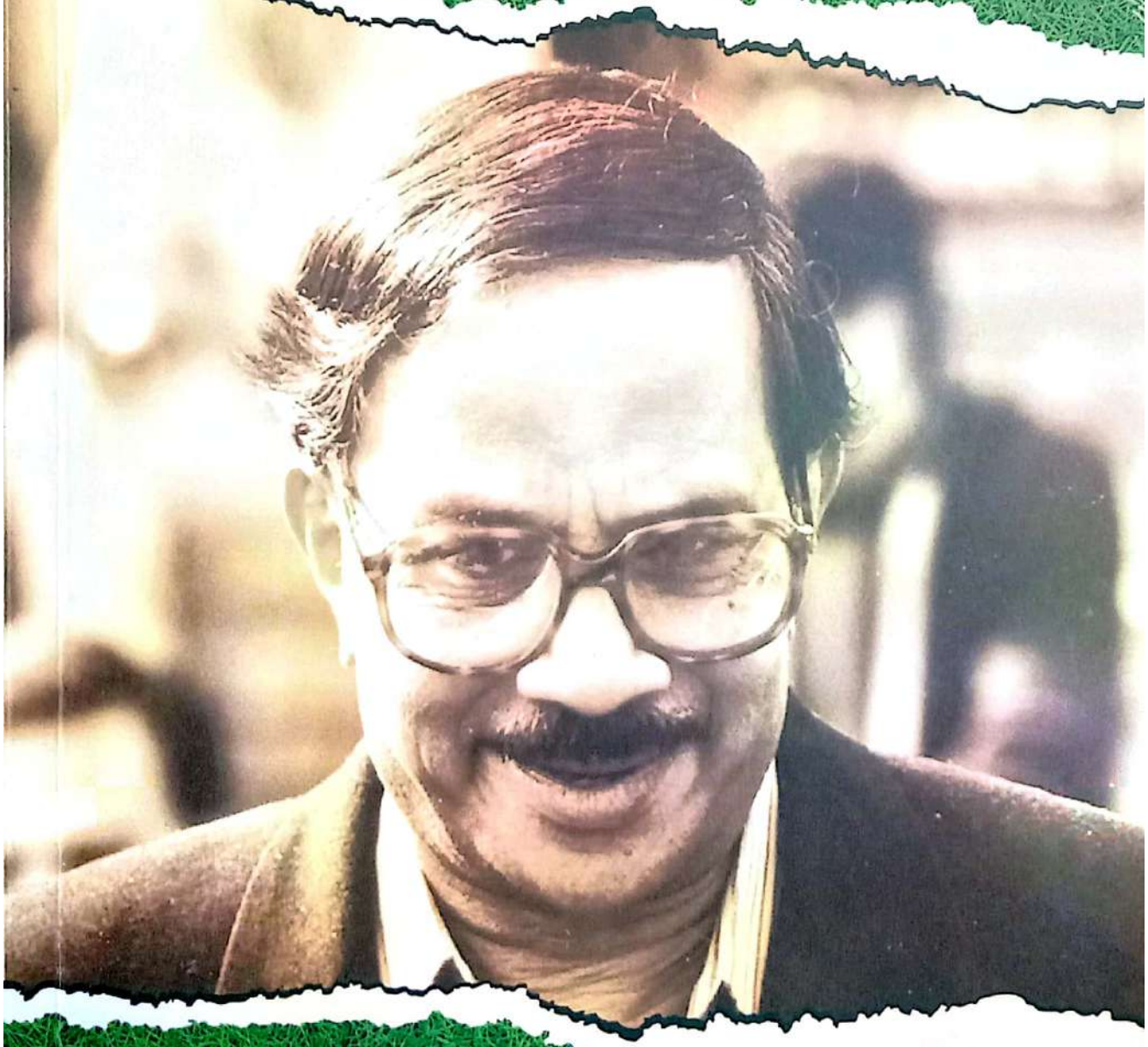

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ആഖ്യാനകലയുടെ സൗന്ദര്യശാസ്ത്രം

കാലത്തിൽ കൂടി തുടരുന്ന സംഭവത്തിന്റെ കഥനമാണ് ആഖ്യാനം (Narration). ഏതു കഥയും പറയുവാൻ ഒരാളുണ്ടാവും. കഥ പറയുന്നയാളാണ് ആഖ്യാതാവ് (Narrator). ആഖ്യാനപ്രക്രിയ ഒരു സൃഷ്ടിപ്രക്രിയ കൂടിയാണ്. ഈ സൃഷ്ടി ആദ്യം ഉണ്ടാകുന്നത് മനസ്സിലാണ്. ആയതിനാൽ ആഖ്യാനവും മനസ്സിന്റെ സൃഷ്ടി തന്നെ. ആഖ്യാനം മനുഷ്യ ജീവിതവുമായി ബന്ധപ്പെട്ടുകിടക്കുന്ന ഒരു സങ്കീർണ പ്രതിഭാസമാണ്. അതിനാൽ ആഖ്യാനപഠനം മനുഷ്യന്റെ മൗലിക സ്വഭാവങ്ങളെക്കുറിച്ചുള്ള പഠനം കൂടിയാകുന്നു.

ഓരോ എഴുത്തുകാരന്റേയും ആഖ്യാനശൈലിയിൽ വ്യത്യാസമുണ്ട്. എത്രയെത്ര ആഖ്യാതാക്കളുണ്ടോ അത്രയധികം ആഖ്യാന സമ്പ്രദായങ്ങളും ഉണ്ടാവും. ആഖ്യാനം നടത്തുമ്പോൾ ആഖ്യാതാവിനുണ്ടാകുന്ന പ്രചോദനത്തിന്റെ സ്വഭാവമനു സരിച്ച് ആഖ്യാനത്തിനും പല രീതികളും സമ്പ്രദായങ്ങളും കൈവരും. ഫലപ്രദമായ കഥാഖ്യാനത്തിന് പലതരത്തിലുള്ള ആഖ്യാനരീതികൾ ഉപയോഗിക്കുന്നുണ്ട്. ഇത് ഓരോ എഴുത്തുകാരനും സ്വയം ആർജ്ജിക്കേണ്ടതാണ്. സാഹിത്യകൃതിയുടെ രൂപസൗകുമാര്യത്തിനും ഭാവസാന്ദ്രതയ്ക്കും ആഖ്യാനരീതി സഹായകമാണ്. അതുകൊണ്ട് ഭംഗിയായി, ഫലപ്രദമായി ആഖ്യാനം ചെയ്യുന്ന സൃഷ്ടി കല തന്നെയാവുന്നു.

ഭാഷയുടെ ആദേശസ്വഭാവത്തെ പ്രയോജനപ്പെടുത്തിക്കൊണ്ട് വിദൂരതയിലുള്ള വസ്തുക്കളുടെ വാചികമായിട്ടുള്ള ആവിഷ്ക്കാരമാണ് ആഖ്യാനം നിർവഹിക്കുന്നത്. ഈ വിദൂരതയാകട്ടെ സ്ഥലകാലങ്ങളുടെ അകലം കൊണ്ട് നിർണ്ണയിക്കപ്പെടുന്നു. വക്താവിന്റെയും ശ്രോതാവിന്റെയും സാന്നിധ്യം ആവശ്യപ്പെടുന്ന, മൗലികമായ ഭാഷയിലൂടെയുള്ള ആശയ സംവേദനമാണ് ആഖ്യാനം. ആഖ്യാനം കൃത്രിമ സൃഷ്ടിയല്ല.

എം.ടി കല ദേശം സ്വത്വം

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എം.ടി. അനുയാത്ര എന്ന പേരിൽ എം.ടി. വാസുദേവൻനായരെക്കുറിച്ച് പുറത്തിറങ്ങുന്ന 11 പുസ്തകങ്ങളിൽ രണ്ടാമത്തെ പുസ്തകമാണ് ഡോ. എ.എസ്. പ്രതീഷ് രചിച്ച എം.ടി: കാലം ദേശം സ്വത്വം.

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A Village Comes To Life

THE STORY OF MADIKKAI

K. Madhavan

Darpan

Dr P. Radhika Menon works as Associate Professor of English, FMN College, Kollam. She translated K. Madhavan's autobiography into *On the Banks of the Tejaswini* (NBT, 2011). Her other major translations include *Selected Short Stories: Karoor Neelakanta Pillai* (Sahitya Akademi, 1998), Devaki Nilayangode's memoir *Antharjanam* (OUP, 2011), S. K. Pottekkatt's *Tales of Athiranippadam* (Orient BlackSwan, 2013), and the forthcoming *In the Land of the Kappiris* (CUP). She, along with co-translator Dr Sreedevi K. Nair, received the International Centre for Writing and Translation Award (University of California, Irvine) in 2011 for the translation of Pottekkatt's *Oru Deshathinte Katha*.

A VILLAGE COMES TO LIFE

The Story of Madikkai

K Madhavan

Translated by

P Radhika Menon

Darpan

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A VILLAGE COMES TO LIFE

The Story of Madikkai

K Madhavan

Translated from Malayalam
P Radhika Menon

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Aechikanam– The Cradle Of Landlordism In Madikkai

Kayyoor and Madikkai[2] were the seedbeds of the Communist movement in Kasaragod district. While Kayyoor witnessed the historic martyrdom of four fearless comrades, Madikkai not only gave birth to many brave hearts who led several struggles but nourished the movement as well, with men and money.

Richly endowed with hills and mountains, forests and brooks, Madikkai is known as 'the Moscow of the Communists'. It lies close to the eastern side of Kanhangad municipality. A fairly large village which has been divided into two units for administrative convenience today – Madikkai First and Madikkai Second – it is from here that the Nileshwaram, flowing from Kinanoor-Karinthalam region, grows into a full river. In olden days this river was the lifeline of local transport. As the Sultan canal linking the Nileshwaram and Valapattanam rivers passed through Madikkai, all the produce of the village was sold at Valapattanam during those times. The Sultan canal was constructed by Tipu Sultan after his capture of Malabar.

From very early days, people had been suffering terribly at the hands of a feudal order that had grown fat on the wealth of

[2] *Both were villages under the British administration. They were part of Hosdurg sub-taluk and erstwhile South Canara district.*

A Village Comes To Life

THE STORY OF MADIKKAI

K. Madhavan

Translated by
P. Radhika Menon

". . . when he [Comrade Madhavan] writes about his own political arena of Madikkai and about all those who sacrificed their lives for the Communist and peasants' union movements in that area, we are able to read it with enthusiasm and in one sitting. Simultaneously, he creates an opportunity for members of the present generation (who are unaware of this past) to experience the bitterness, the sorrow and the courage that the events triggered, by recreating those times that ring so eloquently with beautiful memories of nobility and selflessness. Every comrade ought to read this book. I feel honoured to be one of its first readers."

E. K. Nayanar
(Former Chief Minister of Kerala)

"Any member of the Aechikkanam house in North Kerala, into which Comrade K. Madhavan was born a century ago, was known as Eshaman ("Master", from Skt yajamana.) Madhavan, by his own hard and selfless work, rose from there to the position of being the servant of the people. Such apparent paradoxes are rare."

Dr Kesavan Veluthat
(Professor of History, University of Delhi)

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PREFACE

With the changing times, screening and selection procedures for competitive examinations undergo strategic changes. To address these needs of students appearing for national and state level competitive examiniations such as, UGC- CSIR JRF/ LECTURERSHIP, UPSC- Indian Civil Service, State PSCs, Bank Tests, SET, SLET, etc., a simplified version, perfected across wide spectrum is presented.

The book encapsulates, in a professionally structured format, the various areas usually clubbed under Mental Ability, Mathematical Aptitude, Reasoning, etc., prepared by persons with over two decades of experience in handling such topics. The contents span across seven sections in a lucid manner, with self explanatory problems followed by exercise. We understand the time constrain faced by the aspirants, no matter what age or qualification. Hence we thought of selecting a minimum number of questions which would assure the student full score in the said areas.

Wishing one and all a fruitful journey towards success.

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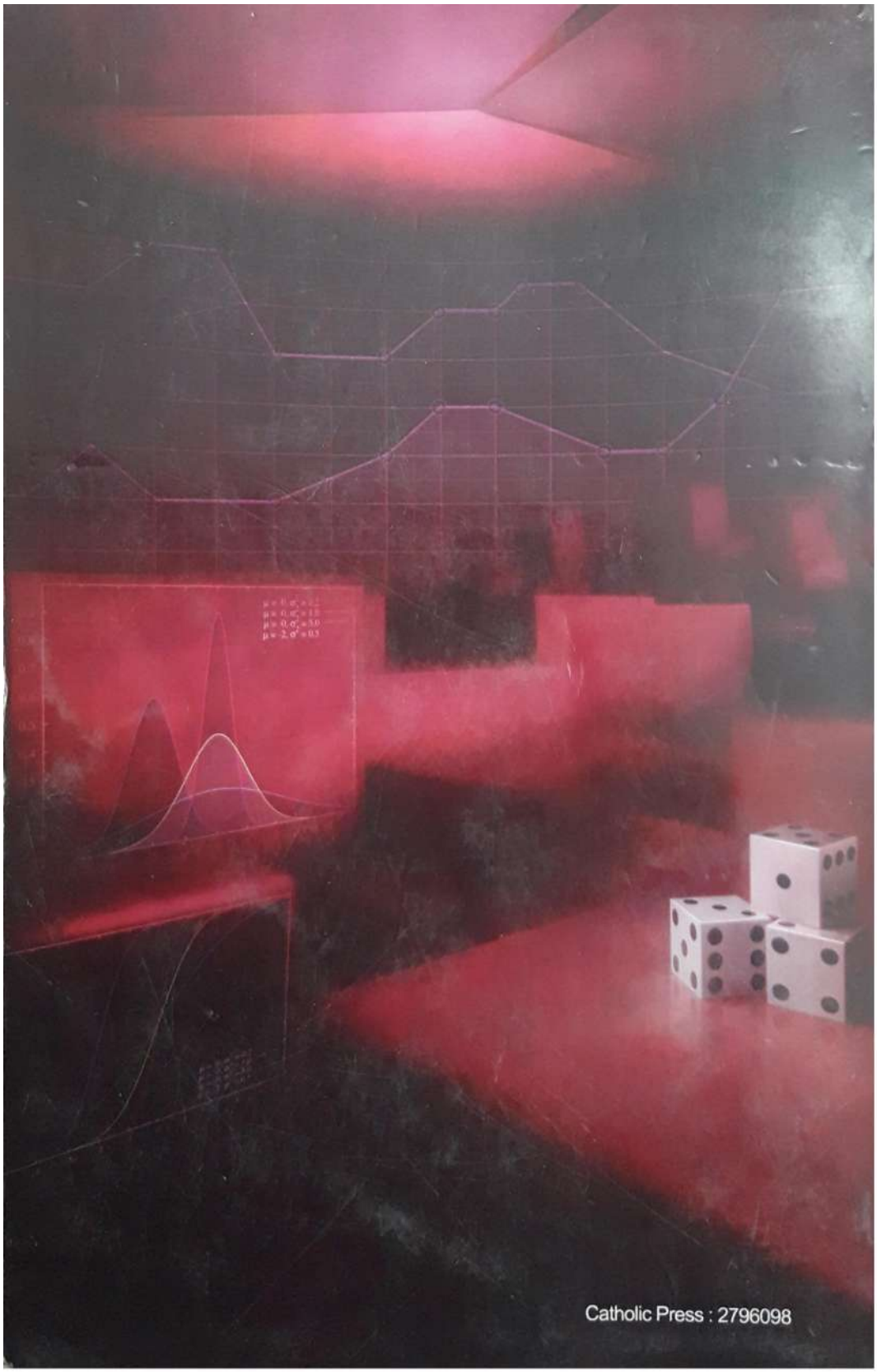
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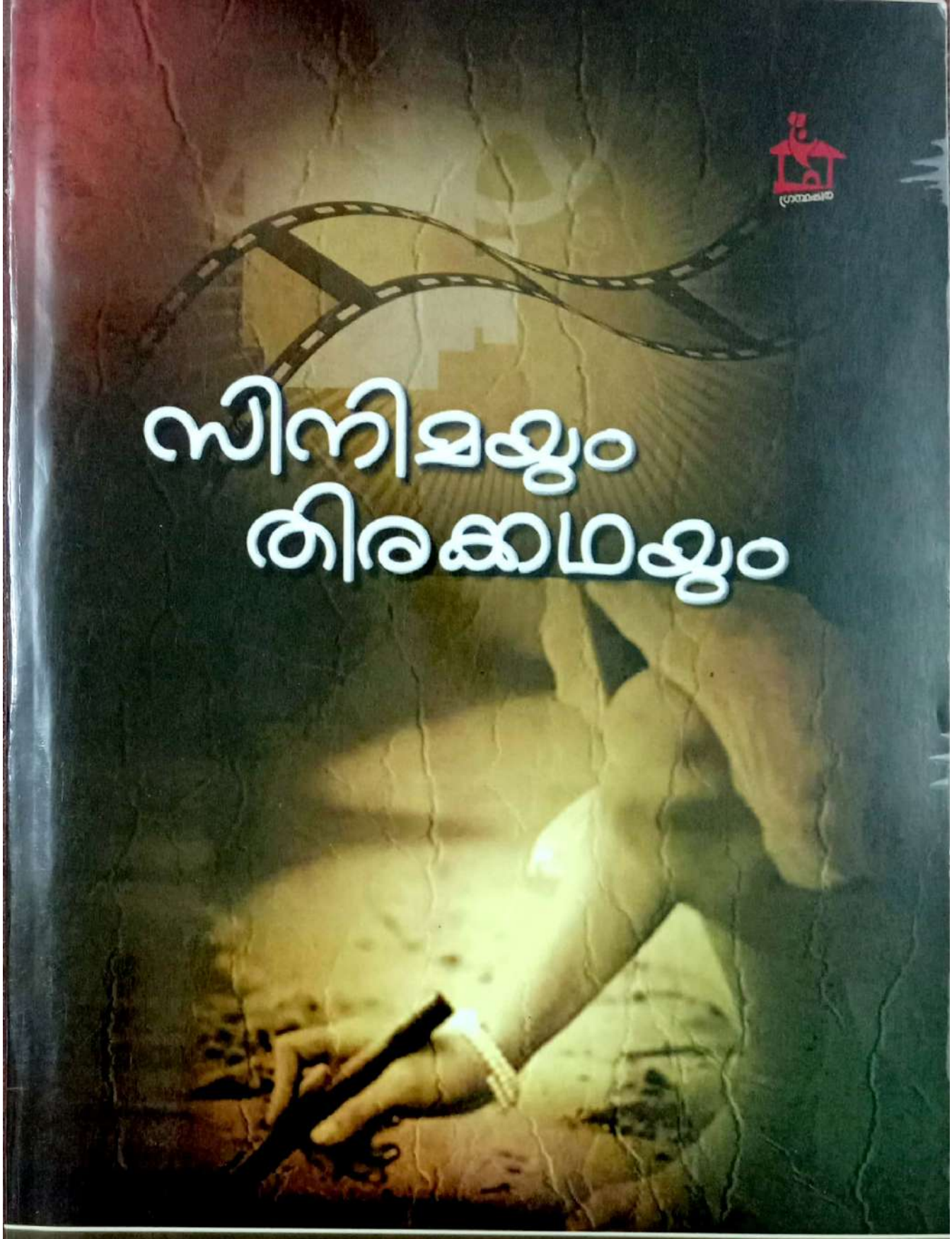

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അവതാരിക

കലാചിന്തയുടെ രംഗത്ത് പുതിയ ചലനങ്ങൾ

കേരളത്തിൽ ഉന്നതവിദ്യാഭ്യാസരംഗത്ത് അർത്ഥവത്തായ ചലനങ്ങൾ ഉണ്ടാകുന്നു. ആഴമേറിയ അന്വേഷണങ്ങളും മൗലികമായ ഗവേഷണങ്ങളും വിരളമല്ല. അതിന്റെ ഫലമായി ആശയോല്പാദങ്ങൾ നമ്മുടെ വിചാരലോകങ്ങളെ സജീവമാക്കുന്നു. ഈ ദിശയിലുള്ള പല പ്രവർത്തനങ്ങളിൽ ഒന്നാണ് കോളേജുകളിലും സർവകലാശാലാ പഠനവകുപ്പുകളിലും നടക്കുന്ന ദേശീയ-അന്തർദേശീയ സെമിനാറുകൾ. ഡോ അജയ ഘോഷിന്റെ നേതൃത്വത്തിൽ ചാത്തന്നൂർ ശ്രീനാരായണ കോളേജിൽ സംഘടിപ്പിച്ച ചലച്ചിത്ര-തിരക്കഥാ സെമിനാറിൽ അവതരിപ്പിച്ച പ്രബന്ധങ്ങളുടെ സമാഹാരമായ 'സിനിമയും തിരക്കഥയും' എന്ന ഈ ഗ്രന്ഥത്തിന് അതുകൊണ്ടുതന്നെ സവിശേഷമായ പ്രസക്തിയുണ്ട്.

കേന്ദ്രവിഷയത്തിന്റെ സമസ്തമേഖലകളെയും സ്പർശിക്കുന്ന പ്രബന്ധവിഷയങ്ങൾ സ്വീകരിക്കുവാൻ കഴിഞ്ഞിരിക്കുന്നുവെന്നത് എടുത്തുപറയേണ്ട മികവാണ്. സിനിമയും തിരക്കഥയും അനുബന്ധ വിഷയങ്ങളും സർവകലാശാലാതലങ്ങളിൽ കൂടുതലായി ശ്രദ്ധിക്കപ്പെട്ടുവരുന്ന കാലമാണ്.

കാളിദാസ കരസ്പർശം വയലാർ ഗാനങ്ങളിൽ

ഡോ. എം.ആർ. ഷെല്ലി

സാഹിത്യവും സിനിമയും തമ്മിലുള്ള ബന്ധം വിരുദ്ധങ്ങളായ അഭിപ്രായഗതികൾക്കിടം കൊടുത്തിട്ടുണ്ടെങ്കിലും സിനിമയുടെ സാഹിത്യബന്ധം പലപ്പോഴും അനിവാര്യമായ ഒന്നായി മാറാറുണ്ട്. വിശ്വസിനിമാചരിത്രം പരിശോധിച്ചാലും സാഹിത്യോപജീവ്യങ്ങളായ അനേകം സിനിമകൾ നമുക്ക് കണ്ടെത്താനാകും.... ഗ്രീക്ക് റോമൻ സാഹിത്യങ്ങളുടേയും ഷേക്സ്പീരിയൻ സാഹിത്യങ്ങളുടേയും ചലച്ചിത്ര പുനരാവിഷ്കാരങ്ങൾ ഓർക്കുക..... മലയാളത്തിലും വിശ്രുത സാഹിത്യകൃതികളെ ആധാരമാക്കി ധാരാളം ചലച്ചിത്രങ്ങളുണ്ടായിട്ടുണ്ട്. ഇതിഹാസ പുരാണാവലംബികളായവ മുതൽ (സീത, ശാകുന്തള, ശ്രീരാമ പട്ടാഭിഷേകം.....)പേർപെറ്റ മലയാളകൃതികളെ അധികരിച്ചുണ്ടായവ വരെ (ഉമ്മാച്ചു,ചെമ്മീൻ,അരനാഴികനേരം.....) ഇക്കൂട്ടത്തിൽപ്പെടും. ഒരു ചലച്ചിത്രം കാണുന്നവരേക്കാൾ അതിലെ ഗാനങ്ങൾ ആസ്വദിക്കുന്നവരുടെ എണ്ണം പലപ്പോഴും കൂടുതലാകയാൽ സാഹിത്യഭംഗിയും രചനാമൂല്യവുമുള്ള ഗാനങ്ങൾ ആധാരചിത്രങ്ങളേക്കാൾ കൂടുതൽ ആസ്വാദനത്തിനു പാത്രീഭവിക്കാറുണ്ട്. അതുകൊണ്ടുതന്നെ രചനാഗുണമുള്ള ഗാനങ്ങളിൽ മിക്കവയിലും ഒരു സാഹിതീയകരസ്പർശം കൊണ്ടുവരാൻ രചയിതാക്കൾ ശ്രമിക്കാറുണ്ട്. ഇത്തരത്തിൽ ഭാവഭംഗി

ഡോ. എസ്. അരുണലോഷ്

സിനിമയും തിരക്കഥയും

"എളുപ്പത്തിൽ ക്രിയചെയ്യാനുള്ള വഴിയായി
സിനിമാ പഠനങ്ങളെ ഉപയോഗിക്കുന്നവരുണ്ട്.
അതിൽനിന്നും തികച്ചും വ്യത്യസ്തമാണ് ഈ ഗ്രന്ഥം.
ഇതിലെ അന്വേഷണങ്ങൾക്ക് മൗലികതയുണ്ട്.
ചലച്ചിത്ര സംബന്ധിയായ താല്പര്യമുള്ളവർക്ക്
'സിനിമയും തിരക്കഥയും' എന്ന ഈ പുസ്തകം
പ്രയോജനകരമായിരിക്കും".

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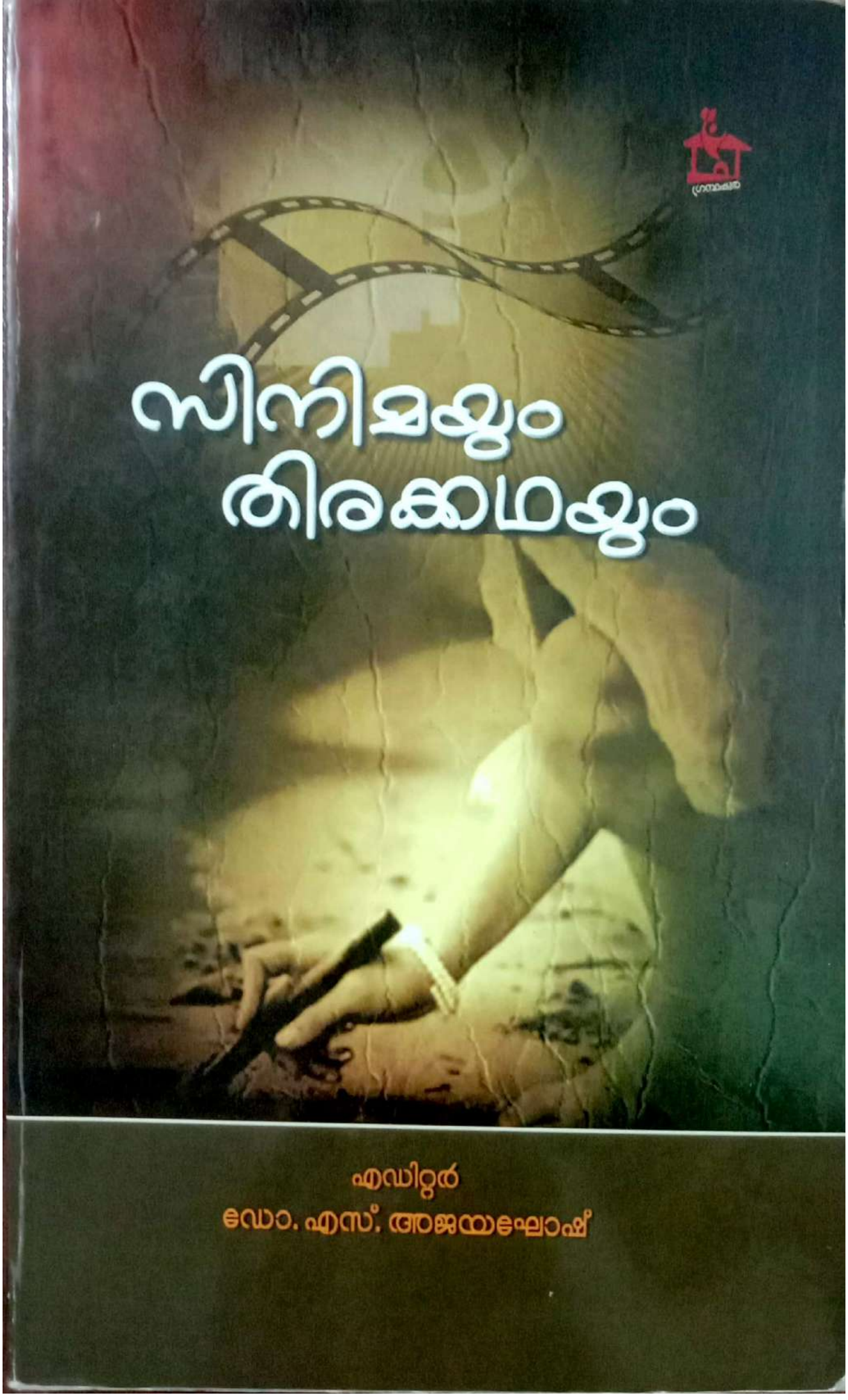
Email : grandhappura.klm@gmail.com



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ഉള്ളടക്കം

അവതാരിക

കലാചിന്തയുടെ രംഗത്ത് പുതിയ ചലനങ്ങൾ

കേരളത്തിൽ ഉന്നതവിദ്യാഭ്യാസരംഗത്ത് അർത്ഥവത്തായ ചലനങ്ങൾ ഉണ്ടാകുന്നു. ആഴമേറിയ അന്വേഷണങ്ങളും മൗലികമായ ഗവേഷണങ്ങളും വിരളമല്ല. അതിന്റെ ഫലമായി ആശയോല്പാദങ്ങൾ നമ്മുടെ വിചാരലോകങ്ങളെ സജീവമാക്കുന്നു. ഈ ദിശയിലുള്ള പല പ്രവർത്തനങ്ങളിൽ ഒന്നാണ് കോളേജുകളിലും സർവകലാശാലാ പഠനവകുപ്പുകളിലും നടക്കുന്ന ദേശീയ-അന്തർദേശീയ സെമിനാറുകൾ. ഡോ അജയ ഘോഷിന്റെ നേതൃത്വത്തിൽ ചാത്തന്നൂർ ശ്രീനാരായണ കോളേജിൽ സംഘടിപ്പിച്ച ചലച്ചിത്ര-തിരക്കഥാ സെമിനാറിൽ അവതരിപ്പിച്ച പ്രബന്ധങ്ങളുടെ സമാഹാരമായ 'സിനിമയും തിരക്കഥയും' എന്ന ഈ ഗ്രന്ഥത്തിന് അതുകൊണ്ടുതന്നെ സവിശേഷമായ പ്രസക്തിയുണ്ട്.

കേന്ദ്രവിഷയത്തിന്റെ സമസ്തമേഖലകളെയും സ്പർശിക്കുന്ന പ്രബന്ധവിഷയങ്ങൾ സ്വീകരിക്കുവാൻ കഴിഞ്ഞിരിക്കുന്നുവെന്നത് എടുത്തുപറയേണ്ട മികവാണ്. സിനിമയും തിരക്കഥയും അനുബന്ധ വിഷയങ്ങളും സർവകലാശാലാതലങ്ങളിൽ കൂടുതലായി ശ്രദ്ധിക്കപ്പെട്ടുവരുന്ന കാലമാണ്.

പഥേർപാഞ്ചാലിയിലെ ദ്വൈതഭാവങ്ങൾ

മനോജ്കുമാർ വി.

മനുഷ്യജീവിതത്തിന്റെ സമസ്ത മേഖലകളിലും നിർണ്ണായകമായ ചാലകശക്തിയായി ദൃശ്യമാധ്യമങ്ങൾ വളർന്നു കൊണ്ടിരിക്കുന്ന ഒരു കാലഘട്ടമാണ് നിലനിൽക്കുന്നത്. ആശയ വിനിമയത്തിനുള്ള ശക്തമായ ഉപാധിയായി ദൃശ്യഭാഷ പരിവർത്തനം ചെയ്യപ്പെട്ടിരിക്കുന്നു. ദൃശ്യഭാഷയുടെ മുഴുവൻ സാധ്യതകളും പരമാവധി പ്രയോജനപ്പെടുത്തുന്ന ഒരു വ്യവഹാരരീതിയായി സിനിമ എന്ന മാധ്യമം ഔന്നത്യം പ്രാപിച്ചിരിക്കുന്നു.

"ലോകസിനിമാഭൂപടത്തിൽ ഭാരതത്തെ രേഖപ്പെടുത്തിയ ചലച്ചിത്രകാരനാണ് സത്യജിത്ത്റേ"യെന്നു ഐ. ഷൺമുഖദാസ് പ്രസ്താവിച്ചുകാണുന്നു. 1955-ൽ പുറത്തിറങ്ങിയ 'പഥേർ പാഞ്ചാലി' അതുവരെയുണ്ടായിരുന്ന ഇന്ത്യൻ സിനിമാസങ്കല്പങ്ങളെ തകിടംമറിച്ചു. "ഒരിക്കൽ ഞാനൊരു മഹത്തായ സിനിമയെടുക്കും" എന്ന റേയുടെ വാക്കുകൾ യാഥാർത്ഥ്യമായി. സിനിമ ഒരു സംഘടിത കലയാണെന്ന പൂർവ്വബോധത്തിൽ നിന്നു തെന്നിമാറി അത് സംവിധായകന്റെ കലയാണെന്നു റേ തെളിയിച്ചു. ഇന്ത്യയിലെതന്നെ ആദ്യത്തെ യഥാതഥ ചലച്ചിത്രം എന്നു വിശേഷിപ്പിക്കാവുന്ന 'പഥേർപാഞ്ചാലി' ബിഭൂതി ഭൂഷൺ ബന്ദ്യോപാധ്യായയുടെ അതേ പേരിലുള്ള നോവലിന്റെ മികവാർന്ന ആവിഷ്ക്കരണ

സിനിമയും തിരക്കഥയും

"എളുപ്പത്തിൽ ക്രിയചെയ്യാനുള്ള വഴിയായി
സിനിമാ പഠനങ്ങളെ ഉപയോഗിക്കുന്നവരുണ്ട്.
അതിൽനിന്നും തികച്ചും വ്യത്യസ്തമാണ് ഈ ഗ്രന്ഥം.
ഇതിലെ അന്വേഷണങ്ങൾക്ക് മൗലികതയുണ്ട്.
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ഡോ. കെ. എസ്. മഞ്ചു | ഡോ. ആർ. എസ്. ജയ | രമ്യ ആർ. | അധീശ് യു.
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Email : grandhappura.klm@gmail.com

നെയ്തൽ

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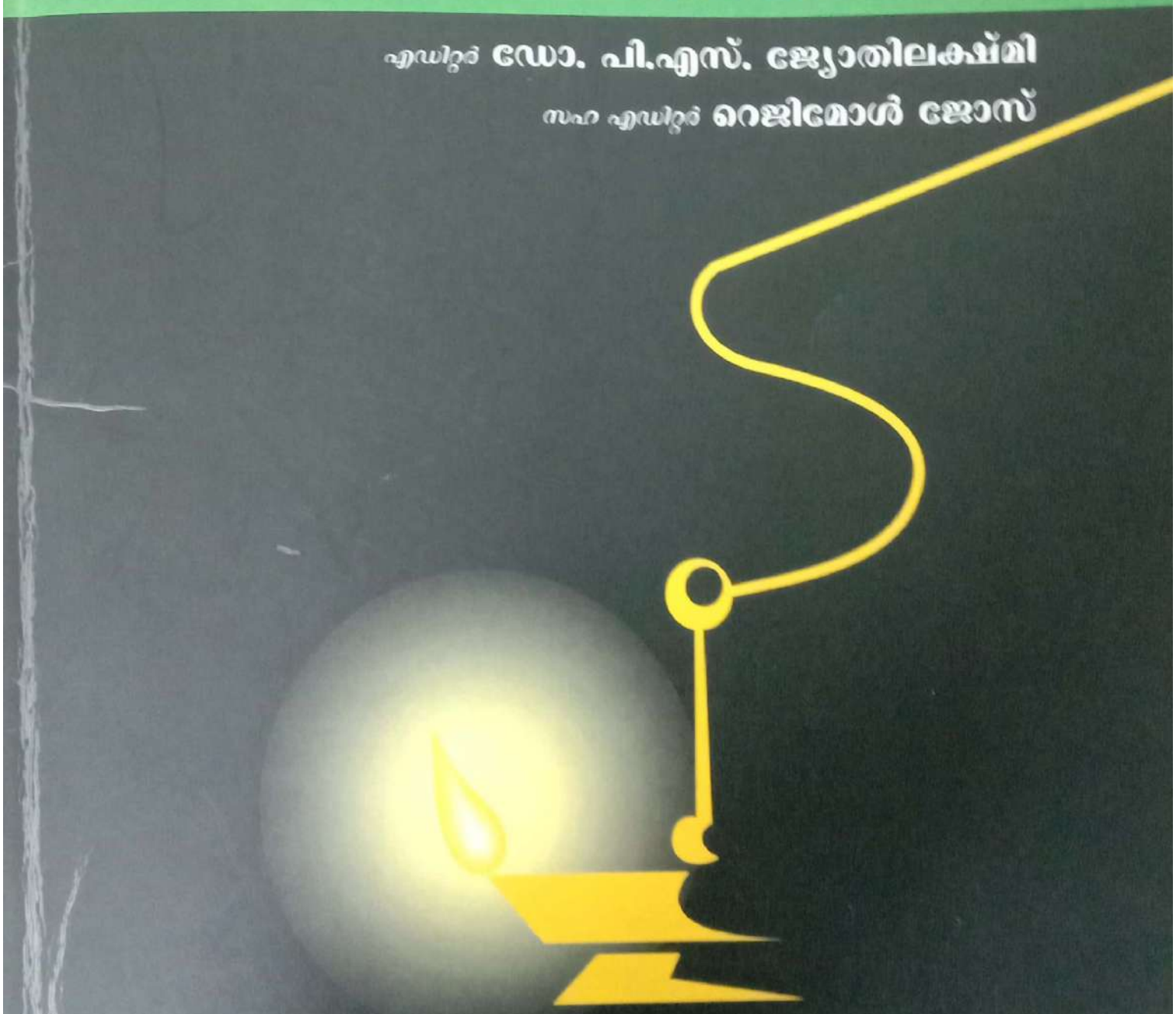

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പ്രസാധനം

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ഫോക്‌ലോറിലെ ലോകപാരിസ്ഥിതിക വീക്ഷണം

ഡോ. സി.ആർ. രാജഗോപാലൻ

നമ്മുടെ സെമിനാറിന്റെ പേര് നെയ്തൽ എന്നാണ്. നെയ്തൽ എന്നുപറഞ്ഞാൽ കടലോര സാമൂഹ്യസാംസ്കാരിക പൈതൃകത്തെയാണ്, ഒരു തിണയെയാണ് അല്ലെങ്കിൽ നമ്മുടെ പ്രാചീനജനത ആഹരിച്ചുവന്നിരുന്ന തിന എന്നുപറയുന്ന ഒരു ധാന്യത്തെയാണ് സൂചിപ്പിക്കുന്നത്. എന്നു പറഞ്ഞാൽ നാട്ടുവാക്കുകളിൽ നിന്ന് നമ്മൾ ചരിത്രത്തിലേക്ക് പോകുകയാണ്. നമ്മുടെ തൊട്ടറിയുന്ന ഓരോ പൈതൃകങ്ങളും തൊട്ടറിയാപൈതൃകങ്ങളും തേടിയുള്ള യാത്രയാണ്, നമ്മുടെ മനസ്സിന്റെ ആഴങ്ങളിലേക്ക് നമ്മുടെ പ്രജ്ഞയുടെ താഴ്വരകളിലേക്കുള്ള ഒരു സഞ്ചാരമാണ് ഫോക്‌ലോർ അന്വേഷണം എന്നുള്ളത്. ഈ സഞ്ചാരം ചെന്നെത്തി നിൽക്കുന്നത് നമ്മുടെ മണ്ണിലാണ് എന്നുള്ളത് കാണാൻ പറ്റും. മണ്ണിനെ ചവിട്ടിയാണ് വിത്തെറിയുന്നത്. സാംബ എന്നു പറയുന്ന ഒരു പുരാവൃത്ത മനുഷ്യരുണ്ട്, ഫിൻലാന്റിൽ സാംബ എന്നുപറഞ്ഞിട്ട്. ഈ നൂറ്റാണ്ടിൽ കണ്ടെടുത്ത ഒരു വലിയ ഇതിഹാസമാണ് കലൈവാല എന്നുപറയുന്ന ഇതിഹാസം. നിങ്ങളെപ്പോഴെങ്കിലുമൊക്കെ ഒന്നന്വേഷിക്കുക. ഈ കലൈവാലയിൽ പറയുന്ന സാംബ എന്നുവച്ചാൽ വിത്തുവിതച്ചുകൊണ്ടു നടക്കുന്നതാണ്. വിത്ത് എന്നുപറയുന്ന ഉർവ്വരതയുടെ ആദിരൂപം, അത് വാക്കാണ്, വിത്താണ് അത് മിത്താണ്. ഇതുവിതച്ചുകൊണ്ട് നടക്കുന്ന ആദിമരായിട്ടുള്ള എത്രയോ മനുഷ്യരുടെ ലോകത്തിൽ നിന്നാണ് നമുക്ക് നെയ്തൽ പോലൊരു വാക്കുണ്ടാകുന്നത്. നമ്മളിപ്പോൾ കുട്ടനാട്ടിലേക്കു പ്രവേശിക്കുമ്പോൾ ഒരു അരങ്ങ് എന്നു പറയുന്നത്, ഒരു നാട്ടരങ്ങ് എന്നുപറയുന്നത് ഒരു സേക്രഡ് പ്ലെയ്സാണ്. ഭൂമിയെ തൊട്ട് നെറുകയിൽ വച്ച് സൂര്യഭഗവാനെ കൈവണങ്ങി. ഇത്രയേ ഉണ്ടായിരുന്നുള്ളൂ പ്രാചീനമനുഷ്യർ. അവന്റെ ഊർജം എന്നുപറയുന്നത് മണ്ണും വെളിച്ചവുമാണ്.

തീരെ ചെറിയ അറിവുകളാണ് തിരിച്ചറിവുകൾ. നമ്മുടെ നാട്ടിലെ നാട്ടറിവുകൾ ഇത്തരത്തിൽ രൂപ്പെട്ടിട്ടുള്ളവയാണ്. അലയുന്ന മഹാമനീഷികളുടെ ജീവിതത്തിൽ നിന്നും തൊട്ടെടുത്തിട്ടുള്ളവയാണതിലേറെയും. മനുഷ്യൻ പ്രാരംഭത്തിൽ അലഞ്ഞു നടക്കുന്ന ജീവിതചര്യയ്ക്കുടമയായിരുന്നു. ഇതിലൂടെ ലഭിച്ച തിരിച്ചറിവുകൾ നാട്ടറിവുകളായി. ഇവയിൽ പലതും ആധുനികതയിൽ കാലഹരണപ്പെട്ടുപോയി. അവയെ കണ്ടെത്താനുള്ള മഹത്തായ ശ്രമമാണ് നാട്ടറിവുപഠനകേന്ദ്രങ്ങൾ നടത്തുന്നത്.

മലയാളത്തിന്റെ ഹോർത്തൂസ് മലബാറിക്കസ് കേരളത്തിന്റെ സസ്യസമ്പത്തിന്റെ വിവരണമെന്നതിനപ്പുറം ഒരു ദേശത്തിന്റെ അടയാളമായി, Geographics Indication (GI) ആയി നിലകൊള്ളുന്നു. ഓരോ പ്രദേശത്തിനും പ്രാദേശികമായ ചില ജൈവസൂചകങ്ങൾ ഉണ്ട്. ഇത്തരം സൂചകങ്ങളുടെ സമാഹാരങ്ങളിലൊന്നായി ഇതിനെ പരിഗണിക്കാം. സസ്യ-ജന്തുജാലങ്ങളും, മണ്ണിനങ്ങളും എല്ലാം ഇത്തരം

മിത്തിന്റെ പാരിസ്ഥിതിക അവബോധപരമായ ഭാഷ്യം

പൂതപ്പാട്ടിനെ അടിസ്ഥാനപ്പെടുത്തി ഒരന്വേഷണം

പെട്രീഷ്യ ജോൺ

കവിതയുടെ ഉണ്മ വാക്കുകളിലൂടെയാണ് ആവിഷ്ക്കരിക്കുന്നത്. സാമൂഹികവും വൈകാരികവും സാങ്കല്പികവുമായ പലതും കവിതയ്ക്ക് വിഷയമാകാം. കാല്പനികതയുടെ മായികതയിൽ നിന്ന് മുക്തമാകുന്ന കാവ്യപരിസരമാണ് ഇടശ്ശേരിക്കവിതയ്ക്കുള്ളത്. ജീവിതത്തിന്റെ കഠിനയാഥാർത്ഥ്യങ്ങളെ മൂർത്തമായി ആവിഷ്ക്കരിച്ച ഇടശ്ശേരി മലയാള കവിതയിൽ വേറിട്ട ഒരു ഭാവുകത്വ പരിസരത്തെയാണ് സൃഷ്ടിച്ചത്. നാടോടി വഴക്കങ്ങൾക്കും, മിത്തുകൾക്കും, ഒട്ടേറെ കവികൾ കാവ്യരൂപം നൽകിയിട്ടുണ്ട്.കാവാലം നാരായണപ്പണിക്കർ തെയ്യം, തോറ്റം, തുടങ്ങിയ നാടോടിക്കലാരൂപങ്ങളിൽ നിന്നും കടമ്മനിട്ട രാമകൃഷ്ണൻ പടയണിയിൽ നിന്നും നാടോടി അംശങ്ങൾ സ്വീകരിച്ച് കാവ്യസൃഷ്ടി നടത്തിയിട്ടുണ്ട്. ഇതിന് മുൻപാണ് ഇടശ്ശേരി പൂതപ്പാട്ട് എന്ന സവിശേഷശ്രദ്ധയർഹിക്കുന്ന രചന നടത്തിയിട്ടുള്ളത്. പി. കുഞ്ഞിരാമൻ നായരുടെയും, വൈലോപ്പിള്ളിയുടേയും കവിതകളിൽ നാടോടി അംശങ്ങൾ സജീവസാന്നിധ്യമായിരുന്നു. ഇടശ്ശേരിയുടെ പൂതപ്പാട്ട് എന്ന കവിതയെ കുറിച്ച് പല നിരീക്ഷണങ്ങളും ഉണ്ടായിട്ടുണ്ട്. അതിൽ പ്രമുഖമായത് ആദിരൂപനിഷ്ഠമായ മാതൃഭാവത്തിന്റെ അന്വേഷണം നടത്തിയ ഡോ. എം. ലീലാവതിയുടെ നിഗമനങ്ങളാണ്. ഡോ: സി. ആർ.രാജഗോപാലിന്റെ പൂതപ്പാട്ട് നരവംശപരമായ പുനർനിർമ്മിതി എന്ന ലേഖനം മറ്റൊരു സമീപനമാണ്. എന്നാൽ ഈ രണ്ടു നിലപാടുകളിൽ നിന്നും വ്യത്യസ്തമായി ഭാരതീയ പ്രകൃതിസങ്കല്പത്തിന്റെ അടിത്തറയിൽ നിന്നുകൊണ്ടുള്ള ഒരു വിശകലനമാണ് ഞാൻ നിർവഹിക്കുന്നത്.

വടക്കേ മലബാറിൽ നിലനിന്നിരുന്ന രണ്ടു മിത്തിക്കൽ സങ്കല്പത്തെയാണ് പൂതപ്പാട്ടിലൂടെ കവി ആവിഷ്ക്കരിക്കുന്നത്. ബാല്യത്തിൽ അയൽക്കാരെക്കാൾ തനിക്ക് പരിചയം ദേവതകളെയായിരുന്നു. ഞാൻ ദുശ്ശാഠ്യം പിടിച്ച് കരയുന്നതുതന്നെ ശ്രദ്ധിച്ച് മച്ചിനകത്ത് ചുകയുന്നചകലാസും മൂടിപ്പുതച്ചിരിക്കുന്ന മൂപ്പർ, മുറ്റത്തെ പിച്ചകവള്ളിപ്പടർപ്പ്, വേനലറുതിയിൽ തൂനിലാവിൽ നിറയെപ്പൂക്കുമ്പോൾ അവിടെ ചുറ്റിപ്പറ്റി നിൽക്കുന്ന വെള്ളവസ്ത്രക്കാരനായ രക്ഷസ്, തണ്ണീരാമൃതത്തോടുകൂടി ഏട്ടൻ പതിഞ്ഞ സ്വരത്തിൽ സ്തോത്രം ചൊല്ലി മണികിലുക്കി പൂജകൊടുക്കുന്ന ഭുവനേശ്വരി, മുല്ലപ്പൂമണക്കാരിയായ തേരുവാഴ്ചയിലെ യക്ഷി തുടങ്ങി ഒട്ടേറെ സങ്കല്പങ്ങളെ ഇടശ്ശേരി അനുസ്മരിക്കുന്നുണ്ട്. ഈ സ്മരണയാണ് പൂതപ്പാട്ടിന്റെ ആധാരം.

പറയന്റെ കുന്നിന്റെ അങ്ങേച്ചരുവിൽ വസിക്കുന്ന പൂതത്തിന്റെ നിഷ്ഠുരമായ മനസ്സിനെ വിവരിച്ചുകൊണ്ടാണ് പൂതപ്പാട്ട് ആരംഭിക്കുന്നത്.

പറയന്റെ കുന്നിന്റെയങ്ങേച്ചരുവിലെ പാറക്കെട്ടിന്നടിയിൽ

കല്ലറമതിലിൽക്കൂടി തുറുകണ്ണും പായിച്ച് കാലികളെ പാർക്കുന്നു പൂതം.

ഉച്ചത്തണലിൽ വിശ്രമിക്കുന്ന ഇടയച്ചെക്കന്മാരെ വഞ്ചിച്ച് പശുക്കളുടെ അകിട് നുകരുകയും നെയ്യും നിലയും വിട്ട് അതുവഴിപോകുന്ന ചെറുബാല്യക്കാരെ അതിചതുരമായി ആകർഷിച്ച് കരിമ്പന മേലേക്കയറ്റി അവരുടെ ഉപ്പേറുന്ന കുരുതി തൊട്ടിനുണച്ച് കഴിയുന്ന പൂതം ആറ്റിൻ വക്കത്തെ മാളികവീട്ടിൽ ആറ്റുനോറ്റു പിറന്ന ഉണ്ണിയെ അപഹരിക്കുകയാണ്. ആറ്റിലൊലിച്ചെത്തുന്ന അമ്പിളിപ്പൂ പോലെ, പൂവൻ പഴം പോലെയുള്ള ഉണ്ണിയെ കണ്ടപ്പോൾ പൂതത്തിനുള്ളിൽ ഇക്കിളിതോന്നുകയും, മാറു കോരിത്തരിക്കുകയും ചെയ്തു. പ്രലോഭനത്തിലൂടെ പൂതം ഉണ്ണിയെ വശത്താക്കി. ഉണ്ണിയെ കാണാഞ്ഞ അമ്മ ആറ്റിൻകരയിലും പാടത്തും കാട്ടിലും അവനെ തേടിനടന്നു. കുറ്റബോധം കൊണ്ട് പൂതത്തിന്റെ മനസ്സ് പിടഞ്ഞു. അവൾ അമ്മയെ പേടിപ്പിച്ചോടിക്കാൻ നോക്കി. ചുഴലിക്കാറ്റായി ആഞ്ഞടിച്ചു. അമ്മ കുറ്റികണക്കെ നിന്നു. കാട്ടുതീയായി വന്ന പൂതത്തെ അമ്മ കണ്ണീരുകൊണ്ടു കെടുത്തി. നരിയായും പുലിയായും പല അടവുകൾ നോക്കി .ഉണ്ണിയെ തരു എന്നു പറഞ്ഞു കൊണ്ട് അമ്മ ഒരേനിൽപു നിന്നു. ഉണ്ണിക്ക് പകരം പൊന്നും മണികളും കിഴികെട്ടി നൽകാമെന്ന് നിധി കാണിച്ചു കൊണ്ട് പൂതം നിന്നു. അവ നോക്കാതെ വിടരുന്ന ചെന്താമര മൊട്ടുകൾ പോലെയുള്ള സ്വന്തം കണ്ണുകൾ ചൂഴ്ന്നെടുത്ത് ഇതിലും വലിയതാണ് എന്റെ പൊന്നോമന എന്ന് അമ്മ പൂതത്തെ ബോധ്യപ്പെടുത്തി. കണ്ണില്ലാതായ അമ്മയ്ക്കുമുമ്പിൽ തെച്ചിക്കോലിനെ മന്ത്രശക്തിയാൽ ഉണ്ണിയാക്കി അമ്മയ്ക്കു നൽകി. കണ്ണില്ലാത്ത അമ്മ ഉണ്ണിയെ തിരിച്ചറിഞ്ഞു.

പെറ്റവയറ്റിനെ വഞ്ചിക്കുന്നൊരു
പൊട്ടപ്പൂതമിതെന്ന് കയർത്താൾ
താപം കൊണ്ടു വിറയ്ക്കെ ക്കൊടിയൊരു
ശാപത്തിന്നവൾ കൈകളുയർത്താൾ

അമ്മയുടെ സ്നേഹശക്തിക്കു മുമ്പിൽ പിടിച്ചു നിൽക്കാൻ കഴിയാത്ത പൂതം ഉണ്ണിയെ വിട്ടുകൊടുത്തു. ശപിക്കാതിരിക്കാൻ അമ്മയ്ക്ക് കാഴ്ചശക്തിയും നൽകി. ഉണ്ണിയെ പിരിയുന്ന പൂതത്തിന്റെ വാത്സല്യം അമ്മയുടെ ഹൃദയത്തെ ആർദ്രമാക്കി. മകരക്കൊയ്ത്തുകഴിഞ്ഞ് എല്ലാ വർഷവും വീട്ടിൽ വരാൻ അമ്മ പൂതത്തിന് അനുവാദം കൊടുത്തു. എന്നാൽ ഉണ്ണി പിറന്ന വീട് ഏതെന്ന് പറഞ്ഞു കൊടുത്തില്ല. കണ്ടാൽ തന്റെ കിടാവിനെ പൂതം കൊണ്ടു പോകും എന്നു കരുതിയാണ് പറയാതിരുന്നത്. അതുകൊണ്ട് എല്ലാവർഷവും തുടികൊട്ടിപ്പാടി ഓരോ വീട്ടിലും പൂതം ഉണ്ണിയെ തേടിയലയുന്നതാണ് പൂതപ്പാട്ടിന്റെ ഇതിവൃത്തം.

ഭാരതീയ സങ്കല്പം അനുസരിച്ച് പ്രകൃതിക്ക് മൂന്ന് ഗുണങ്ങളാണുള്ളത്, അഥവാ ത്രിഗുണാത്മകമാണ് പ്രകൃതി. സത്വം, രജസ്സ്, തമസ്സ് എന്നിവ. പൂതപ്പാട്ടിലെ പൂതം തമോഗുണത്തെ പ്രതിനിധാനം ചെയ്യുന്നു. കറുപ്പ് തമോഗുണത്തിന്റെ നിറമാണ്. കാതിൽ പിച്ചളത്തോടയും കഴുത്തിൽ കലപലപാടും പണ്ടങ്ങളുമുള്ള ചായക്കിരീടം തലയിലണിഞ്ഞിരിക്കുന്ന കരിമ്പൂതം പറയന്റെ കുന്നിന്റെ അങ്ങേ ച്ചരുവിലെ പാറക്കെട്ടിന്റെ അടിയിൽ നിന്നാണ് വരുന്നത്. പൂതം നിഷ്ഠുരയും സ്വാർത്ഥയും മണമേറും അന്തിയിൽ ബന്ധുഗൃഹം പൂകുന്ന വരെ അകലേക്കകലേക്ക് വഴിതെറ്റിക്കുകയും എല്ലാം മറന്ന് തഴുകിയുറങ്ങുന്ന തരുണന്മാരുടെ ഉപ്പേറുന്ന കുരുതി തൊട്ടിനുണയ്ക്കുകയും ചെയ്യുന്നവളാണ്. പൂതം സ്നേഹമോ ആർദ്രതയോ ഇല്ലാത്ത മനസ്സിന്റെയുടമയാണ്. ഇത്തരത്തിൽ തമോഗുണ സമ്പുഷ്ടമായ പൂതത്തിന് സംഭവിക്കുന്ന സാത്വികോത്കർഷമാണ് ഈ കവിത.

പൂതത്തിനു നെല്ലും മുണ്ടും കൊടുത്തില്ലെങ്കിൽ അത് പാപമാണ്. ഇപ്പോൾ അത് ആരേയും കൊല്ലുന്നില്ല. അതിന് എപ്പോഴും വ്യസനമാണ്. ഇത്തരത്തിൽ ഒരു മാനസിക പരിണാമം പൂതത്തിൽ വരുത്തിയത് സാത്വിക വിശുദ്ധിയുടെയും സ്നേഹശക്തിയുടേയും പ്രതീകമായ അമ്മയാണ്. പൊന്നുംകുടം പോലെയും പൂവമ്പഴം പോലെയുമുള്ള തന്റെ പൊന്നോമനയെ അപഹരിച്ച പൂതത്തെ ശപിക്കാൻ തയ്യാറായ അമ്മ പൂതത്തിന്റെ പ്രവൃത്തികളേയും മനസ്സിനേയും ശുദ്ധീകരിക്കുകയാണ് ചെയ്തത്. ഇങ്ങനെ തമസ്സിൽ നിന്ന് ജ്യോതിസ്സിലേക്ക് അഥവാ തമോഗുണത്തിൽ നിന്ന് സത്വഗുണത്തിലേക്ക് പൂതത്തിനുണ്ടാവുന്ന ഈ പരിവർത്തനത്തിലൂടെ ഭാരതീയ പ്രകൃതി സങ്കല്പത്തെ സർവ്വതലസ്പർശിയായി ആവിഷ്ക്കരിക്കുകയാണ് ഇടശ്ശേരി ചെയ്തിരിക്കുന്നത്.

കാല്പനിക കാലഘട്ടത്തിൽ ഗ്രാമീണ സംസ്കൃതിയോടുള്ള മമത മിക്ക കവികളും പ്രകടിപ്പിച്ചിട്ടുണ്ട്. പൂതപ്പാട്ടും ഈ ഗ്രാമീണ സംസ്കാരത്തിന്റെ വെളിപ്പെടുത്തലായി നില കൊള്ളുന്നു. അതിൽ ഉപയോഗിച്ചിട്ടുള്ളത് നാടോടി ബിംബങ്ങളാണ്. അമ്പിളിപ്പൂങ്കുല, കരിമ്പൂതം, ആമ്പൽപ്പൂവ്, തെച്ചിപ്പൂവ്, പൊന്നും കുടം, പൂവമ്പഴം, എന്നിങ്ങനെ ഗ്രാമ്യതയുടെ ലാവണ്യത്തിലാണ് അത് വിഹരിക്കുന്നത്. പൂതം മുറുക്കിത്തുപ്പിയതുകൊണ്ടാണ് തെച്ചിപ്പൂവൊക്കെ ചുവക്കുന്നത് എന്ന സങ്കല്പം തദ്ദേശീയമായ ഭാവനയിൽ നിന്ന് ഉണ്ടായതാണ്. പ്രകൃതി വസ്തുക്കൾക്ക് ഭാവം കൊണ്ട് നിറം കൊടുക്കുമ്പേൾ അവ കാവ്യ ബിംബങ്ങളായി മാറുന്നു. ഇത്തരത്തിൽ നാടോടിത്തത്തിന്റെ തനിമയിൽ നാടൻ പാട്ടിന്റെ സംഗീതവും ഭാരതീയ പ്രകൃതി സങ്കല്പത്തിന്റെ സമഗ്രതയും സമഞ്ജസമായി സമന്വയിപ്പിക്കുകയാണ് ഇടശ്ശേരി, പൂതപ്പാട്ടിൽ .

ആധുനിക ലോകം തമോമയമായ വികാരങ്ങളുടെ ഈറ്റില്ലമായി മാറുകയാണ്. ഹിംസാത്മകമായ മനോഭാവങ്ങളിൽ നിന്നും അഹിംസാത്മകമായ മഹാനന്ദത്തിലേക്ക് നമ്മുടെ സമൂഹം മാറേണ്ടിയിരിക്കുന്നു. അടിയുറച്ച ഗാന്ധിയനായ ഇടശ്ശേരി മൃത്യുവിൽ നിന്നും അമൃതത്വത്തിലേക്കുള്ള മാനവ മനസ്സിന്റെ മാറ്റത്തിന്റെ അനിവാര്യതയെയാണ് ഇവിടെ അടയാളപ്പെടുത്തുന്നത്. ഭയവും വിദ്വേഷവും ക്രൂരതയും വികസിതമായ ഒരു സമൂഹത്തിന് ഭൂഷണമല്ല. തന്റെ സർഗ്ഗാത്മക സംസ്കാരത്തിൽ വേരോടിയിരുന്ന മിത്തുകളെ ,നാടോടി ബിംബങ്ങളെ, പുത്തൻ വെളിപ്പെടുത്തലുകളിലേക്ക് മനോഹരമായി മാറ്റുന്ന രസതന്ത്രമാണ് ഈ കവിതയിൽ കാണുന്നത്. ആദികവിയായ വാല്മീകി മാനിഷാദയിലൂടെ സമൂഹത്തിനു നൽകിയ ഉദ്ബോധനം തന്നെയാണ് ഇടശ്ശേരിയിലും പ്രതിസ്പന്ദമാകുന്നത്. ■

സഹായകഗ്രന്ഥങ്ങൾ

ഇടശ്ശേരിഗോവിന്ദൻ നായർ, പൂതപ്പാട്ട്.

രാജഗോപാൽ സി.ആർ.ഡോ.,
പൂതപ്പാട്ട് നരവംശപരമായ പുനർനിർമ്മിതി.

ലീലാവതി എം. ഡോ., വർണ്ണ രാജി.

ലേഖകപരിചയം

ഡോ. സി.ആർ. രാജഗോപാലൻ
നിരൂപകൻ, വകുപ്പധ്യക്ഷൻ,
മലയാളവിഭാഗം, കേരള സർവകലാശാല,
തിരുവനന്തപുരം

ഡോ. കെ.എം. ഭരതൻ
നിരൂപകൻ, വകുപ്പധ്യക്ഷൻ,
സംസ്കാരപൈതൃകപഠനം
തുഞ്ചത്തെഴുത്തച്ഛൻ മലയാളസർവകലാ
ശാല, തിരൂർ.

ഡോ. എസ്.എസ്. ശ്രീകുമാർ
നിരൂപകൻ, വകുപ്പധ്യക്ഷൻ, മലയാളവിഭാഗം,
മഹാത്മാഗാന്ധി ഗവ.ആർട്സ് കോളേജ്, മാഹി

ഡോ. സന്ധ്യ പി. പൈ
അസോ.പ്രൊഫസർ, സെന്റ്. ജോസഫ്സ്
കോളേജ് ഫോർ വിമെൻ, ആലപ്പുഴ

ഡോ. ചിത്ര എൻ.ആർ.
വകുപ്പധ്യക്ഷ, ഹിന്ദി വിഭാഗം,
സെന്റ് ജോസഫ്സ് കോളേജ് ഫോർ
വിമെൻ, ആലപ്പുഴ

പി. അരുൺ മോഹൻ
ഗവേഷകൻ, മലയാള കേരളപഠനവിഭാഗം,
കോഴിക്കോട് സർവകലാശാല, തേഞ്ഞിപ്പാലം

ഡോ. എസ്. അജയകുമാർ
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
എസ്.ഡി. കോളെജ്, ആലപ്പുഴ

ഡോ. എ.ആർ. ഷെല്ലി
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
ഫാത്തിമ മാതാ നാഷണൽ കോളേജ്,
കൊല്ലം

ഡോ. ജി. ശ്രീജിത്
അസി. പ്രൊഫസർ, മലയാള വിഭാഗം,
മലബാർ ക്രിസ്ത്യൻ കോളേജ്, കോഴിക്കോട്

ഷൈജി സി. മുരിങ്ങാത്തേരി
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
ലിറ്റിൽ ഫ്ളവർ കോളേജ്, ഗുരുവായൂർ

സലാഹുദ്ദീൻ സി.ടി.
ഗവേഷകൻ, മലയാള കേരളപഠനവിഭാഗം,
കോഴിക്കോട് സർവകലാശാല, തേഞ്ഞി
പ്പാലം

മെറിൻ ജോയ്
ഗവേഷക, മലയാള വിഭാഗം,
കോഴിക്കോട് സർവകലാശാല, തേഞ്ഞി
പ്പാലം

ഡോ. കെ. ഷിജു
അധ്യാപകൻ, മലയാളവിഭാഗം,
ഗവൺമെന്റ് കോളേജ്, കട്ടപ്പന

ഡോ. വി. ചിത്രാദേവി
അസി.പ്രൊഫസർ, ചരിത്ര വിഭാഗം,
എൻ.എസ്.എസ്. വനിതകോളേജ്,
തിരുവനന്തപുരം.

മഞ്ജുഷ ഇ.എസ്.
അധ്യാപിക, മലയാളവിഭാഗം,
ഡി.ബി. കോളേജ്, തലയോലപ്പറമ്പ്

പ്രിൻസ് മോൻ ജോസ്
അസി.പ്രൊഫസർ, മലയാളവിഭാഗം,
സെന്റ് തോമസ് കോളേജ്, പാലാ

പ്രിയ പി.നായർ
അധ്യാപിക, മലയാളവിഭാഗം,
സെന്റ് സേവ്യേഴ്സ് വനിത കോളേജ്, ആലുവ

ഡെയ്സി എബ്രഹാം
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
സി.എം.എസ്. കോളേജ്, കോട്ടയം

ഡോ. തോമസ് വർഗീസ്
അസി. പ്രൊഫസർ, മലയാള വിഭാഗം,
ഭാരതമാതാ കോളേജ്, തൃക്കാക്കര

മീരാമധു
അധ്യാപിക, മലയാള വിഭാഗം,
എസ്.ബി. കോളേജ്, ചങ്ങനാശ്ശേരി

ലത പി.
ഗവേഷക, മലയാള വിഭാഗം,
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അസി.പ്രൊഫസർ, മലയാള വിഭാഗം,
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കേരളത്തിലെ ഫോക്‌ലോറിലെ പരിസ്ഥിതിയെയും സാംസ്കാരികസ്വത്വത്തെയും കുറിച്ചുള്ള ഒരന്വേഷണം. ഡോ.സി.ആർ.രാജഗോപാൽ, ഡോ.കെ.എം. ഭരതൻ, ഡോ.എസ്.എസ്. ശ്രീകുമാർ തുടങ്ങി ഫോക്‌ലോർ രംഗത്ത് വ്യക്തിമുദ്ര പതിപ്പിച്ച നിരൂപകരുടെ ലേഖനങ്ങൾ. ഒപ്പം ഈ മേഖലയെ താത്പര്യത്തോടെ വീക്ഷിക്കുന്ന ഒരുകൂട്ടം ഗവേഷകരുടെയും അധ്യാപകരുടെയും അന്വേഷണാത്മക പ്രബന്ധങ്ങളും.

പ്രകടനകലകൾ, നാട്ടുത്സവങ്ങൾ, നാടോടിനാടകങ്ങൾ, പൊല്ലുകൾ, വാമൊഴിവഴക്കങ്ങൾ എന്നിവയിൽ പ്രകടമാകുന്ന പാരിസ്ഥിതികാവബോധങ്ങളും ലോകവീക്ഷണങ്ങളും അനാവരണം ചെയ്യപ്പെടുന്നു.

സാഹിത്യം, നാടകം, ചലച്ചിത്രം തുടങ്ങിയ ആധുനിക ആഖ്യാനങ്ങളിൽ പ്രകടമാവുന്ന ഫോക്‌ലോർ സ്വാധീനങ്ങളും ചർച്ച ചെയ്യുന്നു.

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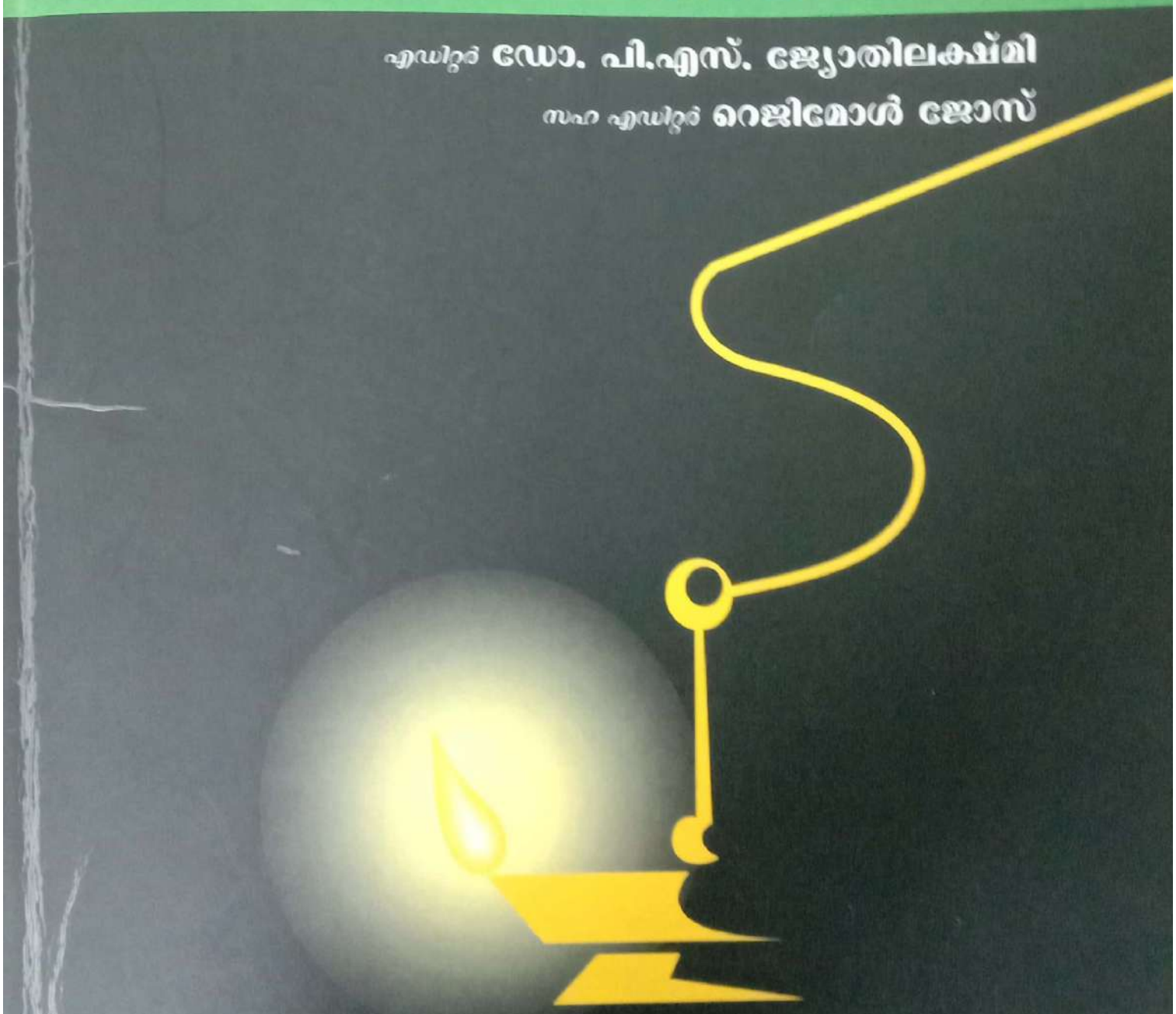

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നമ്മുടെ സെമിനാറിന്റെ പേര് നെയ്തൽ എന്നാണ്. നെയ്തൽ എന്നുപറഞ്ഞാൽ കടലോര സാമൂഹ്യസാംസ്കാരിക പൈതൃകത്തെയാണ്, ഒരു തിണയെയാണ് അല്ലെങ്കിൽ നമ്മുടെ പ്രാചീനജനത ആഹരിച്ചുവന്നിരുന്ന തിന എന്നുപറയുന്ന ഒരു ധാന്യത്തെയാണ് സൂചിപ്പിക്കുന്നത്. എന്നു പറഞ്ഞാൽ നാട്ടുവാക്കുകളിൽ നിന്ന് നമ്മൾ ചരിത്രത്തിലേക്ക് പോകുകയാണ്. നമ്മുടെ തൊട്ടറിയുന്ന ഓരോ പൈതൃകങ്ങളും തൊട്ടറിയാപൈതൃകങ്ങളും തേടിയുള്ള യാത്രയാണ്, നമ്മുടെ മനസ്സിന്റെ ആഴങ്ങളിലേക്ക് നമ്മുടെ പ്രജ്ഞയുടെ താഴ്വരകളിലേക്കുള്ള ഒരു സഞ്ചാരമാണ് ഫോക്‌ലോർ അന്വേഷണം എന്നുള്ളത്. ഈ സഞ്ചാരം ചെന്നെത്തി നിൽക്കുന്നത് നമ്മുടെ മണ്ണിലാണ് എന്നുള്ളത് കാണാൻ പറ്റും. മണ്ണിനെ ചവിട്ടിയാണ് വിത്തെറിയുന്നത്. സാംബ എന്നു പറയുന്ന ഒരു പുരാവൃത്ത മനുഷ്യരുണ്ട്, ഫിൻലാന്റിൽ സാംബ എന്നുപറഞ്ഞിട്ട്. ഈ നൂറ്റാണ്ടിൽ കണ്ടെടുത്ത ഒരു വലിയ ഇതിഹാസമാണ് കലൈവാല എന്നുപറയുന്ന ഇതിഹാസം. നിങ്ങളെപ്പോഴെങ്കിലുമൊക്കെ ഒന്നന്വേഷിക്കുക. ഈ കലൈവാലയിൽ പറയുന്ന സാംബ എന്നുവച്ചാൽ വിത്തുവിതച്ചുകൊണ്ടു നടക്കുന്നതാണ്. വിത്ത് എന്നുപറയുന്ന ഉർവ്വരതയുടെ ആദിരൂപം, അത് വാക്കാണ്, വിത്താണ് അത് മിത്താണ്. ഇതുവിതച്ചുകൊണ്ട് നടക്കുന്ന ആദിമരായിട്ടുള്ള എത്രയോ മനുഷ്യരുടെ ലോകത്തിൽ നിന്നാണ് നമുക്ക് നെയ്തൽ പോലൊരു വാക്കുണ്ടാകുന്നത്. നമ്മളിപ്പോൾ കുട്ടനാട്ടിലേക്കു പ്രവേശിക്കുമ്പോൾ ഒരു അരങ്ങ് എന്നു പറയുന്നത്, ഒരു നാട്ടരങ്ങ് എന്നുപറയുന്നത് ഒരു സേക്രഡ് പ്ലെയ്സാണ്. ഭൂമിയെ തൊട്ട് നെറുകയിൽ വച്ച് സൂര്യഭഗവാനെ കൈവണങ്ങി. ഇത്രയേ ഉണ്ടായിരുന്നുള്ളൂ പ്രാചീനമനുഷ്യർ. അവന്റെ ഊർജം എന്നുപറയുന്നത് മണ്ണും വെളിച്ചവുമാണ്.

തീരെ ചെറിയ അറിവുകളാണ് തിരിച്ചറിവുകൾ. നമ്മുടെ നാട്ടിലെ നാട്ടറിവുകൾ ഇത്തരത്തിൽ രൂപ്പെട്ടിട്ടുള്ളവയാണ്. അലയുന്ന മഹാമനീഷികളുടെ ജീവിതത്തിൽ നിന്നും തൊട്ടെടുത്തിട്ടുള്ളവയാണതിലേറെയും. മനുഷ്യൻ പ്രാരംഭത്തിൽ അലഞ്ഞു നടക്കുന്ന ജീവിതചര്യയ്ക്കുടമയായിരുന്നു. ഇതിലൂടെ ലഭിച്ച തിരിച്ചറിവുകൾ നാട്ടറിവുകളായി. ഇവയിൽ പലതും ആധുനികതയിൽ കാലഹരണപ്പെട്ടുപോയി. അവയെ കണ്ടെത്താനുള്ള മഹത്തായ ശ്രമമാണ് നാട്ടറിവുപഠനകേന്ദ്രങ്ങൾ നടത്തുന്നത്.

മലയാളത്തിന്റെ ഹോർത്തൂസ് മലബാറിക്കസ് കേരളത്തിന്റെ സസ്യസമ്പത്തിന്റെ വിവരണമെന്നതിനപ്പുറം ഒരു ദേശത്തിന്റെ അടയാളമായി, Geographics Indication (GI) ആയി നിലകൊള്ളുന്നു. ഓരോ പ്രദേശത്തിനും പ്രാദേശികമായ ചില ജൈവസൂചകങ്ങൾ ഉണ്ട്. ഇത്തരം സൂചകങ്ങളുടെ സമാഹാരങ്ങളിലൊന്നായി ഇതിനെ പരിഗണിക്കാം. സസ്യ-ജന്തുജാലങ്ങളും, മണ്ണിനങ്ങളും എല്ലാം ഇത്തരം

പരിസ്ഥിതി ദർശനം നാടൻ കലകളിൽ

മേരി സി.

ജീവികളും അവയുടെ പരിസ്ഥിതിയും തമ്മിലുള്ള ബന്ധത്തെപ്പറ്റി പഠിക്കുന്ന ശാസ്ത്രശാഖയാണ് ഇക്കോളജി. സാങ്കേതിക വികാസവും ഉപഭോക്തൃ തൃഷ്ണയും വരുത്തിയ പ്രത്യാഖ്യാതങ്ങളെന്ന നിലയിലാണ് പരിസ്ഥിതി പഠനം ഇന്ന് സജീവമായത്. വ്യാവസായിക വിപ്ലവത്തോടെ സമാരംഭിച്ച കമ്പോളാധിഷ്ഠിത സാമ്പത്തിക ശാസ്ത്രം പ്രകൃതിയെയും ചൂഷണവസ്തുവായി പരിഗണിച്ചു. അങ്ങനെ ഭക്ഷണം എന്ന വ്യവസ്ഥയിൽ നിന്ന് കാർഷികവൃത്തിപോലും നാണ്യവിളയെന്ന സങ്കല്പത്തിലേക്ക് മാറി. ഒപ്പം, നഗരവത്കരണവും. അത് ഭൂമിയുടെ ആവാസവ്യവസ്ഥയ്ക്ക് വരുത്തിയ നാശവും നിലനില്പിന്റെ പുതിയ തത്ത്വശാസ്ത്രം അനിവാര്യമാക്കി. ഭാവിതലമുറകളെ കണക്കിലെടുക്കാതെയുള്ള ഈ പുതിയ സാമ്പത്തിക പരിഷ്കാരങ്ങൾ പ്രകൃതിക്ക് കനത്ത ആഘാതമായി മാറിയപ്പോൾ സ്വച്ഛന്ദമായ പ്രകൃതിയുടെ നിലനില്പ് മനസ്സാക്ഷിയുടെ പ്രശ്നമായി മാറി. തത്ഫലമായി ഇവിടെ പരിസ്ഥിതി സംബന്ധമായ പ്രത്യേകമായൊരു പ്രതിപ്രവർത്തനം സമാരംഭിച്ചു. അതാണ് പരിസ്ഥിതി പഠനത്തിന് വഴിതുറന്നത്. എന്നാൽ നാടോടി വഴക്കങ്ങളിൽ പരിസ്ഥിതി എല്ലാക്കാലത്തും ജീവിതാചാരത്തിന്റെ ഭാഗമായിത്തന്നെ നിലനിന്നിരുന്നു.

ഒരു പ്രത്യേക ജനസമുദായത്തിന്റെ ജീവിത സംസ്കാരമെന്ന് സാമാന്യമായിപ്പറയാമെങ്കിലും ഫോക്ലോറിന്റെ അർഥവ്യാപ്തി മറ്റൊരു ജനസമുദായത്തിന് പൂർണമായും ഉൾക്കൊള്ളാനാകാത്തതുമായിരിക്കും. ഭാഷ, തൊഴിൽ, ആചാരങ്ങൾ തുടങ്ങിയ കാര്യങ്ങളിൽ സമാനത പുലർത്തുന്ന ജനവിഭാഗത്തിന്റെ വിജ്ഞാനമാണ് ഫോക്ലോർ. അതായത് പ്രാദേശിക സംസ്കാരത്തിന്റെ പൊതുവായ ഉടമകളായിരിക്കും ഏത് ഫോക്കും. നിയതമായ വഴക്കങ്ങളാണ് അവരെ ബന്ധിപ്പിക്കുന്ന ഘടകം. പ്രാക്തനത, പാരമ്പര്യം, പരിണാമസ്വഭാവം എന്നിവ ഫോക്ലോറിനെ നിശ്ചയിക്കുന്ന ഘടകങ്ങളാണ്. ഇങ്ങനെ നോക്കുമ്പോൾ മനുഷ്യജീവിതത്തിന്റെ പ്രാക്തനഘട്ടത്തിലെ ജൈവസ്വഭാവത്തെപ്പോലും നിലനിർത്തുന്ന പ്രവണത ഫോക്ലോറിന്റെ പ്രധാന പ്രത്യേകതയായി പറയേണ്ടി വരുന്നു. ഇതുതന്നെയാണ് ഫോക്ലോറിന്റെ സൗന്ദര്യശാസ്ത്രവും. അതായത് ഫോക്ലോർ പ്രകൃതിയുമായി അഭിരമിച്ചു പോകുന്ന പരിസ്ഥിതി സൗഹാർദ സ്വഭാവമുള്ള ജീവിതാചാരമാണ്. പ്രകൃതിയിലെ സമസ്ത ജീവജാലങ്ങളുടെയും ആരോഗ്യകരമായ നിലനില്പിന് അത്യന്താപേക്ഷിതമായ സ്ഥിതിവിശേഷമാണ് പ്രകൃതി അഥവാ പരിസ്ഥിതി. അത്യന്താവശ്യങ്ങളെ നിറവേറ്റുക എന്നതിനപ്പുറം ചൂഷണവും കയ്യടക്കലും പരിസ്ഥിതിയിൽ മനുഷ്യനൊഴികെ ഒരു ജന്തുവും പ്രയോഗിക്കാറില്ല. ഫോക്ലോറിലെ പരിസ്ഥിതി സംബന്ധമായ ചിന്തകളും ഈ കാട്ടുവഴക്കത്തിൽ നിന്ന് ഭിന്നമല്ല. പരിസ്ഥിതിയെ അവലംബമാക്കിയുള്ള ഉപജീവനകലയാണ് ഫോക്ലോർ. ഭക്ഷണം, വസ്ത്രം, പാർപ്പിടം, എന്നുവേണ്ട അത്യാവശ്യങ്ങൾക്കുമാത്രം പ്രകൃതിയെ ആശ്രയിക്കുന്ന ജീവന പ്രക്രിയയായി നാട്ടുവഴക്കങ്ങളെ കരുതാം. എന്നാൽ

ഫോക്‌ലോർ വ്യക്തികളുടെ സ്വന്തമല്ല മറിച്ച് സംഘവഴക്കമാണെന്നത് ഇവിടെ പ്രാധാന്യത്തോടെ സ്മരിക്കേണ്ടതുണ്ട്. വളരെ വലിയൊരു തിരിച്ചിയോളം പരിസ്ഥിതി പ്രവർത്തനം പ്രയോജനപ്പെടുത്തുന്നതും ജനവിജ്ഞാനീയമെന്ന ഫോക്‌ലോറിനെ തന്നെയാണ്. അതുകൊണ്ടാണ് ഇന്ന് ഫോക്‌ലോറിനെ പരിസ്ഥിതി സിദ്ധാന്തങ്ങളിൽ ഒന്നായി അംഗീകരിച്ചിരിക്കുന്നത്.

ഫോക്‌ലോറിൽ പരിസ്ഥിതി പ്രശ്നങ്ങൾ ബോധപൂർവമായ ഇടപെടൽ നടത്താറില്ല. അത് ജീവിതാചാരങ്ങളുടെ ഭാഗമാണ്. പരിസ്ഥിതിയെ ധ്വംസിക്കുന്ന അധികാരത്തെ അത് നേരിടുന്നത് അനുഷ്ഠാനങ്ങളിലൂടെയാണ്. ശക്തൻ തമ്പുരാൻ തൃശൂർ വടക്കുംനാഥക്ഷേത്രത്തിന് ചുറ്റുമുണ്ടായിരുന്ന കാട് വെട്ടിത്തെളിക്കാൻ ഏർപ്പാടാക്കിയപ്പോൾ പാറമേക്കാവിലെ വെളിച്ചപ്പാട് തുള്ളിയെത്തി, എന്റെ ജടയാണ് അത് മുറിക്കരുതെന്ന് ആവശ്യപ്പെട്ടുവെന്നും, ആ വെളിച്ചപ്പാടിനെ വധിച്ചുകൊണ്ട് തേക്കിൻകാട് മൈതാനം നിർമ്മിച്ചുവെന്നുമുള്ള പുരാവൃത്തം ഇവിടെ ഓർക്കാം. അധികാരി വർഗത്തോടുള്ള എതിർപ്പിന് ആ മനുഷ്യനെ പ്രേരിപ്പിച്ചത് അനുഷ്ഠാനത്തിന്റെ പിൻബലമാണ്. ഓരോ കാവും സംരക്ഷിക്കപ്പെടുന്നതും ഇപ്രകാരം അനുഷ്ഠാനത്തിന്റെ പിൻബലത്തിലാണ്. അനുഷ്ഠാനങ്ങളാകട്ടെ കേന്ദ്രീകരിക്കുന്നത് ഈശ്വരവിശ്വാസത്തിലും. കേരളത്തിലാകുമ്പോൾ ഓരോ കാവും ഭദ്രകാളിയുടെ വാസസ്ഥാനമാണ്. ഭദ്രകാളിയുടെ ഓരോ മുടിയിഴയും നാഗമാണ് എന്നാണ് വിശ്വാസം. ഒരുകാതിൽ ആനയെയും ഒരു കാതിൽ സിംഹത്തെയും കുണ്ഡലമായി അണിഞ്ഞ ഭദ്രകാളി മൂലപ്രകൃതിയാണ്. കാവിലെ ദേവതയാണ്.

കാടുകൾ വെട്ടിയഴിച്ച് കൃഷിക്കുപയുക്തമാക്കിയതിന്റെ പാപംപോക്കാൻ നഷ്ടപ്പെട്ട മൂലപ്രകൃതിയുടെ ചൈതന്യത്തെ വയലുകളിൽ വിളിച്ച് തോറ്റി കുടിയിരുത്തി, ഊട്ടുംപാട്ടും നടത്തി തൃപ്തിപ്പെടുത്തുക മലയാളിയുടെ നാടോടിവഴക്കമാണ്. വയലുകൾ ജനാധിവാസകേന്ദ്രങ്ങളായി മാറിയിട്ടും പ്രകൃതി നൽകിയ പീഠത്തിലേക്കാവാഹിച്ചിരുത്തി നാടിന് ശത്രുബാധകളൊഴിഞ്ഞ് സുഖം വരാൻ പൊലിവ് പാടുന്ന തോറ്റംപാട്ടുകാരന്റെ മനസ്സ് നാടോടി വഴക്കങ്ങൾ ഇന്നും പൂർണമായി നഷ്ടപ്പെടുത്തിയിട്ടില്ല. ഈ മനോഭാവം പരിസ്ഥിതിക്കുള്ള തർപ്പണമായി തുടരുന്നു.

കേരളത്തിലെ നാടോടിവഴക്കമുള്ള കലകളിൽ ഭൂരിഭാഗവും ഭദ്രകാളീക്ഷേത്രങ്ങളിലാണ് കേന്ദ്രീകരിച്ചിട്ടുള്ളത്. ഇവയുടെ ഒരുക്കുപടിയിൽ ഇന്നും പരിസ്ഥിതിബോധം നഷ്ടപ്പെട്ടിട്ടില്ല. കാർത്തിക വിളക്കിന് കൊളുത്തുന്ന മൺചെരാതുകൾക്കും നിലവിളക്കിനും ഇന്നും മാറ്റമില്ല. അനുഷ്ഠാനങ്ങളിൽ വാഴയില, നാളികേരം, അരി, നെല്ല്, അവിൽ, പഴം, വെറ്റില, അടയ്ക്ക, ചക്ക, നൊങ്ക് തുടങ്ങിയ കാർഷിക വിഭവങ്ങളുടെ ഉപയോഗവും നാടോടി വഴക്കങ്ങൾ ഇന്നും നഷ്ടപ്പെടുത്തിയിട്ടില്ല.

തെയ്യക്കോലങ്ങൾക്കുള്ള ഒരുക്കുപടികൾ കൊണ്ടുപോകുന്നതിനുള്ള ചൂരലിൽ തീർത്ത പേളിയ എന്ന പെട്ടി ഇന്നും ഉപയോഗിച്ചുവരുന്നു. അതുപോലെ തെയ്യങ്ങളുടെ വസ്ത്രം, ആഭരണം, മുലപ്പടം തുടങ്ങിയവയുടെ രീതിയിലും മാറ്റമില്ല. മുഖത്തെഴുത്തിനുപയോഗിക്കുന്ന മനയോല, ചായില്യം, എണ്ണക്കരി മുതലായവയും കളമെഴുത്തിനുപയോഗിക്കുന്ന മഞ്ഞൾപ്പൊടി, ഇലപ്പൊടി, കരിപ്പൊടി, അരിപ്പൊടി ചുണ്ണാമ്പും മഞ്ഞളും ചേർത്തുണ്ടാക്കിയ സിന്ദൂരം തുടങ്ങിയവയും പ്രകൃതിദത്തമായ നിറങ്ങൾതന്നെ.

പ്രകൃതിയെ കലാപരമായി മനുഷ്യന് പരിഷ്കരിക്കാൻ എങ്ങനെ കഴിയുമെന്നതിന്റെ മികച്ച ഉദാഹരണങ്ങളാണ് പടേനിയിലെ പാളക്കോലങ്ങൾ. വാഴക്കരിയിലയും താമരയിലയും ചൂടിക്കയറും വാഴപ്പോളയും തെറ്റിപ്പൂവും കൊണ്ട് നീലമ്പേരൂർ പടേനിയിലെ അന്നങ്ങളെ കെട്ടിയൊരുക്കുന്ന നാട്ടുതനിമയുടെ കലാബോധം ഉദാത്തമാണ്. ഉത്സവമവസാനിക്കുമ്പോൾ തന്നാണ്ടത്തെ കൃഷിക്കുവേണ്ട ജൈവവളം ക്ഷേത്രാങ്കണത്തിൽ നിന്ന് ഭക്തർക്ക് കൊണ്ടുപോകുകയുമാകാം. വാദ്യോപകരണങ്ങൾ നിർമിക്കുന്നതിനെല്ലാം പ്രകൃതിദത്തമായ വസ്തുക്കങ്ങൾ തന്നെ തെരഞ്ഞെടുക്കുന്നു. ചെണ്ടയുടെ കുറ്റി പ്ലാവിൽ നിർമിച്ച് മൃഗങ്ങളുടെ തോൽകൊണ്ട് പൊതിയുമ്പോൾ തോലുറപ്പിക്കുന്നതിന് പനച്ചിക്കായുടെ കറ ഉപയോഗിച്ചിരുന്നു. ഇതെല്ലാം കലയും പരിസ്ഥിതിയുമായുള്ള ബന്ധത്തിന്റെ ആഴം വ്യക്തമാക്കുന്നു.

കാർഷികവൃത്തിയിൽ ഏർപ്പെടുന്ന സമൂഹ

ങ്ങളിൽ കാർഷിക നൃത്തങ്ങൾ കാണുക സാധാരണമാണ്. കൊയ്ത്തിന്റെ വിവിധ വശങ്ങൾ വെളിപ്പെടുത്തുന്ന തരത്തിലുള്ള നൃത്ത വിശേഷങ്ങൾ ഇന്ത്യയുടെ നാനാഭാഗങ്ങളിലും നിലവിലുണ്ട്. ഉത്തരകേരളത്തിലെ പുലയരുടെയും അടിയാന്മാരുടെയും മറ്റ് ഹരിജനങ്ങളുടെയുമിടയിലുള്ള പല നർത്തനങ്ങളും കാർഷിക വൃത്തിയുമായി ബന്ധപ്പെട്ടവയാണ്. ഉത്തരകേരളത്തിലെ മലയരും പാണന്മാരും നടത്താറുള്ള കോതാമ്മൂരിയാട്ടം ഒരു കാർഷിക നൃത്തമത്രെ. ബീഹാറിലെ ഹരിജനങ്ങൾക്കിടയിൽ വൃക്ഷാരാധനാപരമായ ഒരു നൃത്തമുണ്ട്. കർമ്മോത്സവനൃത്തം എന്നത്രെ അതിന്റെ പേര്. സമൃദ്ധമായ വിളവിനുവേണ്ടിയാണ് കർമവൃക്ഷപൂജയും നർത്തനവും നടത്തുന്നത്. നാടൻ കലാനിർവഹണങ്ങളിൽ അനുഷ്ഠാന നർത്തനങ്ങൾ കൂടുതലുണ്ട്. ദുർദേവതകളെ ഉച്ചാടനം ചെയ്യുന്നതിനുവേണ്ടിയുള്ളതോ, യുദ്ധത്തിൽ വിജയിക്കുന്നതിനായി ദേവന്മാരോട് ചെയ്യുന്നതോ നല്ല വിളവിനും മഴയ്ക്കും വേണ്ടിയുള്ളതോ ആയ പ്രാർഥനകളാണ് പല നൃത്തങ്ങളും. നാടൻ കലകളും പരിസ്ഥിതിയുമായി വളരെ അഭേദ്യമായ ബന്ധമാണുള്ളതെന്ന് ഇതിൽ നിന്നും മനസ്സിലാക്കാം.

ഒരുകാലത്ത് കാവുകളുമായി ബന്ധപ്പെട്ടായിരുന്നു പല കലാരൂപങ്ങളും അരങ്ങേറിയിരുന്നത്. കൂടാതെ വൃക്ഷാരാധനയ്ക്കും നാഗാരാധനയ്ക്കും പ്രാധാന്യമുള്ളതായിരുന്നു കേരളത്തിലെ കാവുകൾ. മനുഷ്യന് നിത്യോപയോഗത്തിന് പ്രയോജനം ചെയ്യാത്ത പലയിനം സസ്യങ്ങളും സംരക്ഷിക്കപ്പെട്ടിരുന്നത് വൃക്ഷാരാധനയുടെയും കാവുകളെ ആധാരമാക്കിയ വിശ്വാസങ്ങളുടെയും പിൻബലത്താലാണ്. നാട്ടുവഴക്കങ്ങളിലെ പരിസ്ഥിതിബോധം എങ്ങനെ ക്രിയാത്മകമാകുന്നുവെന്നതിനും സാമൂഹിക സേവനത്തിന്റെ ഉദാത്തമാതൃകകളാകുന്നുവെന്നതിനുമുള്ള തിരുശേഷിപ്പുകളാണ് കേരളത്തിലെ കാവുകൾ. കാവിനുചുറ്റും കാതം തീണ്ടൽ എന്ന് പറയാറുണ്ട്. അതായത് കാവും ചുറ്റുവട്ടവും ശുദ്ധിയോടും വൃത്തിയോടും സൂക്ഷിക്കേണ്ട സ്ഥലമെന്നാണർഥം. കാവഴിച്ചാൽ കുളം വറ്റുമെന്നൊരു ചൊല്ലുതന്നെയുണ്ട്. മൂലപ്രകൃതിയായ ഭദ്രകാളിയുടെ വാസസ്ഥാനമായി മലയാളികൾ കാവുകളെ കണക്കാക്കി വരുന്നു. അങ്ങനെ പ്രകൃതിയുടെ ഏറ്റവും ശുദ്ധരൂപമായി കാവുകളെത്തന്നെ പ്രതീകമാക്കിയപ്പോൾ നിലനില്പിന്റെ ഭൗതികവും ആത്മീയവുമായ സത്യം നാം കണ്ടെത്തി. കാവും കുളങ്ങളും കേരളീയ ഗ്രാമത്തിന്റെ ചൈതന്യങ്ങളായിരുന്നു. പ്രകൃതിയുടെ സ്വാഭാവിക ജലസ്രോതസ്സുകളായിരുന്ന കാവുകൾ സമീപത്തെ കുളവും കിണറും ജലസമൃദ്ധമാക്കി. ഇതിൽ നിന്നും കാവുകളും കാവുകളുമായി ബന്ധപ്പെട്ടിട്ടുള്ള ആരാധനകളും കലാരൂപങ്ങളും പാരിസ്ഥിതിക ബന്ധമുള്ള ജീവിതക്രമത്തിന് പ്രേരകമായി നിലകൊള്ളുന്നു എന്ന് മനസ്സിലാക്കാവുന്നതാണ്. ഇങ്ങനെ നോക്കുമ്പോൾ പാരിസ്ഥിതിക ബന്ധമുള്ള നാടൻ കലകളാണ് നമ്മുടെ സംസ്കാരത്തെ ഊട്ടിയുറപ്പിക്കുന്നത് എന്ന് മനസ്സിലാക്കാവുന്നതാണ്. ■

ലേഖകപരിചയം

ഡോ. സി.ആർ. രാജഗോപാലൻ
നിരൂപകൻ, വകുപ്പധ്യക്ഷൻ,
മലയാളവിഭാഗം, കേരള സർവകലാശാല,
തിരുവനന്തപുരം

ഡോ. കെ.എം. ഭരതൻ
നിരൂപകൻ, വകുപ്പധ്യക്ഷൻ,
സംസ്കാരപൈതൃകപഠനം
തുഞ്ചത്തെഴുത്തച്ഛൻ മലയാളസർവകലാ
ശാല, തിരൂർ.

ഡോ. എസ്.എസ്. ശ്രീകുമാർ
നിരൂപകൻ, വകുപ്പധ്യക്ഷൻ, മലയാളവിഭാഗം,
മഹാത്മാഗാന്ധി ഗവ.ആർട്സ് കോളേജ്, മാഹി

ഡോ. സന്ധ്യ പി. പൈ
അസോ.പ്രൊഫസർ, സെന്റ്. ജോസഫ്സ്
കോളേജ് ഫോർ വിമെൻ, ആലപ്പുഴ

ഡോ. ചിത്ര എൻ.ആർ.
വകുപ്പധ്യക്ഷ, ഹിന്ദി വിഭാഗം,
സെന്റ് ജോസഫ്സ് കോളേജ് ഫോർ
വിമെൻ, ആലപ്പുഴ

പി. അരുൺ മോഹൻ
ഗവേഷകൻ, മലയാള കേരളപഠനവിഭാഗം,
കോഴിക്കോട് സർവകലാശാല, തേഞ്ഞിപ്പാലം

ഡോ. എസ്. അജയകുമാർ
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
എസ്.ഡി. കോളെജ്, ആലപ്പുഴ

ഡോ. എ.ആർ. ഷെല്ലി
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
ഫാത്തിമ മാതാ നാഷണൽ കോളേജ്,
കൊല്ലം

ഡോ. ജി. ശ്രീജിത്
അസി. പ്രൊഫസർ, മലയാള വിഭാഗം,
മലബാർ ക്രിസ്ത്യൻ കോളേജ്, കോഴിക്കോട്

ഷൈജി സി. മുരിങ്ങാത്തേരി
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
ലിറ്റിൽ ഫ്ളവർ കോളേജ്, ഗുരുവായൂർ

സലാഹുദ്ദീൻ സി.ടി.
ഗവേഷകൻ, മലയാള കേരളപഠനവിഭാഗം,
കോഴിക്കോട് സർവകലാശാല, തേഞ്ഞി
പ്പാലം

മെറിൻ ജോയ്
ഗവേഷക, മലയാള വിഭാഗം,
കോഴിക്കോട് സർവകലാശാല, തേഞ്ഞി
പ്പാലം

ഡോ. കെ. ഷിജു
അധ്യാപകൻ, മലയാളവിഭാഗം,
ഗവൺമെന്റ് കോളേജ്, കട്ടപ്പന

ഡോ. വി. ചിത്രാദേവി
അസി.പ്രൊഫസർ, ചരിത്ര വിഭാഗം,
എൻ.എസ്.എസ്. വനിതകോളേജ്,
തിരുവനന്തപുരം.

മഞ്ജുഷ ഇ.എസ്.
അധ്യാപിക, മലയാളവിഭാഗം,
ഡി.ബി. കോളേജ്, തലയോലപ്പറമ്പ്

പ്രിൻസ് മോൻ ജോസ്
അസി.പ്രൊഫസർ, മലയാളവിഭാഗം,
സെന്റ് തോമസ് കോളേജ്, പാലാ

പ്രിയ പി.നായർ
അധ്യാപിക, മലയാളവിഭാഗം,
സെന്റ് സേവ്യേഴ്സ് വനിത കോളേജ്, ആലുവ

ഡെയ്സി എബ്രഹാം
അസി. പ്രൊഫസർ, മലയാളവിഭാഗം,
സി.എം.എസ്. കോളേജ്, കോട്ടയം

ഡോ. തോമസ് വർഗീസ്
അസി. പ്രൊഫസർ, മലയാള വിഭാഗം,
ഭാരതമാതാ കോളേജ്, തൃക്കാക്കര

മീരാമധു
അധ്യാപിക, മലയാള വിഭാഗം,
എസ്.ബി. കോളേജ്, ചങ്ങനാശ്ശേരി

ലത പി.
ഗവേഷക, മലയാള വിഭാഗം,
ശ്രീശങ്കരാചാര്യ സംസ്കൃതസർവകലാശാല,
കാലടി

മിനി മറിയം സഖറിയ
അസി.പ്രൊഫസർ, മലയാള വിഭാഗം,
സി.എം.എസ്. കോളേജ്, കോട്ടയം

മെൽബി ജേക്കബ്
അസി.പ്രൊഫസർ, മലയാള വിഭാഗം,
ബി.കെ. കോളെജ് ഫോർ വിമെൻ, കോട്ടയം

ശരജ ആർ.
ഗവേഷക, കേരള സർവകലാശാല ലൈബ്രറി,
തിരുവനന്തപുരം

ശ്രീലക്ഷ്മി ടി.ആർ.
ഗവേഷക, മലയാള വിഭാഗം, ശ്രീശങ്കരാചാര്യ
സംസ്കൃത സർവകലാശാല, കാലടി

റോഷിനി എം.
അസി.പ്രൊഫസർ, മലയാളവിഭാഗം,
ഫാത്തിമ മാതാ നാഷണൽ കോളേജ്,
കൊല്ലം

മേരി സി.
അസി.പ്രൊഫസർ, മലയാള വിഭാഗം,
ഫാത്തിമ മാതാ നാഷണൽ കോളേജ്,
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ജാൻസമ്മ കുര്യൻ
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സെന്റ്.ജോസഫ്സ് കോളേജ് ഫോർ വിമൻ,
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ഗവ.കോളേജ്, മൊകേരി

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അസി. പ്രൊഫസർ, മലയാള വിഭാഗം,
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കൊല്ലം

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ലിറ്റിൽ ഫ്ളവർ കോളേജ്, ഗുരുവായൂർ

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പ്രകടനകലകൾ, നാട്ടുത്സവങ്ങൾ, നാടോടിനാടകങ്ങൾ, പൊല്ലുകൾ, വാമൊഴിവഴക്കങ്ങൾ എന്നിവയിൽ പ്രകടമാകുന്ന പാരിസ്ഥിതികാവബോധങ്ങളും ലോകവീക്ഷണങ്ങളും അനാവരണം ചെയ്യപ്പെടുന്നു.

സാഹിത്യം, നാടകം, ചലച്ചിത്രം തുടങ്ങിയ ആധുനിക ആഖ്യാനങ്ങളിൽ പ്രകടമാവുന്ന ഫോക്‌ലോർ സ്വാധീനങ്ങളും ചർച്ച ചെയ്യുന്നു.

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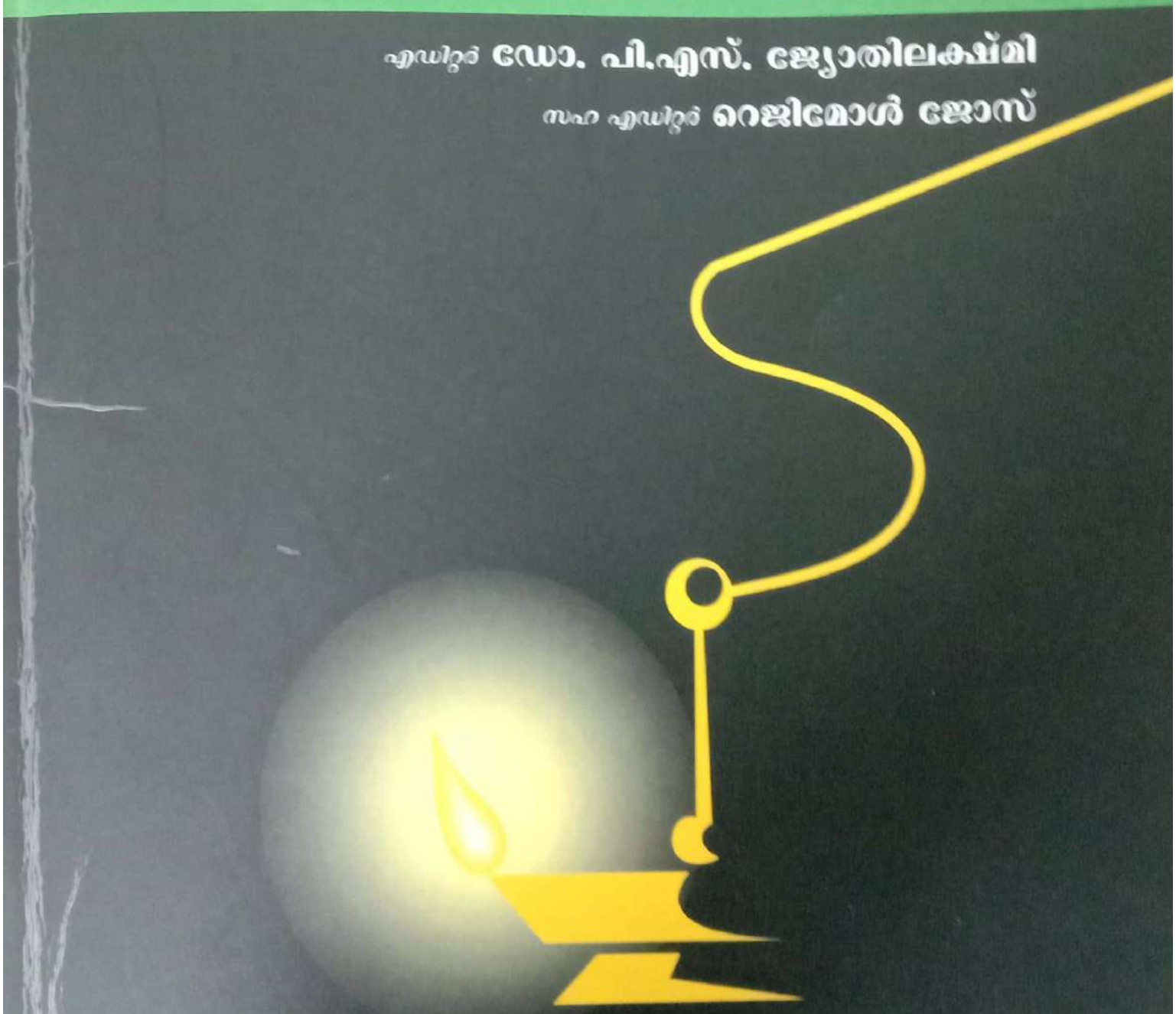

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നമ്മുടെ സെമിനാറിന്റെ പേര് നെയ്തൽ എന്നാണ്. നെയ്തൽ എന്നുപറഞ്ഞാൽ കടലോര സാമൂഹ്യസാംസ്കാരിക പൈതൃകത്തെയാണ്, ഒരു തിണയെയാണ് അല്ലെങ്കിൽ നമ്മുടെ പ്രാചീനജനത ആഹരിച്ചുവന്നിരുന്ന തിന എന്നുപറയുന്ന ഒരു ധാന്യത്തെയാണ് സൂചിപ്പിക്കുന്നത്. എന്നു പറഞ്ഞാൽ നാട്ടുവാക്കുകളിൽ നിന്ന് നമ്മൾ ചരിത്രത്തിലേക്ക് പോകുകയാണ്. നമ്മുടെ തൊട്ടറിയുന്ന ഓരോ പൈതൃകങ്ങളും തൊട്ടറിയാപൈതൃകങ്ങളും തേടിയുള്ള യാത്രയാണ്, നമ്മുടെ മനസ്സിന്റെ ആഴങ്ങളിലേക്ക് നമ്മുടെ പ്രജ്ഞയുടെ താഴ്വരകളിലേക്കുള്ള ഒരു സഞ്ചാരമാണ് ഫോക്‌ലോർ അന്വേഷണം എന്നുള്ളത്. ഈ സഞ്ചാരം ചെന്നെത്തി നിൽക്കുന്നത് നമ്മുടെ മണ്ണിലാണ് എന്നുള്ളത് കാണാൻ പറ്റും. മണ്ണിനെ ചവിട്ടിയാണ് വിത്തെറിയുന്നത്. സാംബ എന്നു പറയുന്ന ഒരു പുരാവൃത്ത മനുഷ്യരുണ്ട്, ഫിൻലാന്റിൽ സാംബ എന്നുപറഞ്ഞിട്ട്. ഈ നൂറ്റാണ്ടിൽ കണ്ടെടുത്ത ഒരു വലിയ ഇതിഹാസമാണ് കലൈവാല എന്നുപറയുന്ന ഇതിഹാസം. നിങ്ങളെപ്പോഴെങ്കിലുമൊക്കെ ഒന്നന്വേഷിക്കുക. ഈ കലൈവാലയിൽ പറയുന്ന സാംബ എന്നുവച്ചാൽ വിത്തുവിതച്ചുകൊണ്ടു നടക്കുന്നതാണ്. വിത്ത് എന്നുപറയുന്ന ഉർവ്വരതയുടെ ആദിരൂപം, അത് വാക്കാണ്, വിത്താണ് അത് മിത്താണ്. ഇതുവിതച്ചുകൊണ്ട് നടക്കുന്ന ആദിമരായിട്ടുള്ള എത്രയോ മനുഷ്യരുടെ ലോകത്തിൽ നിന്നാണ് നമുക്ക് നെയ്തൽ പോലൊരു വാക്കുണ്ടാകുന്നത്. നമ്മളിപ്പോൾ കുട്ടനാട്ടിലേക്കു പ്രവേശിക്കുമ്പോൾ ഒരു അരങ്ങ് എന്നു പറയുന്നത്, ഒരു നാട്ടരങ്ങ് എന്നുപറയുന്നത് ഒരു സേക്രഡ് പ്ലെയ്സാണ്. ഭൂമിയെ തൊട്ട് നെറുകയിൽ വച്ച് സൂര്യഭഗവാനെ കൈവണങ്ങി. ഇത്രയേ ഉണ്ടായിരുന്നുള്ളൂ പ്രാചീനമനുഷ്യർ. അവന്റെ ഊർജം എന്നുപറയുന്നത് മണ്ണും വെളിച്ചവുമാണ്.

തീരെ ചെറിയ അറിവുകളാണ് തിരിച്ചറിവുകൾ. നമ്മുടെ നാട്ടിലെ നാട്ടറിവുകൾ ഇത്തരത്തിൽ രൂപ്പെട്ടിട്ടുള്ളവയാണ്. അലയുന്ന മഹാമനീഷികളുടെ ജീവിതത്തിൽ നിന്നും തൊട്ടെടുത്തിട്ടുള്ളവയാണതിലേറെയും. മനുഷ്യൻ പ്രാരംഭത്തിൽ അലഞ്ഞു നടക്കുന്ന ജീവിതചര്യയ്ക്കുടമയായിരുന്നു. ഇതിലൂടെ ലഭിച്ച തിരിച്ചറിവുകൾ നാട്ടറിവുകളായി. ഇവയിൽ പലതും ആധുനികതയിൽ കാലഹരണപ്പെട്ടുപോയി. അവയെ കണ്ടെത്താനുള്ള മഹത്തായ ശ്രമമാണ് നാട്ടറിവുപഠനകേന്ദ്രങ്ങൾ നടത്തുന്നത്.

മലയാളത്തിന്റെ ഹോർത്തൂസ് മലബാറിക്കസ് കേരളത്തിന്റെ സസ്യസമ്പത്തിന്റെ വിവരണമെന്നതിനപ്പുറം ഒരു ദേശത്തിന്റെ അടയാളമായി, Geographics Indication (GI) ആയി നിലകൊള്ളുന്നു. ഓരോ പ്രദേശത്തിനും പ്രാദേശികമായ ചില ജൈവസൂചകങ്ങൾ ഉണ്ട്. ഇത്തരം സൂചകങ്ങളുടെ സമാഹാരങ്ങളിലൊന്നായി ഇതിനെ പരിഗണിക്കാം. സസ്യ-ജന്തുജാലങ്ങളും, മണ്ണിനങ്ങളും എല്ലാം ഇത്തരം

പ്രകൃത്യാരാധനയും പൊങ്കാലയും

റോഷിനി എം.

നമുക്കുമുമ്പേ കടന്നുപോയ മനുഷ്യ സമൂഹങ്ങളുടെ ജീവിതക്കൂട്ടായ്മയിൽ നിന്നുണ്ടായ അറിവും അനുഭവവുമാണ് ഫോക്‌ലോർ. തലമുറകളായി പകർന്നുകിട്ടിയ സംസ്കാരത്തിൽ നിന്ന് പ്രകൃതിയിൽ നിന്ന് വേർപെട്ടുപോകാത്ത ഒരു ജീവിതാവസ്ഥയുടെ ചൂരുംചൂടും നമുക്ക് അനുഭവിക്കാൻ സാധിക്കുന്നു. കെട്ടുകഥകളും ആചാരാനുഷ്ഠാനങ്ങളും ഐതിഹ്യങ്ങളുമായി കെട്ടുപിണഞ്ഞ നാടോടി ജീവിതകഥ നാം കൈവെടിയുമ്പോൾ ഭൂതകാലത്തിന്റെ ചരിത്രവും സംസ്കാരവും ആണ് നാം കൈവെടിയുന്നത്. പ്രാകൃത മനുഷ്യന്റെ കാർഷിക ജീവിതവും പ്രാകൃതാരാധനയും ആചാരാനുഷ്ഠാനങ്ങളും പുരാവൃത്തങ്ങളും സമകാലിക ജീവിതത്തിൽ എങ്ങനെ ഫലപ്രദമായി ഉപയോഗിക്കാം എന്നിടത്താണ് ഫോക്‌ലോറിന്റെ ഇന്നത്തെ പ്രസക്തി. ആദിമനുഷ്യന്റെ സാമൂഹിക സാംസ്കാരിക ഭൗതിക ജീവിതത്തെക്കുറിച്ചറിയുവാൻ ഉത്സവാദികളെക്കുറിച്ചുള്ള പഠനം പ്രയോജനകരമാണ്. പ്രകൃതിയും മനുഷ്യനുമായുള്ള നിരന്തര സമ്പർക്കത്തിന്റെ മായാത്ത മുദ്രകളാണ് ഉത്സവങ്ങൾ. കാർഷിക സംസ്കൃതിയിലധിഷ്ഠിതമാണ് ഈ ഉത്സവങ്ങൾ എല്ലാം തന്നെ. കാർഷിക ജീവിതത്തിന്റെ ഫലഭൂയിഷ്ഠമായ ഇടങ്ങളിൽ നിന്ന് മുളച്ചു വന്നതാണ് നമ്മുടെ വലിയ വിഭാഗം ഫോക്‌ലോറിയും. നമ്മുടെ നാട്ടറിവുകൾ, ആചാരാനുഷ്ഠാനങ്ങൾ, വിശ്വാസങ്ങൾ, സാമൂഹ്യബന്ധങ്ങൾ, നാടൻപാട്ടുകൾ, നാടൻകഥകൾ, കടങ്കഥകൾ, ചൊല്ലുകൾ, കളികൾ, ഉത്സവങ്ങൾ ഭൗതിക സംസ്കാരം തുടങ്ങി ജീവിതത്തിന്റെ ആഴങ്ങളിൽ വേരുകളാഴ്ത്തി നിന്ന നിരവധി ഘടകങ്ങൾ എല്ലാംതന്നെ കാർഷികവൃത്തിയുമായി ബന്ധപ്പെട്ടവയാണ്.

പൊങ്കാല മതനിരപേക്ഷമായ ഒരു കാർഷികാനുഷ്ഠാനമാണ്. അത് അനുഷ്ഠിക്കാൻ ക്ഷേത്രമോ പുരോഹിതനോ ആവശ്യമില്ല. വീട്ടുമുറ്റത്തോ പറമ്പിലോ നെൽപ്പാടത്തോ എവിടെവെച്ചു വേണമെങ്കിലും പൊങ്കാലയിടാം. നീരും പൂവും കൊടുത്ത് ഇഷ്ടദേവനോ ദേവതയ്ക്കോ സമർപ്പിക്കാം. പ്രകൃത്യാരാധനാപരവും സൂര്യാരാധനാപരവുമാണ് പൊങ്കാല. സൂര്യന്റെ പൊങ്ങിവരവ് സുവർണ പ്രഭാതം, തിളച്ചുപൊന്തൽ എന്നീ അർഥങ്ങൾ പൊങ്കൽ, പൊങ്കാല എന്നീ പദങ്ങൾക്കു പറഞ്ഞു കാണുന്നുണ്ട്. അതിപ്രാചീനർ കാർഷിക ദേവതയായി സൂര്യനെ ആരാധിച്ചിരുന്നു. ജീവജാലങ്ങളുടെ മുഴുവൻ ജനനിയായ സൂര്യൻ മഹാമാതാവായതിനാൽ സൂര്യാരാധന അവരുടെ ജീവിതത്തിന്റെ ഭാഗമായിരുന്നു. അതിന് തെളിവാണ് തമിഴ്നാട്ടിൽ ഇന്നും നിലനിൽക്കുന്ന പൊങ്കൽ മഹോത്സവങ്ങൾ. സൂര്യൻ മകരരാശിയിൽ പ്രവേശിക്കുന്ന നാളിലാണ് തമിഴ്നാട്ടിലെ കാർഷിക ജനത പൊങ്കൽ ആഘോഷിക്കുന്നത്. മകരപ്പൊങ്കൽ, തൈപ്പൊങ്കൽ, സൂര്യപ്പൊങ്കൽ, റാട്ടുപൊങ്കൽ, കണംപൊങ്കൽ എന്നീ പൊങ്കലുകൾ കന്നുകാലി സമ്പത്തിനും കാർഷികാഭിവൃദ്ധിക്കും വേണ്ടിയുള്ള കാർഷികോത്സവങ്ങളാണ്. പൊങ്കാല മാതൃസൂര്യന്റെ ആരാധനയുമായി ബന്ധപ്പെട്ടതായതിനാലാണ് പൊങ്കാല ഒരേസമയം സൂര്യാരാധനയും അമ്മദൈവാരാധനയുമാകുന്നത്. അടുത്തകാലം

വരെ പൊങ്കാലകൾ ക്ഷേത്ര കേന്ദ്രീകൃതമായിരുന്നില്ല. കാർഷിക ദേവതയ്ക്ക് കുടിയിരിക്കാൻ ക്ഷേത്രങ്ങളുണ്ടായിരുന്നില്ല എന്നതാണ് അതിന് കാരണം. കൃഷിയിടങ്ങൾക്കരികിലെ മരച്ചുവടുകളോ മരക്കൂട്ടമായ കാവുകളോ നെൽക്കളങ്ങളോ ഒക്കെയായിരുന്നു ദേവതാസ്ഥാനങ്ങൾ. അമ്മദൈവാരാധന നെൽപ്പാടങ്ങളുമായി ബന്ധപ്പെട്ടിരിക്കുന്നു. അതിന് ഉദാഹരണമാണ് കളം എന്ന പദം. തെക്കൻ കേരളത്തിലെ ചില ഗ്രാമങ്ങളിൽ അമ്മ ദൈവത്തേയും നാടൻ ദൈവങ്ങളേയും ആരാധിക്കുന്ന സ്ഥലത്തെ കളം എന്നു പറഞ്ഞുവരാറുണ്ട്.

പ്രജനനത്തിന്റെയും ഭക്ഷണോത്പാദനത്തിന്റെയും പ്രഭവകേന്ദ്രമാണ് സ്ത്രീ. അതിനാൽ വംശവർധനവിനും കാർഷിക വിളവുകളുടെ അഭിവൃദ്ധിക്കുംവേണ്ടി വിളഭൂമിയെയും പ്രകൃതിയെയും ധാന്യങ്ങളെയും മാതൃദേവതകളായി പ്രാചീനർ ആരാധിച്ചിരുന്നു. കന്നിഫലം അമ്മ ദൈവത്തിനു നേർച്ചയായി നൽകിത്തുടങ്ങിയതോടെ കൊയ്ത്ത് ഉത്സവമായി. കൃഷിയിറക്കുന്ന കാലമാണ് ഉത്സവങ്ങൾക്കു തുടക്കം കുറിച്ചത്. അങ്ങനെ വിതയും കൊയ്ത്തും ലോകമെങ്ങും ഉത്സവകാലമാണ്. ഫീസ്റ്റുമായി ബന്ധപ്പെട്ട ഫെസ്റ്റിവൽ കൊയ്ത്തുകാലത്തെ ഭക്ഷണോത്സവമാണ്. പ്രാചീനകാർഷിക സമൂഹത്തിൽ എങ്ങും നിലനിന്ന പുത്തരിയൂണുത്സവമാണ് യഥാർഥത്തിലുള്ള ഫെസ്റ്റിവൽ. അങ്ങനെ നമ്മുടെ കാർഷികമായ ഭക്ഷണോത്സവമാണ് പൊങ്കാല. മതനിരപേക്ഷിതമായ കാർഷിക സമൂഹത്തിലെ ഭൗതിക ജീവിതത്തിൽ അന്നമാണ് അമ്മയും ദൈവവും അന്നമാണ് ബ്രഹ്മം എന്ന കല്പന തൈത്തിരിയോപനിഷത്തിൽ കാണാം.

കാർഷികവൃത്തിയിൽ ജന്മിത്വ ശക്തികൾ സ്വാധീനമുറപ്പിച്ചതോടെ അമ്മദൈവത്തിനു പരിമിതമായ തോതിലെങ്കിലും ചെറുക്ഷേത്രങ്ങൾ ഉണ്ടാവാൻ തുടങ്ങി. എങ്കിലും അവർണരായ സാധാരണ ജനങ്ങൾ നെൽപ്പാടത്തും വീട്ടുമുറ്റങ്ങളിലും വെച്ച് അമ്മദൈവത്തെ പൂജിക്കുന്ന പതിവ് തുടർന്നുവന്നു. പൊങ്കാല ക്ഷേത്രമുറ്റത്ത് വച്ചുവേണം എന്ന് ഒരു നിർബന്ധവും ഉണ്ടായിരുന്നില്ല. ക്ഷേത്രം തന്നെ വയലായിരുന്നതിനാൽ വയൽക്കരയായിരുന്നു ഭൂരിപക്ഷത്തിന്റെയും ആരാധനാസ്ഥാനം. അവിടെ വച്ച് ആർക്കും അമ്മ ദൈവത്തെ പൂജിക്കാം. അമ്മ ദൈവാരാധനയിൽ പുരോഹിതനോ മന്ത്രമോ തന്ത്രങ്ങളോ ഒന്നുമില്ല. അമ്മ ദൈവാരാധന മതനിരപേക്ഷമായിരുന്നതിനാൽ പുരോഹിതവാഴ്ചയ്ക്ക് പ്രസക്തിയുണ്ടായില്ല.

പൊങ്കാലയുടെ പരിഷ്കൃതി

കാർഷിക ഗ്രാമവ്യവസ്ഥയിൽ സംഭവിച്ച പരിവർത്തനങ്ങൾ അമ്മദൈവാരാധനയെയും സ്വാധീനിച്ചിട്ടുണ്ട്. ഇന്ന് അമ്മദൈവങ്ങൾക്കു പരക്കെ അമ്പലങ്ങൾ ഉയർന്നു. എന്നതുമാത്രമല്ല നിത്യ കന്യകമാരായിരുന്ന അവരെ ഹൈന്ദവ പുരാണത്തിലെ ദേവപത്നികളുടെ അവതാരങ്ങളായി രൂപപ്പെടുത്തി. കൃഷിയിടങ്ങളിലും വീട്ടുമുറ്റങ്ങളിലും പറമ്പിലും നിവേദിച്ചിരുന്ന പൊങ്കാലകൾ മതാത്മക സ്വഭാവമുള്ള ക്ഷേത്രോത്സവങ്ങളായി മാറി. കാർഷികവൃത്തി അന്യം നിൽക്കുകയും കൃഷിക്കാർ കൃഷിഭൂമിയിൽ നിന്ന് തിരസ്കൃതമാവുകയും വൻകിട കമ്പനികൾ ഈ മേഖലയിലേക്ക് അതിക്രമിച്ചെത്തുകയും ചെയ്തു. ചെറുകിട കൃഷികളൊക്കെ നിലനിൽക്കാനാവാതെ പിന്മാറുകയും ചെയ്തു. നമ്മുടെ ഗ്രാമങ്ങൾ ഉപനഗരങ്ങളായി പരിണമിക്കുക കൂടി ചെയ്യുമ്പോൾ പഴയ കാർഷികാനുഷ്ഠാനങ്ങളും അമ്മദൈവാരാധനാരീതികളും സംഘടിത മതാചാരാനുഷ്ഠാനങ്ങളുമായി കണ്ണിചേർക്കപ്പെടുകയും കേരളത്തിലെ ഒട്ടുമിക്ക ക്ഷേത്രങ്ങളിലും പൊങ്കാല ഒഴിച്ചുകൂടാനാവാത്ത ഒന്നായി മാറുകയും ചെയ്തു. ■

ലേഖകപരിചയം

ഡോ. സി.ആർ. രാജഗോപാലൻ
നിരൂപകൻ, വകുപ്പധ്യക്ഷൻ,
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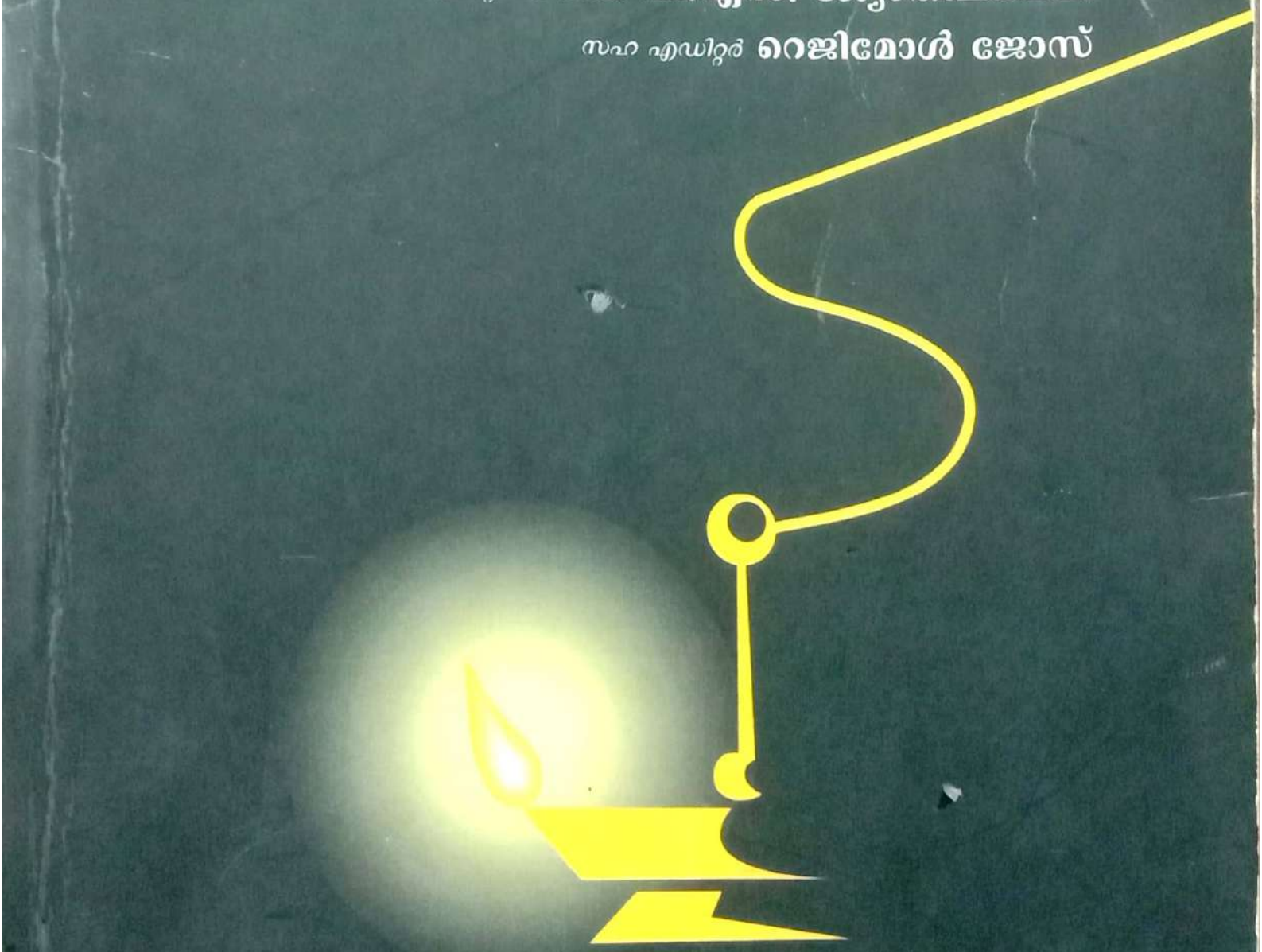

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ഫോക്‌ലോറിലെ ലോകപാരിസ്ഥിതിക വീക്ഷണം

ഡോ. സി.ആർ. രാജഗോപാലൻ

നമ്മുടെ സെമിനാറിന്റെ പേര് നെയ്തൽ എന്നാണ്. നെയ്തൽ എന്നുപറഞ്ഞാൽ കടലോര സാമൂഹ്യസാംസ്കാരിക പൈതൃകത്തെയാണ്, ഒരു തിണയെയാണ് അല്ലെങ്കിൽ നമ്മുടെ പ്രാചീനജനത ആഹരിച്ചുവന്നിരുന്ന തിന എന്നുപറയുന്ന ഒരു ധാന്യത്തെയാണ് സൂചിപ്പിക്കുന്നത്. എന്നു പറഞ്ഞാൽ നാട്ടുവാക്കുകളിൽ നിന്ന് നമ്മൾ ചരിത്രത്തിലേക്ക് പോകുകയാണ്. നമ്മുടെ തൊട്ടറിയുന്ന ഓരോ പൈതൃകങ്ങളും തൊട്ടറിയാപൈതൃകങ്ങളും തേടിയുള്ള യാത്രയാണ്, നമ്മുടെ മനസ്സിന്റെ ആഴങ്ങളിലേക്ക് നമ്മുടെ പ്രജ്ഞയുടെ താഴ്വരകളിലേക്കുള്ള ഒരു സഞ്ചാരമാണ് ഫോക്‌ലോർ അന്വേഷണം എന്നുള്ളത്. ഈ സഞ്ചാരം ചെന്നെത്തി നിൽക്കുന്നത് നമ്മുടെ മണ്ണിലാണ് എന്നുള്ളത് കാണാൻ പറ്റും. മണ്ണിനെ ചവിട്ടിയാണ് വിത്തെറിയുന്നത്. സാംബ എന്നു പറയുന്ന ഒരു പുരാവൃത്ത മനുഷ്യരുണ്ട്, ഫിൻലാന്റിൽ സാംബ എന്നുപറഞ്ഞിട്ട്. ഈ നൂറ്റാണ്ടിൽ കണ്ടെടുത്ത ഒരു വലിയ ഇതിഹാസമാണ് കലൈവാല എന്നുപറയുന്ന ഇതിഹാസം. നിങ്ങളെപ്പോഴെങ്കിലുമൊക്കെ ഒന്നന്വേഷിക്കുക. ഈ കലൈവാലയിൽ പറയുന്ന സാംബ എന്നുവച്ചാൽ വിത്തുവിതച്ചുകൊണ്ടു നടക്കുന്നതാണ്. വിത്ത് എന്നുപറയുന്ന ഉർവ്വരതയുടെ ആദിരൂപം, അത് വാക്കാണ്, വിത്താണ് അത് മിത്താണ്. ഇതുവിതച്ചുകൊണ്ട് നടക്കുന്ന ആദിമരായിട്ടുള്ള എത്രയോ മനുഷ്യരുടെ ലോകത്തിൽ നിന്നാണ് നമുക്ക് നെയ്തൽ പോലൊരു വാക്കുണ്ടാകുന്നത്. നമ്മളിപ്പോൾ കൂട്ടനാട്ടിലേക്കു പ്രവേശിക്കുമ്പോൾ ഒരു അരങ്ങ് എന്നു പറയുന്നത്, ഒരു നാട്ടരങ്ങ് എന്നുപറയുന്നത് ഒരു സേക്രഡ് പ്ലെയ്സാണ്. ഭൂമിയെ തൊട്ട് നെറുകയിൽ വച്ച് സൂര്യഭഗവാനെ കൈവണങ്ങി. ഇത്രയേ ഉണ്ടായിരുന്നുള്ളൂ പ്രാചീനമനുഷ്യർ. അവന്റെ ഊർജ്ജം എന്നുപറയുന്നത് മണ്ണും വെളിച്ചവുമാണ്.

തീരെ ചെറിയ അറിവുകളാണ് തിരിച്ചറിവുകൾ. നമ്മുടെ നാട്ടിലെ നാട്ടറിവുകൾ ഇത്തരത്തിൽ രൂപ്പെട്ടിട്ടുള്ളവയാണ്. അലയുന്ന മഹാമനീഷികളുടെ ജീവിതത്തിൽ നിന്നും തൊട്ടെടുത്തിട്ടുള്ളവയാണതിലേറെയും. മനുഷ്യൻ പ്രാരംഭത്തിൽ അലഞ്ഞു നടക്കുന്ന ജീവിതചര്യയ്ക്കുടമയായിരുന്നു. ഇതിലൂടെ ലഭിച്ച തിരിച്ചറിവുകൾ നാട്ടറിവുകളായി. ഇവയിൽ പലതും ആധുനികതയിൽ കാലഹരണപ്പെട്ടുപോയി. അവയെ കണ്ടെത്താനുള്ള മഹത്തായ ശ്രമമാണ് നാട്ടറിവുപഠനകേന്ദ്രങ്ങൾ നടത്തുന്നത്.

മലയാളത്തിന്റെ ഹോർത്തൂസ് മലബാറിക്കസ് കേരളത്തിന്റെ സസ്യസമ്പത്തിന്റെ വിവരണമെന്നതിനപ്പുറം ഒരു ദേശത്തിന്റെ അടയാളമായി, Geographics Indication (GI) ആയി നിലകൊള്ളുന്നു. ഓരോ പ്രദേശത്തിനും പ്രാദേശികമായ ചില ജൈവസൂചകങ്ങൾ ഉണ്ട്. ഇത്തരം സൂചകങ്ങളുടെ സമാഹാരങ്ങളിലൊന്നായി ഇതിനെ പരിഗണിക്കാം. സസ്യ-ജന്തുജാലങ്ങളും, മണ്ണിനങ്ങളും എല്ലാം ഇത്തരം

തീരദേശാചാരങ്ങളിലെ ഫോക് - പരിസ്ഥിതി ഘടകങ്ങൾ

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കൊല്ലം ജില്ലയിലെ തീരദേശമേഖലകളായ ഇരവിപുരം മുതൽ തങ്കശ്ശേരി വരെയുള്ള ഭാഗങ്ങളിൽ മാത്രം കണ്ടുവരുന്ന ചില സവിശേഷാചാരങ്ങളാണ് വെന്ദ്രൂസും സഞ്ചോൻ തിരുനാളും. പാശ്ചാത്യനാടുകളിൽ കണ്ടുവന്നിരുന്ന "കാർണിവൽ" ആഘോഷങ്ങളെ രാഖീബന്ധനം, ഹോളി മുതലായ ഭാരതീയാചാരങ്ങളുമായി ഒരു പ്രത്യേകാനുപാതത്തിൽ ഇണക്കിച്ചേർത്തുണ്ടാക്കിയതാണ് വെന്ദ്രൂസ് എന്ന കലാരൂപം.

വലിയ നോമ്പ് ആരംഭിക്കുന്ന ബുധനാഴ്ചയുടെ (ക്ഷാരബുധൻ) തലേദിവസമാണ് "വെന്ദ്രൂസ്" കളി ആരംഭിക്കുന്നത്. സൗഹൃദത്തിന്റെയും രക്തബന്ധത്തിന്റെയും ഇഴയടുപ്പമുള്ളവരാണ് ഈ ആഘോഷത്തിൽ പങ്കുചേരുന്നത്. ചാരം കലക്കി ഹോളിയെ അനുസ്മരിപ്പിക്കും വിധം ഓരോരുത്തരും പരസ്പരം ദേഹത്തു വാരിപ്പൂശുന്നു. വർണ്ണാഭമായ ശരീരങ്ങളെ വികൃതമാക്കിയാണ് ഓരോരുത്തരും താന്താങ്ങളുടെ മിടുക്ക് തെളിയിക്കുന്നത്. ആബാലവൃദ്ധം ജനങ്ങളുടെ പങ്കാളിത്തമുള്ള ഈ ആഘോഷം രാവിലെ ഏഴുമുതൽ ഏതാണ്ടു രാത്രി വരെ നീളാറുണ്ട്. ചാരത്തിനു പുറമേ കോഴിമുട്ടയോ-താറാമുട്ടയോ ഈ വിധം ശരീരത്ത് അടിച്ചൊഴിക്കാറുണ്ട്. പേപ്പർകഷണങ്ങൾ കൊണ്ട് മാലയുണ്ടാക്കി കഴുത്തിലണിയിക്കുന്നതും തുടർന്നു കൂളത്തിൽ മുക്കി വൃത്തിയാക്കുന്നതും വെന്ദ്രൂസിന്റെ ചടങ്ങുകളാണ്. പുലികളിയുടെ മട്ടിൽ ആർത്തുതുള്ളുന്ന ജനക്കൂട്ടം രാത്രി ഒത്തുകൂടി അരിമാവു കൊണ്ടുള്ള അപ്പവും ഇറച്ചിക്കറിയും മദ്യവും കഴിച്ച് സന്തോഷപ്രകടനം നടത്തുന്നു. വെന്ദ്രൂസിനോടനുബന്ധിച്ച് പന്തയം വയ്ക്കുന്ന ഏർപ്പാടും ഇവിടത്തുകാർക്കിടയിലുണ്ട്. പ്രധാനമായും തലയിൽ മുട്ടയൊഴിക്കാൻ പറ്റുമോ എന്നതാണ് പന്തയവിഷയം. ഇതേദിനം, മീൻപിടിത്തത്തിനു പോകുന്നവർ തിരികെ വന്ന് തിര വരുന്നതിനു തൊട്ടടുത്തായി ഓലക്കെട്ടുകൾ കത്തിച്ച് വലിയ പന്തമുണ്ടാക്കി ഏതെങ്കിലും വിശുദ്ധന്റെ പേർ പറഞ്ഞ് ബാധോച്ചാടനം നടത്തുന്ന പന്തംകളി, എന്ന ചടങ്ങും അരങ്ങേറാറുണ്ട്. "വെന്ദ്രൂസിന്" വരാൻ പോകുന്നത് എന്നാണ് ഏകദേശാർത്ഥം. ഈ പദത്തിന്റെ നിരുക്തിയെക്കുറിച്ച് ആർക്കും അവിതർക്കിതമായൊരു അഭിപ്രായമില്ല.

ചഞ്ചോൻ-സഞ്ചോൻ എന്നിങ്ങനെ വ്യത്യസ്തരീതികളിൽ വ്യവഹരിക്കപ്പെടുന്ന

കേരളത്തിലെ ഫോക്‌ലോറിലെ പരിസ്ഥിതിയെയും സാംസ്കാരികസ്വത്വത്തെയും കുറിച്ചുള്ള ഒരന്വേഷണം. ഡോ.സി.ആർ.രാജഗോപാൽ, ഡോ.കെ.എം. ഭരതൻ, ഡോ.എസ്.എസ്. ശ്രീകുമാർ തുടങ്ങി ഫോക്‌ലോർ രംഗത്ത് വ്യക്തിമുദ്ര പതിപ്പിച്ച നിരൂപകരുടെ ലേഖനങ്ങൾ. ഒപ്പം ഈ മേഖലയെ താത്പര്യത്തോടെ വീക്ഷിക്കുന്ന ഒരുകൂട്ടം ഗവേഷകരുടെയും അധ്യാപകരുടെയും അന്വേഷണാത്മക പ്രബന്ധങ്ങളും.

പ്രകടനകലകൾ, നാട്ടുത്സവങ്ങൾ, നാടോടിനാടകങ്ങൾ, ചൊല്ലുകൾ, വാമൊഴിവഴക്കങ്ങൾ എന്നിവയിൽ പ്രകടമാകുന്ന പാരിസ്ഥിതികാവബോധങ്ങളും ലോകവീക്ഷണങ്ങളും അനാവരണം ചെയ്യപ്പെടുന്നു.

സാഹിത്യം, നാടകം, ചലച്ചിത്രം തുടങ്ങിയ ആധുനിക ആഖ്യാനങ്ങളിൽ പ്രകടമാവുന്ന ഫോക്‌ലോർ സ്വാധീനങ്ങളും ചർച്ച ചെയ്യുന്നു.

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ആഗോളവത്ക്കരണകാലത്തെ സാഹിതീയ പത്രപ്രവർത്തനം

ഡോ. എസ്. എസ്. ശ്രീകുമാർ

കേരളീയ പത്രപ്രവർത്തനത്തിന്റെ ആദ്യഘട്ടങ്ങളിൽത്തന്നെ സാഹിത്യം നമ്മുടെ പത്രങ്ങളുടെ പ്രധാന പരിഗണനാവിഷയമായിരുന്നു. മലയാള സാഹിത്യ വിമർശനത്തിന്റെ പിതാവെന്നറിയപ്പെടുന്ന സി.പി. അച്യുതമേനോന്റെ സാഹിത്യ വിമർശനങ്ങളെല്ലാം തന്നെ അദ്ദേഹത്തിന്റെ പത്രമായ വിദ്യാവിനോദിനിയിൽ പ്രസിദ്ധപ്പെടുത്തിയവയാണ്. ജനതയുടെ അഭിരുചി പരിവർത്തനത്തേയും അവരുടെ സാമൂഹിക മൂല്യബോധനിർമ്മിതിയേയും പ്രധാന പരിഗണനാവിഷയങ്ങളാക്കിയ അദ്ദേഹത്തിന്റെ സാഹിത്യവിമർശനങ്ങൾ പത്രപ്രവർത്തനത്തിലൂടെ നമുക്കു ലഭിച്ച ശക്തമായ അഭിപ്രായ രൂപീകരണശ്രമങ്ങളായിരുന്നു. പരദാരഗമനത്തെ സാധൂകരിക്കുന്ന കൊച്ചുണ്ണി തമ്പുരാന്റെ കല്യാണീ നാടകത്തെ വിമർശിക്കുന്ന അദ്ദേഹം സാമൂഹികമൂല്യബോധ നിർമ്മിതിയിൽ പത്രപ്രവർത്തകന്റേയും സാഹിത്യ വിമർശകന്റേയും പങ്ക് അസന്ദിഗ്ധമായി എടുത്തു കാട്ടുകയായിരുന്നു.നിർഭയമായ പത്രപ്രവർത്തനത്തിന്റെ പേരിൽ രാജ്യഭ്രഷ്ടനായിത്തീർന്ന സ്വദേശാഭിമാനി രാമകൃഷ്ണപിള്ളയും സാഹിത്യവിമർശനത്തിലൂടെ ജനതയുടെ അവബോധ പരിണാമത്തിന് നേതൃത്വം കൊടുത്ത വിമർശകനാണ്. സ്വദേശാഭിമാനി, കേരളൻ തുടങ്ങിയ പത്രങ്ങളിലും പിന്നീട് ആത്മപോഷിണിയിലും നടത്തിയ വിമർശനയത്നങ്ങൾ അദ്ദേഹത്തിന്റെ പത്രപ്രവർത്തനത്തിന്റെ ഭാഗമായിരുന്നു. രാജാധികാരം ദൈവദത്തമല്ലെന്നും അത് പ്രജകളാൽ ദത്തമാണെന്നും അതിനാൽ ജനങ്ങൾക്ക് അനഭിമതരാകുമ്പോൾ രാജാക്കന്മാരെ തിരിച്ചു വിളിക്കാനവകാശമുണ്ടെന്ന് നോർവ്വെ, സെർബിയ തുടങ്ങിയ രാജ്യങ്ങളുടെ ഉദാഹരണ

പത്രഭാഷ: കതിരും പതിരും

ഡോ. എം.ആർ. ഷെല്ലി

"പത്രഭാഷ ഇന്നൊരു വിവാദവിഷയമാണ്. ഭാഷയുടെ ശാലീനതയെയും ശുദ്ധിയെയും വികലമാക്കിയ പത്രക്കാരെ പ്രതിസ്ഥാനത്തു നിർത്തി വിചാരണ ചെയ്യുന്ന പണ്ഡിതന്മാർ വിരളമല്ല. പത്രക്കാരാകട്ടെ വരേണ്യരുടെ വരമൊഴിയെ പരസഹസ്രം സാധാരണക്കാർക്ക് അഭിഗമ്യമാക്കിയതിന്റെ സമ്മാനം തങ്ങൾക്കു ലഭിക്കേണ്ടതാണെന്ന് അവകാശപ്പെടുന്നു. ഇവരിൽ ആരു പറയുന്നതാണ് ശരി? ഇരുഭാഗത്തും ശരിയും തെറ്റും ഉണ്ടെന്നു സൂക്ഷ്മമായി പരിശോധിച്ചാൽ കാണാം."പത്രഭാഷയെ സംബന്ധിച്ച് കേരള പ്രസ് അക്കാദമി ഏതാണ്ടു മുപ്പത്തിമൂന്നു കൊല്ലം മുമ്പ് നടത്തിയ ഒരു സെമിനാറിലെ പ്രസക്ത ഭാഗങ്ങൾ ക്രോഡീകരിച്ച് തയ്യാറാക്കിയ ഒരു ഗ്രന്ഥത്തിന്റെ മുഖവുര (പത്രഭാഷ-കേരളപ്രസ്സ് അക്കാദമി 1983) ആരംഭിക്കുന്നത് ഇങ്ങനെയാണ്. മുപ്പത്തിമൂന്ന് കൊല്ലം മുമ്പ് വിവാദവിഷയമായിരുന്ന ഒരു സംഗതി ഇന്നും അതേ പ്രതിച്ഛായയോടുകൂടി വർത്തിക്കുന്നുവെങ്കിൽ എവിടെയോ എന്തോ ചീഞ്ഞുനാറുന്നുവെന്നു പറയാതെ വയ്യ. ഒരു വിവാദം പരിഹൃതമാകുന്നതിനെടുക്കേണ്ട സമയത്തിന്റെ പരിധിയെയും ഉല്ലംഘിച്ചുകൊണ്ട് അതിനു ബഹുദൂരം മുന്നോട്ടു പോകുവാൻ കഴിഞ്ഞുവെങ്കിൽ ഉത്തരവാദപ്പെട്ടവരുടെ അനവധാനത അതിനു പിന്നിലുണ്ടെന്നു സൂക്ഷ്മ ദൃക്കുകൾക്ക് കാണാം. ഇന്റർനെറ്റും ഇ-വായനയും സൃഷ്ടിച്ചെടുത്ത വമ്പിച്ച ജനപ്രിയത്വത്തെയും അധഃകരിക്കുന്ന ഒരു പൊതുജനസമ്മതി പത്രങ്ങൾക്കുണ്ടെന്നത് നിഷേധിക്കാനാവാത്ത വസ്തുതയാണ്. ആധുനിക സാങ്കേതികതയ്ക്കു സാധിക്കാൻ കഴിയാത്ത 'ചൂടൻ വായനാനുഭവം' സമ്മാനിക്കുവാൻ അച്ചടിമാധ്യമങ്ങൾക്കേ കഴിയൂ. വാർത്തകൾ വായിക്കുവാനുള്ളതാണ് എന്ന നില

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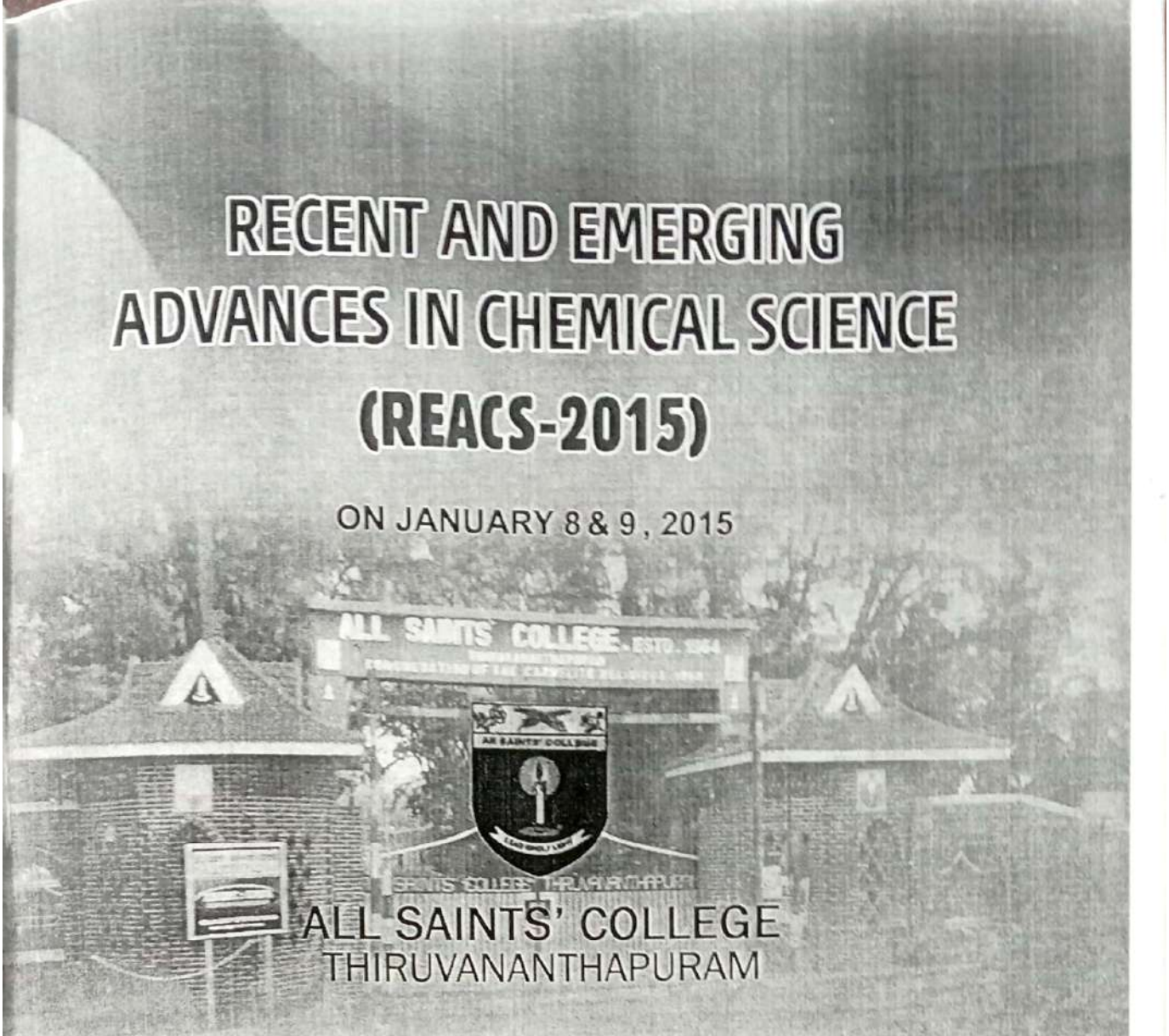

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E- mail: sijivl@yahoo.com

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KEYNOTE ADDRESS

RECENT DEVELOPMENTS PROCESSING AND APPLICATIONS OF NANOCOMPOSITES AND COATINGS

T. P. D. Rajan

Materials Science and Technology Division, CSIR-National Institute for InterdisciplinaryScience and Technology Thiruvananthapuram, India

E-Mail: tpdrajan@niist.res.in, tpdrajan@gmail.com

Nanotechnology offers society the promise of major benefits, even though commercialization of nanotechnology is presently in its infancy and its use in consumer and industrial sectors is expected to increase significantly in the near future. Nanotechnology is defined as the ability to create and use materials, devices, and systems with unique properties at the scale of approximately 1 to 100 nanometers. The recent market research reports reveal that the commercialization of new nanomaterials will open up new doors to possible opportunities for new business and there is no doubt that a healthy and conducive R&D environment is essential prelude for nanomaterials development over the coming years.

Nanomaterials provide exotic ranges of physical, chemical, electronic and engineering properties over the conventional bulk structured materials. The high cost involved in the production of material in nanostate and retention of the nanostructure during storage and further processing makes the components expensive and uneconomical for wider engineering applications. However the improved processing methods developed brings more opportunities for its applications. On the other hand, for the miniatured devices required for electronic and related applications, nanostructured material devices become very much cost effective. The properties are mainly controlled by the structure. Substantial improvements in surface activities, magnetic, thermal, physical and mechanical properties were observed with nanostructured materials compared to the same material in the bulk state. The tribological properties have a significant advantage because it is mainly a surface phenomenon controlled by surface layers of the abrading surfaces. Generally, it has been observed that the nanostructured surfaces offer higher hardness and improved tribological properties compared to the bulk material surface. In fact, even different wear mechanism operates. The amount of nanostructured material required

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PP03

STRUCTURAL AND SPECTRAL INVESTIGATIONS OF 2-(3-METHOXY-4-HYDROXYPHENYL) BENZOTHIAZOLE AND ITS URANYL(VI) COMPLEXES

Sarau Devi.A* and Reena Ravindran
**Department of Chemistry, Fatima Mata National College, Kollam*
Department of Chemistry, S.N College, Chempazhanthy, Trivandrum

Abstract

A benzothiazole derivative ligand, 2-(3-methoxy-4-hydroxyphenyl) benzothiazole, and its uranyl complex has been prepared and their structures and spectral investigations were carried out.

Keywords: 2-(3-methoxy-4-hydroxyphenyl) benzothiazole, uranyl complex, X-ray study, IR, UV studies.

1. Introduction

Benzothiazoles are biologically active heterocyclics with luminescence property, formed by the fusion of benzene ring and thiazole ring. They can coordinate through nitrogen or sulfur atoms on either side of the heterocyclic ring depending on the nature of metal ion [1] The uranyl complex of benzothiazole ligand is interesting because of bigger coordination environments like pentagonal seven-coordination or hexagonal bipyramidal eight coordination

2. Experimental

O-aminothiophenol, vanillin(Merck), $UO_2(NO_3)_2.6H_2O$ (Merck), were used as received without further purification.

2.1. Synthesis of ligand and its uranyl complex

Equimolar mixture of $NaHSO_3$ (1.25g, 0.012M), vanillin (1.82g, 0.012M) were refluxed in ethanol (15mL) for 15-20 minutes. To the mixture o-aminothiophenol (1.25g, 0.01M) was added and continued to reflux for 4-5 h. On slow cooling, colourless crystalline compound formed in each case was filtered, washed with water, recrystallized from ethanol and dried over fused $CaCl_2$. M.p., 171 °C.

A solution of $UO_2(NO_3)_2.6H_2O$ (0.502 g, 1 mmol) in methanol (10 mL) was added slowly to methanolic solution (10 mL, 2 mmol) of the benzothiazole derivative (0.510 g). The reaction mixture was refluxed for 2-3 h, the progress of the reaction was shown by color change of the resulting solution. On evaporation at room temperature a yellow orange product obtained, was washed with small portion of methanol, filtered off and dried over anhydrous $CaCl_2$.

2.2. X-ray crystallography

The crystallographic data were collected using Bruker axs Kappa apex 2 CCD diffractometer, equipped with a graphite crystal incident beam monochromator and a fine focus sealed tube Mo Kα (λ=0.71073) X-ray source at the SAIF, Indian Institute of Technology, Madras, India. The SMART program[2] was used for collecting frames of data, indexing the reflections and determination of lattice parameters, the SADABS program was used for absorption correction and the SHELXL-97 program for space group. The structure was solved by direct methods using SHELXS and refined by full-matrix least-squares refinement on F^2 using SHELXL-97[3]. Molecular graphics employed were ORTEP-III and MERCURY 2.4.

3. Results and discussion

The ligand crystallizes into an orthorhombic lattice with space group P212121. The molecule as a whole adopt almost planar conformation but for the slight tilt of vanillyl ring. The appearance of bands in the 1625-1300 cm^{-1} range is due to overall ring skeletal (benzene and thiazole ring) stretching mode[4]. The characteristic ν(C=N) and ν(C-S) vibrations of thiazole moiety is assigned at 1592 cm^{-1} and 716 cm^{-1} respectively. The ν(O-H) appeared as a broad band in the region 3200-2800 cm^{-1}. The electronic spectrum shows two high intensity bands of almost same absorption maxima, at 212 nm due to π-π* transitions and at 310 nm due to n-π* transitions of substituted phenyl ring.

The molar conducatance data show that thr uranyl complex is non electrolyte. It is found to be diamagnetic. IR spectral data shows that the ligand act as neutral monodentate, coordinating through thiazole ring nitrogen. From elemental analysis and thermal studies we proposed six coordination around linear UO_2^{2+} thereby forming hexagonal bipyramidal geometry.

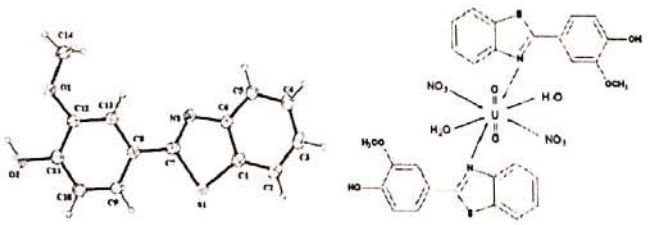

Fig. 1. ORTEP diagram of ligand and proposed structure of uranyl complex

Conclusion

. The structure of ligand has been solved by single crystal X-ray diffraction studies. It crystallizes in orthorhombic $P2_12_12_1$ space group. The complex was characterized by elemental analysis, molar conducatance, IR and UV spectral studies. The molar conducatance data show the complex is non electrolytes. It is found to be diamagnetic. The complex has an six coordination is observed around linear UO_2^2 thereby forming hexagonal bipyramidal geometry.

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P-17

MICROWAVE ASSISTED GREEN CHEMISTRY SYNTHESIS OF POLYMER GRAFTED CELLULOSE FOR THE ENVIRONMENTAL REMEDIATION

* Manohar D. Mullassery, Noeline B. Fernandez and Surya R.

Department of Chemistry, Fatima Mata National College, Kollam, Kerala, India

Abstract

The aim of this work is equilibrium study of the sorption of crystal violet (CV) from aqueous solutions under different experimental conditions using an adsorbent glycidyl methacrylate grafted banana stem (GM-BS). Microwave (MW) irradiation has gained a great deal of attention owing to the molecular level of heating. Banana stem is grafted with glycidyl methacrylate under microwave irradiation. The adsorbent has been characterized using IR. The effects of pH for the removal of CV was studied. The optimum pH for CV adsorption was found to be 10.0. Desorption of CV from the sorbed clay was achieved by eluting with 0.1 M HCl.

Key words: banana stem, adsorption, kinetics, regeneration

PP18

Microwave Assisted Green Chemistry Synthesis of Polymer Grafted Banana Stem for the Removal of Rhodamine-B

* Noeline B. Fernandez, Manohar D. Mullassery and Surya R.

*Department of Chemistry, Fatima Mata National College, Kollam, Kerala, India

Abstract

The aim of this work is equilibrium study of the sorption of Rhodamine-B (RB) from aqueous solutions under different experimental conditions using an adsorbent glycidyl methacrylate grafted banana stem (GM-BS). The adsorbent has been characterized using IR. The effects of pH for the removal of RB was studied. The optimum pH for RB adsorption was found to be 10.0. Desorption of RB from the sorbed clay was achieved by eluting with 0.1 M HCl.

Key words: banana stem, adsorption, kinetics, regeneration

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डॉ. के.एस. दासगुप्ता / Dr. K. S. Dasgupta
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I am very glad that Department of Chemistry IIST, is organizing a National Conference on Material Science and Technology (NCMST-2014), July 28-30, 2014. The influence and impact of materials in technology is all pervasive. Invention of novel and smart materials have greatly influenced the growth of technologies in aerospace, communication, automobiles, medicine etc., and have positively contributed to the endeavors for improving the quality of life. However, scientific community is still in search of newer and smarter materials to meet the future technological challenges. In this context, this national seminar assumes great importance. I am sure that this conference will be discussing on the recent trends in such advanced materials which is very relevant in a scenario of exciting challenges.

I am confident that this conference will offer a great opportunity to scientific and student community to know more about the latest development in 'Materials Science and Technology' from the pioneers and those who do cutting edge work in their chosen area. I wish the conference a grand success and convey my best wishes to the organisers and delegates.

(K. S. Dasgupta)

P 035 Electrochemical Properties of Reduced Graphene- Nickel Oxide

AnithaKumary V[a*] ,K Sreevalsan[b] & Mary Nancy TE[a]
[a] *Post Graduate & Research Department of Chemistry, Sree Narayana College for Women, Kollam, Kerala, India. 691001,*
[b] *Post Graduate & Research Department of Chemistry, Sree Narayana College, Kollam, Kerala, India. 691001,*

This paper describes the preparation, characterization, and electrochemical properties of reduced grapheme oxide –nickel oxide composite. The reduced grapheme oxide was prepared by a modified Hummer's method followed by solar exfoliation. This was characterized by Transmission electron microscopy (TEM), X-ray diffraction (XRD), scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS) .A novel solar graphene-nickel oxide modified glassy carbon electrode was developed and used for the selective detection of dopamine. The sensor exhibited appreciable electrocatalytic effect towards the detection of low concentrations of dopamine in 0.1 M phosphate buffer solution at pH 7 . A very low detection limit of 0.9 ± 0.15 nM was attained in the linear range of 10 nM to 50 nM by chronoamperometry.

P 036 Conductivity Studies of $Pr(OH)_3$ Nanorods

Babu K Thomas, Jeethu Abraham, Lakshmi G Krishna, Gijo Jose*
Department of Physics, St. Berchmans College, Changanasserry, Kerala, 686 101, India
Email: baboothomaz@gmail.com

Complex impedance spectroscopic technique is considered to be a promising non-destructive testing method for analyzing the electrical processes occurring in a compound on the application of ac signal as input perturbation. In this work, the temperature and frequency variation of dielectric constant (ε'), and dielectric loss (D) of praseodymium hydroxidewere studied, which was employed to obtain cole-cole plots, over the frequency range 100 Hz to 5 MHz.

The impedance measurements of the nanorods reveal that their electrical conductivity is attributed to the decreasing resistance of grain boundaries.[1]The increase in ε' with decreasing frequency results from charge accumulation at the interface. This leads to a net polarization of the ionic medium, which contributes to ε', whereas at high frequencies, the periodic reversal of the field takes place so rapidly such a way that there is no excess ion diffusion in the direction of the field, resulting in constant ε' value.[2]Plots of the dielectric loss against frequency shows that the positions of the peaks apparently shift toward lower frequency with the increase of the peak height when temperature increases. The Cole-Cole

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AN INSILICO MODELING AND OPTIMIZATION OF FEW BIOACTIVE COMPOUNDS AGAINST InhA FOR ANTITUBERCULAR DRUG EFFICACY

Jamsheer A.M*,Prasad M. Alex, Umesh C. V., Shibi I.G.

*Assistant Professor, Department of Chemistry, MES College, mampad .
email- jamsheeram@yahoo.co.in, jamsheerchem@gmail.com

Abstract- *The flavonoids from derris indica which is a common plant of south indian forest are promisisng inhibitors of Mycobacterium tuberculosis. The modifications introduced to these compounds help to increase binding affinity. Docking studies using ArgusLab and AutoDock showed that some of these molecules could bind with good affinity to the mutant InhA in drug resistant mycobacterium tuberculosis. In-silico ADME/Toxicity analysis of these molecules also showed promising results.*

Introduction

TB has re-emerged as a threat, with the reported increase of infections involving drug resistant mycobacterium.[1] It is important to achieve a shortened therapy schedule to by designing new drugs to tackle drug resistance. *Derris Indica* or *Pongamia pinnata*, contains several flavonoids and its parts has been used in traditional systems of medicine for different ailments.[2] Three new flavonoids namely 3-Methox y-(3",4 "-dihydro- 3 ",4"-diacetoxy) -2",2"-dimethyl pyrano-(7, 8:5",6")-flavone (I) , 8,4'-Dimethoxy-7-O –γ,γ-dimethylallylisoflavone(II), 3,4-Methylenedioxy-10-methoxy-7-oxo[2]benzopyrano[4,3-b]benzopyran were isolated from hexane and dichloromethane extracts from stems and roots of the plant and characterized. Antimycobacterial activity was assessed against M. tuberculosis H37Ra using the Microplate Alamar Blue Assay (MABA) and reported to have shown antimycobacterial activity with MIC between 6.25 and 100 μg/mL[3] The drugs isoniazid and kanamycin sulfate were used as reference. These flavanoids show structural similarity to isoniazid the standard drug for tuberculosis as evidenced by a structural analysis with Scaffold Hunter. [4] Hence an insilico analysis and optimisation of these flavanoids for anti-tuberculosis activity is taken up here.

Materials And Methods

The 3-D structure of the drug target of isoniazid NADH-dependent enoyl acyl carrier protein reductase of mycobacterium tuberculosis wild type (1ENY) and its mutant S94A were retrieved from the RSC Protein Data Bank.[5] Scaffold Hunter, a highly interactive software tool for navigation in chemical space that helps intuitive recognition of complex structural

Poster presentation

Removal and recovery of natural organic matter from aqueous solution using pillared bentonite clay

* Noeline B. Fernandez, Manohar D. Mullassery

*Department of Chemistry, Fatima Mata National College, Kollam, Kerala, India

*corresponding author. Tel. +91 8281912148.

E-mail address: fernandeznoeline@gmail.com (Noeline B. Fernandez)

Abstract

This work aims to evaluate the performance of aluminium pillared clay for humic acid adsorption from aqueous solutions. Pillared clay was prepared from natural bentonite clay with aluminium chloride and was found to be effective for humic acid removal. The adsorption of humic acid onto Al-PILC has been dynamically and thermodynamically investigated. Batch experiments were carried out as a function of solution pH, contact time, humic acid concentration, ionic strength and temperature. The maximum adsorption capacity was observed at a pH of 3.0. The maximum adsorption of 90 and 80% took place at pH 3.0 from an initial concentration of 15 and 30 μmol L^{-1}, respectively. The maximum adsorption capacity (Q^0) obtained from the Langmuir isotherm plot was 26.18 μmol g^{-1} at pH 3.0 and at 30 °C.The desorption data showed that the spent PILC can be regenerated for further use by 0.1 M NaOH.

1. Introduction

Naturally occurring organic matter (N. O. M.) is ubiquitous in fresh water supplies. NOM is a heterogeneous mixture of complex organic materials including humic substances, hydrophilic acids, proteins, lipids, carboxylic acids, polysaccharides, amino acids and hydrocarbons (Wei Cheng et al., 2005). The dissolved components of naturally occurring organic matter constitutes the most problematic fraction of NOM with regard to drinking water treatment and supply, since they are partly removed from water by conventional treatment processes. A major concern for water utilities is the formation of carcinogenic and regulated disinfection by-products resulting from reactions between dissolved organic matter and chlorine or other disinfectants/oxidants (Kitis et al., 2007). Humic acid is having a complex structure involving a large number of functional groups, such as carboxyl (-COOH) and phenol (-OH) groups (Liu and Gonzalez, 1999). These natural dissolved organic matters are derived from the decay of plant and animal residues and from microbial activities (Frimmel et al., 2002). Humic acid are the main precursors of trihalo methane which are highly toxic to human beings (Gallard and von Gunten,

2002). The presence of humic acid (HA) in water and wastewater provides a yellow to brown colour and also imparts a high BOD load to the liquid waste (Zhou and Banks, 1993).

Removing natural organic matter (NOM) from water in water treatment has attracted much environmental and health interests and various methods for enhancing humic acid removal have been studied including polypyrrole coated granules and chitosan coated granules (Bai and Zhang, 2001), chitosan hydrogel beads (Yan and Bai, 2005). Activated carbon is an effective adsorbent for organic compounds (Ferro-Garcia et al., 1998) especially for phenolic compounds. Other adsorbents include clays, zeolites, hydrated metal oxide gels and organo clays (Beena and Anirudhan, 1999). Pillared clays constitute a novel class of materials prepared by the exchange of an inter layer cation in swelling smectite type aluminosilicate by polymeric hydroxyl cation followed dehydration and dehydroxylation (Bringle et al., 2005; Vinod et al., 2003). Bentonite is a smectite type of layered silicate having silicate tetrahedral and alumina octahedral (2:1), where Al-octahedron is sandwiched between two silicate tetrahedron layers. Montmorillonite, coated and intercalated by aluminium hydroxides exhibits much higher adsorption capacity for some heavy metal ions, than that of natural montmorillonite (Lothenbach et al., 1997). High temperature calcination of intercalated clays results in 'pillared' materials, where the polyhydroxy cationic species are irreversibly fixed to the layers. Aluminium intercalation of a clay consists in the insertion between the layers of 'Al_{13}' referred to as Keggin molecule $[AlO_4Al_{12}(OH)_{24}(H_2O)_{12}]$ (Vaughan, 1988). Pillared clays, first tested as cracking catalyst in view of their acidic properties, have recently been redirected to their applications as adsorbents for the removal of hazardous inorganic and organic compounds (Mathews et al., 1999; Vinod and Anirudhan, 2001). Smectite clays such as bentonite and montmorillonite are fundamental soil components and are abundant in nature. The present communication has been addressed to the use of natural bentonite clay which is found in large reserves in Gujarat (India), for the preparation of aluminium-pillared clay (Manohar et al., 2005; Manohar et al., 2006). Present study explores the possibility of using Al-pillared clay for the removal of humic acid from aqueous solution in a series of batch experiments.

2. Materials and methods

2.1. Materials

All chemicals were of high-grade quality and were used as received unless stated otherwise. A stock solution of 1000 μmol L^{-1} of humic acid was prepared in double distilled water using humic acid obtained from Fluka, Switzerland in deionised distilled water. The $AlCl_3.6H_2O$ and NaOH procured from E.Merck, India were used to prepare the pillaring solution. The HCl and NaCl were obtained from Loba Chemicals (India).

The clay used for this work is natural bentonite clay obtained from M/S Ashapura Clay Mines, Gujarat, India. The chemical composition of the natural clay was estimated by the classical scheme of analysis (Bennet and Read, 1971). The elements normally analysed and reported in the form of percentage oxide are SiO_2, Al_2O_3, CaO, MgO, Na_2O, K_2O, TiO_2 and loss on ignition. The clay samples for analysis were dissolved using HF, HNO_3 and $HClO_4$ acids according to the method described by Rump and Krist (1992). Calcination loss was established by weight difference after heating the sample at 1000 °C.

2.2. Preparation of Aluminium-Pillared Clay (Al-PILC)

The aluminium-pillared clay (Al-PILC) was prepared according to the method described by Zhu et al. (1995). The Na saturated form of the starting clay was obtained by washing the raw clay several times, first with 1.0 M NaCl and then with deionised water. The pillaring solution was prepared by adding drop wise 0.5 M NaOH to 0.2 M $AlCl_3.6H_2O$ by vigorous stirring to an OH/Al ratio of 2.4. At this hydrolysis ratio, Al_{13} is a major species in solution. The pillaring solution containing Al was added drop wise under vigorous stirring to a 1.0 wt % Na-bentonite suspension to a ratio of 20 meq Al/g bentonite. The slurry was aged overnight at room temperature and the clay was separated by filtration and washed with deionised water until the supernatant was chloride free as indicated by the $AgNO_3$ test. The solid was washed, dried at 60 °C and calcined at 450 °C in a furnace for 5 h. The aluminium pillared clay (Al-PILC) particles were sieved to obtain –80 +230 mesh size particle (average diameter 0.096 mm).

Results and Discussion

3.1. Adsorbent characterization

The FTIR spectra of PILC and HA-PILC are shown in Figure 1. The IR spectra of Al-PILC are as follows, the peak at 1044 cm^{-1} was attributed to Si-O-Si asymmetric stretching mode; the peak at 814 cm^{-1} and weak band at 684 cm^{-1} were assigned to O-Si-O asymmetric stretching; the asymmetric bending mode of O-Si-O peak at 457 cm^{-1} as reported in silicate system. The spectra due to HA-PILC shows characteristic peak at 1050 cm^{-1} is due to the deformation of alcohol -OH groups. The presence of carboxyl –COOH is readily identified from the band with a maximum at 1700-1720 cm^{-1}. The intensity of those bands is highly variable. But here in this spectra that band at 1700-1720 cm^{-1} disappears from the IR spectra and band appear at 1590 cm^{-1} due to the existence of humic acid in the ionized form, since humic acid is made a solution by dissolving it in NaOH solution. The peak at 510 and 445 cm^{-1} for humic acid PILC are due to the deformation oscillation of Si-O and Si-O-Al. Al-O-H bonding in both PILC and HA-PILC were confirmed by the presence of peak at 760 and 480 cm^{-1} for PILC and 750 and 470 cm^{-1} for HA-PILC.

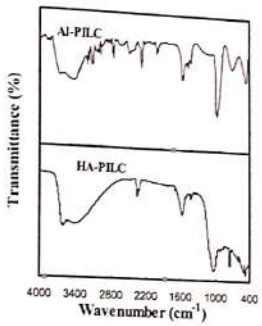

Figure 1. FTIR spectra of Al-PILC and HA loaded PILC

3.2. Effect of pH on humic acid removal

The effect of pH was studied by adjusting pH to different values in different flask. It is shown in figure 2 that increasing pH led to decreased uptake of humic acid by Al-PILC; the higher the pH values the lower the adsorption.

From the figure it is clear that the HA adsorption by PILC is pH dependent. Pillared clay exhibit maximum uptake at the pH of 3, above and below this pH uptake was considerably low. For an initial concentration of 15 µmol L^{-1} the % removal was found to be 90% (6.75 µmol g^{-1}) and for an initial concentration of 30 µmol L^{-1} the percentage removal was found to be 80% (12 µmol g^{-1}).

It has been reported previously that of humic-sorption on clay minerals are pH dependent. It is well known that humic substances are weakly dissociable acids; the ionization is heavily dependent on pH and can be described as follows.

$$HA + H_2O \rightleftharpoons H_3O + A^- \quad (1)$$

Increasing pH increases the ionization of humic substance and hence the concentration of negatively charged anion A^-. As Al-PILC is having a zero point charge of 4.2, above this pH of 4.2 the clay surface is negatively charged, the increasing electrostatic repulsion between A^- and clay particle would lead to reduced adsorption of humic substances. In addition, increase in pH increases the solubility of HA. This also means decreased uptake as there is a nearly inverse relationship involves sorbate solubility and its adsorbate potential.

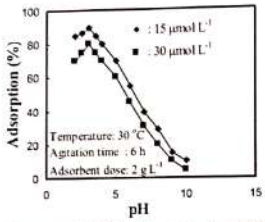

Figure 2. Effect of pH on the removal of Humic acid onto Al-PILC

3.2. Desorption studies

Application of PILC for the removal and recovery of humic acid from aqueous solutions may require that the adsorbent be regenerated efficiently so that the adsorbent can be reused. In the present study, attempts were made to regenerate the adsorbent as well as desorbed humic acid from the spent adsorbent using NaOH, since adsorption of humic acid is highly pH dependent. The total desorbed amount was calculated and compared to the initial sorbent amount. The percentage desorption increase with increase in pH and reaches 96% at pH 11.0., the results clearly show that the quantitative removal of HA from PILC and regeneration of the adsorbent can be done efficiently at higher pH. At alkaline medium OH^- ions compete with the adsorption sites and leading to desorption of negatively charged humic acid from Al-PILC. The results also indicate that HA is adsorbed by the adsorbent through physisorption.

4. Conclusions

Effect of surface modification was studied using Na-bentonite and Al-PILC for the adsorption of HA. It was observed that Al-PILC is 2.5 times more effective than Na- bentonite. Studies on the effect of pH on the removal of HA were conducted. The results showed that the adsorption capacity of HA by Al-PILC was dependent on pH. Adsorption is found to be maximum at a lower pH of 3.0. The spent adsorbent can be reused by alkaline treatment.

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Poster presentation

Adsorptive Removal of Acid Red from Aqueous Solution by Cationic Surfactant-Modified Bentonite Clay

* Manohar D. Mullassery, Noeline B. Fernandez

*Department of Chemistry, Fatima Mata National College, Kollam, Kerala, India

The aim of this work is kinetic and equilibrium study of the sorption of Acid Red (AR) from aqueous solutions under different experimental conditions using an adsorbent cationic surfactant modified bentonite clay. The effects of pH, initial concentration, contact time for the removal of AR were studied. The optimum pH for AR adsorption was found to be 3.0. The applicability of the data was analyzed by Langmuir isotherm equation. The maximum adsorption capacity was found to be 28.57 mg/g at 30 °C. Desorption of AR from the sorbed clay was achieved by eluting with 0.1 M NaOH.

Key words: bentonite, adsorption, kinetics, thermodynamic parameters, regeneration

* *Correspondence to:* Manohar D. Mullassery, *Department of Chemistry, Fatima Mata National College, Kollam-691001, India.*
Email: mdmullassery@gmail.com

Introduction

Presence of numerous dyestuffs with various chemical properties and adverse effects in surface and underground waterways has been concern of public people and government all around the world. The discharge of dye-bearing wastewater into environment natural waterway from textile, paper, leather, tannery, plastics and cosmetics is the first contaminants that are recognized. Due to the colour and turbidity associated with dyes, they are highly visible and cause damage to aesthetic nature of the environment [1-3]. Also these dyes may drastically affect photosynthetic phenomenon in aquatic life due to reduced light penetration [4, 5]. As a result, the removal of colour from waste effluents

has become environmentally important [6-8]. Dyes may also be problematic if they are broken down anaerobic in the sediment, as toxic amines are often produced due to incomplete degradation by bacteria [9]. Direct discharge of dyes laden wastewater into municipal wastewater plants or environment may cause the formation of toxic carcinogenic breakdown product. Today more than 9000 dyes are incorporated in colour index belonging to various chemical application classes. Water soluble anionic group of dyes are one of the most important group of dyes used in the textile dyeing industries, are used to dye fabrics like wool, nylon and silk. Present study investigates the possibility of removing acid red from aqueous solution using cationic surfactant-modified bentonite clays.

Various techniques have been employed for the removal of dyes from wastewaters. Due to low biodegradability of dyes a conventional biological treatment process is not very effective. Among other methods adsorption has been found to be superior to other techniques for wastewater treatment in terms of low cost, simplicity of design, and ease of operation and insensitive to toxic substances [10, 11]. Several wastes and residues have been investigated for the adsorption of dyes with varying success [12-15]. Therefore a new and promising class of adsorbent is needed for alleviating the problems caused by textile dyes. Recently adsorption due to clay has drawn much attraction due to its low cost, easy availability, possibility of enhanced adsorbabilities by surface modification.

Bentonite is a natural clay mineral that is found in many places of the world. Any clay of volcanic origin that contains montmorillonite is referred to as bentonite. It has a 2:1 configuration consisting of two silicon-oxygen tetrahedral sheets and one aluminium-oxygen-hydroxyl octahedral sheet. The adsorptive properties of bentonite can be improved by surface modification. Replacement of inorganic exchange cations with quaternary amine cations $[(CH_3)_2NHR]^+$, where R is large alkyl hydrocarbon chain, yield organo clays, with organophilic clay surfaces by simple ion-exchange resins. It is generally accepted that adsorption of hydrophilic long chain quaternary ammonium cations onto clays occurs according to the ion exchange mechanism [16, 17]. The extent of adsorption of such cations can approach double the cation exchange capacity. The vander Waal's hydrophilic interactions are suggested to operate in such cases and lead to

a bilayer of alkyl chains with positive charge exposed to the bulk of the solution [18]. Earlier workers [19-21] reported that the lyophilic tails from cations of long chain quaternary-ammonium salts, previously retained on the clay lead to adsorption of organics such as benzene, toluene, phenol and its chlorinated compound and herbicides. In the present study an attempt has been made to evaluate the removal of acid red (AR) using hexadecyltrimethylammonium chloride (HDTMA)-modified bentonite clay.

2. MATERIALS AND METHODS

2.1 Reagents

The natural bentonite clay, used in this study as a precursor material for the preparation of adsorbent was kindly provided by M/S Ashapura Clay Mines, Gujarat, India. The surfactant used for the present study was hexadecyltrimethylammonium chloride (HDTMA) with 99.0% purity was purchased from Aldrich Chemicals (U. S. A.) and was used as supplied. All the chemicals used in the adsorption were of analytical grade. The acid red (AR) was purchased from Aldrich-Sigma Chemie (Germany)

The experiments were conducted over a range of pH from 1.0 to 7.0 using 0.1 mol L^{-1} HCl and 0.1 mol L^{-1} NaOH. A stock solution of 1000 mg L^{-1} of AR was prepared by dissolving weighed quantity of AR in 1000 mL of solution.

2.2. Preparation of surfactant treated clay

The organobentonite was prepared by adding a quantity of the hexadecyltrimethylammonium e ($HDTMA^+$) cations equal to twice the CEC of the Na-bentonite. Twenty grams of Na-bentonite was added to 1000 mL of HDTMA solution (284 mg L^{-1}) and stirred for 6 h at 60 °C. The separated organobentonite was washed repeatedly to remove the water soluble particle and was filtered using Whatmann No. 42 filter paper. The product was dried at 70 °C for 24 h and was sieved between the particle size 80 and 230 mesh (average particle size 0.096 mm).

3. Results and Discussion

3.1. Adsorbent Characteristics

The FTIR spectra of Na-bentonite and organoclay are shown in Figure 1. The adsorption bands around 3625 cm^{-1} for Na-bentonite and 3620 cm^{-1} organo clay may be due to the presence of adsorbed or hydration water as well as hydroxyl groups of octahedra like Mg-OH-Al and Fe-OH-Al etc [22]. The presence of adsorbed water is

further confirmed by the presence of bands at 1650 cm^{-1} (H-O-H bending) for organoclay and 1645 cm^{-1} for Na-bentonite. A strong band is observed for Na-bentonite at 1050 cm^{-1} and at 1025 cm^{-1} for organoclay is caused due by vibration of Si-O or O-Si-O valence bonds. The additional peak at 1425 cm^{-1} in organoclay which is absent in Na-bentonite indicate the presence of C-N vibration in tertiary amine. This observation clearly indicates that the surface modification of Na-bentonite is achieved by surfactant.

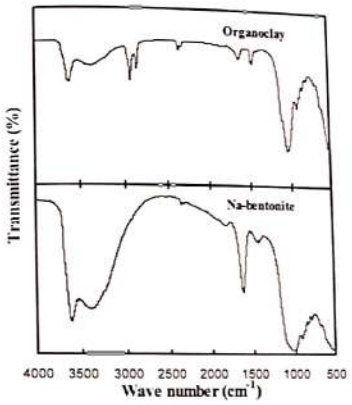

Figure 1. The FTIR spectra of Na-bentonite and organo clay

SEM micrographs show (Figure 2) surface morphology of Na-bentonite and organoclay samples. It can be seen that the Na-bentonite appears as corn flake like crystals with fluffy nature and curved plates like

Figure 2. SEM micrographs of Na-bentonite (A) and organoclay (B)

structures. However, the clay treated with organic surfactant shows significant changes in the morphology. Compared with the morphology of Na-bentonite, there are many small and aggregated particles and the plates become relatively cloudy in the case of organoclay.

The shape of a perfectly straight chain $HDTMA^+$ cations looks like a 'nail' and the chain end holding the three methyl group is the 'nail head'. When the $HDTMA^+$ cations lies stretched the length of the 'nail' is 25.3 Å consisting of the 'nail head' 4.3 Å and 'nail body' 21 Å. However the height of the $HDTMA^+$ cations will vary with its orientation. When the plane of the zigzag arrangement of carbon atoms of $HDTMA^+$ cations is perpendicular to the plane of the Na-bentonite layer the height of the 'nail body' is ~ 4.6 Å and that of 'nail head' is 5.1 Å. However the height of the 'nail body' and 'nail head' are 4.1 and 6.7 Å respectively, when the plane of the zigzag arrangement of carbon atoms of $HDTMA^+$ cations is parallel to the plane of the Na-bentonite layer. Since the increase in d-spacing is only 6.6 Å after surfactant treatment, this value implies that lateral monolayer arrangement of $HDTMA^+$ cations with in the interlayer space of Na-bentonite [23].

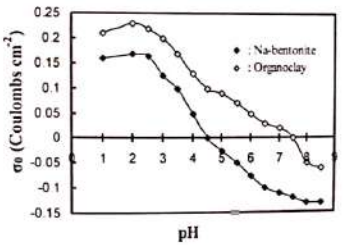

Figure 3. Potentiometric titration curves depicting the surface charge as function of solution pH

The zero point charge pH_{ZPC} is defined as the pH at which surface charge density (σ_o) is zero. The value of σ_o as a function of pH was calculated using the equation

$$\sigma_0 = \frac{F(C_A - C_B + [OH^-] - [H^+])}{A} \quad (1)$$

Where F is the Faraday's constant, C_A and C_B are the concentrations of strong acid strong base after each addition during titration. $[H^+]$ and $[OH^-]$ are the equilibrium concentrations of H^+ and OH^- ions respectively are bound to the suspension surface. 'A' is the surface area of suspension. The plots of σ_o versus pH for Na-bentonite and organoclay are shown in Figure 3. The point of intersection of σ_o with the pH curves gives the pH_{zpc} value of 4.2 and 7.6 for Na-bentonite and organoclay respectively. The increase in pH_{zpc} after surfactant treatment indicates that organoclay becomes more positive and organophilic.

3.2. Effect of pH

The pH is the most important factor affecting the adsorption process. To study the influence of pH in the adsorption capacity of prepared organoclay, experiments were performed using various initial pH varying from 2 to 10. The variation in the adsorption AR over a broad pH range of 2-10 is depicted in Figure 4. It is seen that the lower the pH, the higher the amount of AR adsorbed onto organoclay. The percentage removal of AR was found to be maximum at pH 3.0. Above and below this pH range the extent of uptake was found to be considerably low. At an initial concentration 100 and 200 μmol L^{-1} AR show 95.6% (47.8 μmol g^{-1}) and 82.2% (82.2 μmol g^{-1}) respectively.

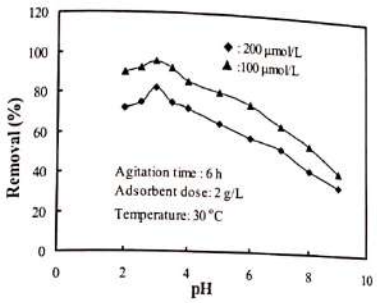

Figure 4. Variation of percentage of adsorption of acid red as a function of pH

Adsorption of acid red has also been found to be maximum at pH 3.0. The removal efficiency of AR decreases with increase in pH. Surface charge of the organoclay is a function of pH. The pH at which the net charge of the organoclay becomes zero is referred to as zeropoint charge (pH_{zpc}). Below the pH_{zpc} the surface has a net positive charge; above pH_{zpc} the surface has a negative charge. Since the pH_{zpc} of organoclay was found to be 7.6, below this pH, a significantly high adsorption between positively charged clay surface and negatively charged anionic dye. As the pH of the system increases, the number of negatively charged sites are increased, negatively charged site on the adsorbent does not favour the adsorption of anionic dyes due to the electrostatic repulsion [24]. In aqueous solution the acid dye is first dissolved and sulfonate groups of the acid dye (D-SO_3Na) are dissociated and converted into anionic dye ion. Also lower adsorption of AR at alkaline pH is due to the presence of excess hydroxyl ion competing with dye anion for the adsorption sites. Similar result was also reported for the adsorption of Acid red 114 onto activated carbon prepared from seed shell, which shows maximum adsorption at a pH of 3.0 [25].

3.3. Desorption and regeneration studies

To make the adsorption process more economical, it is necessary to regenerate the spent adsorbent. Desorption studies of the adsorbed acid red from spent adsorbent were also studied. The organoclay loaded with maximum amount of sorbates were tested using 0.1 M NaOH solution. The results of the multiple adsorption/desorption cyclic test to investigate the suitability of the organoclay are presented in Table 1. An efficiency of 92.2% desorption for AR obtained using 0.1 M NaOH and is therefore suitable for regeneration of sorbate from spent organoclay. The recovery percentage reduced to 87.3% for acid red at the end of fourth cycle. The small fraction of adsorbed solute not recoverable by regeneration, presumably represent the species, which is bound through strong interaction, and, as a result, sorption capacity is reduced in successive cycles.

Table 1. Four cycles of Acid red adsorption-desorption with 0.1 M NaOH as the desorbing agent.
(Adsorbent dose = 2 g L^{-1}; pH = 3.0; Equilibrium time = 6 h; Temperature = 30 °C; Initial concentration = 50 μmol L^{-1})

1	24.98	99.9	23.05	92.2
2	24.15	96.6	21.52	89.1
3	23.42	93.7	20.51	87.5
4	22.38	89.5	19.56	87.3

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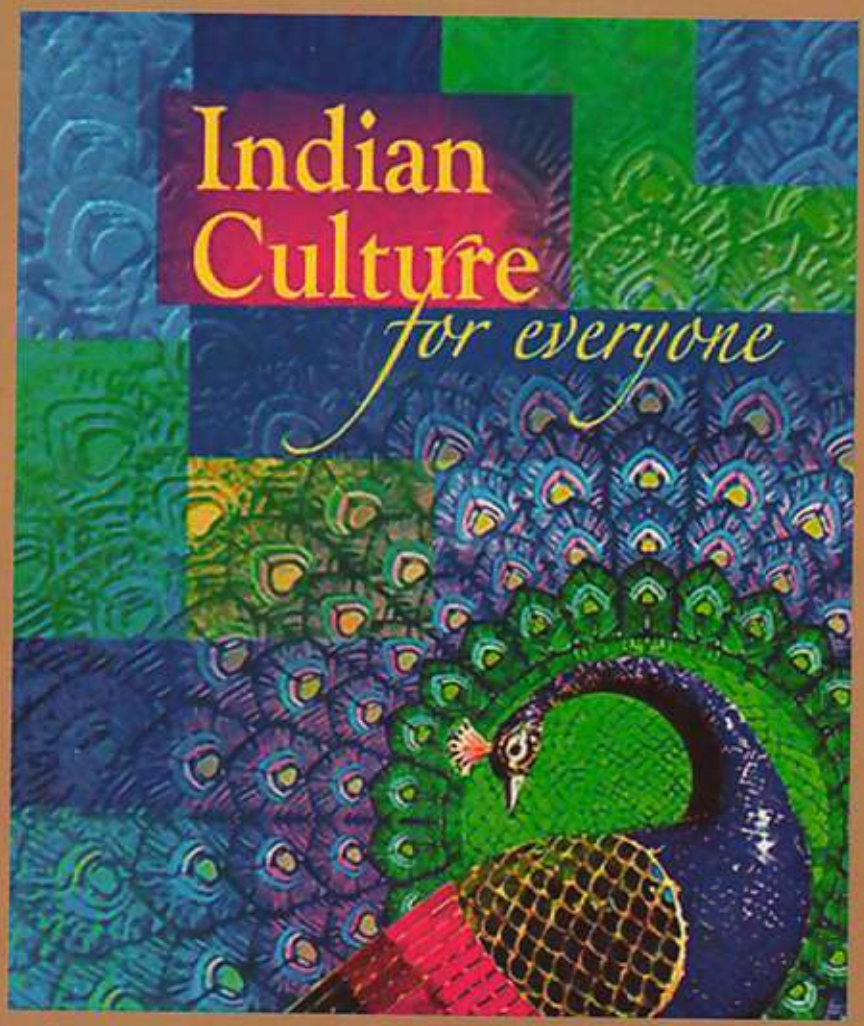

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INDEX

DOMINATION AND REINFORCEMENT OF POWER RELATIONS: AN ANTONIO GRAMSCIAN'S STUDY OF BAMA'S *KARUKKU*

Dr. Y. MERCY FAMILA
Assistant Professor, Department of English,
Fatima Mata National College, Kollam, Kerala.

In Indian culture and heritage, individualism, quest for identity, protests and concepts of rebelliousness have often remained alien ideas, as far as women are concerned. Women are not supposed to raise voices for their rights, protest against injustice or question the already existing beliefs, customs, rituals and superstitions. They have to merely exist subjected to the patriarchal system. Women have to be obedient, quiet, submissive, and passive not claiming any of their rights neither as women nor as human beings. Even the earlier Indian women novelists have been portraying woman as the silent sufferers, the upholder of traditional values and ethics, a strict observer of social taboos, an essence of tolerance and patience, an exemplar to their successors, a being with no space for herself, a woman without an identity (rather identified as subordinates to men), a worshipper of their counterparts, unfortunate and ignorant about their rights as human and so on. Recently, fortunately there is a tremendous change in this trend, with the advent of feminism. Indian women writers have brought incredible transformation to conform a specific genre to explore the unexplored array of maladies; to reveal the explicit reality of the society and the plights of Indian women in the society. Women are no longer characterized to surrender, submit and suffer to martyrdom. Women novelists unveil the hidden secrets and enfold the deliberate denials that are refutable in today's context. A whole band of women novelists beginning with Ruth Prawar Jhabvala, Nayantara Sahgal, Anita Desai, Sashi Deshpande, Kamala Markandaya and many others have highlighted significance of portraying woman as an individual rebelling against the traditional role, breaking the shackles of exploitation and oppression, awakening with a sense of identity, to assert their individuality. Their novels speak about women's frustrations, refusals, retaliations, and their breach of conventional expectations. The Dalit in India is one of such marginalized and excluded community lacking agency and power in society. There are numerous Dalit writers in India who work for the marginalized groups and the lower classes. And one such writer is Bama. Bama is a Tamil Dalit writer and Lakshmi Holmstrom's translation of her work *Karukku* established her as a distinct voice in Indian literature. Born in 1958 as Faustina Mary Fatima Rani (her grandfather had converted to Christianity) in a village called Puthupatti in Tamil Nadu (southern India), her landless ancestors and parents worked as laborers for the landlords. This paper focuses on Dalit women's struggle in Bama's *Karukku*.

Dalit literature is a writing that parallels the revolutionary movement spearheaded by Dr.B.P Ambedkar with a view to bring about psycho social transformations in the minds of the

oppressed. Dalit literature, a strong oppositional voice not only raises important questions but also narrate the ability of the people in the margins to fight against all odds and injustices. Bama's *Karukku*, the autobiography is a narrative of trauma, pain, resistance and atrocities committed on dalit Christian women. It is a document of poverty, violence, rejection and suffering and how the writer strives hard to overcome the problems. Bama, uses her pen like "Karukku" – a sharp edged weapon to cut the weeds of untouchables and patriarchy which have thickly grown over the centuries in this country. Bama's stories "Ponnuthayi", "Molahappodi" (chili powder) and "Samiyattam" (possessed by the Goddess), "Sangati" are powerful Dalit feminist stories which highlight the untold miseries of Dalit women and their indomitable courage to resist oppression. In spite of their subjugation to tyranny by their own men, upper-caste men and the brutal police force, these women possess a rare spirit and zest for life in addition to a free flow of earthy, pungent swear words. Dalit women have been the silent, suffering minority in the works of both upper-caste and Dalit male writer. Women are oppressed both by men from the upper caste and men from their own community. This twice-over oppression from caste and patriarchy has not drawn enough attention from male Dalit writer.

Robert Frost in his poem 'A Servant to Servants,' clearly articulates the feeling of being put at the back on the societal front as, "There is enough work to and there is always much work to do: But that is behind. The worst that you can do is set me back a little more behind. I can't catch up in this world, anyway." (07) It is this feeling of being behind the others is explored by the Dalit writers. Dalits are those people or groups who are located outside the hegemonic power structure in society. They are discriminated on various grounds and lack the basic rights and opportunities in society. Bama's writing of the book *Karukku* and her narration of the events from the lives of the Dalit women is an attempt to over throw the cultural hegemony of the upper-caste. The domination and reinforcement of power relations is termed hegemony. The term was first used in the non-Military sense by Marxist Antonio Gramsci (1881 to 1937), an Italian writer, to refer to any person or group of inferior rank and station, and can be employed in discussions of race, class, gender, sexuality, ethnicity and religion. Some thinkers use it in a general sense to refer to a person rendered without agency by his or her social status.

One of Gramsci's ideas was the concept of "hegemony," or ideological domination. When one ideology or world view, dominates, it suppresses or stamps out, often cruelly, any other ways of explaining reality. Actually, hegemony can contain a variety of ideologies. Some are artificial - theoretical explanations created by academics or political activists or philosophers. Other ideologies are "organic," which means they come from the common people's lived experience. These consist of a culture's way of seeing and believing, and the institutions that uphold these beliefs, like religion, education, family, and the media. Being illiterate dalits are the ones most exploited peripheral groups in the society. Dalit women is been sexually exploited, education is been denied to her and there is also caste race bias. Within her own family she is been alienated by the dominant male and are considered as mere objects for sexual satisfaction and for reproduction and are often defined in terms of the other. They have been labeled ugly, sluggish and

unintelligent. They have been often asked to identify themselves before others and undergo color test and are never treated with respect. It is the patriarchal division that defines woman as a marginalized creature.

Through these beliefs and institutions, society endorses the ethical beliefs and manners which "the powers that be" agree are true, or right, or logical, or moral. The institutions and beliefs that the dominant culture supports are so powerful, and get hold of people when they are so young, that alternative ways of envisioning reality are very hard to imagine. This is how hegemony is created and maintained. The significant aspect presented in the novel is the oppression of dalit Christians in the hands of the church.

Karukku depicts how the dalits are not allowed to sing in the church choir. There were separate schools in the same campus one for the rich, the elitist upper caste Christians and non Christians and the other for poor and dalit Christians.

According to Gramsci, hegemony locks up a society even more tightly because of the way ideas are transmitted by language. The words we use to speak and write have been constructed by social interactions through history and shaped by the dominant ideology of the times. Thus they are loaded with cultural meanings that condition us to think in particular ways, and to not be able to think very well in other ways. Gramsci's point is that we have been conditioned by our language to think — and feel about that thinking — in ways that serve the dominant ideology. And if that dominant ideology insists that poverty is the fault of the individual while systematically keeping certain groups or classes of people poor, that hegemony must be dislodged by substantive, revolutionary change.

This is seen in the novel when Bama retardates to the warden's comment. She exposes the prejudices based on caste leveled upon dalit children through the warden sister who could not abide low caste and poor children"these people get nothing to eat at home; they come here and they grow fat",(*Karukku*17). Bama retreats by saying "Why, is it impossible for the Harijan to study or what?"(19). "I knew I should not touch their goods or clothes. I should never come close to where they are... these were their rules" (46).The important thing is that her school was not the only institution that reeked casteism, but it was widespread everywhere. And when they returned to school after holidays the warden-sister would say:

> Look at the Cheri children! When they stay here, they eat their fill and look as round as potatoes. But look at the state which they come back from home-just skin and bone! (*Karukku*,18)

Bama reveals various forms of violent oppression unleashed on Dalits, specifically on the Paraiyar caste. When analyzed the caste system relegates these lower castes to a single strata of existence, portraying them as a single culture, despite their diversity of custom and beliefs. Religion/ society therefore treats the lower castes as a homogeneous, monolithic whole, stereotyping the people and their habits. The domination of the lower castes by the upper caste has been sustained by a body of rituals, literature, traditions and history. This represented the lower castes repeatedly as unclean and subhuman. Over the centuries of reiteration and self-reference, this created a system that to be accepted as 'common sense' and 'natural' by both the upper and lower castes.

According to Bama Dalit Literature is "Liberation literature like Black Literature, Feminist Literature and Communist-Socialist Literature" (86). Bama records her trials and tribulations in this novel as an individual, as a woman and as a writer. When she arrived at the college with just the clothes that she was wearing and admitted herself into the hostel, she felt deeply humiliated by her classmates where she went around in the same skirt, jacket and daavani for a whole week. She endured all the shame and humiliation and stayed on. Bama's re-reading of the Christian scriptures as an adult enabled her to carve out both a social vision and a message of hope for Dalits by emphasizing the revolutionary aspects of Christianity, the values of equality, social justice and love towards all. Her own life experience urged her towards activity engaging in alleviating the sufferings of the oppressed. Then she decided to become a nun and enter a convent and in that she work hard for other children who struggle as she had done. She discovers, however, that the perspectives of the convent and church are different from hers.

Gramsci adds another dimension to the definition of hegemony: domination by consent. It seems impossible that anyone would consent to be oppressed. And Bama states " When I saw our people working so hard night and day, I often used to wonder from where they get their strength..."(47)for her this is a community that was born to work. They laughed and remain cheerful even though they had to suffer lots of hardships. Their poverty and their manual jobs do not allow their children especially girls to go to school and receive education. We know that the rich are getting richer while the poor and the middle class are feeling less and less secure. We know, but we accept. "What can one person do?" we say. "The poor have always been with us." It's a fatalistic feeling we have, but Gramsci doesn't blame us for it. "Indeed," he says," fatalism is nothing other than the clothing worn by real and active will when in a weak position."(*Hegemony and Revolution: Antonio Gramsci's Political and Cultural Theory*. 81)

Gramsci believed that everyone, no matter what their occupation, their interests, or their education, is able to work out their own coherent ideas of how the world really works. Despite Gramsci's description of hegemony as society's brainwashing, he had great faith in people's ability to go beyond the mere acceptance of the ideas they grew up with and become critical thinkers. As Gramsci states Bama also feels that for the better survival of women, empowerment of women is necessary and it is possible only by irradiating inequality and untouchability, by empowering them through education and employment and by taking pride in their identity.

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Dr. Siji V L
Assistant Professor (Convener, ICEFCC-2014)
Department of Chemistry
All Saints' College, Chackai P.O.
Thiruvananthapuram-695007
Kerala, India
E- mail: sijivl@yahoo.com

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Non-Covalent Interactions in Structural Design: Peptides, Foldamers, and Beyond.

Gangadhar J. Sanjayan
Division of Organic Chemistry, National Chemical Laboratory, Pune 411008, India, Web: http://nclwebapps.ncl.res.in/gjsanjayan/index.html; *E-mail: gj.sanjayan@ncl.res.in.*

The folding and assembly of biomolecules, by means of a collection of non-covalent interactions, are two of the most important events observed in the world of biomolecular science. In an attempt to mimic the bio-machineries, synthetic oligomers were designed and developed. In this context, an area of research that has attained enormous attention in recent years is foldamers whose objective is the development of "conformationally ordered synthetic oligomers" mimicking the conformational features of biopolymers.[1]

The major thrust of our research focus is in the generation of conformationally ordered synthetic scaffolds capable of displaying diverse secondary structural features. Scaffolds with well-defined secondary structural preferences could, for example, be used to create new types of tertiary structures, which in turn may have medicinal applications, e.g., for disruption of specific protein-protein interactions. Over the last few years, we have been able to develop diverse classes of synthetic peptide structures displaying remarkable conformational ordering, as would be evident from their biophysical studies.[2] This talk will cover our efforts directed towards the generation of novel conformationally ordered synthetic oligomers.

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[2] For selected recent publications from our group, see: Sanjayan *et al: J. Am. Chem. Soc.*, **2013**, 135, 11477; *Chem. Commun.*, **2013**, *49*, 2222; *Chem. Commun.*, **2012**, *48*, 11205; *Chem. Commun.*, **2012**, *48*, 9747; *Chem. Commun.*, **2012**, *48*, 8922; *Angew. Chem., Int. Ed.* **2012**, *51*, 4006; *Chem. Commun.*, **2011**, 47, 11593; *Chem. Commun.*, **2009**, 3446; *Chem. Commun.*, **2008**, 712; *Chem. Commun.*, **2008**, 2541; *J. Am. Chem. Soc.*, **2008**, *130*, 17743.

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Removal and recovery of hexavalent chromium from aqueous solution by nitrated potato

Manohar D. Mullassery*, Noeline B. Fernandez[a], Soumya S. Pillai

Department of Chemistry, Fatima Mata National College, Kollam-691001, India

* *Correspondence to:* Manohar D. Mullassery, *Department of Chemistry, Fatima Mata National College, Kollam-691001, India.*

Email: mdmullassery@gmail.com

ABSTRACT: The aim of this work is kinetic and equilibrium study of the sorption of chromium(VI) from aqueous solutions under different experimental conditions using an adsorbent nitrated potato. The effects of pH, initial concentration, contact time for the removal of chromium(VI) were studied. The optimum pH for Cr(VI) adsorption was found to be 1.0. Kinetics for the removal of Cr(VI) was studied by using Lagergren rate plots. The applicability of the data was analyzed by Langmuir isotherm equation. The maximum adsorption capacity was found to be 28.57 mg g at 30 °C. Desorption of Cr(VI) from the sorbed carbon was achieved by eluting with 0.1 M NaOH.

Key words: Nitrated potato, adsorption, kinetics, thermodynamic parameters, regeneration

INTRODUCTION

The presence of heavy metals in the industrial effluents creates a major problem to their discharge in the surface water. Some metal ions do not degrade to harmless end product. Heavy metals like mercury, lead, cadmium, copper, chromium and nickel are toxic even in extremely minute quantities. Chromium is one of the toxic metals, is used in a variety of applications including steel production, electroplating, leather tanning, nuclear power plant, textile industries, water cooling and chromate preparation[1]. chromium occurs in aqueous system in both trivalent (Cr^{3+}) and hexavalent (Cr^{6+}) forms. The trivalent form is an essential nutrient on the other hand hexavalent form is toxic, carcinogenic and mutagenic in nature [2]. It is highly mobile in soil and aquatic system and also a strong oxidant capable of being absorbed by the skin [3]. The hexavalent form is 500 times more toxic than trivalent form [4]. Acute exposure to chromium(VI) causes nausea, diarrhea, liver and kidney damage, dermatitis, internal hemorrhage and respiratory problems [5]. Inhalation may cause acute toxicity, irritation and ulceration of nasal septum [6].Because of high toxicity the chromium content of the effluent should be reduced to below allowable limits before their discharge into surface waters. The allowable limit of hexavalent chromium in surface water is 0.05 mg l^{-1} [7].

A broad spectrum of effluent treatment technologies has been described in the literature. Various techniques have been employed for the treatment of pollutants, such as chemical precipitation [8], reverse osmosis [9], electrocoagulation [10], ion exchange [11] and adsorption [12] etc. Among the numerous techniques of pollutant removal, adsorption has been found to be superior to other techniques in terms of initial cost, simplicity of design and ease of operation. The removal of pollutants from industrial wastewaters using different adsorbents is currently of great interest and is becoming more important with the increasing of industrial activities.

The commercially available activated carbon in granular form is effective for the removal of various heavy metal ions. Due to the high cost of activated carbon prevent its use in developing countries like India. So there is a need to develop low cost and easily available adsorbent for the removal of heavy metal ions from wastewaters. An abundant source of potentially metal-sorbing biomass is cellulosic agricultural wastes. More recently, these byproducts have been shown to have potential as precursor material in the manufacture of activated carbon [13]. Such carbons may have the potential to replace existing carbons especially coal-based carbon used in many industrial applications.

The present study was aimed to explore the utility of nitrated potato as an adsorbent for the removal of Cr (VI) from aqueous solution.

MATERIALS AND METHODS

Reagents

All the chemicals used in the adsorption were of analytical grade. The stock solution of chromium(VI) was prepared from $K_2Cr_2O_7$ in distilled water. The experiments were conducted over a range of pH from 1.0 to 7.0 using 0.1 mol L^{-1} HCl and 0.1 mol L^{-1} NaOH. A stock solution of 1000 mg L^{-1} of Cr (VI) was prepared by dissolving 2.82 g of potassium dichromate in 1000 mL of solution. This solution was diluted as required to obtain the standard solutions containing 50-300 mg L^{-1} of Cr(VI). pH adjustment was carried out by using 0.5 N HCl and 0.5 N NaOH solutions.

Biosorbent preparation

About 5 g of finely powdered raw potato powder (RP) was soaked in 500 mL of 0.75 N Nitric acid over night. The oxidized product was washed thoroughly with double distilled water and dried to get nitrated potato (NP).

Equipments and methods of characterization

The pH and potential measurements were made using a digital microprocessor pH meter (Systronics model μ 362). Accurate weight of chemicals and adsorbent used in the study was taken on an electronic balance, Citizen CX 220, Germany. The FTIR spectra of the adsorbents were obtained using a Schimadzu FTIR model 1801. For kinetic and isotherm studies a Labline temperature controlled water bath shaker with a temperature variation of ± 1.0 °C was used. A potentiometric method was used to determine the pH of zero point charge (pH_{zpc}). The apparent density of the adsorbent was determined by specific gravity bottle. All the glasswares used in the study were of A-type Borosil glass.

Experimental procedure

Batch operation was employed for adsorption studies. To a series of 100 mL flasks, each containing 0.1 g of the adsorbent, added 50 mL aqueous Cr(VI) solution of desired concentration. The initial pH was adjusted to values ranging from 2.0 to 7.0 by using 0.1 M NaOH and HCl. The mixture was shaken in a temperature controlled flask shaker at 200 rpm for 1h. The mixture was then filtered and the filtrate was analyzed for final pH and final Cr(VI) concentration was determined spectrophotometrically by developing a purple- violet color with 1, 5- diphenyl carbazide in acidic solution as a complexing agent (APHA, 1985). The absorbance of the purple- violet colored solution was read at 540 nm with a spectrophotometer (Systronics UV-Visible spectrophotometer 2201) after 20 min. The FTIR spectra of the adsorbents were obtained using a Schimadzu FTIR model 1801. Surface morphology of the adsorbents was probed using a Philips XL 30 CP scanning electron microscope. Adsorption studies were carried out by varying the adsorbate concentration (10-400 mg L^{-1}), the agitation time (1-60 min), adsorbent amount (0.5-4.0 g L^{-1}) and adsorption temperature (30, 40, 50 and 60 °C) at the pH of maximum adsorption efficiency. The amount of adsorption (q_e) was calculated by Eq.1,

$$q_e = \frac{C_o - C_e}{m} V \quad (1)$$

where C_o and C_e are the initial and equilibrium Cr(VI) concentrations respectively. V is the volume of the solution and m is the amount of adsorbent used. All the experiments were carried out in triplicate and the mean values are presented. The maximum variation with batch adsorption data among triplicate values was 4.4%.

Desorption studies

Batch process was used for desorption studies. A 0.1 g adsorbent each was taken in four 100 mL standard flasks. Each flask was treated with 50 mL of 10 mg L^{-1} Cr(VI) solution. After adsorption (1 h) the solution was filtered and percentage adsorption was recorded. Adsorbent was then thoroughly washed several times with distilled water to remove any excess of Cr(VI). To the four flasks (containing the adsorbent after adsorption) added 0.1, 0.01, 0.001 and 0.0001 M NaOH respectively. After 2 h shaking the solution was filtered and analyzed for Cr(VI) concentration. Thus the amount of Cr (VI) desorbed was determined. The same procedure was repeated for four cycles.

RESULTS AND DISCUSSION

Characterization of the adsorbent

The FTIR spectra of (400-4000 cm^{-1}) of raw potato (RP), nitrated potato (NP) and Cr- treated potato (Cr-NP) were plotted in Fig. 1. The broad and intense peak at 3381 cm^{-1} corresponds to the O-H stretching vibration of hydroxyl groups and adsorbed water. The peak at 2929cm^{-1} is due to symmetric and asymmetric stretching vibration of aliphatic acids (Li et al., 2007). The peak observed at 1661 cm^{-1} is due to the asymmetric vibration of C=O in ionic carboxylic groups. FTIR spectrum of oxidized starch show the presence of two absorption bands at 1743 and 1379 cm^{-1}. The peak round 1646 cm^{-1} had been slightly disappeared from the Cr(VI)- loaded nitrated potato, while a peak at 1631 cm^{-1} became larger. This result suggested that the carboxyl groups were involved in the binding of chromium during biosorption.

(a)

(b)

(c)

Fig. 1: FTIR spectra of (a) raw potato (b) Nitrated potato (c) Cr treated nitrated potato

Effect of pH

In the present study, nitrated potato was used as an adsorbent for the removal of Cr (VI) from the aqueous solution. The metallic ion uptake on nitrated potato mainly depends on the pH, ions concentration and amount of adsorbent. The solution pH played a major role in the adsorption of Cr(VI) and it could be related to the type and ionic state of the functional group present on the adsorbent surface [11]. At an initial pH value of 1, the percentage removal of Cr (VI) from the aqueous solution was 96.84% for initial metal concentration of 50 mgL^{-1}. Within the solution pH range of 1.0-6.0, the different forms of chromium ions, such as Cr_2O^{-}, $HCrO_4^-$, $Cr_3O_{10}^{2-}$, $Cr_3O_{13}^{2-}$ of which $HCrO_4^-$ predominates. At lower solution pH value the increase in Cr(VI) adsorption was due to the electrostatic attraction between positively charged adsorbent surface and the $HCrO^{3+}$. The adsorbent surface above pH 3.5 is negatively charged. Thus the electrostatic repulsion between the negatively charged Cr(VI) species and negatively charged adsorbent particles is increased. This led to a decrease in the Cr(VI) adsorption. Another possible reason for the higher adsorption of Cr(VI) on nitrated potato could be the reduction of Cr(VI) to Cr (III) in acidic medium. At low pH, the presence of ions in solution was high which caused the reduction of Cr(VI) to Cr(III) ions.

$$HCrCO_4^- + 7H^+ + 3e^- \rightarrow Cr^{3+} + 4H_2O \quad (2)$$

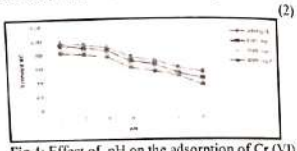

Fig.4: Effect of pH on the adsorption of Cr (VI) using nitrated potato (Initial metal concentration (C_0) =50mgL^{-1}, adsorbent amount = 10 gL^{-1}, pH = 1, temperature(T)=30°C, contact time (t) =2hrs).

Adsorption isotherm study

Experimental equilibrium data were applied to Langmuir, Freundlich and Tempkin isotherm models. The Langmuir isotherm was a monolayer sorption on a surface containing a finite number of binding sites. It assumed uniform energies of sorption on the surface and no transmigration of sorbate in the plane of surface. The linear form of Langmuir equation was:

$$\frac{C_e}{q_e} = \frac{1}{Q^o b} + \frac{C_e}{Q^o} \quad (3)$$

q_e was the equilibrium amount adsorbed (mg g^{-1}), C_e the equilibrium concentration of the adsorbate (mg L^{-1}), Q^o and b were the Langmuir constants related to the adsorption capacity and energy of adsorption.

The Freundlich isotherm theory explained the amount of solute adsorbed onto a given mass of sorbent at different solute concentrations. The linear form of the equation was:

$$\log q_e = \log K_f + \frac{1}{n}\log C_e \quad (4)$$

where K_F and 1/n were Freundlich constants related to adsorption capacity and intensity of adsorption.

The linear form of Tempkin equation was given by,

Table 1: Isotherm constants and regression data for adsorption of Cr(VI) on nitrated potato

Sl. No	Adsorption isotherm	Isotherm parameters		R^2
1	Langmuir	Q_m	28.57	0.982
		b	0.081	
2	Freundlich	K_F	4.063	0.997
		1/n	0.442	
3	Tempkin	A_T	1.875	0.960
		B_T	4.741	
		b_T	531.35	

$$q_e = B_T \ln A_T + B_T \ln C_e \quad (5)$$

Where A_T and B_T were Tempkin isotherm constants. The estimated parameters of these models have been evaluated by regression analysis (Table 1).

The mechanism for the interaction of Cr (VI) on the adsorbent site was based on the adsorption isotherms. It was characterized by certain constants which provide information about the surface properties and the affinity of adsorbent towards Cr (VI). In Langmuir isotherm, R^2 value of 0.982 indicated the monolayer adsorption of Cr (VI) onto the adsorbent surface. The adsorption favorability was found in the range of 0.039 and 0.197 ($0<R_L<1$). According to McKay et al. (1982), R_L values between 0 and 1 indicated favourable adsorption. The values of Freundlich coefficient, 1/n, 0.442 represented the deviation from linearity of adsorption. The Freundlich coefficient of 4.063 indicated the relative adsorption capacity of the adsorbent related to the bonding energy. Tempkin isotherm account for the adsorbent-adsorbate interactions. Considering the overall adsorption process and the values of regression analysis (R^2) (Table 2) Freundlich was the best fit model to explain the adsorption isotherm data.

Regeneration studies

Regeneration studies were done with four different concentrations of NaOH (0.1, 0.01, 0.001 and 0.0001 mol L^{-1}) because the adsorption of Cr(VI) onto the nitrated potato was highly pH dependant. The desorption efficiency was found to be maximum with 0.1 mol L^{-1} NaOH. The four cycles of adsorption–desorption are shown in Table 2. Even after four cycles, the adsorbent displayed not only good adsorption capacity, but also good recyclability. The adsorbent was found to be very stable during the regeneration study in the sense that adsorption-desorption processes did not alter the physical and chemical characteristics of the adsorbent. A slight loss in the amount of adsorbent was noticed during the study, may be due to the personal error occurred which was sometimes inevitable during experiments.

Table 2: Four cycles of Cr(VI) adsorption – desorption with 0.1M NaOH.

Cycles	Adsorption (%)	Desorption (%)
1	96.85	98.2
2	94.65	92.12
3	88.4	90.82
4	83.34	85.15

CONCLUSION

The prepared nitrated potato has much potential as an efficient and useful adsorbent for the removal of Cr (VI) from aqueous solution. The extent of adsorption dependent on process parameters such as pH, initial concentration of Cr (VI), biosorbent dosage and contact time. The maximum percentage removal of Cr (VI) is obtained at pH 1. The percentage removal of Cr (VI) increases with the increase of adsorbent amount and the adsorption capacity of the nitrated potato decreases because of the availability of more unsaturated adsorption sites. Langmuir, Freundlich and Tempkin models are used to analyse the adsorption isotherm. Among the various desorbing agents tested, 98.2% chromium recovery was achieved with 0.1 $molL^{-1}$ NaOH. Results obtained from the present investigation revealed that, nitrated potato is an effective adsorbent for removing Cr(VI) from aqueous solution.

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OP-22
Removal and recovery of Cobalt(II) Ions from Industry Wastewaters Using a Cation Exchanger Prepared from Agriculture residue

Noeline B. Fernandez*, Manohar D. Mullassery
Department of Chemistry, Fatima Mata National College, Kollam-691 001, India
E-mail: fernandeznocline@gmail.com

Abstract
Environmental pollution and its abatement have drawn keen attention for a long time. The problem of removing pollutants from water and wastewater has grown with rapid industrialization. Formaldehyde polymerized banana stem (FPBS) having sulphonic acid groups was investigated as an adsorbent for cobalt (II) removal from aqueous solutions. The outstanding function of the adsorbent was demonstrated at pH 6.0. The adsorption efficiency of FPBS was compared with BS and the result showed that FPBS was found to be two times more effective than BS for cobalt (II) removal. The maximum recovery of 97.3 and 90.3% for 10 and 25 mg L^{-1} initial concentrations were obtained at pH 6.0. 96.6% cadmium recovery was achieved with 0.1 M HCl. The uptake efficiency of cobalt(II) by FPBS was determined. Repeated adsorption-desorption study showed that FPBS can be used as an adsorbent for the removal and recovery of Co(II) from aqueous solutions.

Keywords: Banana stem; cobalt(II); Adsorption; Regeneration

Introduction

Cobalt, a natural element present in certain ores of the earth crust is essential to life in trace amounts. It exists in the form of various salts. Pure cobalt is an odourless, steely-gray, shiny, hard metal. An average of 2 g dm^{-3} in drinking water has been estimated. Cobalt has both beneficial and harmful effects on health. Important natural sources are soil, dust and sea water. Cobalt and its salts are used in nuclear medicine, enamels, and semiconductors, grinding wheels, painting on glass and porcelain, hygrometers and electroplating; as a foam stabilizer ion beer, in vitamin B12 manufacture, as a drier for lacquers, varnishes and paints, and as a catalyst for organic chemical reactions. The permissible limits of cobalt in the irrigation water and livestock watering are 0.05 and 1.0 mg dm^{-3}, respectively.

The effect of acute cobalt poisoning in humans are very serious, among them are asthma like allergy, damage to the heart, causing heart failure, damage to the thyroid and liver. Cobalt may cause mutations (genetic changes) in living cells. Exposure to ionizing radiation is associated with an increased risk of developing cancer. Some isotopes of cobalt do emit ionizing radiation. With a better awareness of the problems associated with cobalt, research studies related to the methods of removing cobalt from waste water have drawn attention increasingly.

The increased use of cobalt(II) in nuclear power plants and in many industries such as mining, metallurgical, electroplating, paints, pigments and electronic industries have resulted in cobalt(II) finding its way to the natural bodies of water. The tolerance limit of cobalt(II) in potable water has been fixed as 0.05 mg L^{-1}[1].

The removal of toxic heavy metals at very low concentrations from water can be readily accomplished by adsorption method. Adsorption process has many advantages over other methods including recovery of metal value, selectivity, sludge free operation, cost effectiveness and meeting of strict discharge specifications. A number of adsorbents such as activated carbon[2],biosorbent[3], cation exchange resin4, clays [5,6] have been used for cobalt ions removal. Among these materials, agricultural byproducts and biomass showed very high adsorption capacities. However, the applicability of these materials has been found to be limited due to leaching of organic substances such as lignin, tannin, pectin and cellulose into the solution. To overcome such problems, chemical treatment on solid adsorbents has been used as a technique for improving physical and chemical properties of them and to increase their adsorption capacity. Banana stem is another commonly available and abundant natural material. Besides its utility in preparing banana fibre with good strength and lustre, any attempt to find a better alternative for the use of banana stem it would be another milestone in our march towards economic development. In the present study a new adsorbent material prepared from banana stem has been employed for the removal of cobalt(II) from wastewater. The main objective of this preliminary study is to investigate the feasibility of using formaldehyde polymerized banana stem with sulphonic acid functionality in removing these metal ions from water and wastewater.

Experimental

Materials

The starting material banana stem BS (pseudo stem of Musa Paradisiaca L.) for the preparation of adsorbent was obtained locally. All the chemicals used to prepare reagent solutions were of analytical reagent grade. The stock solution of Co(II) was prepared by dissolving anhydrous co(II) chloride (Fluka, Switzerland) in distilled water. The metal ion solutions having concentrations 10-400 mg/l were prepared by diluting the stock solution with distilled water and used for adsorption experiments. Constant ionic strength (0.01 M NaCl) was used in all experiments.

The pseudo stem of Musa paradisiaca L. was used for the preparation of the adsorbent. The material was washed several times with distilled water to remove surface impurities and dried at 80 °C. Banana stem (BS) basically contains α-cellulose, hemicellulose and lignin which were determined using the method described by Ott and were found to be 43.3, 20.6 and 27.8%, respectively. The dried sample was ground in order to increase the surface area and sieved to ~80 ÷ 230 mesh size. Two parts of the BS powder was treated with 20 parts of 0.2 N H_2SO_4 and five parts of 39 % HCHO. The reaction mixture was then kept in an air oven at 50 °C for 6 h and occasionally stirred. The product, formaldehyde polymerized BS (FPBS) was washed several times with distilled water and dried at 60 °C. The polymer content of the FPBS was determined using standard method and was found to be 31.9%. The dried sample of FPBS was sieved and the fraction with average particle diameter of 0.096 mm was collected and used for all the experiments.

Batch adsorption experiments

Batch adsorption experiments were conducted to determine the pH range at which the maximum adsorption of Co(II) would take place on FPBS. To a series of 100 ml flasks, each containing 0.1 g of the adsorbent, added 50 ml aqueous solution of Co(II) of desired concentration. The initial pH was adjusted to values ranging from 2.0 to 9.0 using 0.1 M NaOH and 0.1 M HNO_3. The flasks were shaken at 200 rpm for 2 h using a temperature controlled water bath shaker. The contents of the flasks were filtered through filter paper and the filtrate was analyzed for final Co concentration spectrophotometrically at a λ_{max} of 316nm. The amount of Co(II) adsorbed was calculated by the following equation

$$q_e = \frac{(C_o - C_e)V}{w} \quad (1)$$

Where C_o and C_e are initial and concentrations at different time intervals of Co(II) respectively. V is the volume of the solution and m is the amount of adsorbent used.

Adsorption isotherm experiments were performed by agitating 0.1 g of the adsorbent with 50 ml of varying concentrations of Co(II) at 30 °C. The initial pH of suspension was adjusted to 6.0, the optimum pH. After shaking for 2 h, the contents of the flasks were filtered and the filtrate is analyzed for Co(II) concentration.

Desorption studies

Batch process was used for desorption studies. A 0.1 g adsorbent each was taken in four 100 ml standard flasks. Each flask was treated with 50 ml of 10 mg/l Co (II) solution. After adsorption (1 h) the solution was filtered and percentage adsorption was recorded. Adsorbent was then thoroughly washed several times with distilled water to remove any excess of Co(II). To the four flasks (containing the adsorbent after adsorption) added 0.1, 0.01, 0.001 and 0.0001 M HCl respectively. After 2 h shaking the solution was filtered and analyzed for Co(II) concentration. Thus the amount of Co(II) desorbed was determined. The same procedure was repeated for four cycles.

Results and Discussion

Adsorbent characterization

The FTIR spectra of BS and FPBS (400-4000 cm^{-1}) are plotted in Fig. 1. The strong asymmetric absorption band at 3340 cm^{-1} for BS is attributable to the sum of the contribution from adsorbed water and hydroxyl groups from polyphenols originally present in BS. The IR exhibits weak absorption peak at 2923 cm^{-1}, characteristic of the C-H stretching vibrations of the cellulose and hemicellulose. The strong bands at 1519 cm^{-1} and 1209 cm^{-1} are due to the aromatic C=O and C-O stretching vibrations of the lignin component, respectively. The band characteristic to β-glycosidic linkage appears at 885 cm^{-1}.

The FTIR spectrum of FPBS shows a broad peak centered at 3400 cm^{-1} is attributed to the overlapped bands arising from sulphonic acid hydroxyl and free phenolic and alcoholic hydroxyl groups in the BS matrix. Additional peaks at 1169 cm^{-1} (ν_{as} SO_3), 1027 cm^{-1} (ν_s SO_3) and 602 cm^{-1} (ν_s S-O) show the presence of -SO_3H groups in the FPBS. The peak at 1742 cm^{-1} ($\nu_{C=O}$) along with

another peak at 1458 cm^{-1} (ν_{C-O}) indicates the presence of carboxylic acid groups in the FPBS.

Effect of pH

The effect of pH on Co(II) adsorption is illustrated in Figure 2.Adsorption of Co(II) by FPBS is compared with cobalt hydroxide precipitation by NaOH. The Co(II) adsorption increase between 2 and 6, attains a maximum value around 6.0 and does not change considerably for higher pH values. With an increase of pH of the solution from 2.0 to 6.0, the removal capacity increased from 5.0 to 99.8% and 3.0 to 87.0% at an initial Co(II) concentration of 10 and 25 mg l^{-1} respectively. It can be seen that at any pH, in the range 7.0-9.0, Co(II) removal by adsorption onto FPBS is very much greater than the removal by hydroxide precipitation observed in the absence of adsorbent. At an initial Co(II) concentration of 10 and 25 mg l^{-1} the onset of precipitation of $Co(OH)_2$ is at pH 7.5 and 8.0 respectively, and this complicates the removal of Co(II) ions by adsorption. It is known that the increase of pH decrease the competition between the protons and the metal ions for surface sites and results in increased uptake of metal ions by the FPBS.

The equilibrium species distribution of Co(II) (Huang et al., 1985) as a function of solution pH shows that the chemical precipitation of cobalt hydroxide occurs around pH 8.0. Co^{2+} remains as the prevailing species up to pH value of 8.0 thereafter $Co(OH)^+$ and $Co(OH)_2$ starts to form. Experimental results show that the final pH is always less than initial pH. When the initial pH of the reaction mixture varied between 5.0 and 8.0, the final pH of the reaction mixture remained between 4.5 and 7.4 and 4.2 and 7.1 for an initial concentration of 10 and 25 mg l^{-1} respectively. This indicates that cation exchange is a primary retention mechanism for cobalt (II) species at optimum pH range.

Co^{2+} ions are bound on the FPBS, H^+ ions from the peripheral $-SO_3H$ and $-COOH$ groups are released into the solution and it leads to the conclusion that FPBS probably acts an acid-form ion exchanger.

$$2H\text{-FPBS} + Co^{2+} \rightleftharpoons (FPBS)_2Co + 2H^+$$

Test with simulated nuclear power plant coolant water

Two simulated Co(II) nuclear power plant coolant water samples (Rengaraj and Moon, 2002) were also treated with FPBS to demonstrate its adsorption potential and utility in removing metal ions from wastewater in presence of other ions. The composition of the two samples of simulated nuclear power plant coolant water is provided in Table 1. Almost complete removal (100%) of Co(II) ions from 50 ml of wastewater samples containing 1 and 10 mg l^{-1} was possible with 50 and 100 mg FPBS respectively; which is in good agreement with that obtained from the batch experiments as mentioned above. The efficiency of the adsorbent for the adsorption of Cr(III) and Ni(II) ions present in coolant water was also studied. The results clearly show that FPBS can also be used to remove Cr(III) and Ni(II) ions from waste streams.

Desorption Capacity and Recyclability

Recyclability of an adsorbent is of crucial importance in industrial practice for metal ion removal from wastewater. To test the suitability and stability of the adsorbent, it was subjected to successive adsorption and desorption cycles. The procedure was carried out using 50 ml each of 0.001, 0.01, 0.1 and 1 M HCl as elution solutions. Regeneration was found to be very effective with 0.1 M HCl for Co(II) ions. The adsorbent was washed with water before each measurement. The results in Table 2 clearly show that FPBS can be used repeatedly without significantly loosing the adsorption capacity for metal ions. The percentage adsorption/desorption values were calculated in relation with the original amount of the adsorbent. At the end of the four adsorption-desorption cycles, the recovery and removal were little decreased.

Conclusions

The presence of heavy metals in the environment can be detrimental to a variety of living species including man. Copper is one of the toxic metals affecting the environment. Batch adsorption operations were carried out with formaldehyde polymerized banana stem to remove cobalt ions to large range of concentrations (10-400 mg l^{-1}). The optimum pH of 6.0 for Co(II) removal using FPBS is in accordance with reported values. The results also showed that FPBS has the potential of holding heavy metal ions like cobalt(II) from nuclear power plant coolant water in presence of other ions. Regeneration study was done with different concentrations of HCl and the desorption efficiency was found to be maximum with 0.1 M HCl.

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starts only after 2.5kGy. In 5MA-g-NR nanocomposites, the initation of crack is developed only after 7hrs and also the crack is least for 5wt% nanoclay loading. **It is** understood that 5MA-g-NR nanocomposites up to 5wt% clay content are less prone to ozone irradiation which indicates that the proper dispersion of clay in the rubber matrix is up to that level. The flame retardant properties of 5 MA-g-NR nanocomposites at 5wt% and 3wt% nanoclay shows V-2 rating according to U-L94 protocol. From the DSC thermogram it is clear that the Tg value is increased as the clay loading is increased. In general the maleated samples show higher Tg values compared to NR nanocomposites.

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A Novel Iron(II) complex derived from Acetone-N(4)-phenyl Semicarbazone: Synthesis and Crystal Structure.

Sarau Devi.A* and Reena Ravindran

Department of Chemistry, Fatima Mata National College, Kollam

Department of Chemistry, S.N College, Chempazhanthy, Trivandrum **PP-22**

Abstract

The molecular and crystal structure of acetone-N(4)-phenyl semicarbazone (apsH) with Fe(II) obtained after reducing Fe(III) to Fe(II) *in situ* using methanolic solution of hydroxylamine hydrochloride was determined by single-crystal X-ray diffractometry.

Keywords: acetone-N(4)-phenyl semicarbazone,; Fe(II) complex, X-ray study.

1. Introduction

Semicarbazones possess good chelating property and ability to act either as a neutral ligand or as a deprotonated anion in its metal complexes with different structural features. In solid state it predominantly exists in the keto form, whereas in solution state, it exhibit keto-enol tautomerism. Keto form act as a neutral bidentate ligand and enol form deprotonate and serve as monoanionic bidentate ligand in metal complexes. The coordination mode is influenced by the number and type of substituents. Studies of semicarbazones and their metal complexes gain interest because of their chemical and biological applications[1].

2. Experimental

N(4)-phenylsemicarbazide (Sigma–Aldrich) and acetone (Merck), $Fe(NO_3)_3.9H_2O$ (Sigma-Aldrich) were used as received without further purification.

2.1. Synthesis of $[Fe(apsH)_2(CH_3OH)_2](NO_3)_2$

To a hot methanolic solution of $Fe(NO_3)_3.9H_2O$ (0.404 g, 1mmol) was added a methanolic solution of $HONH_3^+Cl^-$ (0.25M, 5 mL; in 0.25 M, 5 mL HCl) with constant stirring for 30 minutes [2]. To this solution semicarbazone, (apsH) (0.382g, 2 mmol) in 20 mL of methanol was added and refluxed for 3h. An yellow precipitate obtained was filtered, washed with methanol and finally with ether and dried over anhydrous $CaCl_2$. The single crystal of the complex, $[Fe(apsH)_2(CH_3OH)_2](NO_3)_2$ suitable for X-ray diffraction were grown from methanol.

2.2. X-ray crystallography

The crystallographic data were collected using Bruker axs Kappa apex 2 CCD diffractometer, equipped with a graphite crystal incident beam monochromator and a fine focus sealed tube Mo Kα (λ=0.71073) X-ray source at the SAIF, Indian Institute of Technology, Madras, India. The SMART program[3] was used for collecting frames of data, indexing the reflections and determination of lattice parameters, the SADABS program was used for absorption correction and the SHELXL-97 program for space group. The structure was solved by direct methods using SHELXS and refined by full-matrix least-squares refinement on F^2 using SHELXL-97[4]. Molecular graphics employed were ORTEP-III and MERCURY 2.4.

3. Results and discussion

The principal ligand acetone-N(4)-phenylsemicarbazone, (apsH), which is formed by direct condensation of N(4)-phenylsemicarbazide with acetone in methanol medium, was used for the synthesis of coordination complexes. During the synthesis of complex $[Fe(apsH)_2(CH_3OH)_2](NO_3)_2$, ferric(III) nitrate was reduced using hydroxylamine in acidic pH.

3.1. Crystal structures of $[Fe(apsH)(CH_3OH)_2](NO_3)_2$

The compound possesses a distorted octahedral geometry with two semicarbazone ligands (apsH) occupying four equatorial sites and two methanol molecules occupying the apical positions. The principal ligand apsH, behave as neutral bidentate N, O donor, coordinating *via* its carbonyl oxygen and azomethine nitrogen, resulting in five membered chelate ring [Fe1-N3-N2-C7-O1]. Two apsH ligands coordinate with same intraligand bite angle of 76.90° each, around iron(II) atom in the basal plane, while apical positions are occupied by methanol molecules at a distance of around 2.11 Å, almost orthogonal (91.9°) to the main plane

The bond angles of O(1)-Fe(1)-O(1), O(2)-Fe(2)-O(2), N(3)-Fe(1)-N(3) are 180°, so the complex is centrosymmetric with respect to the coordinated ligands with Fe(II) situated on an inversion centre. The adjacent units are interconnected through H-bonding interactions involving O(4) and O(5) of the nitrate group with H(1N) and H(2N) of phenyl semicarbazone and H(2O) of methanol molecule. This nitrate group act as a bridge between molecules, in a one dimensional arrangement In the crystal structure, the complex molecules are arranged in face centered cubic lattice with nitrate ions interpenetrating the voids.

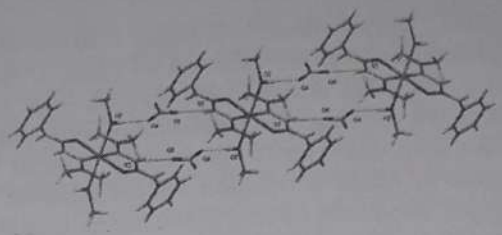

Figure 1. *Brigding nitrate groups in one-dimensional arrangement*

Conclusion

The ligand acetone-N(4)-phenylsemicarbazone (apsH) was coordinated in neutral bidentate manner. Fe(III) has successfully reduced to Fe(II) before complexation, which is proved by X-ray diffraction studies. Intermolecular hydrogen bonding and other weak interactions contribute stability to the crystal. The Fe(II) complex exhibit a distorted octahedral geometry.

Acknowledgements

The authors are thankful to Dr. Babu Varghese, SAIF, IIT Chennai, India for single crystal xrd studies. One of the authors Sarau Devi.A is grateful to University Grants Commission, New Delhi, India for financial support.

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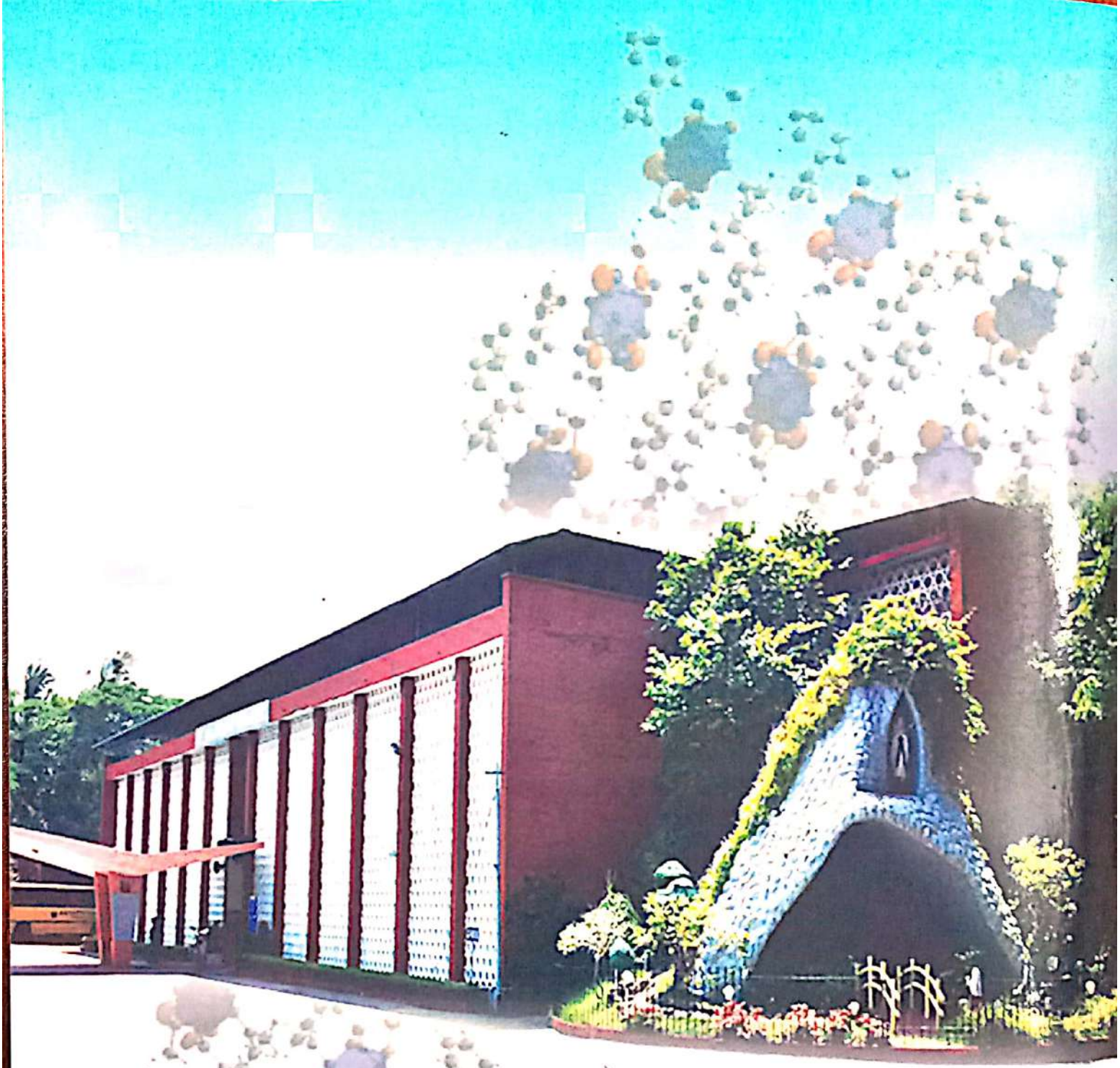
Luminescence Properties of Rare Earth doped Calcium and Strontium Aluminate

Resmi G Nair*, Jayasudha. S and Dr. K. Madhukumar

Dept. of Physics, Mahatma Gandhi College, Thiruvananthapuram-695004.

PP-23

Abstract: Many aluminates have been employed as host materials for phosphors by doping rare earth elements. In this work Thermoluminescent (TL) and Photoluminescent properties of Calcium and strontium aluminates, doped with Rare earths in varying concentrations, via combustion method have been studied systematically. All samples were examined by X-Ray diffraction to ascertain phase



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Contents

Microwave Assisted Green Chemistry Synthesis of Polymer Grafted Banana Stem for the Environmental Remediation

Noeline B. Fernandez*, Manohar D. Mullassery, Surya R., Jasmine J, Chimmu S.

Department of Chemistry, Fatima Mata National College, Kollam, Kerala, India

ABSTRACT

The aim of this work is equilibrium study of the sorption of crystal violet (CV) from aqueous solutions under different experimental conditions using an adsorbent glycidyl methacrylate grafted banana stem (GM-BS). The adsorbent has been characterized using IR. The effects of pH for the removal of CV was studied. The optimum pH for CV adsorption was found to be 10.0. Desorption of CV from the sorbed clay was achieved by eluting with 0.1 M HCl.

Key words: banana stem, adsorption, kinetics, regeneration

INTRODUCTION

Presence of numerous dyestuffs with various chemical properties and adverse effects in surface and underground waterways has been concern of public people and government all around the world. The discharge of dye-bearing wastewater into environment natural waterway from textile, paper, leather, tannery, plastics and cosmetics is the first contaminants that are recognized. Due to the colour and turbidity associated with dyes, they are highly visible and cause damage to aesthetic nature of the environment [1-3]. Also these dyes may drastically affect photosynthetic phenomenon in aquatic life due to reduced light penetration [4, 5]. As a result, the removal of colour from waste effluents has become environmentally important [6-8]. Dyes may also be problematic if they are broken down anaerobic in the sediment, as toxic amines are often produced due to incomplete degradation by bacteria [9]. Direct discharge of dyes laden wastewater into municipal wastewater plants or environment may cause the formation of toxic carcinogenic breakdown product. Today more than 9000 dyes are incorporated in colour index belonging to various chemical application classes. Water soluble anionic group of dyes are one of the most important group of dyes used in the textile dyeing industries, are used to dye fabrics

like wool, nylon and silk. Present study investigates the possibility of removing acid red from aqueous solution using cationic surfactant-modified bentonite clays.

Various techniques have been employed for the removal of dyes from wastewaters. Due to low biodegradability of dyes a conventional biological treatment process is not very effective. Among other methods adsorption has been found to be superior to other techniques for wastewater treatment in terms of low cost, simplicity of design, and ease of operation and insensitive to toxic substances [10, 11]. Several wastes and residues have been investigated for the adsorption of dyes with varying success [12-15]. Therefore a new and promising class of adsorbent is needed for alleviating the problems caused by textile dyes. Considering the eco friendly and cost effective methods, biopolymers prove to be a viable and affordable alternative for the adsorption of dye due to its low cost, easy availability, possibility of enhanced adsorbabilities by surface modification.

Banana stem was another commonly available and abundant natural material. Besides its utility in preparing banana fibre with good strength and lustre, any attempt to find a better alternative for the use of banana stem it would be another milestone in our march towards economic development. In the present study a new adsorbent material prepared from banana stem was employed for the removal of CV from wastewater. The main objective of this study was to investigate the feasibility of using glycidyl methacrylate grafted banana stem in removing CV from water and wastewater.

MATERIALS AND METHODS

Reagents

The starting material banana stem, BS (pseudo stem of Musa Paradisiaca L.) for the preparation of adsorbent was obtained locally. All the chemicals used to prepare reagent solutions were of analytical reagent grade. The crystal violet (CV) was purchased from Aldrich-Sigma Chemie (Germany). The monomer glycidyl methacrylate and dimethyl formamide (DMF) were obtained from Sisco Research Laboratories, India.

The experiments were conducted over a range of pH from 1.0 to 10.0 using 0.1 mol L^{-1} HCl and 0.1 mol L^{-1} NaOH. A stock solution of 1000 mg L^{-1} of CV was prepared by dissolving weighed quantity of CV in 1000 mL of solution.

Preparation of the adsorbent

Weighed quantity of banana stem and 15 mL of DMF and 0.046 moles of glycidyl methacrylate were taken in a RB flask and irradiated in a (IFB-India) domestic microwave oven for 2 minutes. The separated GM-BS was washed repeatedly to remove the water soluble particle and was filtered using Whatmann No. 42 filter paper. The product was dried at 70 °C for 24 h and was sieved between the particle size 80 and 230 mesh (average particle size 0.096 mm).

RESULTS AND DISCUSSION

Adsorbent Characteristics

FTIR spectra of BS and GM-BS (400-4000 cm^{-1}) were plotted in Fig. 1 and Fig. 2. The strong asymmetric absorption band at 3340 cm^{-1} for BS was attributable to the sum of the contribution from adsorbed water and hydroxyl groups from polyphenols originally present in BS. The IR exhibited weak absorption peak at 2923 cm^{-1}, characteristic of the C-H stretching vibrations of the cellulose and hemicellulose. The strong bands at 1519 cm^{-1} and 1209 cm^{-1} were due to the aromatic C=O and C-O stretching vibrations of the lignin component, respectively. The band characteristic to ß-glycosidic linkage appeared at 885 cm^{-1}. The FTIR spectrum of glycidyl methacrylate grafted cellulose adsorbent (Fig. 2) shows characteristic peaks of cellulose O-H, C-O, glycosidic linkages and a distinct peak at 1714 cm^{-1} due to C=O group in the glycidyl methacrylate monomer. Another three bands at 1321, 816, and 699 cm^{-1} could be attributed to epoxy ring [16].

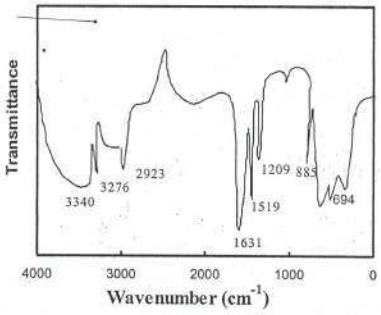

Figure 1. The FTIR spectra of banana stem

Synthesis, Characterization and Crystal Structures of Supramolecular Complexes of Fe(II), ZrO(IV) and UO_2(VI) with Acetone-N(4)-phenyl Semicarbazone

Sarau Devi A[a] & Reena Ravindran[b]

[a.] Dept. of Chemistry, Fatima Mata National College, Kollam
[b.] Department of Chemistry, SN College Chempazhanthy, Kollam

ABSTRACT

Three new complexes *$[Fe(apsH)_2(CH_3OH)_2](NO_3)_2$, $ZrO(apsH)_2(NO_3)_2$* and *$[UO_2(apsH)_2(NO_3)_2]$*, where *apsH=* acetone-N(4)-phenyl Semicarbazone, have been synthesized and characterized by elemental analysis, and other spectral techniques including single crystal X-ray crystallography. The ligand, *apsH*, was coordinated as neutral bidentate manner. Fe(III) has successfully reduced to Fe(II) before complexation, which is proved by X-ray diffraction studies. The Fe(II) exhibit a distorted octahedral, while zirconyl and uranyl cations have a six coordination around it. The intermolecular forces, particularly highly directional metal ligand and hydrogen bonds and other weak interactions contribute stability to the crystal.

Key words: *acetone-N(4)-phenyl Semicarbazone; crystal structure; Infrared spectra; Electronic spectra.*

INTRODUCTION

Recently the construction of supramolecular architectures with favorable properties and fascinating structures has drawn great attention [1]. Acetone-N(4)-phenyl Semicarbazone catch special attention in coordination chemistry as a good ligand to construct supramolecular solid state architectures with interesting structures and useful properties [2]. It can act either as a neutral ligand or as a deprotonated anion in its metal complexes with different structural features. In solid state it predominantly exist in the keto form, whereas in solution state, it exhibit keto-enol tautomerism. Keto form act as a neutral bidentate ligand and enol form deprotonate and serve as monoanionic bidentate ligand in metal complexes. The coordination mode is influenced by the number and type of substituents. Thus semicarbazones are versatile ligands in both

neutral and anionic forms. Studies of semicarbazones and their metal complexes gain interest because of their chemical and biological applications [3]. This paper reports the synthesis and spectral characterization of three metal complexes *viz.*, Fe(II), ZrO(IV) and UO_2(VI) of acetone-N(4)–phenylsemicarbazone.

EXPERIMENTAL

Materials

High purity N(4)-phenylsemicarbazide (Sigma–Aldrich) and acetone (Merck), $Fe(NO_3)_3.9H_2O$ (Sigma-Aldrich), $UO_2(NO_3)_2.6H_2O$ (Merck), $ZrO(NO_3)_2.xH_2O$ (Merck) were purchased and used as received.

Preparation of ligands, p-methoxyphenyl benzothiazole,(mpb),

The ligands ware prepared from N(4)-Phenylsemicarbazide and acetone in methanol by one of the literature method [4].

Synthesis of the complexes

A solution of semicarbazone, (apsH) (0.382 g, 2 mmol) in 20 mL of methanol was mixed with a methanolic solution of $[ZrO(NO_3)_2.xH_2O$ (0.231 g, 1mmol); $UO_2(NO_3)_2.6H_2O$ (0.502 g, 1mmol)] and $Fe(NO_3)_3.9H_2O$ (0.404 g, 1mmol). The mixture was heated under reflux for 5h. In the case of Fe(II) before complex formation Fe(III) is reduced to Fe(II) using hydroxylamine hydrochloride. The complex formed was filtered, washed with methanol and finally with ether and dried over anhydrous $CaCl_2$.

X-ray crystallography

Single crystal of dimensions 0.30 x 0.20 x 0.20 mm was selected and mounted on a Bruker axs Kappa apex 2 CCD diffractometer, equipped with a graphite crystal incident beam monochromator and a fine focus sealed tube Mo Ka (?=0.71073) X-ray source. The structure was solved by the direct method and refined by the full- matrix least-square method on F^2, with all non-hydrogen atoms refined with anisotropic thermal parameters.

RESULT AND DISCUSSION

The semicarbazone (apsH) here acts as a neutral bidentate ligand in all the complexes. The complexes are soluble in CH_3OH, $CHCl_3$, DMF and DMSO. The molar conductivity

before complexation, which is proved by X-ray diffraction studies. Intermolecular hydrogen bonding and other weak interactions contribute stability to the crystal. The Fe(II) exhibit a distorted octahedral, while zirconyl and uranyl cations have a six coordination around it.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. Babu Varghese, SAIF, IIT Chennai, India for single crystal xrd studies. One of the authors Sarau Devi.A is grateful to University Grants Commission, New Delhi, India for financial support.

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Effect of Calcination on the Ion exchange properties of Cerium(IV) Phosphomolybdate

A. P. Apsara[a] & B. Beena[b]

[a] *Department of Chemistry, FMN College, Kollam, Kerala*
[b] *Department of Chemistry, D B College, Sasthamcotta, Kollam, Kerala*

ABSTRACT

Crystalline Cerium(IV) Phosphomolybdate (CPM) an inorganic ion exchanger has been prepared and characterized by elemental analysis, XRD, thermal analysis (TGA) and spectral analysis (FTIR). The protons contained in the structural hydroxyl groups of the material are the active sites. The material shows good potential as cation exchanger. Na^+ exchange capacity was found to be 7.00 meq/g. The material shows high exchange capacity even at elevated temperatures. The irregular variation of ion exchange capacity on heating have been studied with the help of XRD and FTIR.

Key words: cation exchanger, ion exchange capacity, XRD, FTIR

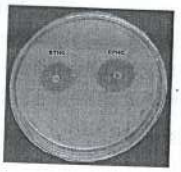
INTRODUCTION

Tetravalent Metal Acid (TMA) salts are cation exchangers obtainable in the crystalline and amorphous forms. They have the general formula M(IV) $(HXO_4)_2 . nH_2O$ where M(IV) = Zr, Ti, Sn, Ce, Th etc and X = P, Mo, W, As, Sb etc. These compounds have structural hydroxyl groups, the H of –OH being exchangeable sites. A number of cations can be exchanged with H^+ due to which the materials possess cation exchange properties [1-3].

EXPERIMENTAL

For the preparation of CPM, equimolar solutions of ceric sulphate, ammonium hepta molybdate and disodium hydrogen phosphate were mixed in the volume ratio1:1:2 with slow and continuous stirring at a pH~ 2. The gel was kept overnight, filtered, washed with conductivity water and dried at 40^0C. The dried material was brought to desired particle size (30-60 mesh) by grinding and sieving and finally converted to acid form by immersing in 1M HCl, the acid being replaced intermittently. It was then washed with conductivity water till free of chloride and again dried at 40^0C.

The azocoumarin compound having chloro substitution (CPHC) exhibited promising antibacterial activity against the bacteria *Escherchia coli*.



CONCLUSIONS

Two azocoumarin dyes were prepared by the coupling reaction of 4-hydroxycoumarin as electron-donor with diazotized 4-chloroaniline and 2-aminobenzothiazole. The dyes were obtained by relatively simple synthesis methods with high and good reaction yields (68-80%). The proposed structures of the dyes were confirmed by spectral analysis performed by IR, UV-Vis, ^{1}H-NMR and elemental analysis. The new dyes showed light yellow-green fluorescence, more intense than that of 4-hydroxycoumarin. That is why these are promising dyes which could be recommended for new applications.

SYNTHESIS AND CHARACTERIAZATION OF BRANCHED GOLD NANOPARTICLES

Sheena Mary [a], Teena [b] & Shibu Joseph S. T[b]*

[a] *Department of Physics, Fatima Mata National Colege, Quilon 691001*
[b] *Department of Chemistry, Fatima Mata National Colege, Quilon 691001*

INTRODUCTION

The optical properties of metal nanoparticles are of great importance for applications in the fields of photonics, electronics, sensing, and various other biochemical uses. It has been demonstrated that the presence sharp edges and tip provides a very high sensitivity to local changes in the dielectric environment, as well as larger enhancements of the electric field around the nano particles. These features constitute the basis of localized surface Plasmon resonance (LSPR)or Surface Enhanced Raman Scattering (SERS)analysis. For this reason an increasing number of synthetic procedures are being developed, aiming at a simultaneous control of the size and shape of the metal nano particles, among which the production of gold nano-spheres, nano rods, or even nano platelets with a certain degree of control of the size/shape distribution can almost be considered as routine experiments. Other more sophisticated geometries have been seldom reported and are often limited by a low yield of the morphology of interest, by a poor control of particle size and high polydispersity, or by ill-defined properties. Herein we report a simple strategy for the controlled synthesis of branched Au nano particles with well-defined optical response.

The size-and shape – dependent physical properties of inorganic nano particles provide tunable materials with broad potential application[1], and the fabrication of structurally complex nanoparticles further enhances their functionality. For example, the synthesis of semiconductor nanowires with core/shell heterostructures creates electronic junctions within the nanowire that can act as tunable nanophotonics light emitting diodes[2]. The synthesis of branched quantum dots[3] could enable studies of entangled quantum sates and quantum information processing within individual nano particles[4]. Metallic nanoparticles also benefit from the formation of complex structures. Magnetic "barcode" nanowires that contain periodic domains of NiFe/Cu[5] and Pt/Cu[6]

Synthesis and Characterization of Graphene – Copper Oxide Nano composite via Chemical reduction and Solar exfoliation methods

S. Renjini[a], T. Jyothish kumar[b], T.E. Mary Nancy[a], M. Biji[a], P.L. Jittimol[a], K. Sreevalsan[b] & V. Anithakumary[a]*

[a] *Department of Chemistry, S.N.College for Women, Kollam 691001*
[b] *Department of Chemistry, S.N.College , Kollam 691001*
Corresponding Author: anithasreevalsan@gmail.com

ABSTRACT

Graphite oxide was prepared by improved Hummer's method. Graphene-CuO composite was prepared by different methods such as solar exfoliation and chemical reduction. The composites were characterized by using XRD and SEM. XRD measurements confirm the formation of monoclinic end centered structure for the composite. Studies reveal that particle size is reduced and the distribution of CuO on graphene is more uniform in chemical reduction method.

Keywords: Graphene, copper oxide, chemical reduction, solar exfoliation

INTRODUCTION

Carbon based nano materials are currently the most attractive nanostructures[1]. Graphene (GN) a monolayer of carbon atoms arranged in a 2D honey comb lattice, has attracted increasing attention of researchers due to their unusual electronic conductivity, high surface area, high mechanical, thermal and chemical stabilities[2]. These unique mechanical, chemical, thermal, optical properties provide excellent application possibilities for these materials in various fields[3]. Considerable effort is currently devoted to the preparation characterization and applications of graphene nanocomposites [4]. The main motivating factor for probing techniques for synthesis GN-based nano composites is to combine the favorable properties of GN with other constituent nanomaterials. Copper (Cu) matrix nanocomposites are attractive and enormously explored , due to their enhanced mechanical, electrical and thermal properties leading to numerous electronic applications[5]. The conventionally used reinforcements in the Cu matrix includes oxides[6], carbide nanoparticles etc, have improved the mechanical

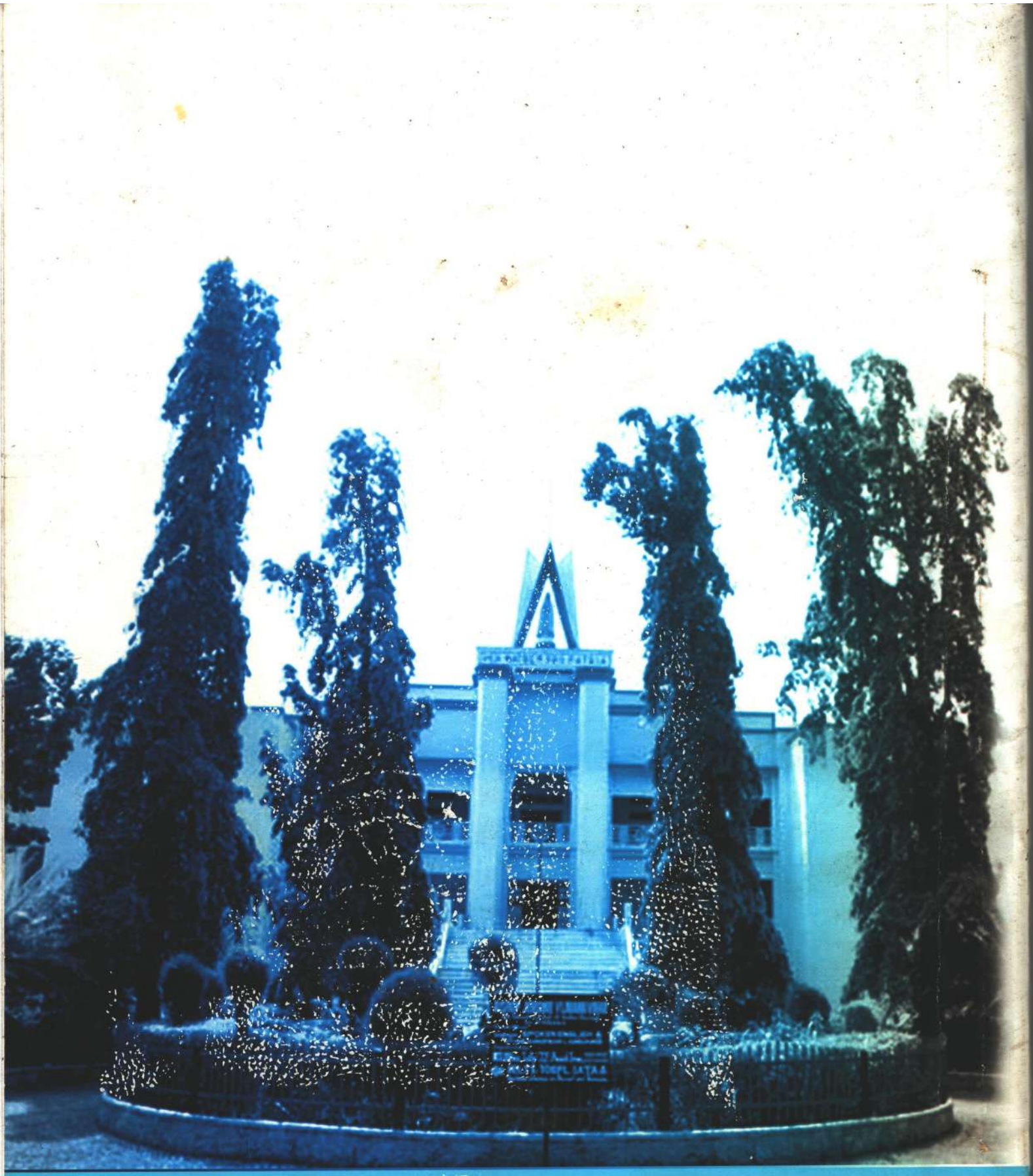
properties considerably[7]. However, because of their poor electrical conductivity, they are not desirable for electronic applications. Therefore, carbon as a reinforcement material, in the form of fibres, nanotubes etc , has aroused the attention of scientific community due to the exhibition of superior mechanical, electrical properties and an extremely high thermal conductivity simultaneously. The Graphene-Copper composites are expected to not only preserve the favorable properties of graphene, but greatly enhance the intrinsic properties due to the synergetic effect between them [8].

EXPERIMENTAL

Graphene Copper oxide composites were prepared via different routes. Graphite oxide (GO) was prepared first by improved Hummer's method[9,10]. In the solar exfoliation method, copper acetate and GO dispersion in methanol was taken, sonicated, stirred and dried. The precursor mixture was then spread on a pertidish and exposed to focused solar radiation using a convex lens of diameter 90mm[3,11]. The exposure to focused sunlight causes simultaneous exfoliation and reduction of the GO-Copper acetate composite resulting in a novel material composed of 2D graphene sheets decorated with copper oxide nanoparticles. In chemical reduction method GO-Copper acetate dispersion in methanol was reduced using sodium sulphide .

RESULT AND DISCUSSION

The as prepared samples of the composites were characterized using XRD and SEM. Fig 1 illustrates the XRD of GO. In the XRD pattern of GO, the strong and sharp peak at $2\theta = 11.7^{\circ}$ corresponds to an interlayer distance of 7.6 Å. No peak is observed around 10° indicating the successful reduction of GO to sG. Solar graphene/copper oxide(sG/CuO) shows characteristic diffraction peaks at 35.5, 39.1, 53.5 corresponding to the (111), (200), (020) crystalline planes of copper oxide (JCPDS card no. 80-1916). Fig.2 shows the XRD of GN-CuO nano composite prepared by solar exfoliation method.



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INFLUENCE OF LOW TO MODERATE INTENSE TRAINING BETWEEN TYPE 1 AND TYPE 2 DIABETES

*Dr. G. Vinod Kumar**

Background: The life style for a diabetic depends upon the activity in which the definite improvement can be achieved by appropriate training. The basic training procedure were severe better when utilized with modification suited to the individual or a group deals with best training program in that increases insulin supply to the body the decide quality at a higher rate without causing unwanted effects. The present study is one of the effects to suggest a method for developing of health status.

Aims and Objectives

The main objective of the study was to assess the influence of low to moderate intense training on type 1& type 2diabetes.

Materials and Methods

The study started with the help of diabetes specialist with 40 subjects; some of them not having diabetics, some of them have very low level of diabetics. From the doctor report 15 subjects were type 2 diabetes; 5 were type 1 diabetes. All subjects have been selected from the Puducherry region, India. These 15 diabetic people were selected on the basis of doctoral report. The age group is ranges between 40-50 years of type 2 diabetes and 25-40 years of type 1diabetes. All subjects were tested with medical assessment and prove the diabetes. According to their health conditions low to moderate intense exercise training consisting of warm up, mobility exercises, strength training, aerobic exercise, flexibility exercise, warm down with stretching program was administered to type 1 & type 2 diabetes for 7 weeks. This experiment group were tested pre-test and post-test on blood sugar, blood pressure, body mass index (BMI) and Body Weight. Results: The result of study shows clearly that both type 1 and type 2 diabetic individual are improved well in secretion of insulin through low to moderate intense physical exercises. The study further proved that the low to moderate physical activities were reduced on Blood sugar (fasting) level, BMI, and Body weight for both type 1 and type 2 and systolic blood pressure was reduced only for type 2 diabetes.

Keywords: *Type 1 & type 2 diabetes, Blood sugar, Blood pressure, BMI, Body weight.*

Introduction

Diabetes mellitus, or simply diabetes, is a group of metabolic diseases in which a person has high blood sugar, either because the pancreas does not produce enough insulin, or because cells do

* Associate Professor, Department of Physical Education and Sports, Pondicherry University, Puducherry.

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ANALYSIS OF TEAM COHESION IN SOUTHINDIAN MALE HOCKEY TEAMS

*Dr. Saju. S**

The purpose of the study is to analyse team cohesion among the south Indian hockey teams. 91 hockey teams (N=1456) from four south Indian states were taken as the subjects of this study. Among the teams, 57 were professional hockey clubs(N=912) and 34 South Indian University teams(N=544). Tool used in the present study was The Group environment Questionnaire (GEQ)(Albert V. Carron, Lawrence R. Brawley, W. Neil Widmeyer,2002) Descriptive statistics and MANOVA were used to analyze the data. The result of the present study indicates that there were no significant differences between South Indian clubs and Universities in individual attraction to group –task (ATG-T) and group integration task (GI-T). Significant differences were found in individual attraction group-social(ATG-S) and group integration social (GIS). The South Indian states showed significant difference in Individual attraction to group –social (ATG-S) and no difference was found in other variables.

Introduction

History is full of examples of talented teams that failed to live up to expectations or less talented teams that performed far above expectations.There is more to success than the individual skills of the members of a team. The well established principle that a group of individuals working together is far more effective than the same individuals working independently of one. another. Need for team members to work together (teamwork) as well as need to like each other and enjoy playing together is crucial for team success.. Cohesiveness enable the team to function together more smoothly and effectively. Group cohesion has been studied in many areas, such as sport psychology, social psychology, military psychology, etc. In looking at cohesion in sport groups, the generally accepted definition is that cohesion is a dynamic process that is reflected in the tendency of a group to stick together and remain united in the pursuit of its instrumental objectives and or for the satisfaction of member affective needs (Carron, Brawley, &Widmeyer, 1998).This definition has several different aspects that are helpful in understanding the construct. First, cohesion is multidimensional, meaning that any number of factors can influence a group's cohesiveness, and these factors may vary from group to group (Carron et al 2005). Second,

* Associate professorF.M.N. College,Kollam, Kerala

cohesion is dynamic. Any group's cohesiveness can change over time and factors that affect cohesion at one point in time may not affect it at other points.

There are many group dynamics that take place within a sporting team. One of the most important is cohesion. One always hears about how important it is for a team to "gel" or "bond" or "have good chemistry." Cohesive teams can achieve dramatic and awesome things. The way players interact has a tremendous impact on the way a team performs. Various group dynamics research reveals that what actually contributes toward building an effective group may run contrary to what intuition would sug-gest. Sport coaches naturally assume that a generic, positive approach to coach-ing maximizes team spirit, producing greater team success as a consequence(Kremer & Scully, 1994). Modern sport psychologists have expressed a growing interest to understand the concept of team cohesion. Several efforts were made to knowhow these high performance aspects worked on different teams and individuals. The purpose of this study is to analyze the team cohesion in male field hockey players.

Method

Subjects selected for this study were 91 hockey teams (N=1456) from four south Indian states. Among the teams, 57 were professional hockey clubs(N=912) and 34 South Indian University teams(N=544). 112 club players(12.44%) and 64 universityplayers(11.76%) were from Kerala state, 224 club players(24.88%) and 224university players (41.17%) were from Tamilnadu ,384 club players(42.66%) and144university players (26.47%)were from the state of Karnataka and192 club players(21.33%) and 112 university players (20.58%)were from Andhra Pradesh. All the subjects selected for the present study were male field hockey players. The professional club teams were selected from the major league tournaments of the concerned state and from various open tournaments held in south India. The university teams were selected from the South zone interuniversity championshipheld at Annamalaiuniversity (2008) and Bangalore university (2009). Tool used in the present study was The Group environment Questionnaire (GEQ) (Albert V. Carron, Lawrence R. Brawley, W. Neil Widmeyer,2002). The 91south Indian teams were given the GEQ and recorded their experiences. descriptive statistics and MANOVA were used to analysis the data of this study. Level of significance was set at 05 level. The data were analysed by using SPSS Version 17.0(SPSS Inc., Chicago, IL.). LSD post hoc analysis was performed when statistical significance (pd" .05) was obtained to identify significant pair wise differences.

Result

The result of the present study indicates that there were no significant differences between South Indian clubs andUniversities in individual attraction to group –task (ATG-T) and group integration task (GI-T). Significant differences were found in individual attraction group-social(ATG-S) and group integration social (GIS). The South Indian states showed significant difference in Individual attraction to group –social (ATG-S) and no difference was found in other variables. Pairwise comparison shown that South Indian Universities had high mean scores in all variables except ATG-T (MD= -.114) compared to South Indian clubs. In ATG-S, Significant difference was found between Kerala and Andhra Pradesh (MD= .244, p=.028) , Kerala and Karnataka(MD=.323,p=.002) and Tamilnadu and Karnataka (MD=.225,p=.003). Tamilnaduand Karnataka showed significant difference in GI-S Among the states Tamilnaduhad a high mean score in IAG-T(4.1713) and GI-S(5.8705), Kerala had the high meanscore in IAG-

S,andKarnatakashowed a high mean score in GI-T (6.665).The MANNOVA results of South Indian teams in GEQ showed statistically significant (Wilksë =.982, F=6.615,p=.000)difference between South Indian clubs and Universities. An overall MANNOVA is also done and result showed statistically significant difference (Wilksë =..980,F =2.447 , p =.004)between South Indian states in team cohesion. Subsequent univariate tests were also done to know the difference

Table 1: Multivariate Tests of south Indian teams-GEQ

GROUP	Pillai's Trace	.018	6.615[a]	4.000	1445.000	.000
	Wilks' Lambda	.982	6.615[a]	4.000	1445.000	.000
	Hotelling's Trace	.018	6.615[a]	4.000	1445.000	.000
	Roy's Largest Root	.018	6.615[a]	4.000	1445.000	.000

Table 1: Estimated marginal means of south Indian universities and clubs

Dependent Variable	GROUP	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
IAGT	University	4.068	.065	3.940	4.196
	Club	4.183	.050	4.084	4.281
IAGS	University	4.540	.053	4.436	4.645
	Club	4.310	.041	4.229	4.390
GIT	University	6.586	.051	6.486	6.686
	Club	6.556	.039	6.479	6.633
GIS	University	5.875	.063	5.751	5.999
	Club	5.601	.049	5.505	5.696

ATG-T - Individual attraction to group-task,
ATG-S - Individual attraction to group-social
GI-T-Group integration-task, GI- S- Group integration-social

Table 2.Pair wise Comparisons of south Indian clubs and universities-GEQ

Dependent Variable	(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
IAGT	University	Club	-.114	.082	.165	-.276	.047
	Club	University	.114	.082	.165	-.047	.276
IAGS	University	Club	.231*	.067	.001	.098	.363
	Club	University	-.231*	.067	.001	-.363	-.098
GIT	University	Club	.030	.064	.636	-.096	.157
	Club	University	-.030	.064	.636	-.157	.096
GIS	University	Club	.275*	.080	.001	.118	.431
	Club	University	-.275*	.080	.001	-.431	-.118

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments)
*. The mean difference is significant at the .05 level.

Discussion

Major findings of the the present study were:

1. Significant differences were found between South Indian Universities and clubs in Individual attraction group-social (ATG-S) and Group integration social(GI-S).No differences were found in individual attraction group-task (ATG-T) and Group integration task (GI-T) .
2. South Indian professional clubs had better score in Individual attraction group task,(IAG-T) and South Indian Universities had better scores in individual attraction group-social(IAG-S), Group integration social(GIS) and Group integration task(GIT).
3. Significant difference was found in Individual attraction group-social (ATG-S)among South Indian states. No differences were found in Individual attraction group task(ATG-T), Group integration –Task(GI- T) and Group integration –Social(GI-S)
4. Among the states, Tamilnadu had the higher score in Individual attraction group task,(IAG-T) and Group integration social(GIS)., Karnataka had the better score in Group integration task(GI-T) and Kerala was higher in individual attraction group-social (IAG)

Result of Slater and Sewell (1994) study to assess team cohesion in University level hockey players showed a positive relationship between team cohesion and performance . The socially oriented aspects of cohesion, in particular ,had significant associations with performance. The present study also had a high social aspect of cohesion among Universities of South India compared to South Indian clubs. In a case study, Esa et.al (2009) examined High group *cohesion* whichis considered to be beneficial and lead to better performance. This qualitative casestudy describes a case in which high social *cohesion* led to a deterioration in a team's performance. As mentioned above the South Indian clubs were the much better performed teams than Universities and a high social cohesion of University team found in this study may be the reason for the deterioration in their performance level
as stated by Esa et.al (2009)Possible reason for such a cohesion pattern may be that the University atmosphere is much different than professional environments. In universities ,individuals are presented with much more freedom in their down time. It is highly conceivable for a University player to get along better with their classmates than their
teammates. University students are also more exposed to peer pressure and its accompanying distractions.

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About the Chief Editor

Dr. Rina, born on 2.03.1978, is working as Asst. Professor and Head, in the department of Physical Education at JECRC University, Jaipur, Rajasthan, India. She is having ten years of experience in the field of physical education. She did her Bachelor of Arts from M.D.S University Ajmer (Rajasthan), Master of Arts (Hindi Literature) From M.D.S University, Ajmer (Rajasthan), Bachelor of physical Education from Rajasthan University Jaipur, Master of physical Education from Rajasthan University, Jaipur and Ph. D. from M.I.S. University, Udaipur (Rajasthan). She has participated in various national and international seminars, conferences and workshops. She has published one book and more than 15 papers in reputed national and international journals. Three Ph.D. scholars are pursuing their research work under her supervision. She is member of many national organizations. Her area of interest is Sports Psychology and Exercise Physiology.

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Contents

IT-01

New Generation Polymer Composite Materials: Status and Future

Prof. Kuruvilla Joseph
Department of Chemistry, Indian Institute of Space Science and Technology, ISRO P.O, Thiruvananthapuram, 695 022, Kerala, India.
Email: kjoseph.iist@gmail.com

Microfibrillar in situ composites are characterized by an isotropic thermoplastic matrix reinforced by fibrils of another thermoplastic material (dispersed phase) which are generated insitu during processing. Thus they are different from the conventional composites which are made by the blending of the constitutive components (matrix and fibre). MFCs are generally prepared by a three step strategy blending (mixing), fibrillization and isotropization. The third step is intended to create an isotropic matrix of the polymer with the lower T_m in which randomly oriented microfibrils of the polymer with the higher T_m is distributed. Since the matrix and the reinforcement are thermoplastic polymers and the reinforcements are generated in situ during the process they are also called in situ reinforced polymer/polymer composites. The morphology of the neat blends, microfibrillar blends (MFBs) and the corresponding microfibrillar composites (MFCs) based on low density polyethylene (LDPE) and poly ethylene terephthalate (PET) was analyzed. As the PET concentration increased, an increase in the diameter of PET fibrils was observed. The fibrils with relatively uniform diameter distribution were obtained in the range of 15 to 25 wt% PET concentration. The tensile properties of the blends and MFCs increased with PET concentration up to an optimum level. The neat blends exhibited inferior tensile properties in comparison with the MFCs. As the PET concentration increased, the solvent uptake reduced. The diffusivity and permeability of the MFCs were lower than the corresponding blends. The solvent uptake was found to be lowest for the composite with 25 wt% PET concentration. The PET microfibrils in the MFCs offered a tortuous path for the diffusion of the solvent.

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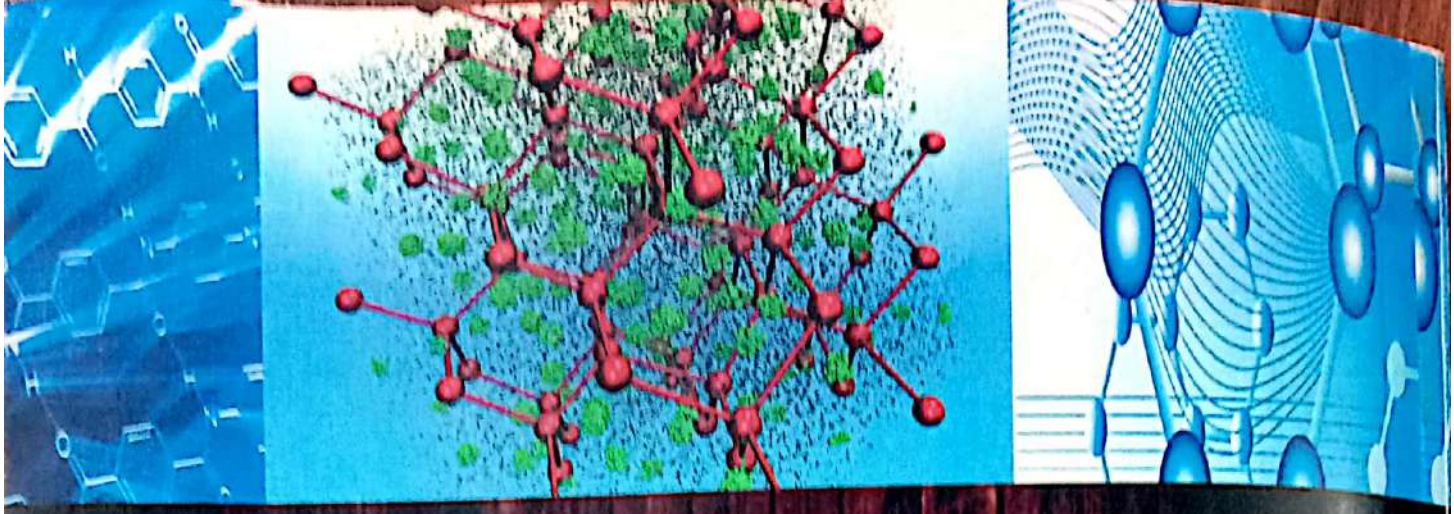
Microwave Assisted Green Chemistry Synthesis of Polymer Grafted Banana Stem for the Environmental Remediation

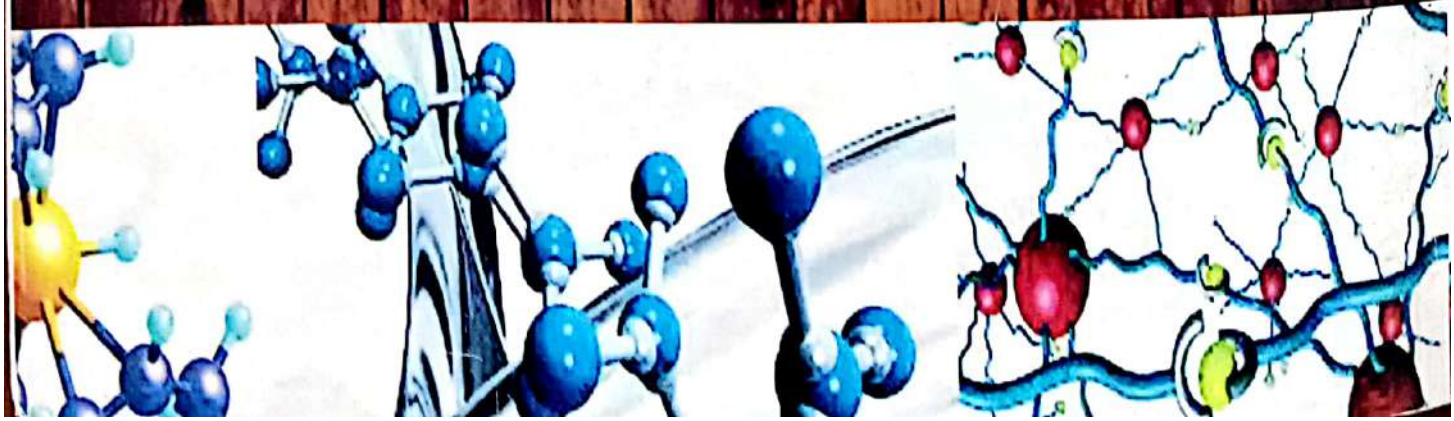
*Noeline B. Fernandez, Manohar D. Mullassery, Surya R.

*Department of Chemistry, Fatima Mata National College, Kollam, Kerala, India

Email: fernandeznoeline@gmail.com

The aim of this work is equilibrium study of the sorption of crystal violet (CV) from aqueous solutions under different experimental conditions using an adsorbent glycidyl methacrylate grafted banana stem (GM-BS). Microwave (MW) irradiation has gained a great deal of attention owing to the molecular level of heating. Banana stem is grafted with glycidyl methacrylate under microwave irradiation. The adsorbent has been characterized using IR. The effects of pH for the removal of CV were studied. The optimum pH for CV adsorption was found to be 10.0. Desorption of CV from the sorbed clay was achieved by eluting with 0.1 M HCl.





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Keynote Address (Inaugural session)

Flowering Plant Reproduction and Diversity

P. Pushpangadan
Padma Shree Awardee

Amity Institute for Herbal & Biotech Products Development, 3 Ravi Nagar, Peroorkada, Thiruvananthapuram, Kerala -695005
E-mail: palpuprakulam@yahoo.co.in

Abstract

21st Century is a 'Century of Biology, and powered and propelled by knowledge and technology expertise. It was a logical outcome of the intellectual triumphs of 20th Century – which we now call as 'Century of Physics', which triggered with the outstanding contribution of a few scientists like Roentgen, Rutherford, Mendeliyev, Max Plank and Albert Einstein.' The vast geographical, diverse climate and topographical realms of India have resulted in enormous ecological diversity supporting about 8% of the world's biological diversity on 2% of earth's surface making it one of the 12 mega diversity countries in the world. Adding to this, there is a very high diversity of human influenced ecosystems including agricultural and pasture lands and impressive range of domestic aided plants and animals. Flowering plants are the dominant plant form on land and they reproduce by sexual and asexual means. Often their most distinguishing feature is their reproductive organs, commonly called flowers. Sexual reproduction in flowering plants involves the production of male and female gametes, the transfer of the male gametes to the female ovules in a process called pollination. After pollination occurs, fertilization happens and the ovules grow into seeds within a fruit. After the seeds are ready for dispersal, the fruit ripens and by various means the seeds are freed from the fruit and after varying amounts of time and under specific conditions the seeds germinate and grow into the next generation. The largest family of flowering plants is the orchids (Orchidaceae), estimated by some specialists to include up to 35,000 species, which often have highly specialized flowers that attract particular insects for pollination. Another large group of flowering plants is the Asteraceae or sunflower family with close to 22,000 species.Sexual reproduction involves two fundamental processes: meiosis, which rearranges the genes and reduces the number of chromosomes, and fertilization, which restores the chromosome to a complete diploid number. In between these two processes, different types of plants and algae vary, but many of them, including all land plants, undergo alternation of generations, with two different multicellular structures (phases), a gametophyte and a sporophyte. The evolutionary origin and adaptive significance of sexual reproduction can be seen from "Evolution of sexual reproduction" and "Origin and function of meiosis."Asexual reproduction produces new individuals without the fusion of gametes, genetically identical to the parent plants and each other, except when mutations occur. In seed plants, the offspring can be packaged in a protective seed, which is used as an agent of dispersal. Vegetative reproduction involves a vegetative piece of the original plant (budding, tillering, etc.) and is distinguished from apomixis, which is a replacement for sexual reproduction, and in some cases involves seeds. Apomixis occurs in many plant species and also in some non-plant organisms. For apomixis and similar processes in non-plant organisms, see parthenogenesis.

Theme Presentations

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Flowering plant diversity of Southern Western Ghats with special reference to Kerala

Sasidharan N
Kerala Forest Research Institute, Peechi, Thrissur, Kerala – 680653

Abstract

The Western Ghats or the Sahyādris constitute a mountain range along the western side of India. The range starts near the border of Gujarat and Maharashtra, south of the Tapti River, and runs approximately 1,600 km through the states of Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu, ending at Kanyakumari, at the southern tip of Peninsular India. The Western Ghats covering an area of 180,000 sq. km, constitute about 6 per cent of the land area of India and contain more than 30% of the biodiversity recorded from India. The Western Ghats, recognized as World Heritage Site by UNESCO is one of the world's ten "Hottest biodiversity hotspots" and has over 5000 species of flowering plants. The high rain fall, great variation in the altitudinal range in the mountains and diverse soil types favoured the formation of diverse habitats rich in species diversity. Anamudi peak (2,695 m) in Kerala is the highest peak in the Western Ghats.

The Kerala State lies along the south-west corner of Peninsular India, between 80 18' and 120 48' N latitude and 740 52' and 770 22'E longitude. The boundaries of the State are the Lakshadweep Sea in the west, Tamilnadu in the south and east and Karnataka in the north. The State has an area of 38,863 km2, which is about 1.18 percent of the total area of the country and is administratively divided into 14 districts. Due to the long tract of Western Ghats along the eastern side and Arabian Sea along the western side, the physiography of the State is highly diversified. The State has a complex topography with mountains, valleys, ridges and scarps. The altitude varies from sea level to 2695 m asl. Based on the altitude, the land is divided into high ranges (above 750 m asl; highlands (between 75-750 m asl); midland (between 7.5-75 m asl) and lowlands (below 7.5 m asl). The highlands with an average height of 900 m have several peaks over 1,800 m and constitute about 43 per cent of the land area followed by midland (42 percent); high ranges (15 per cent) and lowland (10 per cent). A narrow strip of land bordering the sea constitutes the low land area of the State and this region holds the back waters and estuaries. Mangroves and coastal vegetation are confined to this region. Parallel to the coastal strip, there is wider more or less undulating midland zone. Most of the human activities and agricultural settlements are located in this region. The natural vegetation is rather scanty and occurring as small refugees. These two regions constitute the major human habitats in the State. Wider eastern highland region constitutes the important region with regard to the Biodiversity. This region is highly undulating and has a complex geography compared to the other zones. These mountain ridges are continuous from north to south except the 30 km wide gap in the Palakkad district. These mountain chains influence the climate of the State to a greater extent.The varied topographical features, high rainfall and geologic conditions have favored the formation of different ecosystems from Shola forests on the mountain valleys to the mangrove forests along

sea coasts and estuaries. The most outstanding feature of the State is the formation of tropical rainforests along the windward side of the Southern Western Ghats, which is lying parallel to the west coast. A small extent of area of the State is along the rain shadow region the Western Ghats, where the vegetation is dominated by dry deciduous forests and scrub jungles. The wet lands are mostly confined to the low land region of the State. The southern Western Ghats, comprising Kerala, parts of Karnataka and Tamila Nadu is considered as the richest region with respect to biodiversity and endemism. Nayar (1996) has recognized six hotspot centres of endemic plants viz. Shimoga-Kanara, Nilgiris-Silentvalley, Wayand-Kodagu (Nilgiri Biosphere), Palni Hills, Anamalai and High Ranges and Agasthyamaiai Hills. The forests of Kerala are situated along the Western Ghats. The area under forest cover is estimated to be 11309.5032 sq.km (Kerala Forest Dept., 2013). The paper highlights the flowering plants diversity of southern Western Ghats with emphasis on Kerala. As per the compilation, 5094 flowering plants are recorded from Kerala including 880 exotics introduced as ornamental, horticultural as well as invasive weeds.

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Grasses of Western Ghats-Floral Diversity

Ravichandran P

Sri Paramakalyani Centre for Environmental Sciences, Manonmaniam Sundaranar UniversityAlwarkurichi, Tamilnadu - 627412
E.mail:grassravi@gmail.com

Abstract

Grasses are undoubtedly the most important to man and other forms of all life on planet earth hence the bible quotes “all flesh is grass”. They contribute tremendously to the earth’s green mantle of vegetation. Grasses are the source of principal foods of man and his domestic animals. Without grasses agriculture would be virtually impossible. Grain, sugar, syrup, spice, paper, perfume, pasture, oil, timber and a thousand other items of daily use are the products of various grasses. They hold the hills, plains and mountains against the destructive erosive wind and water. Despite the fact that the grasses are so important to us, we usually know very little about them, Why? Because we think that all grasses are alike”, difficult to identify due its complicated, miniatures and puzzling floral structures, and similarities hence we grant less importance to study them. Otherwise we ignore them because we don’t understand them and value their use. Many of us consider grasses as useless and so no due attention is given. The world constitutes about 10000 species and 668 genera of grasses - the 4th largest families of flowering plants. India has around 1400 species with 261 genera. The Western Ghats harbors about 950 species of grasses falling under 175 genera. Grasses constitute the dominant vegetation all over the planet earth and so their need and utility by all living organisms are explicable. Grasses are a diverse group of herbs which thrive in many types of habitats. In India no true grassland existed as per the consensus of Grass biologists. Grass cover in India is of five types of which the greater part of India is occupied by Sehima - Dicanthium type of grasses. Grasses of Western ghats occupy all the sub families such as Arundinoideae, Bambusoideae, Chloridoideae, Oryzoideae, Panicoideae and Pooideae. Among these except for Pooideae the rest of them are prevalent in all kinds of habitats. Members of Pooideae are exclusive and prefer to grow in high altitude ranges. Broadly grasses are habitat specific and some of them are

distributed in more than one ecological type. Ten habitats have been recognized for grass distribution based on their occurrence and preference. Perennials grasses are more than annuals by their distribution. Flowers and fruits (Seeds) of grasses are unique and mesmerizing as they vary enormously with miniature structures. The seeds exist as caryopsis and nut like. They are of taxonomic importance due their variations, diversity in colour, shape, size and ornamentation. Seeds are dispersed by wind, water and by special devices that they have. There are about 40 endemic grasses which also signify the grassland communities and their successful existence to thrive in any kind of habitats.

Oral Presentations

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Cypsellar morphology of the genus *Spilanthes* Jacq. (Asteraceae) and their taxonomic significance

Reshmi G R and Rajalakshmi R

Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram-695581
E.mail: grrehugr@gmail.com

Abstract

The genus *Spilanthes* consists of 30-40 species which are distributed along the new and old world tropics. Among them only 7 species are now distributed all over Kerala, which include *S. ciliata, S. uliginosa, S. vazhachalensis,* with rayed heads and *S. radicans, S. calva, S. paniculata* , *S. ghoshinis* with non-rayed heads. The *Spilanthes* is known as toothache plant and is accredited with the local anesthetic action due to the Spilanthol content. It is also used as traditional medicine for various ailments. The fruits of the *Spilanthes*, denominated cypselae, are dry, indehiscent, unilocular, with a single originating from an inferior ovary. The achene morphological features were the most striking species separation factor in this genus. Seed morphological characteristics proved to be useful taxonomic features, helpful in identification of large number of species and genera. Seed characters, such as shape, size and seed-coat surface, have low phenotypic plasticity and are less affected by environmental conditions. The purpose of this study was to describe and compare external seed morphological characteristics in the genus *Spilanthes* of the family Asteraceae and to evaluate their possible use for taxonomic considerations. The seeds were collected and examined using stereo and scanning electron microscopy (SEM). Obtained data were statistically processed using analysis of variance, Principal Component Analysis, Principal co-ordinate analysis, and UPGMA clustering. The results showed that seeds were heteromorphic or homomorphic with trigonous or laterally compressed and showed morphological variations in size, presence of marginal cilia, arrangement of marginal cilia, presence and nature of pappus bristle, nature of surface striations. Exomorphic characters of cypselas serve as reliable taxonomic marker in systematic study. A key is provided for the identification of the investigated species based on seed characters.

Key words: Spilanthol, Cilia, bristles, exomorphic characters

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Survey of Climbers in Atchankulam, Kottaram Panchayat, Kanyakumari District,Tamilnadu

Beema Jainab S.I*, Mary Kensa V, Kavitha A, AnushaL, Rejitha S and Vinitha G

Department of Botany, S.T. Hindu College, Nagercoil, Kanyakumari District, Tamil Nadu
E. mail: surejkensa@gmail.com

*Department of Plant Biology and Plant Biotechnology, J.B.A.S college for women, Chennai
E.mail: beemaj@gmail.com

Abstract

Climbing plants are one of the most interesting group but a much neglected group of plants. But, they also play a part in historical importance of our ancient buildings which owe their attraction to the green veil which covers up their architectural or structural defects making them assume perfect beauty in our eyes. The present survey reveals that angiosperm climbers of the study area are represented by 94 species under 63 genera belonging to 32 families. Among all families, Convolvulaceae, Papilionaceae (7 species) and Vitaceae are the most dominating family species as well as genera wise. The dominant families are Convolvulaceae, Papilionaceae, Vitaceae, Apocynaceae, Menispermaceae and Oleaceae. The most abundant liana species include the thorny stragglers *Pterolobium hexapetalun* (Caesalpiniaceae), *Lantana camara* (Verbenaceae), and the twiners *Jasminum angustifolium* (Oleaceae), *Gymnena sylvestre* (Asclepiadaceae) and *Aganosma cymosa* var. *cymosa* (Apocynaceae). The enumerated climbing modes were classified into woody vines, the lianas (75) and herbaceous vines (19). Six climbing modes of lianas were recognized as stem twiners (37) followed by stragglers-unarmed (28), stragglers unarmed (10), tendril climbers (17), root climbers (1) and hook climber (1)

105
Exploration of *in vitro* hepatoprotective and antioxidant activities of root methanol extract of *Pseudarthria viscida* (L.) Wight and Arn.

Sangeetha G, Nikhila G. S, Devi C. M and Swapna T. S*

Department Of Botany, University College, Thiruvananthapuram-34, Kerala
*E.mail:swapnats@yahoo.com

Abstract

Pseudarthria viscida (L.) Wight and Arn. (Leguminosae) commonly called "Moovila", is a perennial viscid pubescent semi erect diffuse under shrub. This plant is an essential component of many famous Ayurvedic formulations like Dashamoola, Mahanarayana taila and Dhantara taila. It has high medicinal value. The main aim of the proposed work is the phytochemical screening and evaluation of hepatoprotective and antioxidant activities of medicinally important plant *Pseudarthria viscida.* The preliminary phytochemical study of root methanol extract was done for the detection of phytoconstituents, using standard chemical tests.In the case of hepatoprotective activity, the root methanol extract was tested for its inhibitory effect on Chang

liver cell line. The percentage viability of the cell line was carried out by MTT assay. Silymarin was used as positive control drug. Three different antioxidant assays such as DPPH assay, Superoxide and Hydroxyl radical scavenging assay were carried out in different concentration of root methanol extract (12.5, 25,50,100 and 200 µg/ml) of *Pseudarthria viscida*.The results indicated the presence of important secondary metabolites such as glycosides, flavanoids, alkaloids, terpenoids and tannins which could be the reason for hepatoprotective and antioxidant activitiesof the plant.In the MTT assay the percentage viability were found to be 31.39%, 55.94%, 71.43% for sample concentration 10µg/ml, 50µg/ml and 100µg/ml respectively.From antioxidant assays, high free radical scavenging activity were noticed in DPPH assay, Superoxide scavenging assay and Hydroxyl radical scavenging assay that is 95.41%, 90.20% and 88.58% respectively in 200 µg/ml concentration of root extract which was comparable with standard (Ascorbic acid). The present study thus confirmed that methanol root extract of *Pseudarthria viscida* (L.) possessed good hepatoprotective and antioxidant activities.Bioactive molecules present in roots could be the reason for these activities. and further studies are necessary to evaluate and isolate the active principles responsible for these activities.

Keywords: Chang cell line, MTT assay, DPPH assay, superoxide and hydroxyl radical scavenging assay

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Floristic diversity analysis of a vulnerable low altitude hillock ecosystem in the gap region of the Western Ghats, Kerala

Soumya M* and Nair M.C**

*Environmental Resources Research Centre, Thiruvananthapuram, Kerala-695 005
** Department of Botany, Govt. Victoria College, Palakkad, Kerala – 678001

Abstract

Low altitude hillocks are characteristic hydrogeomorphic habitats distributed at the gap region of Western Ghats in Palakkad district of Kerala State. Despite the high diversity, studies on such small isolated geographical systems are limited. Seasonal variations create diverse microhabitats which gets reflected in the herbaceous vegetation of these ecosystems. Many of such hillock systems has been transformed into vulnerable habitats due to intense grazing and prevalence of quarrying. In this backdrop, floristic exploration of such a hillock system in a micro scale level was conducted in Vengappara, Kollengode (Geographical location: 10°36'13.3"N 76°42'33.2"E) in Palakkad district. Floristic exploration during June 2013 – August 2014 revealed the presence of 102 plants of which 96 species are distributed under angispermous families and 6 under lower plant groups. Herbaceous flora form prominent vegetation of the area with seasonal variations in floristic composition. Explorations on a floristic and ecological perspective revealed the existence of seven microhabitats with their own unique adaptive traits and floristic associations. The plant species associations, such as *Utricularia lazulina-Drosera indica*, *Parasopubia delphinifolia -Striga angustifolia*, *Heliotropium rottleri-Indigofera uniflora-Catharanthus pusillus* were observed within microhabtats. Presence of *Isoetus coromandelina* along with new distribution record of *Dipcadi montana* add to the richness of floristic composition. Of the recorded taxa, six species are found to be endemic to

Peninsular India and four are endemic to Southern Western Ghats.The present study revealed the need of conservation measures for the hillocks along with the main hills and mountains of the Ghat system for effective conservation of unique micro habitats and the comprehending floristic associations.

Key words: hillock, Western Ghats, Palakkad, micro-habitats

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Nutritional and anti-nutritional properties of a potential medicinal plant- *Talinum portulacifolium* (Forssk) Asch ex. Schweinf

Parvathy L, Sangeetha G, Nikhila G and Swapna T. S*

*Department of Botany, University College, Thiruvananthapuram-34; E-mail: swapnats@yahoo.com

Abstract

India's flora comprises of 6000 species of plants which were used for consumption, 1/3rd of which are green leafy vegetables. Green leafy vegetables are fresh and edible portions of herbaceous plants. Green leafy vegetables have been used as medicines since ancient times and have been playing an important role in our diet and nutrition. *Talinum portulacifolium* (Forssk) Asch ex. Schweinf, known as Flame flower is an erect under shrub belonging to the family Portulacaceae is an important plant in the local system of medicine. It grows wild in Kerala especially in Western Ghats and is used as a green leafy vegetable by Chetti and Kattunayika tribes of Wayanadu district. The plant is used as a traditional medicine for the treatment of diabetic disorders, constipation, mouth ulcers, stomach ache and malaria. Even though it is widely used for medicinal and culinary purposes the nutritional and antioxidant properties are not yet fully known. The present study is intended to evaluate nutritional and anti-nutritional properties of plant along with its antioxidant potentials. The nutritional factors tested include fatty acids, amino acids, reducing sugars, carbohydrates etc and anti-nutritional factors include total phenol, tannic acid, phytic acid etc. Enzymatic antioxidants like SOD, POD, PAL, PPO and non-enzymatic antioxidants like tocopherol, ascorbic acid etc were also studied. Results showed that *Talinum portulacifolium* is rich in vitamin A, amino acids, fatty acid and moisture content whereas other proximate parameters such as vitamin C, vitamin E, lipids, carbohydrates etc were present in moderate amounts. As *Talinum portulacifolium* is rich in iron content it could be included in our daily diet in order to prevent certain disease such as anemia. Hence supplementation of the leaves of this plant in diet could be useful for improving nutritional status and strengthening the body.

Key words:*Talinum portulacifolium*, nutritional analysis, antioxidant potentials.

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Sacred Groves - Natural protection for biodiversity

Aparna P[1] and Khaleel K. M[2]

1.Department of Botany, Sree Narayana College, Kannur, Kannur University.
2. Department. of Botany, Sir Syed College, Taliparamba, Kannur, Kannur University.

Abstract

In our religion and culture there is a lot of emphasis on forests and their conservation. *Kavus,* which were mostly located along with a collection of thick natural vegetation, were a major place of worship associated with many believes. It is because of this believes and tradition, most of the sacred groves were protected in the past by local people. Protection of these natural vegetation is done also because of the explicit connections they show between cultural and biological diversity and their potential of people-oriented conservation efforts. Therefore, a holistic understanding of the current status and structure is essential for assessing their ecological role and formulating strategies for their conservation.This paper briefly reviews the studies conducted at some of the major sacred groves in Kannur district. The study highlights the floral diversity, and conservation strategies which could be a powerful tool for ensuring biodiversity conservation through community participation. The sacred grove was rich in plant genetic diversity and was composed of many ethnobotanically useful species, including wild edible fruits, medicinal plants etc.

Key words: Sacred groves, strategies for conservation, biodiversity conservation, community participation.

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Purification, characterization and kinetics of protease inhibitor from fruits of *Solanum aculeatissimum* Jacq.

Meenu K. V. G* and Murugan K

Department of Botany,University College, Thiruvananthapuram, 695 034, Kerala

Abstract

Solanum species are rich source of protease inhibitors (PI). Most PIs were low-molecular mass molecules that inhibit trypsin and/or chymotrypsin. PIs differ from each other in mass, amino acid content and number of reactive sites.A potential protease inhibitor was isolated, characterized including kinetics from the fruits of the tropical *Solanum* species, *Solanum aculeatissimum*(SAPI). Purification was carried through ammonium sulfate precipitation, ion exchange, gel filtration and affinity chromatography. The purity was checked by reverse phase HPLC chromatography. Purified SAPI showed a specific activity of 433.7 U/mg, with 0.95 mg protein content. Overall, the specific activity increased about 129.5 fold with 8.5 % yield of activity. The molecular mass estimated by size exclusion chromatography was agreed fairly with the SDS-PAGE results i.e., 22.2 kDa. Native-PAGE showed four isoinhibitors (p*I*: 4.7, 5.2, 5.6

and 5.9) and, inhibited both trypsin and chymotrypsin in 1:1 molar ratio. Dixon plots and Lineweaver-Burk double reciprocal plots revealed competitive inhibition of trypsin and chymotrypsin activity, with inhibitory constants (K_i) of 1.6×10^{-10} and 1.4×10^{-10}M, respectively. High pH amplitude (2-12) and broad temperature optima (10 to 80^0C) were noted for SAPI, and time course experiments indicated gradual loss in inhibitory potency on treatment with dithiothreitol (DTT). Circular dichroism spectrum of native SAPI displays random structure with more β-layers. Further, extreme physico-chemical parameters alter the inhibitory potential of SAPI. Chemical modification studies reveal that lysine residue(s) present in the reactive site of SAPI is vital for its inhibitory potentials. Future studies are warranted to analyze the biological potentialities of SAPI.

Key words: Chromatography,*Solanum aculeatissimum,*kinetic studies; protease inhibitors; purification.

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A comparative study of riparian and terrestrial species of *Cassia alata.* L. with reference to selected biochemical and anatomical parameters

Shary G and Nirmala J J

Abstract

The present study compares a plant species of *Cassia alata.* L., growing under two different vegetations namely riparian and terrestrial. The riparian species of cassia were collected from the Ithikkara river basin of Kollam district and the terrestrial species from Kollam town area. The plant samples were subjected to biochemical studies such as estimation of total chlorophylls, estimation of total proteins, estimation of chlorophyll proteins and estimation of total carbohydrates. The anatomical study of stem and root of the two species were done. The study clearly reveals that the total chlorophylls, chlorophyll proteins, total proteins and total carbohydrate content of the riparian species showed lesser amounts in relation to all the parameters than the terrestrial species which showed higher levels of chlorophylls, proteins and carbohydrates. In the riparian area, the pH of the soil was found to be 3.9 (more acidic) than in terrestrial area (7.5). The pH level of 7.5 – 7.7 was normally found to be the optimum for maximum rate of photosynthesis. The rate of photosynthesis was reduced because of more acidic pH. The decrease in the rate of photosynthesis also leads to reduced carbohydrate content in the riparian species. The decrease in the concentration of proteins is also related to high acidic pH of the soil, because low pH generally reduces the nitrogenase activity. The anatomical study of the stem and the root of the riparian and terrestrial species revealed prominent variations in both stem and root. The riparian stem showed more amounts of xylem parenchyma and medullary rays and less number of xylem tracheids whereas more amounts of xylem tracheids with few or no medullary rays in terrestrial species has been observed. This may be an ecological adaptation of the plant for various stress conditions particularly in riparian areas.

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Morphological and biochemical characterization of *Steviarebaudiana* Bertoni growing under different soil samples of Kerala

Thressiamma M[1*] and Suma M. T. S[2]

[1]Department of Botany, Mar Ivanios College, Thiruvananthapuram, Kerala,
*E-mail- thressiammamathew@gmail.com
[2] Department of Botany, H.H.M.S.P.B N.S.S.College for Women, Thiruvananthapuram, Kerala

Abstract

In the present investigation, the morphological and biochemical variations of *Stevia rebaudiana* Bertoni, a non-caloric biosweetner was characterized. Morphological characters of the plant grown vegetatively in different edaphic conditions were collected and studied from eight different districts of Kerala. Ethanolic extract was used for isocratic HPLC analysis to estimate the amount of sweet diterpene glycosides (Stevioside, Rebaudioside and Isosteviol) in *Stevia*. The obtained results showed wide and promising variations in morphological and biochemical observations. The biochemical studies showed high Rebaudioside (4.211 mg/ml) and Stevioside (18.346 mg/ml) from the plants grown in the soil collected from Aluva (Ernakulam district). The sandy soil collected from Cherthala (Allapuzha district) showed comparatively lower amount of all the three Diterpene glycosides. *Stevia* grown in the laterite soil from Munnar (Idukki district) comparatively showed highersweetner content with all the three glycosides. The study reveals the suitability of different soil types for the growth of *Stevia*, since it can be used as a substitute for sugar at low cost.

Key Words: *Stevia rebaudiana*, stevioside, Rebaudioside Isosteviol, HPLC

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Analysis of diversity in fruit morphology of different varieties of Pineapple *Anona comosus* (Ananas comosus (L) MER. cultivated in Kerala

Nisha A P and Radhamany P. M

Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, Kerala.
E.mail: ap_nishahari@yahoo.com

Abstract

Pineapple (*Ananas comosus* (Linn.) Merr. Is one of the most appreciated fruit from tropical and sub-tropical area because of its attractive flavor and refreshing sugar- acid balance. It belongs to the family Bromeliaceae. It is a herbaceous, self-sterile plant of about 90- 100cm in height with spreading leaves, which gives the plant a rosette appearance. The plant bears a single fruit, terminally on a peduncle, protruding out from the centre of the rosette. In the present study diversity in fruit morphologicalcharacters were studied in six accessions of *Ananas comosus* which include three varieties,Mauritius, Kew, and Amritha. The first principal component accounted for 96.625% phenotypic variance followed by 1.24%. The characters which show more variability in PC1 and PC2 include fruit height, fruit diameter, number of fruitlets, eye

number and eye number in the longest spiral. The UPGMA clustering revealed two principal clusters which separated all the accessions between Euclidean distance of 1.175- 1.647. The PCO scatter plot also showed the same results. Both cluster results and principal co- ordinate analysis revealed that MRKt 2, an accession of Mauritius variety is distinct in fruit morphology which needs further analysis on the basis of vegetative and floral characters or molecular markers.

Key words:*Ananas comosus,* Bromeliaceae, Principal component, UPGMA, Principal co-ordinate analysis.

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The diversity and distribution of *Osbeckia* (L.) of Kerala

Jomy Augustine and Ebin P J

Department Of Botany, St. Thomas College, Pala, Kottayam District, Kerala
E.mail: jomyaugustine@rediffmail.com; ebinpadiyara@gmail.com

Abstract

A study was conducted to find out the diversity and distribution of different species *Osbeckia* Linn. of Southern Western Ghats. Several field trips were conducted in the study area and collected materials for identification. Among the 11 species of *Osbeckia* collected, eight are endemic to Southern Western Ghats, of which three species are exclusively endemic to Munnar region of Idukki District. High altitude grasslands and ecotone between of shola forest and grassland are the major habitat of most species. High species diversity was observed in Idukki district. There are very significant variations existing within many species of *Osbeckia*. The variations are observed with the characters such as vestiture on hypanthium, leaf shape, leaf size, stem hairs, size of bract, mere of flower and flower colour. In order to avoid the confusions during the identification process, a new key is proposed.

Key words:*Osbeckia* of Kerala, endemic plants, variations in *Osbeckia*, key to species.

Poster presentations

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Ophiorrhizabarberi, a new source of wonder drug camptothecin from Western Ghats

Manu K. S, Renson T., Vijeesh Kumar P. V, Sonu S., Ginu J.*

Department of Botany, B. A. M. College, Thuruthicad, Pathanamthitta, Kerala
E.mail:ginujoseph1@gmail.com

Abstract

The genus *Ophiorrhiza* L. is known for its cytotoxic alkaloid, camptothecin. Camptothecin derivatives are well known cancer drugs and are considered as the most promising anticancer drug of the twenty-first century. Even though, many *Ophiorrhiza* species like *O.mungos, O.rugosa, O.pumila* etc. were reported as good source of this important alkaloid, most of the species are rare, endangered or even possibly extinct category. With an objective to

find out alternative sources for this vital alkaloid, the present study reports *O.barberi*, an endangered species endemic to Western Ghats as a new source of camptothecin. Organ wise phytochemical screening showed that the root produces 0.1% D.W camptothecin.

Key words: Camptothecin, *HPLC,*HPTLC, *Ophiorrhizabarberi,* Western Gats, endangered species.

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A complete profile on *Michelia champaca*- traditional uses, pharmacological activities and phytoconstituents

Ravindranadh K. R. S and Krishna C. R

GITAM Institute of Pharmacy, GITAM University, Visakhapatnam, Andhra Pradesh-530 045

Abstract

Indian medicinal plants are used as ancient style of providing helps too many ailments. Presently, variant peoples are looking on healthful plants for his or her primary health care wishes. The current review designates the morphological, ethnopharmacological aspects and active principles of *Michelia champaca* Linn. Being it's a vital healthful plant in Indian medication this are supposed to vary medical specialty activities like antipyretic, analgesic, anti-inflammatory, antihelmintic, anticancer, antihyperglycemic, antiulcer, antimicrobial, wound healing, antioxidant and antifertility activities. Different active constituents such as alkaloids, saponins, tannins, sterols, flavonoids, triterpenoids, michelia-A, liriodenine, parthenolide and guaianolides, methyl linoleate, methyl anthranilate, stigmasterol and 3β-16α- dihydroxy- 5-cholestene-21-al are a unit to date according in *Michelia champaca*. Well conducted biological studies area unit still required for many indications of this species. This review is useful to make interest towards *Michelia champaca*and should be helpful in rising new formulations with additional therapeutic and economical worth.

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Foliar epidermal studies in selected members of Rubiaceae and Fabaceae

Sheeba M.J

Department of Botany,T.K.M.College of Arts and Science Kollam, Kerala

Abstract

The Presentstudy is concerned with the leaf surface characters such as epidermal cell shape, distribution of stomata, type of stomata and stomatal density in two families namely Rubiaceae and Fabaceae. Stomata provide an additional tool in ascertaining the systematic position of the disputed taxa, when considered along with other parameters. The foliar epidermis provides characters of diagnostic value since its structure varies from plant to plant in angiosperms. The selected members of Rubiaceae are *Canthium didymum, Coffea arabica,Hamelia patens, Ixora coccinia,Morinda tinctoria.* The members selected from Fabaceae are *Gliricidia sepium, Flemingia stobilifera, Crotalaria striata, Clitoria ternatea, Sesbania sesban.* The foliar epidermal studies on Rubiaceae and Fabaceae were carried out to

assess the systematic position and the results are used to discuss how stomatal studies played a notable role to distinguish intra specific variation and evolution. It showed that the shape of the epidermal cells of Rubiaceae was regular but in *Morinda* it is irregular. In Fabceae epidermal cells are irregular. In Rubiaceae, stomata are present only in lower side were as in Fabaceae it is amphistomatic in most cases. InRubiaceae paracytic type of stomata and in Fabaceae anomocytic type. But Morinda showed the anomocytic type of stomata .The overall data of the various features of stomata, namely their distribution and size appear to show that remarkable variation occur in Rubiaceae and Fabaceae.

Key words:foliar epidermis, amphistomatic, anomocytic, Rubiaceae, Fabaceae

Systematics and Conservation Biology

Theme Presentations

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Conservation Biology- a holistic approach:strategies revisited

Nair G.M

Inter-University Centre for Genomics and Gene Technology
Department of Biotechnology, University of Kerala, Kariyavattom, Thiruvanathapuram 695 581
E. mail: gmnair51@gmail.com

Abstract

Conservation Biology is a holistic science which needs to bring in biologists from all the disciplines to a common platform for better defining of conservation and evolving strategies. A paradigm shift in approaches, therefore, is necessary for a meaningful conservation as there are multifarious problems that corners a biological organism to the point of rarity and thereby its extinction. Unless the problems are deeply dissected and the inherent and ecological dimensions of rarity analyzed and understood, no stand-alone conservation strategy would bring in the desired results. At this juncture, a multidisciplinary, inter-institutional and convergence approach is the need of the hour. The talk shall address the current approaches that are practiced for conserving biological organism to its abundance in nature as well as its establishment and sustenance in the ecosystem.

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Progression of classification to systematics

Mathew Dan

Plant Genetic Resource Division, Jawaharlal Nehru Tropical Botanic Garden
and Research Institute, Palode, Thiruvananthapuram, Kerala 695562

Abstract

Primitive classification was an applied science with extremely practical aims and benefits as for simple categorization of plants as medicinal, edible or toxic.The terms classification,

taxonomy and systematics are mutually bonded triad. While 'Classification' is the arrangement of organisms into groups based on trait similarity, 'Taxonomy' refers to the naming of organisms and their categorization, whereas 'Systematics' denotes the clustering of groups or organisms based on a unifying set of principles including interrelationships, evolutionary traits etc.The progression of classification to the present day systematics was not through a simple, smooth and straighttrail. The perception on classification underwent a series of refinement and revision through centuries and still the process is on-going. The botanical knowledge of our early forefathers was organoleptic, chiefly pertained to colour, shape, texture, smell or taste of a plant or plant part, merely based on the observations through sensory organs. The advent of microscopes and various other devices resulted in a renaissance to the progression of classification.Sooner or later, different schools of classification were evolved such as Artificial, Natural, Phenetic, Phylogenetic, Evolutionary etc. Consequently,the term 'biosystematics' was originated and attained popularity. Biosystematics "is at the same time most elementaryand most inclusive part of biology, most elementarybecause organisms cannot be discussed or treated ina scientific way until some taxonomy has beenachieved, and most inclusive because systematics inits various branches gathers together, utilizes,summarizes, and implements, everything that isknown about organisms, whether morphological,physiological, or ecological" (George Gaylord Simpson, 1961). Since the biodiversity of each country was recognized as its prestigious wealth,the biodiversity assessment became be a mandate to all countries, for which the tools of systematics are inevitable. Characterization of the genetic variability of crop plants attained great reputation as it is directly linked with the economy of a country. Such an attempt is relevant in the case of several wild plant species also, especially with respect to the food security and health security. Investigations on assessing the genetic variability may result in the discovery of elite genotypes with high level nutrition, potential secondary metabolites or disease resistant traits. In this context, the role of different tools of systematics is highly significant.

Oral Presentations

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Annona glabra, a successful invader- a case study from selected wetlands of Kannur, Kerala

Sreeja P

Department of Botany, Sir Syed College,Taliparamba, Kannur, Kerala- 670142
E.mail:drsreejarajeev@gmail.com

Abstract

Kerala is well known for wetlands. *Annona glabra* is one of the most common invasive species of mangrove rich wetlands in Kerala. About 3500 ha of mangrove rich wetlands present in Kerala, of which highest percentage is present in Kannur. The study area is located in the banks of Kuttikol river of Taliparamba, in Kannur district of Kerala.. This wetland is occupied with about 300 ha of pond apple *(A.glabra)*. It is a native from Florida. Today it is regarded as a worst weed in many countries because of its invasiveness, potential for spread and economical and environmental impacts. The methodology of the study includes the floristic study and also the socio economic impact of the plant. Survey conducted and interviewed many personalities related with agriculture and also stakeholders. The anatomical and morphological features also

studied. The morphological and taxonomical studies revealed that they are deciduous and woody with simple entire leaves and solitary flowers. Flower has two whorls of fleshy petals, 3 large outer petals enclosing 3 small inner petals. Blooms open at night and emit fragrance. The indehiscent mature fruit are greenish yellow when mature and has sweet aroma. Flooding during rain brings seeds and rapidly invades in this area. Several hectares of the land is now occupied with this invader and are created great economic loss to the farmers. Its overgrowth also influences the mangroves. It is very essential to utilize this plant for some beneficial aspects or as bio fuel etc., otherwise it become a great threat to our ecosystem and also lead to the extinction of many native species.

Key words: Kuttikkol, mangroves, pond apple, invasive

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Arborescent Angiosperm species of the Agasthyamalai Biosphere Reserve endemic to the Western Ghats

Jagadeesan R*[1], Gangaprasad A[1],Sam P Mathew[2]

1. Department of Botany, University of Kerala, Kariyavattom,Thiruvananthapuram, Kerala
2. Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Karimankode P.O., Thiruvananthapuram district, Kerala-695562, India.

*Email: vishnulamourplantes888@gmail.com

Abstract

Agasthyamalai Biosphere Reserve established in 2001, located between the latitudes 8° 8' to 9° 10' N and longitudes between 76° 52' to 77° 34' cover an area of 1672.36 km², straddles along the southern most part of the of the Western Ghats in Kerala and Tamilnadu states. According to an official estimation, an area of 1828 km² of the biosphere reserve is located in Kerala shares the border with Kollam and Thiruvananthapuram districts and remaining 1672.36 km² in Tirunelveli and Kanyakumari districts of the Tamilnadu state. It includes three wildlife sanctuaries such as Neyyar, Peppara and Shenduruny and their adjoining areas in the Kerala and Kalakkad-Mundanthurai Tiger Reserve in Tamilnadu. The pristine Agasthyamalai sub-cluster including the Agasthyamalai Biosphere Reserve is under consideration by the UNESCO World Heritage Committee for the selection as one of the World Heritage Sites. The vegetation of the biosphere reserve consists of moist deciduous forests, montane tropical rain forests and shola forests. This region is known to host approximately2000 medicinal plant taxaincluding severalrare endemics. The present work demonstrates details of endemic arborescent Angiosperm species of the Agasthyamalai Biosphere Reserve.

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In vitro morphogenic response in cotyledon explants of *Anacardium occidentale* L.

SijaS.L*, **PottyV.P****and SanthoshlalP.S ***

* Department of Botany, S.N.College, Kollam.
**CEPCI Laboratory &Technical Division, Cashew Bhavan, Kollam.

Abstract

Cashew (*Anacardium occidentale*L.), an important edible nutcrop, is cultivated in tropical areas of India, Brazil, and the Africancontinent. It belongs to thefamily *Anacardiaceae*. It is much known for its commercially valuable kernals and liquid from nut shell called CNSL.CNSL is essentially a mixture of phenolic compounds namely anacardic acid, cardol and cardanol.It has lot of applications in medical and industrial field. The present investigation was conducted to study theeffects of auxin and cytokinin on callus induction and root organogenesis in cotyledon explant of cashew cultured in MS and WP medium. The *in vitro* propagation of cashew isstill faced with lots of challenges such as blackening or browningof tissues prior to culture due to the oxidation of phenoliccompound by polyphenolic oxidase enzyme present in the tissuewhen excised. In the present study, inhibitory effects ofdifferent treatments such as adding activated charcoal (AC),polyvinylpyrrolidone (PVP), ascorbic acid/citric acid combinationto the medium, daily transfer of explants into fresh medium orchanging culture conditions to the dark were studied againstbrowning problem of the explants. Based on the results of this study, maximum callusing was noticed on the cotyledon explants grown on MS basal medium augmented with 2,4-D (20 mg/l) and BAP (15 mg/l)than WP medium.The results also revealedthat WP medium with high concentration of 2,4-D and BAP exhibited profuse root organogenesis thanMS medium. Theimportance of developing the callus line has increased overthe years because of active compound production, and thepossibility of genetic transformation in the pharmaceuticalsector and, in the future, also has considerable potential as analternative means for production of known and new secondarymetabolites.

Key words: *Anacardium occidentale*, callus induction, Woody Plant (WP) medium, Murashige and Skoog (MS) medium, root organogenesis.

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Population studies of *Garcinia imberti* - an endangered endemic tree of the southern Western Ghats

Anto Mathew*, Prajith T.M, Jothish P. S and Anilkumar C

Jawaharlal Nehru Tropical Botanic Garden and Research Institute
Palode, Thiruvananthapuram – 695 562
*antokmmavady@gmail.com

Abstract

Garcinia imberti Bourd. is an endangered species of the family Clusiaceae endemic to the southern Western Ghats. It was originally described by Bourdillon from Travancore hills. Tribals

of this area use the exudates from the stem bark as an antiseptic for wounds. Floristic studies revealed that this species is confined to the distracted populations amongst the Chemunji hills of Peppara sanctuary, Athirumala of Agasthyamala Bio Reserve and Ponmudi shola forests. In order to study the population structure of *G. imberti,*15 permanent quadrates of 10x10 m were established at its native ranges of Chemunji hills and Ponmudi hills. All the individuals of *G. imberti* in these quadrates were marked and their dbh, height, number of branches *etc.* were noted. Seedlings parameters of every plot such as their height, number of leaves, branches if any were also recorded. The density, abundance, relative dominance and Important Value Index (IVI) of the species were calculated. Based on the result conservation implications of *G. imberti* will be discussed.

Key words: *Garcinia imberti,* Conservation, population structure, quadrate analysis, the Western Ghats.

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Studies on the comparative morphological characters of two species of *Cinnamomum* Schaeffer (Lauraceae)

Remya Krishnan R.V.[1], E.S. Santhosh Kumar[2], Radhamany P.M. [1] and Valsaladevi G.[1]

1. Department of Botany, University of Kerala, Kariavattom P.O., Kariavattom, Kerala, India.
2. Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Karimankode P.O., Thiruvananthapuram district, Kerala-695562, India.
email. id: remyakrishnan519@gmail.com

Abstract

The genus *Cinnamomum* schaeffer, belongs to the family Lauraceae consists of *c.* 250 species and is distributed from Southeast Asia to Australia (Kostermans, 1995). In India, the genus is represented by 45 species (Baruah & Nath, 2007; Geethakumary et al., 2014; Gangopadhyay, 2008) of these 25 species are reported from South India and 19 of them are endemic to this region (Kostermans, 1983; Nayar et al., 2006). In the present study, a comparison on morphological characters of two species of *Cinnamomum* i.e., *Cinnamomum malabatrum* and *Cinnamomum verum*, was carried out with different measures of variability. From each species, four accessions were collected and the data (ten observations for each parameter) was subjected to morphometric studies by means of statistical analysis (ANOVA and CLUSTER analysis). Morphometric variability records showed significant variation among accessions selected. In PCA (Principal Component Analysis), 40 characters were analyzed. First and second principal component together accounted for 99.939% variability. Dendrogram plotted on the basis of morphological data showed existence of two broad groups of clusters. Accession of *C. malabatrum* (CM1) from Alappuzha (Euclidean distance 0.75) is identified as most distantly related from other accessions. Second distantly related accession is of *C. verum* (CV1) collected from Kozhikode (Euclidean distance 0.733). The cluster analysis based on vegetative and reproductive morphological traits revealed that some accessions from both the species showed similarities without species delimitation. Principal Co-ordinate Analysis and its Scatter Plot also support the cluster analysis. There for the present study reveals morphological diversity within the species and also interspecific relationship.

Keywords: *Cinnamomum*, morphology, ANOVA, cluster analysis

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High frequency induction of multiple shoots from nodal explants in *Catharanthus roseus* (L.) G – Strategy for conservation

Priji S and ⋆ Sreedevi S
Department of Botany and Biotechnology, Sree Narayana College, Kollam, Kerala, India.
E-mail: ssdevijk@rediffmail.com

Abstract

Catharanthus roseus (L.) G. Don (family Apocynaceae) is a highly valued medicinal plant cultivated mainly for its alkaloids, which possess anticancerous and antihypertensive activities. The increasing demand together with lack of cultivation of the plant necessitates efforts for its conservation. This study reports the high frequency induction of multiple shoots using nodal explants. Single nodes from established plantlets could be recultured at 4-5 week intervals without decline in proliferation rate. Half strength Murashige and Skoog's (MS) basal medium supplemented with indole 3- butyric acid (IBA)at 0.2 mg L^{-1}gave cent percent rootinduction.This paper also describes rapid and efficient protocol for callus induction using explants such as leaf, shoot tip, node and internode explants. Among the different explants, leaf explants gave the best response in MS medium supplemented with 2, 4- dichlorophenoxy acetic acid (2, 4-D) 0.5 mg $^{-1}$ and 6-Benzyladenine (BAP) 1mg^{-1}. The findings may contribute to establishment of good cell suspension cultures as well as studies on secondary metabolite production. Considering the medical importance of this plant, the protocol standardized in this work may be effectively utilized for germplasmconservation, cryopreservation and mass multiplication to supply quality planting material to growers as well as material for pharmaceutical industries.

Key words: Multiple shoot, callus, explant, conservation

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Ex-situ conservation and creation of awareness of medicinal and aromatic Plants through establishment of Gene bank at S.F.R.I., Jabalpur.

Pandey R.K, Prakash R, Krishnmurty G, Homkar Uand Haldkar A

State Forest Research Institute,
Gwarighat Road, Polipather, Jabalpur- 482008

Abstract

Madhya Pradesh represents the rich diversity zone after two mega-diversity areas of India, *i.e.* Western and Eastern Ghat. The state of M.P., as geographically middle part, between Western and Eastern Ghat is the main producer of varieties of natural forest resources in central India, Diversified indigenous NTFPs are the main source of livelihood and provide food, medicine, fiber etc. *In-situ* and *Ex-situ* conservation of such medicinal forest resource are the

need of the day. In this context, State Forest Research Institute, Jabalpur is aimed to conserve medicinal and aromatic plants in *Ex-situ* gene bank which was established in 1996. There are 415 plant species are conserved in this gene bank from different climatological zones of the Madhya Pradesh. In this gene bank, some red listed plants like *Acorus calamus, Curcuma caesia* and *Swertia chirayita* (Critically Endangered), *Berberis aristrata, Gloriosa superb, Hedychium coronarium, Rauwolfia serpentine, and Sertia angustifolia* (All endangered)*; Clerodendrum serrahum, Curculigo orchioides, Thalicrtum foliolosum Tylophora asthmatica and Unginia indica* (All vulnerabhle); *Celastrus paniculatus* (Low risk) and *Evolvulus alsiniodes* (Low risk least concern) have also been conserved successfully. Some of these conserved plants are also being multiplied successfully in the medicinal plant nursery. More than 1000 visitors including students, farmers and personnel from various departments, institutions and industries visit his gene bank every year. Important medicinal plants from the gene bank are exhibited in different exhibitions, and fares also for crating awareness among the people regarding conservation of medicinal plants.

Key words: Gene bank, medicinal plants, ex-situ conservation, awareness and red listed plants

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Mikania scandens B.L. Rob.- climbing hempvine (Asteraceae)- a fast naturalizing exotic weed in Indian subcontinent

Preetha S.S and KaladeviV*

Department of Botany, St.John's College, Anchal
Department of Environmental Sciences, St.John's College, Anchal.
rojinpreetha@yahoo.com, kalahainandhanam@gmail.com

Abstract

Mikania scandens a troublesome weed is naturalizing in the country with faster rate. Naturalization of exotics poses very serious threats to the survival of many of our indigenous flora. It wide spreads in wet places, forest borders and clearings, along the banks of streams and rivers, road sides and railway tracks, in pastures, forest plantations, agricultural and agro-forestry system, open distributed areas and barren lands. Mikania grows luxuriantly on leached and nutrient poor sandy loam to clay soils. It is a perennial twining herb, only little information is available about its identity and floral characters, hence described here with illustrations.

Keywords: Naturalization, indigenous flora

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Section *Trifoliata* (Oleaceae) in Kerala State

Yohannan R[1]andDevipriya V[2]

Department of Botany, Sree Narayana College, Kollam, Kerala
[2]Department of Botany, Sree Narayana College, Chempazhanthy, Kerala
E.mail: devipriyascorp@gmail.com

Abstract

Jasminum L. is the largest genus of the olive family Oleaceae, with approximately 200 species world over. It has been considered to be native to tropical and warm temperate regions of the old world, with distribution from Portugal to Canary Islands across Southern Europe and whole of Africa as far as Formosa, Thahiti and Australia. The genus is represented in India by 47 species, three subspecies and four varieties, of which 16 are endemic to the region. The genus *Jasminum* is traditionally classified into 4 sections (*Alternifolia, Unifoliolata, Pinnatifolia* and *Trifoliolata*) by De Candolle in 1844, based on the leaf arrangement and the leaflet number. In addition to this, Green (2001) had contributed a new section, *Primulina*. Section *Trifoliolata* is an artificial group with all the members possessing trifoliate leaves being brought together for the sake of convenience, and hence is easily recognized. Six taxa belonging to this section have been collected from different parts of Kerala through extensive field explorations all over the State. They are *Jasminum auriculatum* Vahl., *Jasminum azoricum* L., *Jasminum brevilobum* A. DC., *Jasminum calophyllum* Wall. ex A. DC., *Jasminumcaudatum* Wall. ex Lindl. and *Jasminumflexile* Vahl. The collected taxa were identified after consulting standard flora and herbarium specimens. The voucher specimens are deposited in Sree Narayana College herbarium.

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Environmental and ethnobotanical studies of *Thespesia populnea* Linn.

Kaladevi V and Preetha S.S *

Department of Environmental Sciences, St. John's College, Anchal
*kalaharinandhanam@gmail.com

Abstract

Thespesia populnea is a reputed ever green tree belonging to the family Malvaceae; commonly known as Indian tulip tree. The plant is distributed in tropical regions and coastal forest in India. It is well known and all the parts are used in Indian system of medicine. The plant has been used as astringent, antibacterial, hepato-protective, haemostatic, anti-diarroheal and anti-inflammatory. The Plant also shows various pharmacological activities like Dermatitis, Anti-steroidogenic activity, wound healing activity, Antioxidant activity etc. The plant *Thespesia populnea* (Malvaceae) traditionally claimed to be useful in the treatment of cutaneous affections such as scabies, psoriasis, ringworm, guinea worm, eczema and herpetic diseases. Oil prepared by boiling the ground bark in coconut oil is applied externally in psoriasis and scabies. From the

above data, it is can be said that, the plant *Thespesia populnea* is promising for further investigations to prove its multi activity.

Keywords:hepatoprotective, haemostatic, anti-diarroheal, antioxidant activity

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Pollination ecology of *Palaquium ellipticum* (Daltz.) Baillon – a key ecological species in tropical evergreen forests of the Western Ghats

Jothish P.S*andAnilkumar C

Division of Conservation Biology, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thriuvananthapuram – 685 562; *jothishtbgri@gmail.com

Abstract

Knowledge on phenology and pollination biology are basic elements that should be considered for evolving *in situ* conservation strategies.The present study describes the pollination ecology of *Palaquium ellpticum* (Sapotaceae), an ecologically important endemic tree species of the Western Ghats. It is one of the important elements of the *Cullenia-Mesua-Palaquium-Gluta* and *Mesua-Palaquium-Poeciloneuron-Hopea* associations found in the mid elevation tropical evergreen forests of the Western Ghats. Phenology, anthesis, floral longevity, pollen fertility, stigma receptivity, pollination events, flower visitors and breeding system of *P. ellipticum* was studied for a period of three years. It was observed that flower bud initiation occurs in October and peak flowering was observed in February – March. Flowers are borne in fascicles on the leaf axils. There is no specific time for anthesis. Flower opening was marked by enlargement of corolla. Pollen grains are smooth and produced in large quantity. Stigma is protogynous, pointed and sticky and protruded out of the corolla tube. Highly viscous nectar was produce during the late stage of flowers. A large number of animals (6 species of mammals, 19 species of birds and 12 species of insects) visited flowers of for nectar. Even though, the flowers are wind pollinated, the study showed that *P. ellipticum* need an external agency for releasing pollen into air. Controlled pollination experiments on autogamy, geitenogamy, xenogamy and open pollination showed that *Palaquium* is an outcrossing species.

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Insecticidal potentiality of flavonoids from cell suspension culture of *Marchantia linearis* Lehm. & Lindenb against *Spodoptera litura* F.

Remya Krishnan* and Murugan K

Department of Botany,University College, Thiruvananthapuram, 695034, Kerala

Abstract

Bryophytes were diverse, primitive non vascular amphibious taxa distributed worldwide and form the second largest category of plants. Bryophytes synthesize an array of phytochemicals to combat against the unhospitable environmental conditions including

predation, UV radiation, high temperature and pest and pathogens. The present investigation was undertaken to elucidate flavonoids from *in vitro* cell cultures of the liverwort *Marchantia linearis* Lehm. & Lindenb. its fractionation and analysis of insecticidal potentialities. Initially, callus culture was initiated from spores in MS/5 media containing growth regulators BAP and NAA at the concentration of 2 mg/L and 0.5 mg/L. Agitation of the friable callus at lower rpm bring about lower level of cell dispersion, on the contrary at higher rpm might have risk of cell collision that is why rpm was kept at moderate speed i.e., 110 rpm. Continuous sub culturing process substantially improves cell growth and biomass. In the second phase, the flavonoids were isolated from cell suspension cultures of *M. linearis* and were fractionated by TLC and HPLC PAD chromatogram, which revealed the presence of quercetin, luteolin, apigenin, rutin and kaempferol.*In vivo* insecticidal analysis revealed significant antifeedant,larvicidal and pupicidal activities at all the concentrations against 5th instar larvae of *Spodoptera litura*. The extract also exhibited feeding deterrent activity with *M. linearis.* Similarly, the nutritional parameters were also affected i.e., reduced ECI (Efficiency of conversion of ingested food) and ECD (Efficiency of conversion of digested food) and increased AD (Approximate digestibility) and metabolic cost for the larvae, when compared with the control. The consumption of the basal diet with the incorporation of flavonoids by *S. litura* larvae was not significantly different compared to the consumption of the control diet by the larvae. Faecal production reduced proportionally with concentrations of the extract.

Key words: Bryophytes, Cell suspension, *Marchantia*, insecticidal, metabolic cost, *Spodoptera litura*

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Morphological and Taxonomical Studies on Eight Species of *Salacia* L.

Devipriya M.S*, Devipriya V[1] and Udayan P.S[2]
Department of Botany, Sree Narayana College Kollam, Kerala
[1] Department of Botany, Sree Narayana College, Chempazhanthy, Kerala
[2] Department of Botany, Sree Krishna College, Guruvayoor, Kerala
E-mail: devinaveen04@gmail.com

Abstract

A detailed morphological study on eight species of *Salacia* L.was conducted by collecting data from the foliar and floral parts. The members were mostly wild lianas with *S. agasthiamalana*, a newly discovered species from Agasthiamala, alone being a bushy shrub, while *S. chinensis* and *S. fruticosa* were straggling shrubs. Further, majority of them were restricted to selected forests of Kerala, but S. *fruticosa* proved to be an exception, with a state-wide distribution. The leaves were mostly opposite, spinach green, oblong to elliptic, entire or slightly serrate, coriaceous and glabrous with curved petioles. The small green or yellow flowers were arranged in axillary or cauliflorous cymes often fascicled or in dichasial cymes or umbellate clusters. The number of flowers per cluster ranged from 1 to 30. The pedicellar features also showed much variation .The flowers were minute, and there was consistency in the number of members in different floral whorls –calyx and corolla (5), stamens and carpels (3) and stigma (1). Except in *S. beddomei* and *S. malabarica* the calyces were mostly polysepalous.

The calyx margins were fimbriate in most members, but serrulate in *S. chinensis* and *S. oblonga*, and truncate and sparsely toothed in *S. fruticosa*. The variation in calyx margin is expected to serve as a valuable character in species identification.The corolla was mostly green or yellow with tinges of cream, yellow or brown towards the margins. The petals were clawed in *S. chinensis*. The discoid anthers were variously coloured being white, creamy, yellow or even bright orange as in *S. chinensis*. The extrorse and reflexed filaments were also cream, yellow or green in colour.The superior tricarpellary ovary was mostly triradiate from upper view, but conical in the case of *S. chinensis* and *S. oblonga*. The nectariferous disk was fleshy, annular-pulvinate, conical or platform-like and greenish yellow, yellow or orange. The slender style and simple umbonate stigma were green, or yellow in colour. The berries were red when mature and globose, sometimes elliptical or pear-shaped with a smooth or rugose, rarely coriaceous surface, beaked in *S. macrosperma* and warted when young in *S. vellaniana,* the second newly discovered species. The floral morphological features serve as distinguishing characters in identifying the various species of *Salacia.*

Key words: Morphology,*Salacia,* Kerala, straggling, Taxonomy

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Floral morphometrics of the genus *Alternanthera* Forsskal (Amaranthaceae) from South India

Resmi A. R, Anilkumar S[1] and Preetha T.S*

Department of Botany, University College, Thiruvananthapuram-695034
[1] Sree Narayana College, Chempazhanthy,Thiruvananthapuram
E.mail: preethahemanth@yahoo.com

Abstract

Family Amaranthaceae is in need of a revision on a global scale. The current classification within the genus *Alternanthera* is based mostly on the vegetative morphology. The present investigation presents a systematic approach to study the genus *Alternanthera* using floral morphological characteristics. The species under study are,*Alternanthera brasiliana*(L.) Kuntze, *A. paranychioides* St. Hil., *A. philoxeroides*(C. Martius) Griseb., *A. pungens* Kunth, *A. sessilis* (L.) R. Br. ex DC., *A. tenella*Colla along with one of its cultivar. At least two accessions belonging to six species of *Alternanthera*and two accessions of a variety was selected for the study.Floral morphology was thoroughly observed with the help of hand lens and stereo zoom microscope based on 12 qualitative and quantitative traits. Twenty five inflorescences from each accession were analysed. Statistical tools such as one way ANOVA, UPGMA Cluster analysis, PCoA and PCA have been used for elucidating species boundaries and inter relationships. The qualitative and quantitative data on floral characters analyzed by PCA and one way ANOVA showed significant variation in different parameters among the floral characters of *Alternanthera* species. The UPGMA phenogram and the PCoA scatter plot clearly pointed out the existence of two species groups: the first group with *A. sessilis, A. tenella* along with its variety and the second one with *A. brasiliana, A. paronychioides, A. philoxeroides* and *A. pungens*. The results

of floral morphological analysis can be utilized as a diagnostic character in systematics and can be better utilized in discrimination of plants at intra/ interspecific levels in *Alternanthera* which will provide a concrete support for a future revision of Amaranthaceae throughout its range of distribution.

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Ecological niche modeling to trace unknown populations and restoration planning of endangered plant species: A case study in *Vanda wightii* Rchb.f., an endangered orchid species of the Western Ghats.

William Decruse S

Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram-695562

Abstract

Ecological niche modeling is a machine tool used to study distribution of a plant/animal species over ecologically similar habitats. Maximum entropy modeling using maxent software is one of the tools that was evaluated in the present study, for its utility to trace unknown populations as well as to find suitable place for reintroductionof *Vanda wightii* Rchb.f. an endemic and endangered orchid of India and Sri Lanka. The occurrence points recorded as longitude and latitude data of already reported localities and those discovered during our preliminary survey enabled to create a distribution model using maxentsoftware. Out of the 14 climatic variables used for modeling, precipitation during October-December, contributed 72.5% to the maxent model and emerged as the most effective predictive variable.Out of the 31 occurrence points selected for modeling, 56.16% of them fell in the 65-100% and 41.9% in the 48-65% probable region of most suitable habitats for their survival, as per the created model. Only 6.4 % of the points fell in the 0-32% probable region. The model revealed climatic conditions suitable for the species extending from Idukki district of Kerala to Dakshina Kannada district of Karnataka in addition to SriLanka. The presence records were mostly in inhabited areas or disturbed forests except those in Idukki Wild Life sanctuary.The study revealed efficiency of ecological niche modeling to trace new populations and identify protected areas for restoration of *V. wightii*.

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Underutilized vegetables of Kerala

Praseedha P.S and Merylin V.J

Department of Botany, Fatima Mata National College, Kollam, Kerala
E.mail:praseeps44@gmail.com

Abstract

Indian subcontinent is an important centre of origin for a large number of crops.The country is blessed with diverse climatic conditions enriched with enormous genetic wealth and, has immense potential to grow an array of vegetables which can meet the requirement of phytochemicals essential for human health. A number of underutilized vegetableplants for fruits,stems,roots,flowers,legumes,several coloured greens are adequately rich in antioxidant and phytochemicals besides some necessary nutritional components like vitamins,minerals and dietary fibres. It is almost essential to supplement the diet with vegetables rich in antioxidant to fight and prevent aging related diseases,obesity etc.The high population density and increasing demand on agriculture led to destruction of biodiversity and consequently narrowing down the versatility of food baskets.In this context underutilized vegetables embedded with rich nutrients potentials and ability to stand against diverse climatic conditions may prove boon,particularly to the world's poorest people tapped properly.Conservation and utilization of underutilized vegetables will bring immense prosperity not only locally but also globally.

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Morphometric characterization of ten *Capsicum* varieties

Chinchu S. K and Resmi L*

Department of Botany, Christian College, Kattakada, Thiruvananthapuram
*Present Address: Department of Botany, University of Kerala, Kariavattom

Abstract

The genus *Capsicum* belongs to the family Solanaceae (Night shade). Present study characterized ten *Capsicum* varieties belonging to three species *C. annuum*, *C. chinense* and *C. frutesence* from Thiruvananthapuram, Kerala, using morphological descriptors. Varieties were identified with the help of experts in Department of Olericulture, Agriculture College, Vellayani, Thiruvananthapuram. Thirty nine morphological characters were assessed, 26 qualitative and 13 quantitative. Vegetative characters were evaluated 100 days after planting, and non-vegetative characters were evaluated after fruiting stage. Ten plants and 10 fruits of each replication were used for this analysis. The qualitative characters were evaluated according to the grading scale proposed by the Brazilian National Plant Variety Protection Systems (SNPC, 2012). Each character was observed based on descriptor states and each state was assigned by numerical codes. The coded data was tabulated and compiled. In the present study, fruit characters are seem

to be more discriminating among accessions. Significant differences were observed among the samples for the majority of characters assessed revealing the presence of high amount of genetic diversity.

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Reinforcement of mechanical properties in irradiated coconut leaves by methyl methacrylate (MMA)

Kavitha K.R* and Dhanya C**

*Department of Botany, Sree Narayana College, Chempazhanthy,Thiruvananthapuram, Kerala.
** Research & P.G Department of Botany, Sree Narayana College, Kollam, Kerala.
E-mail: drkavithakr@gmail.com

Abstract

In recent times efforts are being made to improve the quality of different plant materials. Agricultural or biodegradable materials have played a major role in human life. Kerala is the largest producers of coconut palms. The coconut leaf has been used in different purposes. However the coconut leaves undergoes rapid deterioration and needs annual replacement. The purpose of the present investigation is to study the possibility of irradiation methods to reduce leaf deterioration of coconut palms. The collected leaves were categorized in to tender, mature and dried leaf bits. 20 samples from each of the samples were immersed in a beaker containing 150ml of unstabilized methyl methacrylate (MMA) monomer for 180 hrs. The irradiation process was carried out using electron beams for inducing the polymerization of monomer infiltrated leaf bits. For electron beam irradiation, the samples were grouped in to three sets for giving radiation doses 5 kGy, 10 kGy and 15 kGy. 20cm long and 2cm wide specimens were used for tensile testing on an Instron testing machine. The mean value of the property measured was compared with the control samples without any monomer treatments.From these studies, assure that the monomer treated Coconut leaf samples cured by electron beam irradiation at particular doses made a change in their mechanical properties (tensile strength) thereby enhancing the durability and longevity of the samples. These converted leaf bits offers a big possibility of making high utility commercial products accessible to ordinary people.
Key words: irradiation, methyl methacrylate, coconut leaves, electron

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Shoot multiplication, organogenesis and somatic embryogenesis in *Plumbago capensis* Thunb.

Anoop Ashok, Indu P. Balachandran, Syam O. S. and Rubin Jose A.S

Biotechnology Laboratory, Department of Botany,Fatima Mata National College, Kollam

Abstract

Tissue culture protocols were standardized for the micropropagation of *Plumbago capensis* Thunb., a highly medicinal plant of the family Plumbaginaceae. Rapid clonal multiplication was

achieved via nodal segments and inters nodal segments. Shoot multiplication was observed in combination of BA and IAA. Indirect organogenesis was observed from callus formed in presence of BA and IAA. Friable callus is obtained from cultures containIg 1mg/l IAA and 1mg/l BA. Somatic embryos were initiated from callus cultures derived from medium containing BA along with IAA/IBA.

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Micropropagation of *Rhinacanthus communis* Nees.

Indu P. Balachandran, Anoop Ashok, Syam O. S and Rubin JoseA. S.

Department of Botany,Fatima Mata National College, Kollam

Abstract

Rhinacanthus communis, Nees. commonly known as snake jasmine. It is a highly medicinal plant native of India. It is used as a remedy for the snake bite. The fresh roots and leaves are used as a remedy for ringworm and other skin affections. The plant is at the brim of extinction and hence the plant was selected for tissue culture for the large scale propagation through shoot multiplication, organogenesis and somatic embryogenesis. MS medium, is used for the tissue culture studies of *Rhinacanthus communis*, with different concentration of BA and IAA/IBA. Only two shoots were emerged from callus containing 2mg/l BA. Callus regeneration was noted from callus containing IAA/IBA (1.5mg/l) and BA (0.5mg/l). Somatic embryogenesis was also noticed along with callus regeneration. Histochemical localization is also performed using callus formed from the explant. Starch, lipids and proteins which are histochemicaly localized at different stages of organogenesis. The starch is localized by potassium iodide solution, lipids by Sudan black B and proteins by bromophenol blue and acetic acid. Starch deposition was observed in the shoot bud forming regions of organogenetic callus.

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Micropropagation of *Andrographis paniculata* Nees.

Simi Mathew and Rubin Jose A. S

Department of Botany,Fatima Mata National College, Kollam

Abstract

Tissue culture protocols were standardized for micropropagation of *Andrographis paniculata* Linn; a medicinal plant of family Acanthaceae. Rapid clonal multiplication was achieved via, nodal segments and shoot tip culture, indirect organogenesis and synthetic seed production. A gradual increase in the number of shoot was noticed from lower to higher concentrations of BA. 3 shoot were produced from the nodal segments cultured on MS medium containing 2.5mg/l after 25 days. MS medium containing varying concentrations of IAA produced green callus after 20 days inoculation. Different types of green callus were obtained in MS medium containing varying concentration of BA along with IBA. Synseeds were produced by

encapsulating *in vitro* buds in calcium aiginate beads. They retained germination capacity for more than 3 months when stored at 4^{o}C.Lipids were not common in the initial stages of callus differentiation. Callus with shoot buds showed the maximum deposition of lipids. Protein deposition was found near the root initiating regions. Proteins were also seen associated with parenchyma cells near the vascular regions. Heavy starch deposition was noticed at the meristematic regions of the organogenic calli. Chlorophyll b content was lowest in shoots developed from cultures containing 1 mg/l BA and 1 mg/l IAA. Maximum carotenoid content was noticed in shoots developed from cultures containing 3mg/l BA and 3 mg/l IAA.

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Tissue culture studies in *Hemidesmus indicus*(L.) R.Br.

Syam O. S, Anoop Ashok, Indu P. Balachandran and Rubin Jose A. S

Department of Botany,Fatima Mata National College, Kollam

Abstract

The present tissue culture study was carried out in an important medicinal plant *Hemidesmus indicus* (L.) R.Br. belonging to the family Asclepiadaceae . The investigation was conducted to standardized protocols for rapid clonal multiplication through Shoot tip/nodal segment culture, Direct organogenesis -and-Synthetic seed as well as to analyse the biomolecules in the callus and regenerates using General cytochemistry;, Pigment analysis, ,General protein analysis. The shoot tips and nodal segments from the plants were cut into pieces of about lcm length and inoculated into full strength MS medium supplemented with 0.5-2 mg/1 and 1-4mg/1 IAA. There was development of multiple shoots after 4 weeks of inoculation. Nodal segments developed a maximum of four shoots in MS medium supplemented with 1.5mg/1 BA. Nodal segments cultured on MS medium supplemented with 3mg/1 IAA produced a maximum of three shoots. A gradual decrease in concentration of kinetin reduces the rate of shoot multiplication. Callus induction was obtained this from nodal explants. Compact creamy white callus obtained from leaf explants cultured on MS medium containing 2mg/l BA alone. Nodal explants cultured on MS medium containing 1 mg/1 IAA produced creamy white friable callus.

Reproductive mechanisms and their failures in flowering plants

Theme Presentations

301
Factors limiting recruitment of tropical forests

Sinu Palatty Allesh

Scool of Biological Sciences, Central University of Kerala, Kasargod
sinupa@gmail.com

Abstract

The stability of the species depends on recruitment of new individuals to sustain populations. Seedling recruitment in tropical rainforests is a major constraint as seeds and seedlings are subjected to an extensive predationand herbivory. For species which is a source of non-timber forest products (NTFP), human intervention in the form of fruit and nut collection becomes an additional constraint for recruitment particularly in the developing countries, where millions of people depend the forests for their livelihood. In tropical climates, most wild plants have to undergo a series of events that may affect the natural recruitment. This includes pollination, seed dispersal, pre-, and post-dispersal seed predation. Pollination is a very critical step in the entire recruitment process. Over 98% of the tropical wild plants are animal-dependent for pollination. Since it is a mutualistic interaction between two parties, plants and animals, legitimate behavior of the visitors is critical for effecting pollination. Seed dispersal is the second important step in the recruitment of plants in tropics. Frugivorous animals play an important role in the spatial arrangement and distribution pattern of plants in the tropics. Seed dispersal mutualism is vulnerable in fragmented habitats of the tropics. The behavior of the frugivores on fruiting plants is critical for favorable distribution of the seeds across space and time. As an important selective force, seed predation can affect plant community structure, population density, species richness and spatial dynamics of plant recruitment in tropics. Ecosystem processes, such as habitat fragmentation, disturbance and transformation can affect the seed predator fauna, predation rate and eventual recruitment of tropical plants. Plant-animal interactions which occur during pollination, frugivory, seed dispersal and seed predation are critical in determining reproductive success and seedling recruitment of the plant species. My study on Terminalia bellirica has shown that about 97% of the fruits are lost to seed predators at pre-, and post-dispersal stages. My presentation will cover all the three types of plant-animal interactions with suitable case studies. I will explain the importance of behavioral ecology, particularly the foraging ecology of the animals that affects the pollination, seed dispersal and seed predation.

Key words: Pollination, seed dispersal, seed predation, foraging behavior

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Reproductive Mechanisms and incompatibility in flowering plants

Sreekala A.K

Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Palode, Thiruvananthapuram, Kerala- 695562

Abstract

Plant reproductive biology is the study of the mechanisms and process of sexual and asexual reproduction in plants. It may encompass study of pollination mechanisms, gene flow, genetic variation and propagule dispersal between and within populations. Knowledge on reproductive mechanisms of plants can help to assess the adaptive significance and homology of descriptive characters used in plant systematics. Studying reproductive biology can also give insight into the delimitation and classification of species and infraspecies. Therefore, detailed information on the reproductive biology of plants is essential for developing effective strategies for their conservation and sustainable utilization. Any conservation approach has to be based on an in depth study of plant reproductive biology. Reproductive characteristics such as seed dispersal, germination capacity, survival rate of seedlings and adults, age at flowering, reproductive lifespan and number of flowers and seeds refer to a set of responses that allow a species to adapt to a particular environment. Besides these, the process of gamete development, pollination, endosperm and embryo development and other reproductive features can provide important clues regarding the reproductive constraints of plants that need conservation. In conservation and management of biological resources, reproductive aspects of each species in relation to their interactions with other biotic and abiotic components play an important role. Plants and animals are inter-dependent and cannot live in isolation. Interactions occur in a variety of ways. One such interaction is at the level of reproduction be it a plant or an animal species. In plants, reproductive biology includes several components such as flowering phenology, floral structure, sexual system, breeding system, pollinator behavior, fruiting phenology, seed dispersal and establishment. Each component has a unique role for the success of sexual reproduction. Sexual reproduction is the natural process that incorporates variability and ensures survival of species under adverse condition. The subject of reproductive biology deals with the study of various interactions taking place between plants and pollinators and fruit/seed dispersers. The process of pollination is an essential event in the sexual life of flowering plants. It represents a biotic mutualism basic to flora and fauna. Pollinator species are essential for obligate out crossers and even for most of the self-pollinating plants. Declines in pollinator communities or species will have catastrophic effects on sexual reproduction in plants. Pollination studies can provide a lot of information about the loss of many species, because pollination is the fundamental step in plant reproduction. Plants have co evolved with their pollinators and large ecological changes can decouple their coinciding flowering and breeding cycles. For outcrossing of entomophyllous plants, population size and plant density are closely associated with the attraction and activity of pollinators. Because small populations may be less attractive to pollinators, the reduction in population size results in decreased fruit or seed production because of insufficient pollen transfer. Fruit or seed dispersals also mostly associated with animals. Seed dispersal is an essential event for the plant to produce its population in different favorable habitats and take part in forest recruitment. The availability of pollinators and

seed dispersal assumes importance for the success of sexual reproduction in plants. Field observations and experimentation on diverse aspects of pollination biology and seed dispersal ecology are must in order to understand the various intricacies involved in plant pollinator-seed dispersal systems. This information is very essential for the conservation and management of plant species and their dependent animal species in both *in situ* and *ex situ* approaches. Studies in reproductive biology will also help in developing strategies to preserve the genetic potential of our plant species, which are crucial for restoration and reintroduction.

Oral presentations

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Evaluation of pollen viability, stigma receptivity and fertilization success in *Hamelia patens*Jacq.(Rubiaceae)

Renjumol R and Radhamany P.M

Department of Botany, University of Kerala, Kariavattom,Thiruvananthapuram695581
Email:renjur88@gmail.com

Abstract

*Hamelia patens*Jacq.commonly called fire bush, is a fast growing, semi woody and evergreen perennial shrub of the family Rubiaceae. It is a native of central and southern Florida. It is chiefly grown for the showy bunch of beautiful flowers.In *Hamelia* sexual reproduction is best due togametophytic self-incompatibility which is controlled by a single multiallelic locus, called S-locus.To provide theoretical basis for artificial pollination in *Hamelia,* pollen viability and stigma receptivity were tested and the morphological changes of stigma was observed. Pollen fertility was estimated using glycerine acetocarmine method and viability tested byFluorochromatic Reaction (FCR) test. *In-vitro* pollen germination studies were carried out using Brewbaker and Kwack's medium supplemented with different concentrations of sucrose. *In- vivo*pollen germination study and stigma receptivity were examined byhydrogen peroxide test, baker's procedure and benzidine-H_2O_2 test.Setting of fruits wasestimated by field artificial cross pollination of morphologically dissimilar accessions of *Hamelia* were analyzed in this study. Pollen viability and its germination under *in-vitro* conditions will help to extend to find reason for the reproductive failure.

Key words:*Hamelia patens*, *In-vitro* pollen germination, FCR test, stigma receptivity

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Palynology of *Murraya koeinigii* (L.) Sprengel (Curry bush) and *Murraya paniculata* (L.) Jack (Honey bush)

Divya K.G, Nair M.C[2] and Nair P.K.K[3]

[1,3]Environmental Resources Research Centre (ERRC), P.O. Peroorkada, Thiruvananthapuram, Kerala-695 005
[2]Department of Botany, Govt. Victoria College, Palakkad, Kerala

Abstract

Pollen morphology of the two species of the genus *Murraya* found in India, *M.koeinigii*(L.) Sprengel(Curry bush) cultivated for culinary purposes, and *M.paniculata* (L.) Jack(Honey bush) naturally occurring semi-evergreen and evergreen forests and often grown as garden plant in the plains, was attempted through light microscopic (LM), scanning electron microscopic (SEM) and micrometric approaches. The light microscopic examinationof pollen grains only revealed that both speciespossessed tricolporate grains with a thin exine, leaving very little scope for comparative morphological analysis. When finer details of exine ornamentation of the grains were deducted with the aid of scanning electron micrographs, together with other parameters including pollen size and aperture, the species manifested reliable individual micro-morphological differences. The pollen grains of *M.koeinigii* showed scrobiculate foveolate exine ornamentation, while those of *M.paniculata* exhibited striate fossulate pattern. Since SEM offers a rapid means of observing pollen wall surfaces with greater resolution, it can be considered a definite supplement to light microscopy. Thus the use of SEM for exine stratification provides better data for understanding of pollen morphology from systematic as well as evolutionary point of view.

Key words: Pollen, *Murraya*, exine, SEM

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An improved seed germination method for *Elaeocarpus serratus* L.

Raji R and Siril E.A

Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, Kerala
*E.Mail: easiril@yahoo.com

Elaeocarpus serratus L(Family Elaeocarpaceae; Common name: Ceylon olive) is an underutilized, medium sized fruit treedistributed throughout the in peninsular India.The mature ripened fruits are edible and pickled. The fruits of *E. serratus* have hard and highly ornamental stony endocarp.The hardness of the endocarpowing to poor germination coupled with prolonged dormancy and consequent reduced regeneration of this species.To improve germination behavior of *E. serratus*, viability of seeds, water uptake capacity of seeds, effect of seed mass on germination and pre treatments (mechanical and chemical) were performed. Various seed treatments indicated mechanical scarification improved germination (43.3%) and reduced mean time taken for germination (MTG; 90 days) over control (18.3%, MTG; 180 days). Seed viability

test revealed 66% mean viability.Water uptake offour seed mass (<1.5, 1.5-2.5, 2.6-3.5, >3.5g) classes of *E. serratus* resulted in more or less similar pattern of water imbibitions and attained saturation at 60 hrs of soaking. Maximum water uptake capacity was among the class >3.5.Germination capacity of seeds collected from different populationsvaried significantly and suggests maximum germination registered from Varkala population (18.3%). Germination of seeds that grouped in to different seed mass classes showed maximum response in seed mass class of 2.6g-3.5g. The improved germination method evolved through the study can be applied to large scale propagation and conservation of *E. serratus*.

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Floral biology and distyly of *Ophiorrhiza radicans* Gardner ex Thwaites (Rubiaceae): an endangered herb of Southern Western Ghats

Theresa M, Sreekala A.K and Jayalakshmi M

Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Palode, Thiruvananthapuram, Kerala- 695 562
E.mail: mariavempally@gmail.com

Abstract

Ophiorrhiza radicans Gardner ex Thwaites is a heterostylous Rubiaceous plant located from the evergreen forest areas of Rosemala, Kollam district in Kerala. The term heterostyly is generally used to describe the condition characterized by two or three different morphs of flowers in a given species with respect to style length in relation to position of stamens. The plant is an endangered annual creeping herb which exhibit distyly with pin and thrum flowers. The present study covers morph specific patterns of flowering phenology, floral morphometry, pollen viability, pollen germination and pollen ovule ratio. The plant starts flowering from July and extends up to December. Morphometric analysis shows floral variations among the two morphs. Pin plants have more number of pollen grains but they are smaller in size when compared to thrum plants. Pin and thrum plants show maximum pollen germination in BrewBaker's medium containing 20% and 10% sucrose respectively.

Key words: Anthesis, Distyly, Floral Biology, *Ophiorrhiza radicans*, Rubiaceae

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Morphology and flowering phenology of *Humboldtia decurrens* Bedd. Ex Oliver (Fabaceae)

JayalakshmiM, Sreekala A.Kand Theresa M.

Tropical Botanic Garden and Research Institute, Conservation Biology Division Palode, Trivandrum-695562; jeevaa88@gmail.com

Abstract

The Indian sub-continent is known as one of the mega diversity centers of the world due to richness of flora and fauna and holds 8% of global phytodiversity. But the current biodiversity crisis is heightening interest in ways to conserve Earth's biota. The depletion of vegetation may be due to habitat degradation, anthropogenic pressures or reproductive constraints. By keeping this in background, a study has been conducted on morphology and flowering phenology of *Humboldtia decurrens*, an endemic tree species of Southern Western Ghats with an intension of understanding population reduction of this species in the natural habitat. *Humboldtiadecurrens* is an endemic legume of family Fabaceae which flowers in the month of November, extends up to May and reaches a peak during March. The candidate species was located in the evergreen forest areas of Sasthanada and Shangili of Kollam and Ponmudi of Trivandrum districts between altitudes of 800-1000m. An inflorescence consists of 20-25 flowers in cauliflorus racemes. Two varieties of plant species were observed with pink and white coloured flowers.In all the three study sites, 10-15% fruit set was observed in the natural condition. Small size of the population, patchy distribution and small area of occurrence attract concern on the future.

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Stylar lobe micromorphology in*Thotteaduchartrei*Sivar.,Babu&Indu, and *Thotteaidukkiana*Pandura. & Nair- two medicinal undershrubs from Western Ghats.

Suresh Kumar P[1], Athira M and Shaiju P.N[2]

1. Department of Botany, University of Kerala, Karyavattom,Thiruvananthapuram 695581
2. Department of Botany, Fatima Mata National College, Kollam; E mail: skpuzha@gmail.com

Abstract

Thottea is an Indo-Malayan genus represented in the Western Ghats by eight species. Two among them – T. *duchartrei*and T. *idukkiana*are sharing most of the common vegetative and floral characters except some significant differences in the gynostemium. The present study envisages the detailed micromorphology of the stylar lobes in these two species in order to characterize the stigmatic tissue in this component of the highly complex gynostemium. The light, stereo and scanning electron microscopic studies on the morphology and anatomy of the stylar lobes in these two species clearly differentiate the specific stigmatic portion with

characteristic properties. But the present study do not offer any evidences to separate these two species based on their stylar micromorphology.

Key words:*T. duchartrei*, *T. idukkiana*, gynostemium

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p^H induced floral color variation in *Hydrangea macrophylla*

Vishnu.V.S[1] and Sophiammal Nettar P

Department of Botany, Fatima Mata National College, Kollam; E.mail: vishnuvs2212@gmail.com
1. current address- Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram 695581

Abstract

Hydrangea macrophylla has been a popular, low maintenance garden plant available in an array of colors white, various shades of pink, blue etc. *H.macrophylla* formerly included in the saxifragaceae family *Hydrangea*has been reclassified in the Hydrangeaceae family. The plants are evergreen shrubs having large domed or flattened flower heads. Flowers are in large clusters, either white or blue depending on the acidity of the soil. Color of the flower depends on pH of the soil. The availability of Aluminum to the plants alters flower color. With the presence of Aluminum; flower turns blue to lavender, without Aluminum, flowers are pink or red. Aluminum availability is depending upon the pH of the soil. With pH less than 5.5 Aluminum is readly available and the flowers will turn blue. Hence the present study was undertaken to assess the influence of pH in color variation in *Hydrangea macrophylla*

Key words:*Hydrangea macrophylla*, Aluminum

Modern trends in Plant Systematics and Reproductive Biology

Theme Presentations

401
Reproduction in tropical trees: Implications on amelioration and conservation

Nagarajan B

Institute of Forest Genetics and Tree Breeding, Indian Council of Forestry Research and Education, P.B 1061, Forest Campus, Coimbatore 641 002

Abstract

Studies in most Asian Countries indicate that Forest Genetic Resources (FGRs) are on a rapid decline trend and in some regions their future looks jeopardized (FAO 1999, ITTO/RCFM 2000). Initiative to estimate FGRs with proper action plan is the need of the hour in Asia (Rao and Koskela,2001). According to The Convention of Biological Diversity (CBD), individual countries are responsible for conservation and sustainable use of their biological diversity (UNEP 1992, 2012). Oldfield *et al.* (1998) has estimated that about 10% of the world's 1, 00,000 tree species are under threat and about 1000 species are critically endangered and may face extinction. In most of these species the processes of reproduction remains unknown. It is conflicting to observe that disappearance of forests in tropics comes at a time when our knowledge on their reproduction, structure and dynamics is woefully inadequate (Hubbel and Foster 1992; Owens, 1993). Precise information on reproductive patterns in tropical ecosystems is scarce and their determining factors are still debated (Borchert 1983; De Bie *et al.,* 1998). Quantitative data on phenology, floral characteristics and pollination are important in understanding breeding systems (Gitiru *et al.,* 2002). Thus, understanding reproductive processes is a prerequisite for genetic amelioration, conservation and rational management of forest genetic resources (Congdon and Herbohn, 1993; Aronson *et al.,* 1994). It seems that beyond the regular management practice could be inadequate physical protection of forests is not adequate in the case of mangrove ecosystems. Forest ecosystem being a highly dynamic seems to be dependent on very intricate interactions such as ecology, biological traits, geological and hydrological changes. For instance there has been an enormous change in the climate regimes during the past few decades. The major reason attributed to its rapid disappearance of certain species is poor rate of reproduction. Most wild species particularly trees still remain to be the least comprehended in terms of breeding and reproduction. Inadequate reproduction perhaps could be attenuated owing to resource limitation, pollinator limitation and other biological constraints or a cumulative effect of all the said parameters. It is important that we perceive that to improve or conserve forests whether on the basis of species centered approach (SCAP) of ecosystem based approach (ECAP) documenting the complexities of reproduction is a prerequisite. The pressure of conservation is not to be a subject limited only to policy makers or the responsibility governmental agencies. It needs to percolate in to academicians, citizen scientists and most importantly to future biologists. This lecture shall attempt to introduce how reproduction influences the present and future demography of forest ecosystems.

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Plant Biosystematics – Modern approaches or unending synthesis?

Jomy Augustine

Department of Botany, St. Thomas College, Palai, Kottayam District, Kerala
E.mail: jomyaugustine@rediffmail.com

Abstract

The evolutionist Charles Darwin's theories are still in full impact in the development of Plant Taxonomy. The impacts were in both lower categories and higher levels. All the four aims of taxonomy namely, Description, Identification, Nomenclature and Classification (DINC) are turned tremendously by the incorporation of more characters of plants. This leads the two process of taxonomy, analysis (segregation and delimitations) and synthesis (grouping and classification) in to an unending synthesis. Various branches of biology especially phytochemistry, molecular biology and evolution have reached their maximum in generating more data in biology. The developments of various biological techniques have much influenced the plant biosystematics especially in phylogenies and segregations of taxa. The reconstruction of past events in plant evolution (early branching) is now made much easier with computers. The origins of major groups of angiosperms are traced with the help of certain highly weighed indicators. One of the fast developed approaches of plant systematics is phytochemistry. Though the last few decades of 20^{th} century is considered as the age of chemosystematics it is still a vibrant subject in plant science research. Finding of new plant borne chemicals, design of various medicinal drugs, lower level segregations and plant-animal interactions are newer prospects in this field. The development of various separation techniques have accelerated this trend which resulted in the generation of huge information that helped much in tracing the phylogeny in plant evolution. Many existing problems of monophyly-paraphyly-polyphyly and such complexes are effective solved by phytochemical investigations. Plant macromolecular systematics is another approach in plant taxonomy where the characters of proteins and DNA/RNA are effectively used. The enormous variations existed in the genetic materials (4 nucleotides and innumerable combinations) and proteins (20 amino acids and billions of combinations) are found as potential storage of characters to be used in plant biosystematics. Systematic serology uses the characters of plant proteins as it behaves like an antigen in animal body. Initially serological researches have resulted in finding relationships in lower categories. Later it is developed by the introduction of double diffusion serology, immune-electrophoresis, Raadio-immuno assay, Enzyme-linked immune-sorbent assay (ELISA), protein electrophoresis, iso-electric focusing and amino acid sequencing of various enzymatic proteins. The findings of various allocymes and isocymes have been resulted at below generic levels especially in the recognition of polyploids. The amino acid sequencing of the universal protein namely Cytochrome C throws light to the origin and diversification of flowering plants. The information from the genetic materials namely, DNA or RNA is found more valuable and reliable than any other source. In earlier days DNA-DNA hybridization was found with good results. The finding of restriction endonucleases enzymes which can cut the DNA at specific sites only changed the scenario of DNA systematics into a more attractive face. The constancy and specificity of restriction sites for each species is the basis of this approach. The digestion of DNA with restriction enzymes has replaced the

previous DNA-DNA hybridization techniques and resulted in a better comparison between species and tracing the phylogeny of angiosperms. The digestion of chloroplast DNA using restriction endonucleases (cpDNA restriction sites) started the DNA revolution in plant systematics. It is directly used in plant taxonomy as a phylogeny tracer (cpDNA phylogeny). Many rearrangements are made on the basis of these studies. The enormous variations in the nucleotides sequence in the DNA within and between the species became good taxonomic characters. The automated sequencing of DNA became a powerful tool in finding relationships at lower level and also in tracing the phylogeny of flowering plants. The potentiality of using the sequence data of rbcl (gene coding the large subunit of RuBisCo) for tracing the phylogeny has been successfully utilized by many workers. This is followed by the use of sequence data of atpB, another plastid gene and atpl and matR (mitochondrial genes). The recognition of larger clades in angiosperm evolution (earlier separation of deeper branches) became a reality by the help of these data. The attempt of using the sequence data of two chloroplast genes and one gene codes for ribosome by 29 plant systematists have resulted a new classification called APG system. Since the naming of plants by using two words (binomial nomenclature) is immaterial in naming the clades, the unit of APG system, a new approach to name the clades is under development. It is phylogenetic nomenclature and the code is phylocode. The introduction of a unified mechanism for the identification of plant species was the dream of most of the taxonomists. It became the reality when the DNA bar-coding for species is introduced. Each species has a specific sequence in a gene which is present in all plants. The rbcl and matK genes of chloroplast are selected for this purpose. The last approach of plant taxonomy is in its use. Recently information from plant taxonomy is used extensively in the field of conservation biology. The identification of species, vegetation, community, associations and ascertaining the rarity status of various species are to be done with the help of taxonomist. It is actually an oxygenating process of Field taxonomy which is going to be extinct due to the over perpetuation of various experimental taxonomy which get more popularity and funds.

Oral Presentations

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Taxonomic significance of morphological, palynological and molecular features for the delimitation of *Sesamum malabaricum* Burm. (Pedaliaceae)

Akhila H and Suhara Beevy S

Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram-695581
s.beevy@rediffmail.com

Abstract

The present investigation is an attempt to resolve the taxonomic controversy of the species S. *malabaricum* Burm. of the family Pedaliaceae, based on the data from morphological, palynological and molecular characterizations. Difference of opinion prevalent among taxonomist, regarding the treatment of the taxa, either as an independent species or as a variety of the species, *S.indicum*. As part of this, analysis of the morphological characterization including epidermal characteristics of stem, leaf, corolla and capsule along with seed structure pattern, pollen characters and molecular dataof *the* species, *S. malabaricum* and *S.indicum* have been carried out. The quantitative characters (31) were subjected to one way ANOVA and t-test,

whereas, the qualitative data (40) were analyzed using Kolmogorov-Smirnov Z test to find out the significance at $p<0.05$ level. The two taxa showed variations in the morphological characters like stem colour, branching pattern, leaf colour, basal leaf shape, leaf margin, lobe incision, petiole colour and corolla (lower lip) colour. Remarkable differences were noticed in the pattern and distribution of trichomes in stem, leaf and capsule. Seed surface characteristics and exine ornamentation were also found to be species specific. Statistical analysis revealed significant differences between *S.indicum* and *S.malabaricum* in morpho, epidermal and palynological characters. Genetic differences detected by Random Amplified Polymorphic DNA (eight primers) suggests the possibility of concurring a species rank to the taxa *S.malabaricum,* rather than a variety of *S.indicum,* in concordance with the morphological and palynological features.

Keywords:*S.indicum, S.malabaricum,* Morphology, Pollen grain, Random Amplified Polymorphic DNA

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Intra specific karyotypic variations and its concordance with morphological characterization in *Momordica charantia* L.

Haseena Bai N and Suhara Beevy S

Department of Botany, University of Kerala, Thiruvananthapuram-695581
haseenabai@gmail.com

Abstract

Momordica charantia L. an important medicinal plant belonging to the family Cucurbiataceae is cultivated as a vegetable crop throughout the tropics. Five accessions of *M. charantia* L. including the wild and cultivated varieties, collected from different districts of Kerala were examined to explore the intra specific morphological and karyotypic variations. Morphological characterization of the taxa revealed significant differences in the quantitative and qualitative characters. The morphological variations may probably due to genetic differences since there was no overall correlation between morphology and geographic distribution. All the accessions exhibited the chromosome number, 2n=22, but they could be differentiated by their karyotype formulae and the quantitative parameters. Evaluation of different asymmetry indices showed that the cultivated variety MC1 had the most asymmetrical karyotype. The study noticed significant positive correlation between 'AR'&'A_1' and 'A_2'&'CVcl' at probability level 0.01. Principal Component Analysis suggested that the vine length, number of primary branches, clutch size and fruit weight were the main morphological traits and 'Syi-Rec' index and 'TF%' were the main karyotypic traits that creates intra-specific variation. Cluster analysis of morphological and karyotypic data revealed that the morphological variation was in accordance with the karyotypic variation. The investigation emphasizes the origin of cultivated variety from the wild variety with sculptured seed and suggests the possibility of the separation of the accession of the wild variety by giving the status of forma.

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FTIR Spectroscopy: an effective tool in pharmacognostic studies of ethnobotanically exploited *Solanum* species from southern Western Ghats of Kerala

Anil Kumar V.S[1*], Sunila A.V[2] and Murugan K[3]

[1.] Government college, Kottayam, PIN 686013 Kerala;
[2,3.] Plant Biochemistry and Molecular Biology Laboratory, University college, Thiruvananthapuram, PIN 695 034 Kerala.

Abstract

Solanum is the largest genus of Solanaceae with over 2000 species worldwide. Many *Solanum* species are having medicinal value and several of them are exploited by ethnic societies of Kerala. *Solanum torvum*, *Solanum americanum*, *Solanum capsicoides*, *Solanum violaceum* ssp *violaceuum*, *Solanum aculeatissimum* , *Solanum trilobatum* , *Solanum melongena* var *insanum* and *Solanum mauritianum* are considered for the present study. Many of these species are consumed by the tribal people and they were also reported to have curative properties against respiratory ailments, digestive complaints, tooth aches, skin diseases and even against tumours. FTIR data reveals the presence of functional phytochemical groups in the plants based on the presence of specific range of spectral peaks. The spectral bands were observed to be species specific. Peaks at 470, and 3597 were specific to *Solanum capsicoides* indicative of polysulphides and amides; 3741.9 specific to *Solanum trilobatum* corresponding to NH stretch of amide groups; peaks at 3020 specific to *Solanum violaceum* ssp *violaceum* representing alkenyl C-H stretch; 698.23 specific to *Solanum melongena* var *insanum* representing alkynes; 906.54 specific to *Solanum mauritianum* for disubstituted alkenes; 597.93 to *Solanum torvum* corresponding to alkyl halides; 647.13 to *Solanum americanum* representing alkynes and peak at 3035.90 specific to *Solanum aculeatissimum* for alkenes. It was also observed that peaks in the range 2853-2856 were shared by *S. americanum*, *S. trilobatum* and *S. mauritianum* corresponding to alkyl C-H stretch while peak at 1458.18 was shared by *S. violaceum* ssp *violaceum* and *S. Mauritianum* indicating the presence of aromatic hydrocarbons. As there is high degree of adulteration in many medicinal herbs owing to their increased demands and scarcity, present study offers an effective tool in identification of medicinally potential *Solanum* species from their allied taxa.

Key words:*Solanum*, FTIR spectra, spectral peaks.

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Synthesis, characterization and study on the biocompatibility of *Myristica fragrans* incorporated hydroxyapatite dental biocomposite

Rohini B. R and Rajesh Ramachandran

Biogenix Research Centre, Thiruvananthapuram

Abstract

Dental caries is a destruction of enamel, dentin, or the cementum resulting from acid production by bacteria in dental plaque. It leads ultimately to a carious lesion in the crown or root surface. The most recent epidemiological data on the prevalence of dental caries in children indicate a halting of the increasing levels as in many developing countries. Development of secondary infections following caries treatment can be accounted to retention of residual bacteria and the inefficiency of temporary filling to check their growth. In this aspect a biocompatible resin was synthesized using *Myristica fragrans* endosperm extracts. The extracts showed higher antioxidant activity which can effectively check the generation of radicals and oxidative damage in extraction sites. Hydroxy apatite and Poly vinyl alcohol incorporated composite was found to be non-toxic to normal fibroblast cells. The composite effectively reduced the growth and proliferation of three major cariogenic bacteria such as *Streptococcus mutans*, *Enterococci* and *Lactobacillus acidophilus* suggesting its potent application as intermitted fillers.

Keywords: Dental biofilm, *Myristica fragrans*, *Lactobacillus acidophilus, streptococcus mutans, Enterrococci,*biocomposite

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Assessment of morpho-biochemical variation and 'elite' selection in Drumstick (*Moringa oleifera* Lam.)

Drisya Ravi R.S, Siril E.A* and Bindu R. Nair

Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram-695 581
*E.Mail: easiril@yahoo.com

Abstract

*Moringa oleifera*Lam. (common name: drum stick, horseradish tree)belongs tothemonogeneric family Moringaceae. Immature pods, fresh leaves and flowers of *M. oleifera*are used for culinary purposes. The leaves and young pods contain significant amount of minerals and vitamins A, B, and C. Genetic diversity assessment is a prerequisite for future crop improvement programme therefore in the present study, morphological and biochemical diversity among the 12 South Indian drumstick trees was assessed. Morphological characterization based 14 qualitative and quantitative characters were duly recorded in accordance to standard descriptions. Biochemical factors such as carbohydrate, protein and vitamins offruits and leaves in various collections were determined using standard analytical

methods. Morphology, yield and quality attributes of these accessions were substantially vary among candidate tress. Multivariate analyses were performed in order to establish similarity and dissimilarity patterns. Principal component analysis revealed that first three PC axes explained 99% of the total multivariate variation. The growth characters such as tree height, tree girth, tree spread, number of fruits per tree and fruit length were the major determinants of the genetic diversity in the collection. Cluster analysis identified two main clusters based on morpho-biochemical characters. Single elite plant selection was made from these collections based on yield potential.

Key words: genetic diversity, elite plant, *Moringa oleifera, y*ield potential

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Identification of RAPD markers linked to BB & ABB *Musa* genome groups

Resmi L and Ashalatha S. Nair

Department of Botany, University of Kerala, Kariavattom

Abstract

Musa cultivars (bananas and plantains) are tropical giant perennial herbs of the family Musaceae in the order Zingiberales and are evolutionarily derived from intra and inter specific hybridization between two diploid wild progenitor species *M. acuminata* Colla (AA) and *M. balbisiana* Colla (BB). Modern edible bananas are therefore classified into different genomic groups at different ploidy levels as AA, AAA, AB, AAB, BB and ABB. Many of the cultivars cannot be easily distinguished on the basis of their morphology, especially if they are closely related. The practice of assigning local names to cultivars on the basis of their fruit and plant characteristics has resulted in numerous synonyms and homonyms of banana cultivars which are a major source of confusion in the collection and classification of genetic variation and maintenance of comprehensive germplasm collections. Present study attempted the characterization of thirty eight *Musa* cultivars from Kerala using twenty random decamer primers and identified RAPD markers linked to ABB and BB genome groups which can be further validate by converting into SCAR markers.

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RAPD analysis and indican production from different accessions of *Indigofera tinctoria* Linn.

A. S. Rubin Jose and G. M. Nair*
Plant Biotechnology Laboratory, Department of Botany, FMN College, Kollam-691 001.
*Inter University Centre for Genomics and Gene technology, University of Kerala, Kariavattom, Thiruvananthapuram, Kerala-695 581.

Abstract

Indigofera tintoria Linn. belonging to the family Fabaceae is an important medicinal plant yields indigo dye. *Indigofera tintoria* Linn. collected from different regions of Kerala and Tamil Nadu were analysed using RAPD markers. Different primers were used to amplify the genomic DNA fragments. Certain Markers were identified using different primers. Almost all primers produced bands common to all the DNA templates. OPX-16, OPX-20 and OPX-13 produced certain distinct and specific bands for certain populations. Six markers generated by OPP-01, OPP-02, OPP-04, OPP-08, OPP-16 and OPX-17, were shared by 6 accessions except I_7. Markers generated by OPX-17, OPB-19, OPX-02 and OPX-11 were observed across accessions of all species. Highly distinct bands were present in all the identified loci for the DNA samples of I_6 and I_7. Among the two, I_7 showed a marked variation from the other accessions. The secondary metabolite content, indican which yields indigo on hydrolysis was isolated and quantified using HPLC from different accessions. Indican content of different accessions of *I. tinctoria* showed pronounced variation. Indican content was maximum in I_2 and minimum indican content was noticed from two accessions I_6 and I_7.

Key words: *Indigofera tinctoria,* RAPD analysis, primers, indican, indigo

Poster presentations

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A re-evaluation of the intrageneric system of classification for the genus *Plectranthus* L'Her(Lamiaceae) based on molecular and morphological evidence

Cherian M. and Radhamany P.M

Department of Botany, University of Kerala, Karyavattom, Thiruvananthapuram, Kerala

Abstract

Taxonomy of the genus*Plectranthus* based mainly on morphology and morphometric studies resulted in conflicting concepts of the classification of these species. In recent classifications, the genus*Pletranthus*includes the species formerlyincluded in the genus *Coleus* also and the genus *Coleus* is no longer recognized. An attempt is made in the present study to re-

evaluate the current infra-generic classification of species of *Plectranthus*using a molecular approach with supportive evidence from morphology of different accessions belonging to nine species of *Plectranthus*available in south India. For molecular study, 15 RAPD markers and 15 ISSR markers were used.RAPD markers were more efficient than the ISSR markers with regard to polymorphism detection and production of bands per primer. They detected 100% polymorphism across the 50 genotypes as against 90.7% for ISSR markers. But the observed number of alleles (na), effective number of alleles (ne), Nei's genetic diversity (h), Shannon's Information Index (I), total genotype diversity among population (Ht), within population diversity (Hs), mean coefficient of gene differentiation(Gst) and gene flow (Nm) estimates were more for ISSR compared to RAPD markers. Both the markers are thus equally important for genetic diversity analysis in the different species of *Plectranthus.* Though the clustering of genotypes into groups was not similar in RAPD and ISSR derived dendrograms,the pattern of clustering remained almost the same in both with three major clusters, with a few discrepancies in RAPD clustering. Two clusters correspond to two sections within the genus namely a *Coleus* clade comprising of three species formerly included under the genus *Coleus*(*P.amboinicus*, *P.barbatus, P.caninus*) and a *Plectranthus*clade which comprises of two species included within the genus *Plectranthus* itself (*P.fruticosus*, *P.coesta*), giving a good representation of traditional taxonomic relationships. The third section represented an intermediate clade which grouped members from both the traditional genera *Coleus* and *Plectranthus*(*P.malabaricus*, *P.zeylanicus*, *P. mollis*, *P.wightii*). Principal Coordinates Analysis (PCoA) analyses carried out for both ISSR and RAPD markers supported the UGPMA clustering. For morphological study sixty two qualitative and sixteen quantitative character states were analyzed based on UPGMA clustering, Principal Component Analysis (PCA) and PCoA which is also found in congruent with the molecular data. The position of *Plectranthusmalabaricus*is found distinct invariably in all the analyses. As the results of the present study cannot provide any conclusive evidence to delineate the species of *Plectranthus* based on the available molecular or morphological data we propose to treat this group as a single genus. Further studies including DNA barcoding are necessary to arrive at a feasible infra-generic classification of the genus which are underway in our laboratory.

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Study of morphological, palynological and antioxidant potential of *Allamanda* L.

Akhil R and Brigit M.*

*Department of Botany, Fatima Mata National College, Kollam, Kerala

Abstract

Allamanda L. an ornamental plant belongs to the family Apocynaceae consists of 300 genera and 1400 species. Members of this family occur mostly in the tropical, subtropical regions poorly represented in temperate region. Plants of Apocynaceae are often poisonous and are rich in alkaloids or glycosides especially in the seed and latex. The present study investigates some feature of nine taxon of *Allamanda* species. *Allamandablanchetii,Allamandaschotii* and 6 varieties of *Allamanda cathartica*. In Apocynaceae showed interesting features of vegetative morphology, reproductive morphology and antioxidant potential of one species

Allamandacathartica. The analysis of pollen types have been a significance in the biosystamatic characters useful in rechecking these taxonomic limits of taxa. The present study has been under taken to obtain information regarding the antioxidant potential as well pharmaceutical importance in the wild variety *Allamandacathartica.* The plant leaves are having H_2O_2, phenolic compound which indicates the antioxidant scavenging activity of the plant. The detailed study of vegetative morphology, reproductive morphology and antioxidant potential of taxon *Allamanda* can help nomenclature and taxonomical classification.

Valedictory Lecture

Conservation and utilization of agro-biodiversity-a case study of *Momordica* L. in India

Joseph John K

National Bureau of Plant Genetic Resources, Regional Station, Thrissur, Kerala-680656

Abstract

Agro-biodiversity is a specialized branch of biodiversity where human selection, in addition to natural selection, played a big role in evolution and perpetuation of diversity in cultivated plants. India is the center of origin and diversity for many important crops and three world mega bio diversity hotspots are part of Indian gene center. Genetic erosion, especially after the green revolution, is taking place at a faster rate threatening species survival and needless to say genetic diversity. Plant genetic resources (PGR)are the key component of any agro ecosystem without which no adjustments to the changing climatic or biotic stress situation can be made. Conservation has to be complementary, both *ex-situ* and *in situ*. The National Bureau of Plant Genetic Resources (NBPGR), under the Indian Council of Agricultural Research, is the nodal agency for conservation of Agro bio-diversity in India. The institute with its ten regional stations located in various agro-ecological zones and a network of National active germplasm sites (NAGS) carry out the task of conservation of genetic diversity in cultivated crops and their wild relatives. At the NBPGR, conservation of PGR is addressed through various strategies like seedgene bank, field gene bank,tissue culture storage, genomic repository, cryo-preservation and *in-situ* on-farm methods. Active collections are maintained at 7 ^{o}C under MTS and long term storage at the National Gene Bank is maintained at - 18 ^{o}C. Seed moisture level and storage temperature are the two important factors affecting viability of seeds. *Momordica* L. is a genus of high value nutritional vegetables with medicinal properties. Fifty two species occur in the world, of which seven occur in India. The reproductive biology, diversity, conservation and utilization of this genus are presented as a case study.

Survey of climbers in Atchankulam, Kottaram Panchayat, Kanyakumari District, Tamilnadu

Beema Jainab S.I*, Mary Kensa V, Kavitha A, Anusha L, Rejitha S and Vinitha G

Department of Botany, S.T. Hindu College, Nagercoil, Kanyakumari District, Tamil Nadu
E. mail: surejkensa@gmail.com

*Department of Plant Biology and Plant Biotechnology, J.B.A.S college for women, Chennai -600 018; E. mail: beemaj@gmail.com

Abstract

Climbing plants are one of the interesting groups but a much neglected group of plants. But, they also play a part in historical importance of our ancient buildings which owe their attraction to the green veil which covers up their architectural or structural defects making them assume perfect beauty in our eyes. The present survey reveals that angiospermic climbers of the study area are represented by 94 species under 63 genera belonging to 32 families. Among all families, Convolvulaceae, Papilionaceae and Vitaceae are the most dominating family species as well as genera wise. The dominant families are Convolvulaceae, Papilionaceae, Vitaceae, Apocynaceae, Menispermaceae and Oleaceae. The most abundant liana species include the thorny stragglers *Pterolobium hexapetalun* (Caesalpiniaceae), *Lantana camara* (Verbenaceae), and the twiners *Jasminum angustifolium* (Oleaceae), *Gymnena sylvestre* (Asclepiadaceae) and *Aganosma cymosa* var. *cymosa* (Apocynaceae). The enumerated climbing modes were classified into woody vines, the lianas (75) and herbaceous vines (19). Six climbing modes of lianas were recognized as stem twiners (37) followed by stragglers-unarmed (28), stragglers unarmed (10), tendril climbers (17), root climbers (1) and hook climber (1).

Introduction

Climbing plants are defined as plants incapable of autonomous vertical support once they reach a certain height and depend on other plants for support in their natural environment (Gentry, 1991).The climbing habit has arisen several times in the evolutionary history of Angiosperms, and this has resulted in a great taxonomic diversity of climbing plants (Gentry, 1985). Climbers are typical constituents of rain forests. The distribution and abundance of climbing plants in forest varies greatly with the geographic locality of forests. Forest locality and type appears to influence the distribution of climbers (Grubb, 1987). There is some evidence that vines are increasing in dominance in both tropical (Phillips *et al.* 2002; Wright *et al*. 2004; Swaine and Grace, 2007) and temperate forests (Allen *et al.* 2007). Some authors consider that this pattern could be related to climate change (Malhi and Wright, 2004). Climbers not only form important structural components but also play an important ecological role in forest dynamics, diversity and nutrient recycling (Gentry and Dodson 1987; Schnitzer and Bongers, 2002). Liana species constitute a very important group of non-timber forest products, as it becoming clear over the last decade (Abbiw, 1990; Malaisee, 1997; Van Andel, 2000). In addition to being a conspicuous structural component of the rain forest, lianas play important role as food plants for insects (Gentry, 1985) and monkeys (Emmons and Gentry, 1983).

India is one of the 12-mega biodiversity centres with three hot spots of biodiversity viz., Western Ghats, western Himalayas and eastern Himalayas. In the Western Ghats, 80% of the medicinal plants in the world are available. Majority of the medicinal plants in India

are higher plants with trees (33%), shrubs (20%), herbs (32%), climbers and others (3%). Nearly 60% of all dicotyledonous has at least one representative climber (Heywood, 1993). Chellam *et al.,* 2009 provide a check list of angiosperm climbing plant species along with their climbing modes enumerated from a total of one hundred and fifty grids in tropical forests of southern Eastern Ghats peninsular India. The Eastern Ghats constitute an important bio diversity area in India and have been studied earlier mainly for the floristic, and that too confined to a few prioritized sites. Lianas, the woody vines contribute substantially to the diversity and structure of most tropical forest. Yet little is known about the important of habitat specialization in maintaining tropical Liana diversity. A total of 175 climbing plant species that belong to 100 genera and 40 families are included in this enumeration. In recent years some workers (Palanisamy, 1993; Balasubramanian *et al.* 1997; Hamasavalli, 2001; Nikkitha, 1999; Karthikeyan, 2003; Senthil Kumar, 2004; Senthilkumar *et al.,* 2005; 2006) have reported various medicinal plants used by Irular tribes in Coimbatore. However, no work has been attempted so far to ascertain the curative climbers from the study area.

Materials and methods

Description of the study area: The present study was carried out in Atchankulam of Kottaram Panchayat and Agastheeswaram Taluk of Kanyakumari District. This District constitute the southernmost region of India, with Kerala on the West-North, Tirunelveli District in the North-East, Arabian sea in the South–West, Bay of Bengal in the south-East and Indian ocean in the south. The annual rainfall of this area is low compared to the other areas of Kanyakumari District.

Floristic Survey: Intensive and extensive field visits were carried out during January 2014-July 2014. During the field survey, plants were collected in their flowering and fruiting stages as far as possible from the natural habitats. They are identified with the help of local floras (Gamble and Fischer 1015-1936; Matthew 1983; Nair and Henry 1983; Henry *et al.,* 1987; Chandrabose and Nair 1988). Further, their identities were confirmed referring authentic specimens and the voucher specimens deposited in the Herbarium of Department of Botany, South Travancore Hindu College, Nagercoil.

Results and Discussion

Plasticity in eco-physiological traits has been related to the ecological breadth of forest forms and shrubs, but this issue has not been addressed for climbing plants (Saldana *et al.,* 2005). It is verified that climbers and rest supporting species would share functional strategies to successfully cope with light heterogeneity, despite the intrinsic differences between these growth forms (Rowe and Speck, 2005). It has been earlier shown that climbing plants exhibit life history trade-offs along forest light environments similar to those of trees (Gilbert *et al.,*2006) and that the relationship between photosynthetic rate and dark respiration is comparable among lianas and trees (Domingues *et al.,* 2007). Because earlier work has suggested possible differences in the ecology of climbing plants in tropical and temperate rain forests.

This result is consistent with the conclusion of Rundel and Franklin (1991), who in their study on vines of arid and semiarid environments, reported that the great majority of arid zone climbers are herbaceous (vines), while woody climbers are rare. Even though *Olax scandens* (Oleaceae), *Chilocarpus atrovinens* (Apocynaceae), *Artabtrys zeylamicus* (Annonaceae) and *Calamus gamblei* (Arecaceae) were reported as most abundant species in the Western Ghats and *Strychnos minor* (Loganiaceae) in the tropical dry evergreen forests on the colonnade coast of India (Parthasarathy *et al.,*2004) these species did not occur in the study site. Only one climbing mode, the grapnel-like climbing (rattans) which was reported

from Western Ghats sites (Muthuramkumar and parthasarathy, 2000) did not occur in our study sites.

Contrary to findings from tropical forests (Balfour and Bond, 1993, Sridhar Reddy and Parthasarathy, 2003, Dewalt *et al.,* 2006, Yan *et al.,* 2006) trees were not represented among the 94 climbing plants of study area. According to EL Hadidi *et al.,* (1992) some climbing plants were considered endangered, including *Cadapa farinosa, Maerua oblongifolia, Ephedra foemina* and *Plicosepalus curviflorus.* Tackholm (1974) considered another climbing plant species to be very rare (eg. *Podostelma schimperi, Merremia semisagittata, Corallocarpus suhimperi, Kedrostis foetidissima, Corallocarpus schimperi, Kedrostis foetidissima, Cissus quadrangularis, Peatatropis rivalis* and *Pergularia daemia*)

The comparison between the members of desert climbing plants in Egypt and those of deserts in other continents revealed that Convolvulaceae, Leguminosae, Cucurbitaceae and Asclepiadaceae were the dominant plant families (Parsons, 2005). In the present survey Convolvulaceae, Papilionaceae and Vitaceae are the dominant families. Speciation in the family Convolvulaceae, has been more prolific in the deserts of India where it is the fourth largest family of vascular flora (Shmida, 1985). Vitaceae, the fifth largest vine family in the North American deserts were poorly represented in the Egyptian deserts but not known at all in Australian deserts. Australia has only about 34 species of the approximately 700 species of Vitaceae found worldwide (Morley and Toelken, 1983), the family being considered Laurasian (Krings, 2000).

It has been reported that woody vines are increasing in dominance, relative in both tropical (Philips *et al.,* 2002; Wright *et al.,* 2004; Swaine and Graace, 2007) and temperate forests (Allen *et al,* 2007). This pattern has been related to climate change (Malhi and Wright, 2004, Vander *et al.,* 2008). One of the global change drivers (Matesaaz *et al.,* 2010) but more comprisal evidence is needed. Schnitzer (2005), reported that the abundance of woody vines in tropical forests is correlated negatively with precipitation and positively with seasonality. He further proposed that this pattern may be explained by the greater efficiency in water uptake and transport of woody climbers as compared to trees. Our study area is wet and cold (Dorsch, 2000), where light availability is the major ecological factor affecting distribution and abundance of trees (Lusk *et al.,* 2006, Lusk, 2002; Saldana and Lusk, 2003) but not woody vines (Gianoli *et al.,* 2010, Carrasco *et al.,* 2009) in the temperate rainforest, where the potential evapotranspiration is very low, water availability is not a limiting factor and therefore water use features are was likely to determine plant distribution and abundance. From an applied perspective, the results of the present study suggest that the dominant climbers in the southern temperate rainforest could be able to cope with another global change driver, and use change if forest clearing occurs due to human activities.

Vegetations are subjected to various anthropogenic pressures and hence the data on lianas will be useful in highlighting the importance of this vegetation in species conservation and management. The present survey reveals that angiospermic climbers of the study area are represented by 94 species under 63 genera belonging to 32 families. Among all families, Convolvulaceae, Papilionaceae and Vitaceae are the most dominating family species as well as genera wise (Fig.1 & 2). The dominant families are Convolvulaceae, Papilionaceae, Vitaceae, Apocynaceae, Menispermaceae and Oleaceae (Fig.3). The most abundant liana species include the thorny stragglers *Pterolobium hexapetalun* (Caesalpiniaceae), *Lantana camara* (Verbenaceae), and the twiners *Jasminum angustifolium* (Oleaceae), *Gymnena sylvestre* (Asclepiadaceae) and *Aganosma cymosa* var. *cymosa* (Apocynaceae). The enumerated climbing modes were classified into woody vines, the lianas (75) and herbaceous vines (19) (Fig.4). Six climbing modes of lianas were recognized as stem twiners (37) followed by stragglers-unarmed (28), stragglers unarmed (10), tendril climbers (17), root climbers (1) and hook climber (1).

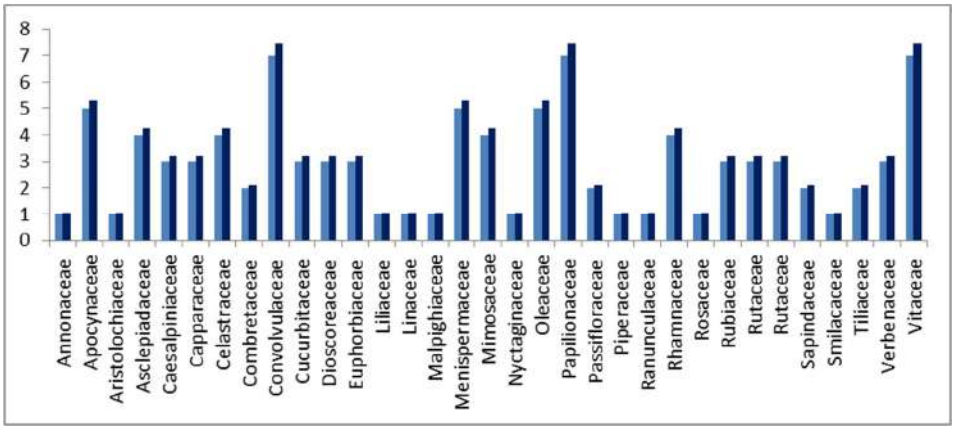

Fig.1: Family-wise distribution of identified plants.

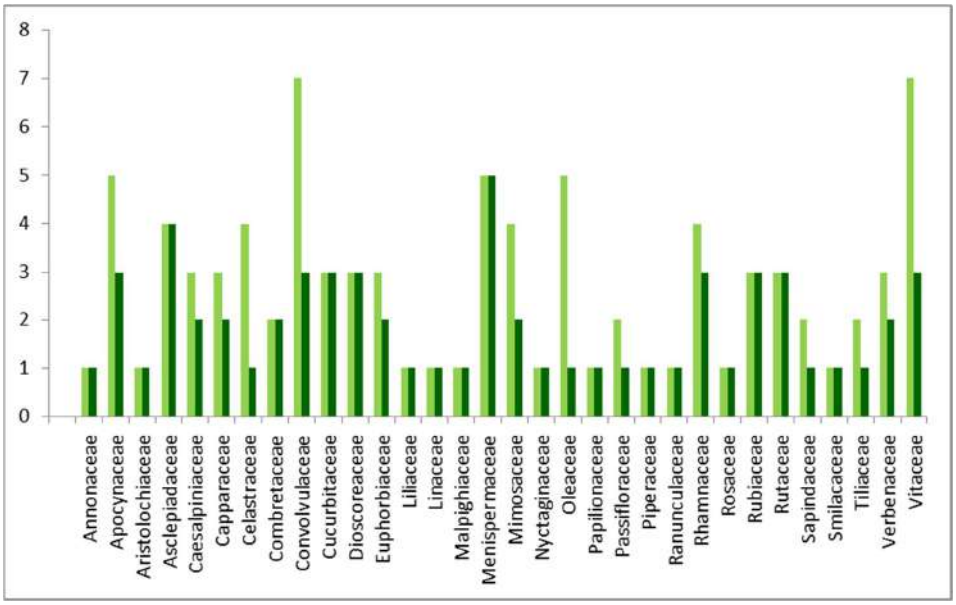

Fig. 2: Taxonomic data of identified plants in the study area

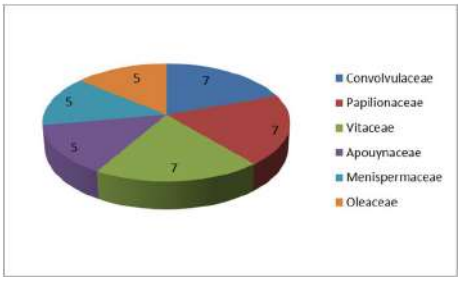

Fig.3: Dominant families identified

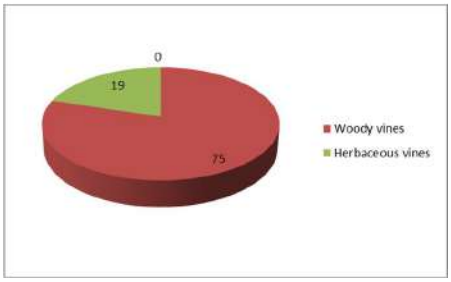

Fig.4: Types of climbers

Conclusions

The present survey reveals that angiospermic climbers of the study area are represented by 94 species under 63 genera belonging to 32 families. Among all families, Convolvulaceae, Papilionaceae and Vitaceae are the most dominating families in species as well as genera wise. The most abundant liana species include the thorny stragglers *Pterolobium hexapetalun* (Caesalpiniaceae), *Lantana camara* (Verbenaceae), and the twiners *Jasminum angustifolium* (Oleaceae), *Gymnena sylvestre* (Asclepiadaceae) and *Aganosma cymosa* var. *cymosa* (Apocynaceae). The enumerated climbing modes were classified into woody vines, the lianas (75) and herbaceous vines (19). Six climbing modes of lianas were recognized as stem twiners (37) followed by straggless-armed (28), stragglers unarmed (10), tendril climbers (17), root climbers (1) and hook climber (1).

Because of the presence of climbers in most of the ecosystems, morphological characteristics of the climber communities in disturbed versus stable, wetland versus well drained and open versus shaded forest ecosystems should help us recreate the distribution and importance of climbers in ecosystems throughout the last 30 million years. However, destruction of habitat through deforestation and over exploitation for commercial purposes and changes in cultural attitude threatens to constrain many of these climbers in to extinction. Over exploitation of some climber species particularly for collection of roots and underground parts from them causes damage to these plants. Therefore, these plants have to be conserved in their original habitat. Climber abundance is dependent on climate and forest structure. Great heterogeneity is observed in the sites of climbers. It is possible that sites with different dry seasons combined with tree heterogeneity can enhance the rates of climber speciation.

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Floristic diversity analysis of a vulnerable low altitude hillock ecosystem in the gap region of the Western Ghats, Kerala, India

Soumya M* and Maya C. Nair**

*Environmental Resources Research Centre, Thiruvananthapuram, Kerala, India -695005

** Department of Botany, Govt. Victoria College, Palakkad, Kerala, India-678001

Abstract

Low altitude hillocks are characteristic hydrogeomorphic habitats distributed at the gap region of Western Ghats in Palakkad district of Kerala State. Despite the high diversity, studies on such small isolated geographical systems are limited. Seasonal variations create diverse microhabitats which get reflected in the herbaceous vegetation of these ecosystems. Many of such hillock systems have been transformed into vulnerable habitats due to intense grazing and prevalence of quarrying. In this backdrop, floristic exploration of such a hillock system in a micro scale level was conducted in Vengappara, Kollengode (Geographical location: 10° 36' 13.3" N 76° 42' 33.2" E) in Palakkad district. Floristic exploration during June 2013 to August 2014 revealed the presence of 102 plants of which 96 species are distributed under 37 angispermous families and 6 under lower plant groups. Herbaceous flora forms the prominent vegetation of the area with seasonal variations in floristic composition. Explorations on a floristic and ecological perspective revealed the existence of seven microhabitats with their own unique adaptive traits and floristic associations. The plant species associations, such as *Utricularia lazulina-Drosera indica*, *Parasopubia delphinifolia -Striga angustifolia*, *Heliotropium rottleri-Indigofera uniflora-Catharanthus pusillus* were observed within microhabitats. Presence of *Isoetus coromandelina* along with *Dipcadi montanum*, a new distribution record, adds to the richness of floristic composition. Of the recorded taxa, six species are found to be endemic to Peninsular India and four are endemic to Southern Western Ghats. The present study revealed the need of conservation measures for the hillocks along with the main hills and mountains of the Ghat system for effective conservation of unique micro habitats and the comprehending floristic associations.

Key words: Hillock, Western Ghats, Palakkad, Micro-Habitats

Introduction

Palakkad, the granary of Kerala, is endowed with numerous low altitudinal hillocks (<100 m), and has its own distinctive floristic diversity as the climate of the region is influenced by the Palakkad gap. Though less heavily impacted than the mainstream hills and forest systems, the hillocks represent small isolated geographical systems which are currently

subjected to grazing and quarrying activities. This condition in turn alters and degrades these small ecological niches beyond their restorability.

Two prominent studies that deal with floristic diversity of Palakkad district were done by Vajravelu (1990) and Manilal (1988). Exclusive floristic studies on the hillock systems have not been attempted so far. Floristic explorations in Madayippara hillock system in Kannur district enumerated 512 plant species which is given as checklist by Balakrishnan *et al* (2010). Floristic studies on such systems in Kerala reveal that the hillock systems contribute their own unique floristic elements, with some turned out to be new to science, such as *Eriocaulon madayiparense* (Swapna *et al*, 2012), *Justicia ekakusuma* (Pradeep *et al*, 1991), *Lindernia madayiparense* (Narayanan *et al*, 2012), *Rotala malabarica* (Pradeep *et al*, 1990), and *Nymphoides krishnakesara* (Joseph and Sivarajan, 1990).

Many of such hillock systems have been transformed into vulnerable habitats due to grazing and prevalence of quarrying. Recent micro-level studies conducted by the Kerala Sastra Sahithya Parishad (KSSP) on 163 hillocks in eight districts of the State revealed the fact that 94 hillocks in the northern part of the district are affected by the excavation. In this backdrop, floristic exploration of such a hillock system in a micro scale level was conducted in Vengappara, Kollengode to assess the floristic composition, endemic species and plant species associations in an ecological perspective.

Materials and Methods

The study site in Vengappara (geographical location: 10° 36' 13.3" N and 76° 42' 33.2" E) is a rocky hillock system which is about 26 km towards South of Palakkad District headquarters and 2 km from Kollengode. The region lies towards the foot hills of Nelliampathy. The hillock is seen as isolated land elevation separated from mainstream hill ranges in the midst of cultivated lands and paddy fields. From the Vengappara hillock, Nelliampathy hills can be viewed with scenic beauty of live waterfalls, namely Palakappandi, Seethar kundu, etc., appearing during the onset of monsoon. Besides scenic beauty, the herbaceous flora is linked to formation of microhabitats created by monsoon showers. Though the extent of the hillock is around one hectare, the area seems to be ecologically and floristically significant as evident from the field studies.

Floristic explorations were conducted from June 2013 to August 2014, covering the three prominent seasons - summer or pre-monsoon (March-May) which represents dry phase, monsoon (June-October) which represent wet phase and winter or post-monsoon (November-February). For micro level studies, the area was categorized into microhabitats depending upon the topological variations, seasonal water retention capacity and soil depth. Geographical location was noted using GPS. Plant associations within these diverse microhabitats were critically observed in an ecological and floristic perception and plant specimens were collected and identified using floras (Hooker 1872-1897; Gamble 1915-1936) Herbarium preparations were made following standard methods, and the voucher specimens were deposited in the herbarium of Environmental Resources Research Centre (ERRC), Thiruvanathapuram. Adaptive traits among the species were noted and phenology was recorded and compared with checklist of Flowering Plants of Kerala by Sasidharan (2010). Endemic status of the floral elements was ascertained based on checklists (Sasidharan, 2010; Ahmedullah and Nayar, 1987). Status of the species was assigned as per IUCN Red list Category version 2014.

Results and Discussion

***Analysis of flora*:** Floristic survey reveals the presence of 102 plants in the Vengappara hillock system hillock, of which 96 species are angiosperms (distributed under 38 families) together with four species of pteridophytes and two species of bryophytes. Physignomically,

65 species are herbs, 9 species each represent shrubs and climbers, and 13 species constitute trees. The dominant family is Fabaceae, comprising of 15 species, followed by Scrophulariaceae (7 species), Lamiaceae (6 species) and Poaceae (5 species). Analysis

Plate 1
a. *Dichrostachys cinerea* (L.) Wight & Arn. b. *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult. c. *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don. d. *Sterculia urens* Roxb. e. *Calycopteris floribunda* Lam. f. *Eriocaulon xeranthemum* Mart. in Wall.

Plate 2
g. *Drosera indica* L. h. *Cleistanthus collinus* (Roxb.) Benth. ex Hook.f. i. *Polycarpaea corymbosa* (L.) Lam. j. *Parasopubia delphiniifolia* (L.) H.-P. Hofm. & Eb. Fisch. k. *Pterolobium hexapetalum* (Roth) Sant. & Wagh. l. *Commelina wightii* Raiz.

PLATE 3
m. *Ophioglossum costatum* R. Br.f n. *Murdannia semiteres* (Dalz.) Sant. o. *Dipcadi montanum* (Dalz.) Baker p. *Isoetes coromandelina* L, f q. *Heliotropium rottleri* Lehm. r. *Dalbergia latifolia* Roxb.

PLATE: 4
Figure a & b showing quarrying operation in progress.

reveals that herbaceous flora the forms the prominent vegetation component, which comprises of 68% of the total flora. While analyzing phytogeographical affinities, the overall floristic composition with high percentage of Fabaceae and Scrophulariaceae, simulates the African outcrops (Porembski *et al* 1997). Table 1 and 2 shows the details of species composition enumerated from the Vengappara hillock system (Plates 1-3 shows the pictorial representation of some of the notable floral elements).

***Characterization of micro habitats and plant associations*:** The south west monsoon plays an important role in the creation of specific microhabitats for the emergence of diverse flora in the hillock system. As plant species associations form the fundamental basis of community ecology, analysis of such associations provide reliable information on environmental heterogeneity, biotic interactions and patterns of seed dispersal (Saiz and Aldos, 2012). Distinct plant communities were seen associated with the diverse microhabitats in the hillock system, which is summarized below under specific categories following rock outcrops categorization by Porembski (2007), with slight modification.

1. Exposed Rock Surfaces (EPS): *Polycarpaea corymbosa* and *Cyanotis burmanniana* are the two common species seen on uneven surfaces, which are directly exposed to sun light during the wet and dry phases of the year.
2. Rock crevices or fissures (RC): Plant species such as *Allmania nodiflora, Commelina wightii, Chamaecrista absus, Catharanthus pucillus, Indigofera uniflora, Murdania semeteres, Cheilanthes mysurensis* can be seen associate with such microhabitats.
3. Marshy Ephemeral flush vegetation (EFV): This type of microhabitat is created commonly during the wet phase in the form of marshy patches and marshy crevices. The most notable peculiarity of such microhabitat is that the water content is maintained throughout the rainy season which creates diverse floristic associations. Most common associations found are *Eriocaulon xeranthemum-Drosera indica-Utricularia lazulina* and *Heliotropium rottleri-Indigofera uniflora* in the marshy ephimeral patches. Association of *Heliotropium rottleri-Lindernia ciliata* was also seen during the post-monsoon phase. Occurrence of *Ophioglossum costatum* is noticed in the marshy patches between rocks; the presence of *Isoetes coromandelina* was observed in marshy crevices. *Aeschynomene indica-Murdannia nudiflora* association was noticed along the fringe areas of water flowing paths near the vegetation patches.
4. Soil filled shallow Depressions (SFD): Healthy population of *Dipcadi montanum* was observed in shallow depressions covered with soil.
5. Seasonal Pools (SP): Temporary seasonal pools were seen inhabited by *Dopatrium junceum* and *Utricularia aurea*.
6. Soil covered areas (SCA): *Parasopubia delphinifolia-Striga angustifolia* association was observed in these areas. *Striga asiatica, Anisochilus carnosus, Pennisetum polystachyon, Chrysopogon aciculatus* were also seen in such microhabitats.
7. Soil rich areas (SRA): *Ipomoea pes-tigridis, Leucas aspera, Kyllinga bulbosa, Cyperus compactus,* and *Leonotis nepetifolia* were found growing in soil rich areas.

Scruby jungle elements: *Ziziphus mauritiana, Calycopteris floribunda, Pterolobium hexapetalum, Canthium coromandelicum* are the common scruby jungle elements seen in the hillock system.

Tree cover: Tree species were sparsely distributed towards the hillock top and slopes. Some common tree species on the hillock top are *Givotia moluccana, Phyllanthus emblica, Strychnos potatorum, Cleistanthus collinus* and *Dichrostachys cinerea,* while *Sterculia urens, Terminalia paniculata, Holarrhena pubescens* and *Dalbergia latifolia* are seen towards the slope of the hillock.

Observations on phenology and adaptive traits: Most of the herbaceous plant species were observed to complete their phenology in the favorable wet-phase between June and December. Adaptive traits help some plant species to overcome harsh environmental stresses such as drought, high temperature, and nutrient deficiency. Plant species showing such traits observed in Vengappara is summarized below:

1.Carnivorous traits: Insectivorous plant species such as *Drosera indica, Utricuaria lazulina, Utricularia aurea* were observed in certain microhabitats, the presence of which indicates the prevalence of N, P, S deficient soil conditions.

2. Succulence: *Cyanotis burmanniana* is common in the Vengappara hillock system. It is having pink or green fleshy leaves, as a desiccation avoidance strategy in xeric conditions.

3. Subterranean perennating organs: Healthy population of the plant species *Dipcadi montanum* was present in Vengappara hillock system. It survives dry conditions in the form of bulbs which sprouts in rainy season.

4. Semi-parasitism: Plant species such as *Parasopubia delphinifolia, Striga augustifolia, Striga lutea* exhibiting semi parasitism were also present in microhabitats.

Endemism of flora and its status: Of the recorded taxa, six species are found to be endemic to Peninsular India, namely *Heliotropium rottleri*, *Indigofera uniflora*, *Pterolobium hexapetalum*, *Terminalia paniculata*, *Murdannia semiteres* and *Cyanotis papilionacea*, and 4 species are endemic to Southern Western Ghats namely *Commelina wightii, Dipcadi montanum, Polygala bulbothrix, Utricularia lazulina, Cyanotis burmanniana.*

Rare category plants: A total of 26 plant species fall under the various rare categories of IUCN (Red List of Threatened species-Version 2014.3), of which three species *Cleistanthus collinus, Cyanotis burmanniana* and *Dalbergia latifolia,* come under the Vulnerable (V) category and 23 species figure under the Least concern category (LC). *Isoetes coramandelina*, which is now becoming rare, and *Heliotropium rottleri* an endemic species restricted to scrub jungles and moist deciduous forest regions of Palakkad district of Kerala also occur in the Vengappara hillock system. The new distribution record of *Dipcadi montanum* for Kerala adds to the richness of floristic composition.

Threats and conservation: The region is under the threat of quarrying operations for nearly the past 6 years. One fourth of the hillock system is demolished and the operations are still continuing (Plate4). The seriousness of the situation prevailing there has not yet been formally assessed and no such comprehensive studies undertaken. If quarrying is continued, in addition to the habitat loss of many species, the natural system in these areas may respond through cascading impacts like lowering of water table and land collapse. Therefore conservation strategies have to be formulated for the sustenance of floristic diversity and ecological services and the very existence of the hillock system.

Conclusion

The study dealt with the present status of Vengappara hillock system in Palakkad district in terms of floristic diversity, endemism, plant associations within diverse microhabitats, and the threat factors. It revealed the presence of 102 species of plants, with 6 endemic and 3 vulnerable taxa. Some newly recorded taxa and some others forming new distribution records to the State seem to be distributed in the hillock systems concerned. Thus the present study highlights the need for conservation of the hillocks along with the main hills and mountains of the Ghats system for effective management of unique natural microhabitats and their comprehending floristic associations.

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Ophiorrhiza barberi, a new source of wonder drug camptothecin from Western Ghats

Manu K. S, Renson Thomas, Vijeesh Kumar P. V, Sonu Sebastian, Ginu Joseph*

Department of Botany, B. A. M. College, Thuruthicad, Pathanamthitta, Kerala

Abstract

The genus *Ophiorrhiza* L. is known for its cytotoxic alkaloid, camptothecin. Camptothecin derivatives are well known cancer drugs and are considered as the most promising anticancer drug of the twenty-first century. Even though, many *Ophiorrhiza* species like *O. mungos, O.rugosa, O.pumila* etc. were reported as good source of this important alkaloid, most of the species are rare, endangered or even possibly extinct category. With an objective to find out alternative sources for this vital alkaloid, the present study reports *O. barberi*, an endangered species endemic to Western Ghats as a new source of camptothecin. Organ wise phytochemical screening showed that the root produces 0.1% D.W camptothecin.

Key words: Camptothecin, *HPLC,* HPTLC, *Ophiorrhiza barberi,* Western Gats, endangered species.

Introduction

Nature is an attractive source of new therapeutic compounds as tremendous chemical diversity is found in millions of species of plants. Even today, 25% of the entire drugs produced are still derived from plants. The Western Ghats is an area with immense medicinal plant diversity. But the plant diversity of the area is not yet explored well. As the natural habitat for wild plant is being destroyed by environmental and geographical instabilities, several important medicinal plants are under threat of extinction. The genus *Ophiorrhiza* L. is known for its cytotoxic alkaloid, camptothecin. Camptothecin derivatives are well known cancer drugs and are considered as the most promising anticancer drug of the twenty-first century. With an objective to find out alternative sources for this vital alkaloid, the present study reports O. *barberi*, a new camptothecin producing plant from Western Ghats region.

Camptothecin was first extracted by Wall and Wani in 1996 from *Camptotheca accuminata*. Later *Ervatamia heyneana* (Hsiang et. al., 1985), *Mapia foetida* (Aiyama et. al., 2003) are reported for camptothecin production. Recently *Ophiorrhiza* species became an important source of camptothecin. Many *Ophiorrhiza* species like *O. mungos* (Vandana et. al., 2005), *O. pumila* (Priel et. al., 1991), *O. eriantha* (Hao et. al., 2002), *O. rug*osa ver. *Documbance* (Zhang et. al., 2007), *O. rugosa* var. *prostate* (Gunasekara et. al., 1979) etc. were reported as good source of this potent alkaloid. But most of the species are rare, endangered or even possibly extinct category.

Ophiorrhiza barberi Gamble is found growing wild in Tamilnadu and Kerala especially in Munnar Ghat. The plant grows on cool shady places at 1025-1350 m above m. s. l. It is a herb, 35- 50 cm tall, stem erect, branching, glaborous; Leaves 4-16 x2-5 cm, elliptic, caudate-acuminate at apex; inflorescence axillary scorpiod cyme, branches spreading; Flowers 6- 8 mm long, white; Seeds 0. 35- 0. 4 x 03- 0. 4 mm, 4- 8 angular, brown.

Materials and Methods

Plant material: *O. barberi* was collected from Munnar, Idukki district, Kerala. Flower, leaf, stem and root were separately dried in hot air oven at 40^{o} C to constant dry weight and ground to fine powder. Stirring extraction was carried out on REMI magnetic stirrer. Plant

sample (500 mg) was taken in a 250 ml beaker and 100 ml 70% methanol was added. After two hours stirring, supernatant was taken and extracted with chloroform. The chloroform layer was pooled out, filtered, evaporated and dissolved in HPLC grade methanol.

Thin Layer Chromatography (TLC): TLC analysis was carried out for the qualitative estimation of Camptothecin. Pre-coated Silica Gel^{60} F_{254} aluminium sheets were used for chromatography. For confirmation standard Camptothecin was also run along with the samples. Saturated chambers with chloroform: Ethanol in the ratio 24:1 was used as mobile phase. After separation the chromatogram was visualized at 254 nm using U. V. chamber.

High Performance Liquid Chromatography (HPLC): Quantitative estimation was carried out by HPLC (SHIMADZU LC- 2010) using reverse phase C-18 column with a solvent system of methanol: water (6:4) and detected at 254 nm.

Results and Discussion

Leaf, stem, flower and shoot were separately tested for camptothecin content. Qualitative and quantitative analysis showed that only root extract showed CPT (0.1% DW). Leaf, flower and stem didn't show presence of CPT even in trace. The percentage of CPT recovery was almost equal or higher when compared to other *Ophiorrhiza* species. Early reports showed that *O. mungos* produced 0.1% DW CPT in its root whereas *O. rugosa* and *O. pectinata* showed CPT less than 0.05% DW. Therefore the CPT content obtained in the present study is not negligible. Yamasaki et al. (2003) reported that CPT biosynthesis may occur in limited parts where expression of mRNA and enzyme activity (Stricosidine synthese) takes place and then CPT is transported to other parts of the plant. As this results indicates, organ limited camptothecin production may lead light into the origin of camptothecin biosynthesis. As the root produce this vital alkaloid, total harvesting may lead to the disappearance of this rare species. So it is necessary to conserve this important plant species using *in vitro* techniques.

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Foliar epidermal studies in selected members of Rubiaceae and Fabaceae

Sheeba M.J

Department of Botany, T.K.M. College of Arts and Science Kollam, Kerala

Abstract

The present study is concerned with the leaf surface characters such as epidermal cell shape, distribution of stomata, type of stomata and stomatal density in Rubiaceae and Fabaceae. Stomata provide an additional tool in ascertaining the systematic position of the disputed taxa, when considered along with other parameters. Foliar epidermis provides characters of diagnostic value since its structure varies from plant to plant in angiosperms. The selected members of Rubiaceae are *Canthium didymum, Coffea arabica, Hamelia patens, Ixora coccinia, Morinda tinctoria*. The members selected from Fabaceae are *Gliricidia sepium, Flemingia stobilifera, Crotalaria striata, Clitoria ternata, Sesbania sesban.* The foliar epidermal studies in Rubiaceae and Fabaceae were carried out to assess the systematic position and the results are used to discuss how stomatal studies played a notable role to distinguish intra specific variation and evolution. It showed that the shape of the epidermal cells of Rubiaceae is regular but in *Morinda* it is irregular. In Fabceae, epidermal cells are irregular. In Rubiaceae, stomata are present only in lower side were as in Fabaceae it is amphistomatic in most cases. In Rubiaceae, stomatal type is paracytic and in Fabaceae, it is anomocytic. But Morinda has anomocytic type of stomata .The overall features of stomata, namely their distribution and size appear to show that remarkable variation occur in Rubiaceae and Fabaceae.

Key words: foliar epidermis, amphistomatic, anomocytic, Rubiaceae, Fabaceae

Introduction

Foliar epidermis provides characters of diagnostic value since its structure varies from plant to plant in angiosperms. It bears various structures like stomata, hairs, glands and multi-cellular emergences. Cuticular features such as epidermal cells, shape and type of stomatal complex and trichome types are helpful in determining phylogeny and systematic position of the taxa as suggested by Metcalfe and Chalk (1950). Epidermis is mostly single-layered, but sometimes it becomes few-layered, called multiple epidermis. Epidermal cells are parenchymatous in nature with comparatively small amount of cytoplasm lining the cell-wall

and a large vacuole filled with colourless cell-sap. In leaves and young green shoots, epidermis possesses numerous stomata through which an interchange of gasses takes place between the plant and the atmosphere. Stomata are very minute opening formed in the epidermal layer in green aerial parts of the plant, particularly the leaves, roots and non-green plants of the stem are free from them. Each stoma is surrounded by two semi-lunar cells, known as the guard cells. The term 'Stoma' is often applied to the stomatal opening plus the guard cells. Guard cells are living cells containing chloroplasts and with thick inner walls and thinner outer walls. Sometimes the guard cells are surrounded by two or more cells which are distinct epidermal cells. Such cells are called subsidiary cells. Present study is concerned with leaf surface characters such as epidermal cell shape, distribution of stomata, type of stomata and stomatal density in two families namely Rubiaceae and Fabaceae.

Materials and Methods

Information on the source of plant used in this study were collected from Kollam District in south India. For detailed stomatal studies fresh mature leaves were collected from plants growing in the field and washed well in the running water. The method adopted by Ahamad (1964) was followed in all details. Epidermal peelings were taken from both upper and lower surfaces of leaf with sharp razor blade. These peelings were washed in distilled water, stained in Safranin, washed well in distilled water and mounted on clean glass slide using 50% glycerin and observed under the microscope. Frequency of stomata was calculated for the adaxial and abaxial leaf epidermis as the number of stomata per unit area 10X and 40X fields of microscope. The average sizes of the guard cells including the stomatal pore were measured with micrometer using 10X and 40X magnifications. Frequency of stomata and all measurements were taken from an average of five readings. Leaf areas were calculated using graph paper.

Results and Discussion

Plants in Rubiaceae are Herbs, Shrubs, trees and climbers sometimes thorny leaves simple entire opposite (decussate) or whorled, with inter-petioles, stipules are present sometimes reduced to glandular setae (pentas). The Family includes about 500 genera and 6,000 species in India the family is represented by 551 species.

1. *Canthium didymium:* In *Canthium,* shape of the epidermal cells of the lower epidermis cells are regular and rectangular. Guard cells are kidney shaped with chloroplast granules (Fig-1).Cuticle present on the upper epidermis. Stomata are seen only on the lower side. Stomata are absent on upper side. Stomata are paracytic (table-1). Epidermal hairs are absent on both upper and lower surface. Leaf area of *Canthium* is 177.35cm^2. Average size of Guard cells including the stomatal pore was 9 x 5µm.

2. *Coffea arabica:* Foliar epidermal studies in *Coffea* revealed that the shape of cells of lower epidermis is regular and rectangular. Guard cells are kidney shaped with chloroplast granules (Fig-3). Cuticle is present on the upper epidermis. Stomata are present only on the lower side and absent on upper side. They are also paracytic (table-1). Epidermal hairs are absent on both upper and lower surface. Leaf area of *Coffea* is 138.00cm^2. Average size of Guard cells including the stomatal pore was 5 x 7µm

3. *Hamelia patens:* Shape of lower epidermal cells is regular and rectangular in *Hamelia*. Guard cells are kidney shape with chloroplast granules (Fig-5). Cuticle is present on the upper epidermis. Stomata are observed only on the lower side and areparacytic (table-1). Epidermal hairs are absent on both upper and lower surface. Leaf area of *Hamelia* is 52.00cm^2. Average size of Guard cells including the stomatal pore was 4 x 8µm.

4. *Ixora coccinia:* Foliar epidermal studies in *Ixora* revealed that the epidermal cells of the lower epidermis are regular and rectangular. Guard cells are kidney shaped with chloroplast

granules (Fig-2). Upper epidermis has cuticle covering. Stomata are present only on the lower side and are paracytic (table-1). Epidermal hairs are absent on both upper and lower surface. Leaf area is 51.76cm^2. Average size of the guard cells including the stomatal pore was 2 x 3µm.

5. *Morinda tinctoria:* ***C***ells of the lower epidermis are regular and rectangular in *Morinda*. Guard cells are kidney shape with chloroplast granules (Fig-4). Cuticle is present on the epidermal surface. Stomata are observed only on the lower side and are anomocytic (table-1). Epidermal hairs are absent on both upper and lower surface. Leaf area is 91.75cm^2. Average size of the guard cells including the stomatal pore was 5 x 9µm.

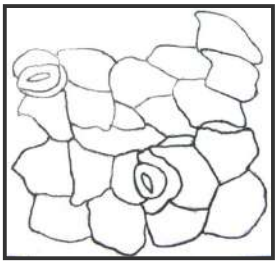


Fig.1

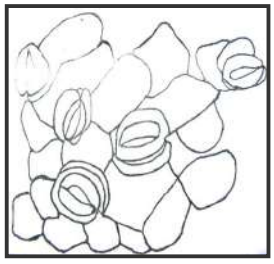


Fig.2

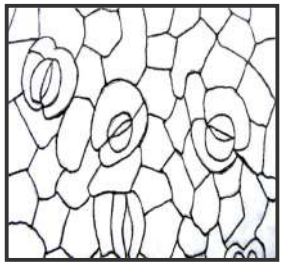


Fig.3

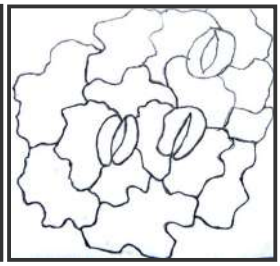
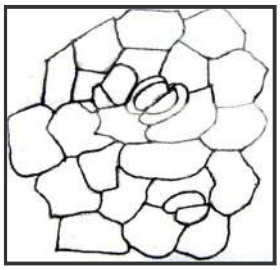


Fig.4



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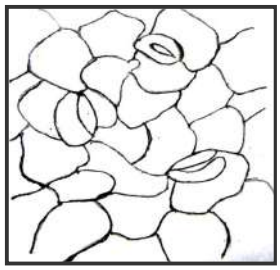

Fig.6

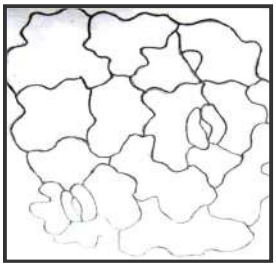

Fig.7

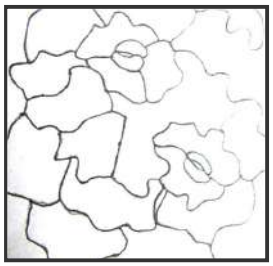

Fig.8

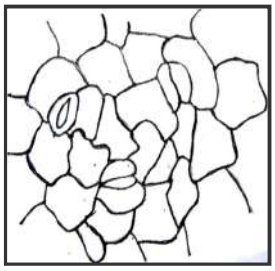

Fig.9

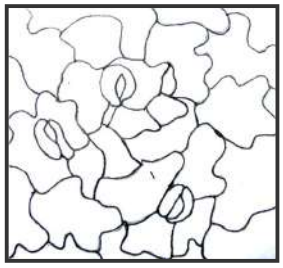

Fig.10

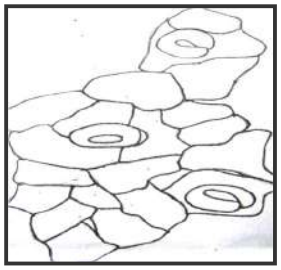

Fig.11

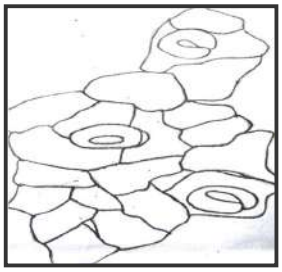

Fig.12

Plants belonging to Fabaceae are herbs, shrubs, climbers or climbers. Leaves are unipinnate, sometime trifoliate, rarely simple, stipules often present. The Family includes about 754 species in India.

1. *Gliricidia sepium*: Foliar epidermal studies in *Gliricidia* revealed that the the upper epidermal cells are irregular. Guard cells are kidney shape with chloroplast granules (Fig-6). Stomata are present on lower surface of the leaf only. They are anomocytic (table-2). Leaf area is 17.88cm^2. Average size of Guard cells including the stomatal pore in upper side of the leaf was 4 x 7µm. Average number of stomata in the lower side was 13.00.

2. *Flemingia strobilifera*: Shape of the epidermal cells of the upper and lower epidermis are irregular. Guard cells are kidney shaped with chloroplast granules (Fig-7). Stomata present on

the both upper and lower surface of the leaf, anomocytic (table-2). Average number of stomata in upper side is 7.3 and lower side is 20.33. Average size of guard cells including the stomatal pore was 4 x 6µm. Leaf area was 42.36cm^2.

3. *Crotalaria striata*: Epidermal cells of the upper surface of leaf are irregular. Guard cells are kidney shape with chloroplast granules (Fig-8). Upper epidermis has cuticle. Stomata are only on the upper side. They are anomocytic (table-2). Leaf area is 14cm^2. Average size of guard cells including the stomatal pore was 3 x 6µm. Average number of stomata on upper side is 14.

4. *Clitoria ternate*: Shape of the epidermal cells of the upper side of the leaf irregular in *Clitoria*. Guard cells are kidney shaped with chloroplast granules (Fig-9).The cuticle present on the upper epidermis. Stomata present only on the upper side, anomocytic (table-2). Leaf area is 13.33cm^2. Average size of guard cells including the stomatal pore was 4 x 7µm.

5. *Sesbania sesban*: Epidermal cells of the upper and lower are regular. Guard cells are kidney shaped with chloroplast granules (Fig-10). Cuticle is on the upper epidermis. Stomata present on the upper & lower side, anomocytic (table-2). Leaf area is 7.2cm^2. Average size of guard cells including the stomatal pore in the upper surface is 7 x 9µm and 4 x 6µm on lower surface. Average number of stomata on the upper side was 10.66 and lower surface was 17.33

TABLE - 1

RUBIACEAE

Name of the Plant	Types of Stomata	Average No of Stomata		Average Leaf Area	Average Size of Guard Cell Including Stomatal Pore	Day	Date
		Upper	Lower				
CANTHIUM	PARACYTIC		22.66	59.11cm^2	9 X 5µm	Sunny Day	12.12.08
IXORA	PARACYTIC		20.33	17.25cm^2	2 X 3µm	Sunny Day	19.12.08
COFFEA	PARACYTIC		19.66	46cm^2	5 X 7µm	Sunny Day	01.01.09
MORINDA	ANOMOCYTIC		21.03	30.58cm^2	5 X 9µm	Sunny Day	15.01.09
HAMELIA	PARACYTIC		11	17.33cm^2	4 X 8µm	Sunny Day	19.12.08

TABLE - 2

FABACEAE

Name of the Plant	Types of Stomata	Average No of Stomata		Average Leaf Area	Average Size of Guard Cell Including Stomatal Pore	Day	Date
		Upper	Lower				
GLIRICIDIA	ANOMOCYTIC		13	17.88cm^2	8 X 7µm	Sunny Day	19.12.08
FLEMINGIA	ANOMOCYTIC	7.3	20.33	42.36cm^2	4 X 6µm	Sunny Day	12.12.08
CROTALARIA	ANOMOCYTIC	14		14cm^2	3 X 6µm	Sunny Day	12.12.08
CLITORIA	ANOMOCYTIC	11		13.33cm^2	4 X 7µm	Sunny Day	01.01.09
SESBANIA	ANOMOCYTIC	10.66	17.33	2.4cm^2	4 X 6µm	Sunny Day	15.01.09

Foliar epidermal characters are often relayed upon to establish systematic relations for they provide characters of diagnostic importance. Further features such as epidermal cells,the shape, type of stomata and their frequency, occurrence of trichoms etc. are found to very among angiosperms. The present investigation was carried out verify the systematic position and the role of stomatal charecters in distinguishing intra specific variations and evolutionary lineage. Soleredor (1908) considered the number, position and structure of the subsidiary cell bordering the stomata as well as the level of stomata in the epidermal tissue and its structure important in taxonomical studies. Van Cotthem (1973) pointed out its importance not only a diagnostic character, but also very valuable taxonomic and perhaps even a phylogenetic clue. Present study shows that the epidermal cells in Rubiaceae are regular except in Morinda. In Leguminoceae, the epidermal cells are irregular. Epidermal cells other than those modified by their relationship to trichome stomata the venation system or other. Special structures provide characters of taxonomic value. Stomatal distribution pattern is considered to have taxonomical value (Rajagopal, 1979; Leelavathy, etal, 1980). This study could reveal that in Rubiaceae stomata are present only lower side. Whereas in Fabaceae, some species are amphistomatic (Flemingia & Sesbania). But in others (Gliricidia, Crotalaria & Clitoria), stomatal distribution is on the upper side. In Rubiaceae stomata is paracytic. Fabaceae has anomocytic type as in Morinda. Various authors proposed different classification the stomata is the one proposed by Metcalfe and Chalk (1950) in which the four classic types recognized are anomocytic, anisocytice , paracytice and diacytice.

Conclusion

The whole study on foliar epidermal features in Rubiaceae and Fabaceae clearly demonstrated the existing remarkable stomatal variations. In Rubiaceae, the type of stomata is paracytic except in Morinda which is anomocytic. In this family, stomata are seen only in the lower surface of the leaf. The leaf area was highest in Canthium and lowest in Ixora. The result revealed that the number of stomata increase in plants with high leaf surface area. In Fabaceae, the type of stoma are anomocytic in Flemingia and Sesbania. Stomata were seen on both upper and lower surface of the leaf and in Gliricidia. Stomata were seen in lower surface only. Leaf area was highest in Flemingia and lowest in Sesbania. The overall data of the various futures of stoma, namely their distinquish and size appear to show that recognizable variation occurs in Rubiaceae & Fabaceae.

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Annona glabra - a successful invader: A case study from selected wetlands of Kannur, Kerala

Sreeja P

Department of Botany, Sir Syed College, Taliparamba, Kannur, Kerala- 670142
E.mail : drsreejarajeev@gmail.com

Abstract

Kerala is well known for wetlands. *Annona glabra* is one of the most common invasive species of mangrove rich wetlands in Kerala. About 3500 ha of mangrove rich wetlands present in Kerala, of which highest percentage is present in Kannur. The study area is located in the banks of Kuttikol river of Taliparamba, in Kannur district of Kerala. This wetland is occupied with about 300 ha of *A. glabra* which is considered as a worst weed in many countries because of its invasiveness, potential for spread and economical and environmental impacts. The methodology of the study includes the floristic study and also the socio-economic impact of the plant. A survey was conducted and interviewed many personalities related with agriculture and also stakeholders. The anatomical and morphological features also studied. The morphological and taxonomical studies revealed that they are deciduous and woody with simple entire leaves and solitary flowers. Flower has two whorls of fleshy petals, 3 large outer petals enclosing 3 small inner petals. Blooms open at night and emit fragrance. The indehiscent mature fruit are greenish yellow when mature and has sweet aroma. Flooding during rain brings seeds and rapidly invades in this area. Several hectares of the land is now occupied with this invader and are created great economic loss to the farmers. Its overgrowth also influences the mangroves. It is very essential to utilize this plant for some beneficial aspects or as bio fuel; otherwise it become a great threat to our ecosystem and also lead to the extinction of many native species.

Key words: Kuttikkol, mangroves, pond apple, invasive

Introduction

Annona glabra, commonly known as Pond apple or Alligator apple is native from Florida. Pond apple occurs at the margin of sloughs, streams, mangrove rich wetlands and lakes over a wide area. This plant is considered as the worst in weeds in many countries because of its invasiveness, potential for spread, and economic and environmental impacts. This species is graft compatible with several commercial *Annona* species (Sanewski *et al*., 1991), and it has been suggested that its use as a rootstock could allow commercial, flood-sensitive *Annona* species to be grown in areas subjected to periodic flooding (Popenoe, 1920; Kennard and Winters, 1960). Introduced as grafting stock for the closely related custard apple, it is a very hardy tree and an aggressive invader. Over time, the dense thickets it forms can gradually replace everything else in the canopy and create an undesirable new habitat. Pond apple thrives in a wide range of habitats, particularly tidal or seasonally inundated coastal ecosystems and mangrove communities. Pond apple produces large amounts of fruit during the wet season, when flood events allow large-scale seed dispersal by water, both in fresh water and out to sea and then via ocean currents (Setter *et al* 2008). *A. glabra* is observed from mangrove wetlands of Payangadi, Kuppam, Vellikkeel, Kuttikkol etc. Its maximum density is seen in Kuttikkol where an *Annona* forest is formed. Its richness depends on salinity. Its density is very least in Valapattanam estuary areas like Thekkumbadu, Kattampally and Kavvayi estuaries like Kunchimangalam. Small trees of large patches of pond apple were spotted from the marshy areas of Kuttikol and

Vellikkeel of Kannur District along with mangroves like *Excoecaria, Kandelia and Avecennia* species. *A. glabra* is in the family Annonaceae and its close relatives include the *A.squamosa* (sugar apple), *A.muricata* (soursop) and *A.reticulata* (custard apple). The specific name, *glabra*, is from the Latin for smooth and refers to the pond apple fruit. Pond apple is a semi deciduous woody tree, typically grow 30 to 40 feet tall and 10 to 20 feet wide. The crown is broad and irregular. Trees usually form a single short trunk. However quite frequently clusters of seedlings produce that appear to be tightly packed multi-stemmed trees.

The main objective of this study is to study the morphological, anatomical, floristic and the socioeconomic impact of the invasive species, of *A. glabra*. We selected Kuttikol, one of the mangrove rich wetland of Kannur District for our study. Kuttikkol belongs to Taliparamba municipality and is well known for agriculture and fishing. Our study area concentrated on the two sides of the Kuttikkol River. The river has its origin from the remote hilly areas of Kuttiari and flows through different villages like Karimbam, Kurumathoor, Muyyam, Vadakkanchery, Kanool,Vellikkeel etc. Its depth increases when passing through Kuttikkol bridge. It discharges into Vellikkeel where a branch of Kuppam River meets and finally joins Payangady river and there to the Arabian Sea.

Materials and Methods

The entire study is divided into morphology, anatomy and socioeconomics. It focused mainly on the invasive character of *A. glabra* and hence very essential to analyze the factors that favor it. We selected one of the mangrove rich wetlands from Kannur District, Kuttikol as it is covered with a thick band of *A. glabra*.

To analyze morphological features various parts of the plant were studied by giving special emphasis on colour, shape, size and height. The morphological features of stem, secondary wood, leaves, fruit, seeds and seedlings were given importance. Systematic position of the plant is identified. Character of flower, leaf, fruit etc. studied.

To study anatomical features the stem, leaf, and the root of the plant were taken. It is done by taking micropreparations of the specimens and viewing them under microscope. Sections were stained and made temporary preparations. The anatomical features are explained with the help of literature and from experts. Microphotographs were taken. Series of seedling sections are also made.

The socioeconomic studies were conducted by selecting two localities with one area enriched with *A. glabra*, Kuttikol and other with scattered distribution, Vellikkeel. Both sites are in Taliparamba municipality and also in the banks of Kuttikol River. Survey was conducted using a questionnaire prepared. About 20 houses from each locality selected and informations collected. The impact of rapid spreading of *A. glabra* is studied from local people, farmers and fisherman. The total study interpreted and thesis prepared. Each and every result documented and photographs were taken.

Results and Discussion

Pond apple is a semi deciduous woody tree, typically grow 30 to 40 feet tall and 10 to 20 feet wide. The crown is broad and irregular. Trees usually form a single, short trunk. However, quite frequently clusters of seedlings produce what appears to be tightly packed multi-stemmed trees. With age, trunks become crooked displaying up curved branches. In wet sites, older specimens develop enlarged, fluted or buttressed bases, somewhat like bald cypress trees (*Taxodium distichum*). There are great variations in bark appearance. The youngest trees have light grey bark which may be smooth and scaly. Older trees may retain their grey coloured bark but others develop reddish-brown colourations. Barks of older trees are fissured with deep vertical grooves. Wood from the tree is light brown, soft and cork-like. Growth rings are present but indistinct and not necessarily annual. Twigs are spotted

with reddish brown, warty, raised projections called lenticels. Renewal growth is in late spring, usually in April. First, old leaves become spotted and fall. Trees are either briefly deciduous or semi-deciduous. There is a quick exchange of old and new leaves. This process initiates flowering and eventually fruit production. Leaves are simple, entire and alternately arranged. Leaf blades are ovate to oblong, commonly 4 to 8 inches long and 2 to 4 inches wide. Leaves on basal suckers are the largest. Leaf blades tapered at the base and have a short pointed apex. Leathery, glossy, and dark green above, they turn upward to form a V-shape along a prominent midrib. The petioles are short, usually 0.5 to 1 inch long. If crushed, the leaves emit a characteristic fragrance that can be used to identify the tree in case of potential confusion.

Flowers appear solitary with occasional bunches at the base of the new shoots. Perfect flowers are attached to stout stems. There are two whorls of fleshy petals with three large outer petals enclosing the three smaller inner petals. The petals are distinctly triangular shaped. Outer petals are creamy white to pale greenish yellow when fresh around 0.5 to 1 inch long. Inner three petals are narrower, whitish or dull greenish outside, usually blood red within or spotted with red or wine colour near the base. Flowers begin to emerge in abundance in spring, but depending on the environment, flowers can be produced year round. Blooms open at night and emit their fragrance as a lure to entice beetles to enter the centre chamber to effect pollination between the stamens and stigmas.

Fruits are oblong to elliptical-shaped. They are usually 3 to 5 inches long and 2.5 to 3.5 inches in diameter. The surface is slightly outlined, but never elevated or scaly like other fruits in the genus. Indehiscent mature fruits begin falling from trees in late summer. However, most fruits mature in the fall, lasting to winter. They drop from trees when green or greenish yellow. Both fruits and seeds float and remain viable for many months. Mature fruit have a sweet aroma. The pulp is fleshy, mealy and pithy. The colour is yellowish-orange. They are important food for birds, squirrels, turtles and even alligators. Ripe fruits are considered edible but unpalatable to humans. Each fruit frequently has more than 100 caramel-coloured, brown or black seeds most about 0.5 inches long. Seeds are not edible and are poisonous. When ripe, the thick stem easily pulls away from the fruit leaving a central cavity.

Anatomy of stem, leaf and root has the following features. Secondary growth observed in very early stages itself. Epidermis is thickened and are two to three layered. Periderm is hard with lenticels. Medullary rays are conspicuous. Cortex contains storage grains. C.S of stem shows wavy outline (Fig.C). Mechanical tissues like sclereides and stone cells are prominent. No well-developed intercellular air spaces were observed in the stem xylem and phloem. We expected to find aerenchyma tissue with large intercellular air spaces (Fahn, 1990), in the swollen stem base since it forms the boundary, at the water line, between the aerobic shoot and the submerged stem base and root system.

The study area has a total of 60 houses with a total human population of 246. Land area owned by each family differs. Most of the families in this area is in the working class. Agriculture is only the secondary source of income. Education facilities and health services are not satisfactory. Most of the land remains as bare. But, a small proportion is used to cultivate paddy. Other major crops are mango, coconut, arecanut, pepper and vegetables like peas, pumpkin, cucumber etc. But the landholders are less interested in cultivation due to high labour charge and also lack of labors. During severe rain, flooding of water occurs and seeds of pond apple disperse into the bare paddy fields and they germinate and grow fast by absorbing nutrients. Seedlings grow competitively and invade the entire area. So lack of farming is a major reason for the wide spreading of *A. glabra*.

Fig. A- seeds

Fig. B-Habit

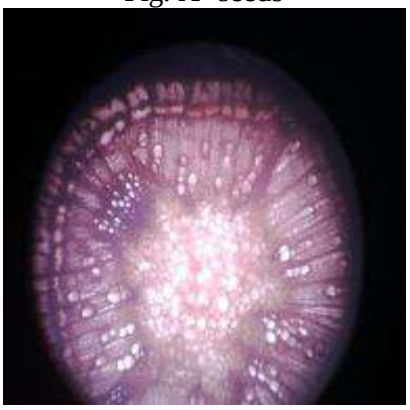

Fig. C- stem anatomy

Fig. D- fruit cut open

According to the stakeholders, the phenomenon occurred within the last five years. Now they are in trouble as it is very difficult to remove. Earlier, the respondents depended on *A. glabra* for firewood; but they are not using it now as is not at all fuel efficient. Some families convert its twigs and leaves as compost for coconut plantations. Another use of the plant is that its twigs can be used as support for the growth of climbing vegetables. *A. glabra* cannot be used as a fodder. Even though the seeds of pond apple are not poisonous the people consider the whole fruit as poisonous. The negative impacts are more while considering the positive aspects. Due to thick vegetation, there are disturbance to the local community from wild animals. During night, foxes living under these trees enter in the residential areas and destroy their crops. These small forest areas are the breeding houses of mosquitoes and other disease spreading vectors. As those areas are always wet and water logging, its chances are high. Human and animal excreta gets flushed through water and mixed in nearby freshwater sources resulting in spread of contagious diseases. A single tree itself produces about 100 fruits at a time. They are fleshy and each contains about 300 seeds. Its decay in the soil also invites disease causing agents. The striking fact recognized by the socio-economic survey is that most of the local people are not bothered about the weed and they are not giving much importance to it. Our observations revealed that only around 40% are anxious about the growth of *A. glabra*. Hence, it is very essential to give awareness about its invasion and also to implement necessary measures to minimize its spreading. It is better to utilize it as bio-fuel or some other eco-friendly products.

Conclusion

Annona glabra, commonly known as pond apple is a very troublesome invasive species grow in swamps and are salt tolerant. Its seedlings carpet the banks and prevent other species to grow. A typical fruit contain 100 or more seeds and flow by water and dispersed

rapidly. This results shows the significance of the habitat of *A. glabra* and its ecology that help to know this plant more and thereby its management. Effective utilization of this species helps minimize the risk created by this species in the ecological balance.

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Mikania scandens B.L.Rob., Climbing Hempvine (Asteraceae) – a fast naturalizing exotic weed in Indian subcontinent

Preetha S.S and Kaladevi V*

Department of Botany, St. John's College, Anchal, Kollam, Kerala
Department of Environmental Sciences, St. John's College, Anchal, Kollam, Kerala
E mail:rojinpreetha@yahoo.com ,kalahainandhanam@gmail.com

Abstract

Mikania scandens B.L. Rob**.** a troublesome weed is naturalising in the country at faster rate. Naturalisation of exotics poses very serious threats to the survival of many of our indigenous flora. It widely spreads in wet places, forest borders and clearings, along the banks of streams and rivers, road sides and railway tracks, in pastures, forest plantations, agricultural and agro-forestry system, open distributed areas and barren lands. Mikania grows luxuriantly on leached and nutrient poor sandy loam to clayey soils. It is a perennial twining herb, only little information is available about its identity and floral characters, hence described here with detailed structure.

Introduction

Naturalisation of exotic possesses very serious threats to the survival of many of our indigenous flora. Several western species have invaded our country and many of them have become naturalised and even dominate our native species. *Mikania scandens* is one among these which has become threat to many of the ephemerals.

Mikania scandens B.L. Rob. (Asteraceae), known as climbing hemp weed in English, is a twining herbaceous climbing vine with long-petioled, opposite leaves and small homogamous flower-heads, grown abundantly throughout the plains of India. Traditionally, the plant has been used for some medicinal purposes in the Indian subcontinent. Aqueous leaf extracts of this plant have been used in folk medicine to treat stomach ulcers. The plant is thought to be efficacious in the treatment of gastric problems. The genus *Mikania* is the largest of its kind in the Eupatorieae (Asteraceae) tribe, with more than 430 species concentrated mainly in the tropical regions (King & Robinson, 1987). Although it is one of the most distinctive and easily recognized genera of the tribe, species delimitation is often difficult due to the very large number of taxa and the existence of highly polymorphic species complexes (King & Robinson, 1987). In Brazil, the genus with 171 species is

mainly found in the states of Sao Paulo, Minas Gerais and Rio de Janeiro (Gasparetto et al., 2010). The species of this genus are characterized by herbaceous, annual or perennial (Pio Correa, 1984), and scandent habit, though there are as well commonly erect and decumbent representatives (Ritter & Miotto, 2005). Some species known as "guaco" have shown a broad spectrum of action and are used to treat fever, rheumatism, colds and respiratory diseases (Silva et al., 1984; Moura et al., 2002; Oliveira et al., 2007; Soares et al., 2007; Freitas et al., 2008). Approximately 12% of *Mikania* species and their chemical composition have been studied. The most commonly used are *M. glomerata* and *M. laevigata*, generally employed in respiratory disorders treatments (Gasparetto et al., 2010), and because their morphological and anatomic similarities are sold indiscriminately and used without distinction (Ritter & Miotto, 2005; Bolina et al., 2009). However, other species are described in the literature, and are characterized for their chemical components activities. *Mikania micrantha* is native to Mexico, Central and South America and the West Indies, but is seldom a weed in those areas. It has become naturalized widely in the old World tropics and is a problem in tropical Asia and the Pacific Islands. It is a serious weed of newly planted plantation crops such as tea, coffee, cacao, coconuts and oil palms, but it can be found as a weed in mature plantings as well (Holm et al. 1977). The potential range of this species in the United States is not known, but it survived experimental planting in China as far north as 28° N (Holm et al. 1977; Zhang et al. 2004) which is comparable to Orlando (28.5383355 N) in Florida. A study based on records from herbaria in 22 countries found that most observations of this species are below 600 m, but one was over 1,200 m above sea level, suggesting that the species could survive in colder areas (Day et al. 2012).

Mikania scandens is native to the eastern United States from Maine to Florida and westward to Texas and Michigan as well as Mexico and the West Indies, but it has likely been extirpated from the northernmost extremes of its range. In Hawaii and other Pacific Islands, it has become weedy. Even in Florida, this species can exhibit unrestrained growth in disturbed locations, given ideal light and moisture conditions. In moist, shady, natural habitats, *M. scandens* can climb over other vegetation, but does not tend to form dense mats. It is most often found along stream banks and swamps to 500 m elevation. *M. cordifolia* is native to the south-eastern United States (Alabama, Florida, Georgia, Louisiana, Mississippi, Texas), Mexico, the West Indies, and Central and South America. It grows in wetlands and moist areas to 100 m elevation.

This study was conducted aiming the identification of key species, their chemical components and the main pharmacological properties reported in order to serve as a guide to future research in *Mikania* genus.

Materials and Methods

This study was done after collecting specimens from almost all parts of Kerala. Field trips were conducted during different climatic seasons. The collected specimens were studied and noted all characters such as habit, habitat, colour of leaves, bark, flowers and fruits, flowering seasons etc. Detailed descriptions for all taxa were made and the characters observed were tested with characters mentioned in the prologue and various revisionary and monographic work.

Result and Discussion

Family: Asteraceae

Habitat: Prefers moist sites, with at least partial sun and soil pH between 5.7 and 7.5. Forms dense mat over thickets of brush and small trees. It can also be found in almost all crop fields, plantations, open fields etc.

Vegetative description: Leaves simple, acuminate, coarsely dentate or shallowly, unevenly lobed (sinuate), 1-8 cm wide and 1.5- 10 cm long with a deeply cordate base. Leaves bear 3-7 strong basal veins, giving them a palmate venation and are arranged oppositely at swollen nodes along the slightly four-angled, glabrous stem. Petioles are slender and shorter than the leaf blades, 1 to 10 cm long.

Climbing Mechanism: The plant is an apical twiner that climbs dextrally (from left to right). Dextral climbing is unusual in this genus.

Flower Description: Flowers in small heads 5-7 mm long, crowded in round-topped, lateral and terminal, modified panicles (corymbs); involucral bracts four, linear-lanceolate, 4 - 5 mm long, attenuate, often purplish tinged, with an additional smaller bract; corolla green to white.

FL.& Frs. Throughout the year.

Pollinator: Small, aggregated tubular flowers and floral nectaries suggest pollination by insects.
Fruit Type and Description: The indehiscent fruit is “an achene, oblong, 1.5 to 2.5 mm long, brownish black, five-angled.
Seed Description: Because the fruit is a plumed achene (a single-seeded fruit that does not open), the seed is dispersed with the achene. No reports give features of seeds of this species.
Seed dispersal: Seeds are primarily wind-dispersed but can be moved unintentionally by people or animals. Whether wind-dispersed or by animals, the pappus bristles are the main mechanism. They can act as a parachute or sail or can catch onto an animal via the same feature or can be modified into a barb or awn. Vegetative reproduction is more important than sexual reproduction in this species as broken stems can re-root and form new plants.
Distribution: Throughout regions of Kerala, occurs as a noxious weed, growing well in almost all coastal regions. Flowers secrete certain enzymes which causes skin allergy. Its fast naturalization has become a threat to native flora as case of Eupatorium, Eclipta etc.

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Environmental and ethnobotanical studies of *Thespesisa populnea* Linn.

Kaladevi V and Preetha S.S *

Department of Environmental Sciences, St. John's College, Anchal
E mail: kalaharinandhanam@gmail.com
*Department of Botany St. John's College, Anchal

Abstract

Thespesia Populnea Linn is an ever green tree belonging to the family Malvaceae; commonly known as Indian tulip tree. The plant is distributed in tropical regions and coastal forests in India. It is well known and all the parts are used in Indian system of medicine. The plant has been used as astringent, antibacterial, hepatoprotective, haemostatic, anti-diarroheal and anti-inflammatory. The Plant also shows various pharmacological activities like anti-dermatitis, antisteroidogenic, wound healing, antioxidant etc. The plant *Thespesia populnea* (Malvaceae) traditionally claimed to be useful in the treatment of cutaneous affections such as scabies, psoriasis, ringworm, guineaworm, eczema and herpetic diseases. Oil prepared by boiling the ground bark in coconut oil is applied externally in psoriasis and scabies. From the above data, it is can be said that, the plant *Thespesia populnea* is promising for further investigations to prove its multi activity. This investigation is an attempt to collect more information on the pharmacological properties of the plant by interactions with practitioners in herbal medicine.

Key words: *T. Populnea*, Chemical constituents, Ethno botany.

Introduction

Thespasia populnea Linn belonging to Family Malvaceae, is a fast growing, medium sized evergreen tree, up to 10 m tall with yellow, cup-shaped flowers having maroon centre and distributed throughout coastal forests of India and also largely grown as an avenue tree. It has heart shaped leaves, glossy green in colour and grows well under full sunlight and tolerates drought conditions. The tree is valuable as a coastal windbreaker because of its high resistance to wind. Almost all parts of the plant are used in traditional system of medicine. Bark, leaves, flowers and fruits are useful in cutaneous infections such as scabies, psoriasis, eczema, ringworm, and guinea worm. An ayurvedic preparation "panchvalkala" contains *Thespesia populnea* possess free radical scavenging activity. Barks and flowers have astringent, hepatoprotective, antioxidant and anti-inflammatory activities in rats, and also supposed to improve the memory. Leaves and bark are also for the treatment of wounds and as an anti-inflammatory poultice for ulcers and burns in folk medicine. Gossypol was found to be the major component of *Thespesia populnea* producing anti-fertility effects in rats as well as in human beings. Four naturally occurring quinones viz. thespone, thespesone, mansonone-D, and mansonone-H have been extracted from heart wood of the plant. The phytochemical study of bark reveals the presence of gossypol, tannin and coloring matter and leaf extract indicates the presence of lupeol, lupenone, β-sistosterol and also acacetin, quercetin, vanillic, syringic, melilotic, and ferulic acid. The fruit extract of the plant has already shown a significant hypoglycemic effect.

In India, herbal medicines have been the basis of treatment and cure for various diseases or physiological conditions in traditional methods practiced such as ayurveda, unani and siddha. The decoctions of *Thespesia populnea* is considered to be used in the treatment of cutaneous infections, skin and liver diseases (Shirwaikarkumar et al., 1995). The bark, leaves, and flowers are useful in cutaneous infections such as scabies, psoriasis, eczema, ringworm and guinea worm (Elmo et al., 1986). The bark and flowers possess astringent, hepatoprotective and antioxidant activities. In the present study, more information on the ethno pharmacological properties of the plant were collected, analysed and documented for assisting further research in the field.

Materials and Methods:
During the course of present study, field trips were utilized to collect more information on the ethnobotanical importance of Thespasia. Environmental and ethno botanical data were also gathered by interviewing Ayurvedic, Sidha and Unani practitioners throughout Kerala.

Result and Discussion
Because of its tolerance to salinity, *T. populnea* is suitable for controlling soil erosion in coastal region and it is planted in abundance for the purpose. Leaves are used as green manure. Wood chippings have also been tried as a green manure. In many parts of Kerala, *T. populnea* is a sacred tree, often planted near temples and because of its attractive flowers, it has been planted as an ornamental tree. In mangrove areas, *T. populnea* is often planted to consolidate ridges and bunds in an aqua-silviculture system for prawn production.

Wood shavings are used in the treatment of dermatitis. The white exudate has anti-hepatoprotective activity. The extract of *T. populnea* reduces the weight of uterus and ovaries significantly. Cholesterol and ascorbic acid content in ovaries increase significantly on treatment with the extract. Leaves are used in post-delivery treatment. Powdered fruits heal wounds very fast. It also shows anti-inflammatory, analgesic and antipyretic properties. Bark extracts are good for the treatment of diabetes and Alzheimer's disease. Whole plant is used in the treatment of Psoriasis. Leaf juice is used in the treatment of ulcer. Almost all tribal communities use the leaf powder to enhance memory. Decoction of the bark is commonly used for treatment of skin and liver diseases. A compound oil of bark and capsules is useful in urethritits and gonorrhea. The bark, root, fruits were used in dysentery, cholera and hemorrhoids. Fruits of the plant are used in Ayurveda for the control of diabetes. The heartwood has a healing property useful in treating pleurisy and cholera, colic and high fevers; it is carminative. The cooked fruit crushed in coconut oil provides a salve, which, if applied to the hair, will kill lice. Sap of the leaves and decoctions of the plant parts are used externally to treat various skin diseases. Juices from the pounded fruits and leaves are ingredients used to treat headaches and itches. A decoction of the astringent bark is used to treat dysentery, haemorrhoids and colds. The fruit juice is used to treat herpes. Extracts of the plant have significant antimalarial activity. Leaf and bark decoctions are administered for high blood pressure. Leaf tea is taken for rheumatism and urinary retention.

Conclusion
Collection of more information on the ethno botanical importance of *T. populnea*, is very helpful to researchers who investigate deeply in the subject. This investigation could reveal some uses of the plant which are not documented. Hence new areas for research are now open for those who are involved in identification of the active principles responsible for the aforesaid medicinal properties. The active constituents needs to be isolated and should be considered for further in-vivo or in-vitro studies to confirm the traditional claims and to explore the potential of development of drugs.

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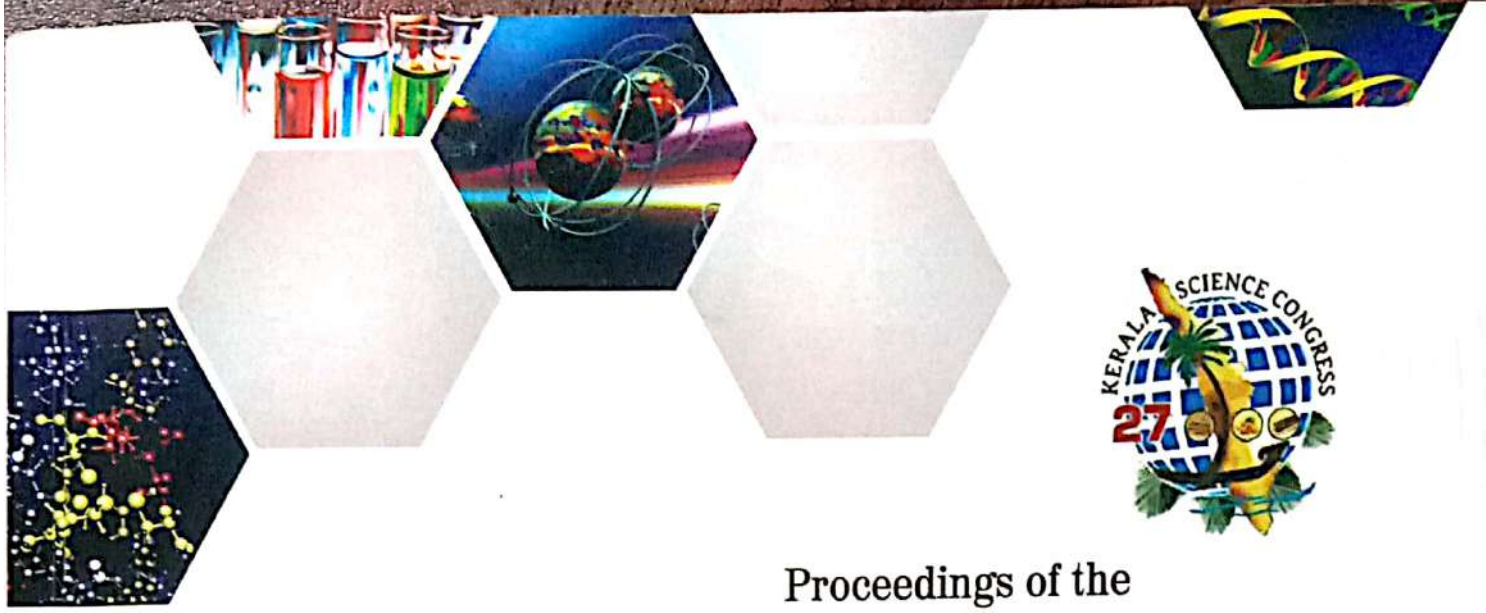

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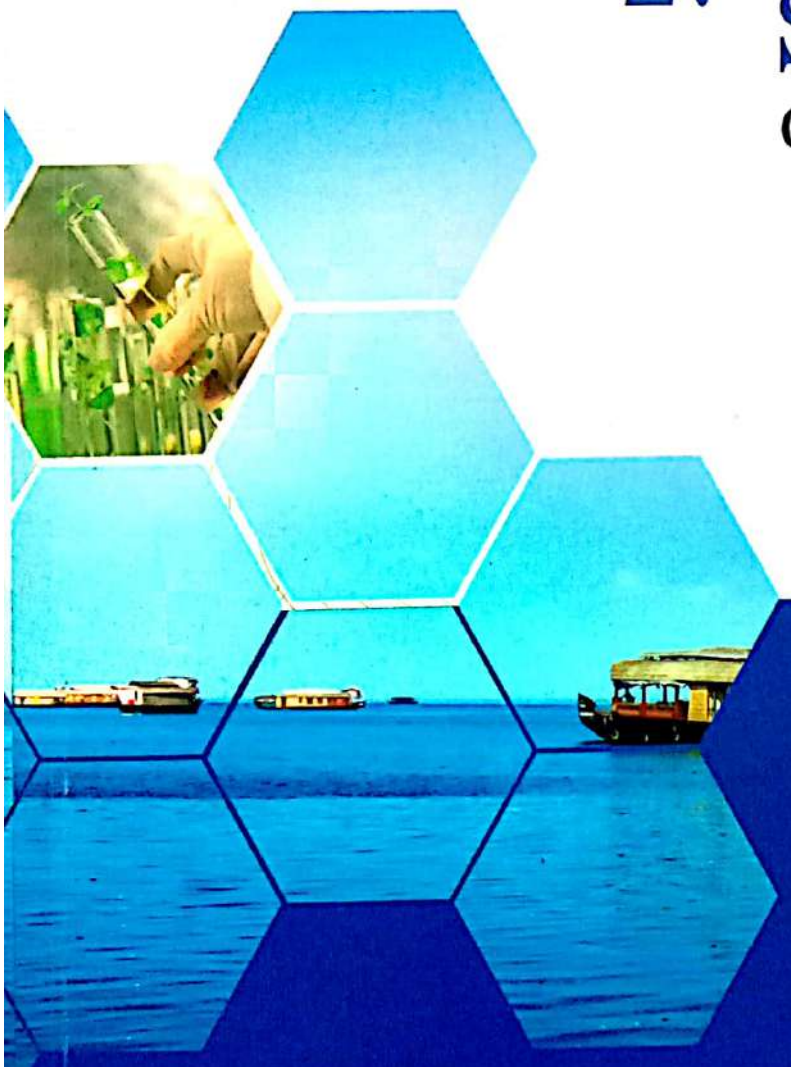

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Isolation, Characterization and Evaluation of Soil Microorganisms for Bioremediation of Chlorpyrifos

Karolin K.P., Meenakumari. K, Subha.P
Department of Microbiology College of *Agri*culture
Vellayani -695 522, Kerala, India
E-mail: karolin153@gmail.com

The present study on "isolation, characterization and evaluation of soil microorganisms for bioremediation of chlorpyrifos", was conducted in the Department of Agricultural Microbiology at College of Agriculture, Vellayani during 2012-14, with the objective of isolation, characterization and evaluation of microorganisms for of chlorpyrifos degradation, development of consortia and evaluation of bioremediation potential against chlorpyrifosin vivo.Microorganisms capable of degradation of chlorpyrifos were isolated by enrichment culture technique from identified locations with high residue levels of chlorpyrifos. In all, nineteen isolates comprising eleven bacteria, seven fungi and one actinomycete obtained were subjected to a preliminary screening based on the ability of isolates to utilize 50,100,200,400 and 800 ppm concentrations of chlorpyrifos at intervals of 7, 15, 20, 25, 30 DAI. The six isolates selected (M5, M6, M7, M10, M12, M17) were further evaluated for their ability to degrade different concentrations of chlorpyrifos based on population build up , analysis of chlorpyrifos residue and chloride released into the medium. The fungal isolates, M5, M6, M7 and M17 which recorded significant growth in terms of viable count, maximum reduction in chlorpyrifos residue and release of chloride were selected and subjected to morphological and molecular characterization. The isolates M5, M6, M7 and M17 were identified as Isariafarinosa, Aspergillusfumigatus, Trichodermavirideand Penicilliumgriseofulvum respectively.

In order to develop a consortium, the compatibility of the selected fungal isolates - M5, M6, M7 and M17 was tested by co-culturing in liquid MSM and by dual culture technique. All the fungal isolates were compatible and no inhibition could be recorded. A consortium of the four fungal isolates was prepared in liquid formulation and its ability to degrade different concentrations of chlorpyrifos was studied under in vitro conditions on 25th day of inoculation. The percentage degradation of chlorpyrifos by the isolates increased with increase in concentrations, but showed a decline at 800 ppm. The percentage degradation of chlorpyrifos was higher in consortium compared to individual isolates under in vitro conditions.

The developed liquid consortium was evaluated in sterilized soil spiked with 100 and 400 ppm concentration of chlorpyrifos with cowpea as the test crop. Significant reduction in all biometric characters was observed due to spiking with chlorpyrifos at 100 and 400 ppm concentrations. Application of consortium in soil spiked with chlorpyrifos enhanced all the biometric characters and reduced the residue of chlorpyrifos. The study also established efficient colonization of the chlorpyrifos degraders present in the consortium in the rhizosphere of cowpea.

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Microwave assisted Green Chemistry Synthesis of Polymer grafted Banana Stem for the Environmental Remediation

*** Noeline B. Fernandez, Manohar D. Mullassery, Surya R.**
*Department of Chemistry, Fatima Mata National College, Kollam, Kerala, India
* *Correspondence to:* Noeline B. Fernandez, Department of Chemistry,
Fatima Mata National College, Kollam-691001, India.
Email: fernandeznoeline@gmail.com

The aim of this work is equilibrium study of the sorption of crystal violet (CV) from aqueous solutions under different experimental conditions using an adsorbent glycidyl methacrylate grafted banana stem (GM-BS). Microwave (MW) irradiation has gained a great deal of attention owing to the molecular level of heating. Banana stem is grafted with glycidyl methacrylate under microwave irradiation. The adsorbent has been characterized using IR. The effects of pH for the removal of CV was studied. The optimum pH for CV adsorption was found to be 10.0. Desorption of CV from the sorbed clay was achieved by eluting with 0.1 M HCl.

Keywords: banana stem, adsorption, kinetics, regeneration

10-33

Evaluation of antimicrobial activity of Marine Macroalgal extracts against Human Pathogens

Ann Lawrence* and **M.T.P Miranda**
Department of Zoology, Fatima Mata National College, Kollam - 691001, Kerala, India.
*Email: alwinjc@gmail.com Phone: 8547147700

Seaweeds or macroscopic marine algae are recognized as natural resources of bioactive substances. Many of the seaweeds produce secondary metabolites which inhibit the growth of certain bacterial and fungal pathogens. Marine algae are widely distributed along the coast of Thirumullavaram, Kollam, Kerala. The present work is an attempt to evaluate the *in vitro* antibacterial and antifungal activity of marine macroalgae *Acrosiphonia orientalis*, *Ulva lactuca* and *Gracilaria corticata* collected from Thirumullavaram and thus to identify the algal extracts that can act as antimicrobial agents in pharmaceutical industry. The three seaweed species collected from the intertidal zone of Thirumullavaram were tested against three pathogenic bacteria and four pathogenic fungal species using the disc diffusion method. Methanolic extracts of the seaweeds were screened against the Gram negative bacterial pathogens viz., *Vibrio parahaemolyticus* ATCC 17802, *Salmonella enteritidis* ATCC 12022 and *Escherichia coli* ATCC 25922 and the fungal pathogens viz., *Aspergillus flavus* MTCC 277, *A. niger* MTCC 281 / ATCC 9029, *A. fumigatus* MTCC 343 and *Penicillium chrysogenum* MTCC 160 / ATCC 10106. The extract of *U. lactuca* showed inhibition in the growth of the tested bacteria *Vibrio parahaemolyticus*. The algal extracts were ineffective against the other microbial strains. The study reveals that the methanol extracts of green alga *Ulva lactuca* harvested from Thirumullavaram coast is an effective source of natural antibiotics. The structure and nature of the bioactive components responsible for the antibacterial activity is to be further investigated.

Keywords: *Ulva lactuca*, antimicrobial activity, methanol extracts, bacterial and fungal pathogens.

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