

“Multidisciplinary Approach towards Indian Knowledge System”

Recent Trends in Arts, Humanities, Management & Science

JANUARY 2023



Chief Editor

Dr. S. R. Kattimani

Publisher

Siddharth Publications (M.S.)

ISBN : 978-93-5980-212-1

“Multidisciplinary Approach towards Indian Knowledge System”

Recent Trends in **Arts, Humanities, Management & Science**

JANUARY 2023

Chief Editor

Dr. S. R. Kattimani

Publisher

Sidharth Publications,(M.S.)

“Multidisciplinary Approach towards Indian Knowledge System”

Recent Trends in Arts, Humanities, Management & Sciences

Index

Sr. No.	Name of the Teacher/'s	Title of the Research Paper	Page No.
1.	Dr. Sanmati Vijay Dhanawade	Alfred Joyce Kilmer's Trees: A Tribute to Nature	1
2.	Ms.S.Z. Mullani ¹ , Dr. R. D. Kumbhar ²	Image Sentiment Analysis: A Critical Review	7
3.	Dr. Nisha R. Mugade, Dr. Shubhangi S. Kale	Importance of Mangrove Conservation in India: A Comprehensive Review	15
4.	Dr. Shubhangi Kale, Prof. Dr. Sambhaji Shinde, Dr. G. S. Ubale, Dr. Nisha R. Mugade	Analysing the Geographical Dynamics of Religious Tourism Growth and Current State in Kolhapur District, Maharashtra, India	23
5.	Dr. Sanmati Vijay Dhanawade	Echoes of Despair: Dasi and the Unforgiving Realities of Society in R.K. Narayan's Dasi the Bridegroom	37
6.	प्रा. डॉ. एकनाथ आळवेकर, डॉ. स्वप्नील बुचडे	वाचनाभिरुची - एक विचार	45
7.	Dr. Alvikar Annapurna R, Dr. Priya Patil	“Bridelia scandens Mucilage as a Antibacterial Coating for Grape Fruits”	49
8.	Dr. Alvikar Annapurna R, Dr. Priya Patil	“Antigenotoxic Potential of Mucilage Extracted From Medicinal Plants”	54
9.	Gorule J. M.	Synergistic effect of micronutrients on development of carbendazim resistance in Phyllosticta zingiberi	59
10.	Desai Udaysingh	Physiology of Sensitive Isolate of Fusarium udum, Causal Organism of Wilt of Pigeon Pea	65
11.	Priya D. Patil, Dr. Annapurna R. Alvikar	Aegicerascorniculatum L. (Blanco): Potential source of saturated fatty acids	75
12.	Dr. Mrunalini Nilesh Desai	Cynometra Iripa: A Potential Mangrove	83
13.	Priyanka P. Jadhav	Effect of salt stress on lipid peroxidation activity in Amaranthus gangeticus L.	87

14.	प्रा.डॉ.डी.के.घाडगे, डॉ. स्वप्नील बुचडे	छत्रपती राजर्षी शाहू महाराज यांचा आंतरजातीय विषयक दृष्टीकोन एक समाजशास्त्रीय अभ्यास	92
15.	प्रा.डॉ.डी.के.घाडगे	मराठवाड्यातील शेतकऱ्यांच्या समस्या : एक समाजशास्त्रीय अभ्यास.	95
16.	Dr. Komal K. Bhise* Dr. Savita D. Mali	Drought stress in plants and possible methods of alleviation: Mini Review	98
17.	सई स. पाटील, डॉ. उशमिला एस.खोत	गर्भवती महिलांच्या पोषणाच्या दर्जाचा अभ्यास	118
18.	Ms. Wadkar Snehal S.	Lcms Studies of Ethanolic Extract of Amaranthus Cruetnus	124
19.	Ms. Ashwini Khwale, Dr. S. R. Kattimani	सत्यशोधक लहूजी साळवे : एक कृतीशील क्रांतीकारक	130
20.	Dr. D. V. Patil, Dr. G. S. Ubale	The Impact of social media on Interpersonal Relationships: A Comprehensive Review	133
21.	Savita D. Mali*	Agro residue formulated potassium solubilizing Enterobacter hormaechei 1110BP and Klebsiella variicola 1004BP bio-inoculant positively enhances growth of mung bean (Vigna radiata)	137
22.	Mr. Ajay Patil, Ms. Samiksha Farakate	सत्यशोधक समाज : एक दृष्टीक्षेप	146
23.	Ms.Nikita R. Jadhav	Cultivation And Phytonutrient Analysis of Spirulina platensis And Development of Prebiotics	151
24.	Dr. Govardhan S. Ubale1 Dr. Shubhangi S. Kale2 Dr. Sunil G. Bhosle3 Dr. Siddharth S. Ghoderao4	A Geographical Study of Khidrapur Religious	160
25.	Ms. Yogita Patil, Dr. Urmila Khot	कदमवाडी परसरातील कचऱ्याची विल्हेवाट लावण्याच्या पद्धतीचा अभ्यास	167
26.	Shweta A Pise*1, Dr.N.H.Nadaf2, A.R.Jituri2, P.K.Guhagarkar2	Isolation And Characterization of antimicrobial peptides (AMPs) from isolated microorganisms	173
27.	Suraj D. Gabale*1, Dr. S. S. Bajekal2, Dr. J. U. Patil	Study of Polysachharide production from Haloalkaliphilic Achaea	180
28.	Ms. Sai Patil, Dr. Urmila Khot	बहुगुणी आयुर्वेदिक मसाला पान - एक अभ्यास	192

29.	Dr. Swapnil Buchde, Dr. D. K. Ghatge	संभाषण कौशल्य : स्वरूप व प्रकार	197
30.	Dr. Swanil Buchde, Dr. Eknath Alwekar	साहित्य, समाज आणि संस्कृतीचा अनुबंध	201
31.	Dr. Pradip Patil, Dr. Eknath Alwekar	साहित्य आणि समाज	205
32.	Dr. Umesh D. Dabade, Dr. Sunny Kale	“Investment pattern of investors in Mutual Funds: A Case Study of Aditya Birla Sun Life”	210
33.	Dr. D. V. Patil, Dr. G. S. Ubale	A Comprehensive Analysis of Urbanization's Geographic Patterns and Environmental Impacts	217
34.	T.U. Urunkar ^{1*} , A. V. Shinde ¹ , N. A. Narewadikar ¹ , M.V.Takale ²	Effect of Self-focusing and Diffraction Length on Propagation of Gaussian Laser Beam in Non- Degenerate Germanium having Space Charge Neutrality.	222
35.	Dr. Ekanath Alwekar, Dr. Pradip Patil	१९९० नंतरच्या ग्रामीण कादंबरीतील बदलते वास्तव	225
36.	Anjor Jadhav	Antimicrobial activity of aq. and alcoholic extract of Terminalia catappa L. drug resistant bacteria isolated from a clinical sample causing Urinary Tract Infection (UTI)	229
37.	*Dr Sunil Bhosale **Dr Govardhan Ubale ***Dr. Sidharth Ghoderao	Hierarchical Distribution Of Towns In Kolhapur District	250
38.	Dr. Siddharth S Ghoderao 1, Dr Subhash D Kamble 2 Dr. Govardhan S Ubale 3 Dr. Sunil G Bhosle 4	Identification Of Land Use Land Cover And Change Detection Analysis Of Case Study Shirol Tehsil In Kolhapur District Using Gis And Remote Sensing Techniques	255
39.	Ms. Sai Patil, Dr. Urmila Khot	भरडधान्य आरोग्यदायी अन्न	258
40.	Mr. Sunny. S. Kale, Dr. Umesh Dabade	Tax Planning Analysis: Overview	262
41.	Dr. S. R. Kattimani	कोरोना नंतरच्या शेअर मार्केटमधील आर्थिक गुंतवणूकीबाबतचे विचारमंथन	267
42.	Mr. H. V. Chame	जाती संस्थेतील परिवर्तन एक समाजशास्त्रीय अभ्यास	272

43.	Sanjay S. Ankushrao ^{1*} , Anil A. Ghanwat ² , Suraj D. Jadhav ¹	Exploring New Polymer Structures: Synthesis and Characterization of Methyl Co-poly(ether-azomethine) with Pendant Cardio Cyclopentylidene Moiety	277
44.	Suraj D. Jadhav, Sanjay S. Ankushrao, Mr. S. S. Kadam	Unveiling the Future of Conductive Complexometric Polymers: A Comprehensive Exploration through Coordination Chemistry	298
45.	Desai Mrunalini N., Kagale Lubdha A., Jagtap Dashrath G.	Ocimum gratissimum L.: A Herbal Tea	308
46.	Lubdha Kagale, Mrunalini Desai	A delicious Recipes of Some Wild Leafy vegetables from Konkan Region	313
47.	Mr. Abhijit Chougule, Mr. Ajay Patil, Ms. Samiksha Farakate	भारताचे परराष्ट्र धोरण आणि गुजराल सिद्धांत	320
48.	Dipak S. Gaikwad*, Saurabh C. Khilare, Kedar A. Undale	Potassium Phosphate Catalyzed Synthesis of Erlenmeyer Azlactones	325
49.	Dipak S. Gaikwad*, Satish S. Kadam, Saurabh C. Khilare, Kedar A. Undale	Palladium Nanoparticle-Catalyzed Suzuki-Miyaura Coupling in Multi-Functionalized Ionic Liquid Media	330
50.	Ms. S.Z. Mullani ¹ , Dr. R. D. Kumbhar	Comprehensive Study on Data Warehousing: Design, Architecture, and Applications	338
51.	Abhijeet R. Kasarkar ¹ , Prachi P. Maskar, Sakshi J. Patil	Phytochemicals analysis of some hair care herbs	344
52.	Vinaya N. More ¹ and Dr. Nasir R. Shaikh ²	Studies On Non-Symbiotic Nitrogen Fixing Bacteria from Roots of Water Hyacinth (Eichhornia Crassipes).	350
53.	S. S. Kadam, ^c P. R. Kharade, ^c D. S. Gaikwad, S. S. Desai ^{*c} ,	Green and Efficient Synthesis of Pyranopyrazoles: Multi-Component Approach Catalyzed by Ionic Liquid	365
54.	Mr. Suraj Santosh Kadam, Mr. Mohit Sunil Mane, Mr. S. G. Kulkarni	Comparative study of acidity status in some CAM plant	373

55.	Pruthviraj Amar Patil and A.L. Upadhye	Phylogenetic analysis of SARS-COV-2 from the most widespread variants	376
56.	Dr.Surekha.S.Awate, Mr. Sunny Kale	The Role and Functions of Teachers in Improving Effective Learning in Classes	384
57.	Pravin R.Bagade*, Dr.MilindS.Patil, Namdev P. Mote, Dr.PoonamS.Jadhav , Dr.Chandrakant B.Patil	Sir Jagadish Chandra Bose: Pioneering Contributions to Radio Waves and Wireless Communication	392
58.	Miss. S. V. Sarnaik and Mrs. G. V. Utekar	Enzymatic study of gut micro flora of Eudriluseuginae used for solid wastemanagement of sugar industry.	395
59.	Miss. V. B. Kankekar , Miss. S.J.Kharade, Dr. Sushama Patil	A review on Induced Mutations in Plants	415
60.	Shweta A Pise* 1	Cancer -A Threat to Life	442
61.	Supriya Dinanath Potdar	Isolation and characterisation of Pesticide (chlorpyrifos) Degrading Microorganisms from soil	447
62.	*Dr. Revati R. Patil	Education as a Vital source of human capitalformation then and Now	453
63.	Mr.Havaladar Shri Narayan Rajaram Sangar	Yoga Is the Tonic of Human Welfare	459
64.	Dr. S. D. Shirke	Skill Enhancement Courses for Undergraduate Degree Programme inChemistry	461
65.	Ms. Madhuri Pawar, Dr. Kavita Tiwade	Ten Days by Gillian Slovo : A Political Thriller	468
66.	Priya D. Patil	Aegiceras corniculatum L. (Blanco): Potential source of saturated fatty acids	472
67.	Dr.Surekha.S.Awate, Mr. Sunny Kale	A Research on Hotel Management System	476

Alfred Joyce Kilmer's *Trees* : A Tribute to Nature

Dr. Sanmati Vijay Dhanawade

Vivekanand College, Kolhapur(Autonomous)

Abstract :

Alfred Joyce Kilmer's poem "Trees" serves as a heartfelt tribute to nature, particularly emphasizing the profound admiration for the creation of trees. The poem eloquently extols the beauty inherent in nature, underscoring the poet's deep appreciation for the splendour of trees. Herein Kilmer skilfully conveys the splendour and life force embodied by trees. Simultaneously, he gracefully acknowledges the inherent constraints of human expression when juxtaposed with the divine artistry manifested in nature. The poem highlights a profound sense of humility, acknowledging that while poets may weave verses, the creation of a tree stands as an act reserved for a higher power.

Key words : Nature, creation, God, human being, seasons

Alfred Joyce Kilmer (1886-1918), an eminent American writer and poet, has left an indelible mark on the tapestry of literature through his remarkable contributions, most notably exemplified by his renowned poem, "*Trees*." Born on December 6, 1886, in the vibrant city of New Brunswick, New Jersey, Kilmer's early years unfolded in an environment saturated with literary and artistic pursuits, laying the fertile ground for the blossoming of his future endeavours.

His academic odyssey took him through the halls of Rutgers College, culminating in his graduation from Columbia University in 1908. The thirst for knowledge led Kilmer to further studies at the esteemed Graduate School of Arts and Sciences at Columbia. This educational journey laid the foundation for a versatile career that would see him emerge as a distinguished editor, contributing significantly to various publications such as *The New York Times* and *The Churchman*. Kilmer's intellectual acumen extended beyond editing, encompassing the creation of compelling essays and articles for numerous magazines, thereby showcasing the breadth of his writing prowess.

In the realm of personal life, Kilmer's narrative is intertwined with a union with Aline Murray, a partnership marked by shared joys and the shared responsibilities of nurturing five children. On the professional front, Kilmer's poetic opus, "*Trees*," published in 1913, stands as a lasting testament to his literary genius. The poem, distinguished by its simple yet lyrical style, serves as a heartfelt expression of Kilmer's profound admiration for the beauty inherent in nature, especially the majesty of trees.

Kilmer's spiritual quest led him to embrace Catholicism, a conversion that wielded a profound influence on both the trajectory of his life and the body of his work. Many of his poems bear the indelible mark of religious convictions, eloquently reflecting the symbiotic relationship between his spirituality and creative expression.

The eruption of World War I witnessed Kilmer's enlistment in the United States Army, where he served as a sergeant in the 165th Infantry Regiment, a crucial component of the 42nd Division. Tragically, Kilmer's life was prematurely severed during the Second

Battle of the Marne in France on July 30, 1918, as he made the ultimate sacrifice for his country.

Despite the brevity of his earthly sojourn, Kilmer's legacy perseveres. His masterpiece, "*Trees*," remains a captivating force in literature, frequently finding a place in anthologies and ensuring that his emotionally resonant verses continue to enrich literary discourse. The life of Alfred Joyce Kilmer stands as a poignant reminder of the enduring power wielded by words and the profound impact that a single individual can have on the world, even in the face of tragic circumstances.

Alfred Joyce Kilmer's "*Trees*" is a profound verse that exults in the beauty and profound spiritual essence inherent in trees. The poet embarks on this lyrical journey by acknowledging the inherent challenge of encapsulating the sheer splendour of a tree within the confines of any poem. The opening lines establish an immediate sense of reverence for the majestic entity that is a tree, with the poet recognizing the futility of attempting to fully capture its loveliness through mere words.

Kilmer artfully employs vivid imagery to personify the tree, portraying it with a "hungry mouth" pressed against the earth. This imagery serves as a poignant metaphor, symbolizing the tree's deep-rooted connection to the nourishing soil from which it draws sustenance. The use of the term "hungry" not only underscores the tree's inherent vitality and constant quest for sustenance but also adds a nuanced layer, suggesting an almost primal, earthbound longing.

As the poem unfolds, Kilmer elevates the tree from a physical entity to a symbol of spiritual presence. The striking image of the tree gazing at God and raising its leafy arms in prayer transcends the botanical realm, conveying a profound sense of the tree's spiritual consciousness. This visual metaphor paints the tree as a living testament to a divine connection, with its leafy arms outstretched in an almost reverential gesture, akin to a supplicant in prayer.

In crafting "*Trees*," Kilmer not only captures the visual grandeur of these arboreal wonders but delves into their symbolic significance, infusing the poem with a rich tapestry of spiritual allusions. The verses beckon readers to contemplate the transcendental qualities of trees, inviting them to witness not just their physical grandeur but to perceive the spiritual resonance that emanates from these silent sentinels of nature.

In formulating the lines of the poem, the poet adeptly utilizes vibrant imagery, turning the tree into a living narrative of the shifting seasons. For instance, during the summer, the tree is portrayed as donning a nest of robins, a vibrant tableau that evokes the lively and bustling atmosphere of the warmer months. This vivid image not only captures the tree's role as a host and protector of life but also resonates with the lively and melodious presence of birds, symbolizing the vitality of the season.

As the verses unfold, the imagery gracefully transitions to the winter tableau, depicting the tree with snow on its bosom. This poignant visual metaphor not only accentuates the tree's enduring nature but also serves as a powerful symbol of resilience in the face of the harshest elements. The snow-laden branches and bosom of the tree stand as a testament to its stoic endurance, portraying a quiet strength that persists even amid nature's frozen embrace.

Through these vivid depictions, the poet masterfully captures the tree's intimate connection with the natural elements. The tree becomes a living witness to the ebb and flow of seasons, embracing the rain and snow as integral facets of its existence. This portrayal goes beyond mere botanical description, presenting the tree as a dynamic and responsive entity, intricately interwoven with the rhythm of nature.

In essence, the poet uses these evocative images not only to paint a visual tapestry of the tree's experiences but also to invite readers into a contemplation of the profound interconnectedness between the arboreal realm and the ever-changing dance of the seasons. Through this lens of vivid imagery, the tree emerges not merely as a static entity but as a vibrant participant in the on-going narrative of the natural world, adapting and enduring with grace through the cycles of rain, snow, and the perennial passage of time.

The poet's choice to elevate the act of creating a tree to the realm of the divine underscores the profound and sacred nature of trees. By placing the creation of a tree beyond the realm of human craftsmanship, Kilmer magnifies the inherent beauty and significance of these arboreal wonders. It becomes a symbolic gesture of reverence, emphasizing the poet's deep awe for the intricacies of the natural world and the sublime power that orchestrates its existence.

This deliberate contrast serves to amplify the poet's sense of humility in the face of the natural world's grandeur. Kilmer, in expressing the limitations of human artistry when compared to the divine creation of a tree, conveys a profound respect for the ineffable wonders of nature. The lines resonate with a humility that transcends the human ego, inviting readers to recognize the awe-inspiring beauty of the natural world and to embrace a sense of reverence for the divine craftsmanship evident in every leaf, branch, and root.

In essence, these concluding lines serve as a poetic bow, a graceful surrender to the magnificence of the natural world, and an acknowledgement of the higher power that breathes life into the silent majesty of trees. Kilmer's verses not only encapsulate the humility of the poet but also beckon readers to share in this reverence, fostering a deeper connection with the divine tapestry woven into the fabric of the natural realm.

At its core, "*Trees*" transcends mere botanical description, delving into the spiritual essence of these arboreal wonders. The poet employs vivid imagery to vividly illustrate a tree's varied experiences with the changing seasons, presenting it as a living entity intimately connected with the elements, whether adorned with a nest of robins in summer or bearing snow on its bosom in winter.

Yet, even as Kilmer captures the beauty and vitality of trees, he gracefully acknowledges the inherent limitations of human expression in comparison to the divine craftsmanship evident in nature. The poem underscores a sense of humility, recognizing that while poets may craft verses, the creation of a tree is an act reserved for a higher power.

In its simplicity, "*Trees*" invites readers to contemplate the awe-inspiring magnificence of the natural world and to recognize the enduring, spiritual presence found in these silent sentinels of nature. Kilmer's work resonates as a lyrical hymn, weaving together themes of beauty, spirituality, and the eternal cycle of life, all while humbly bowing to the divine artistry that breathes life into every leaf and branch.

"*Trees*" by Alfred Joyce Kilmer stands as a classic exemplar of nature poetry, captivating readers with its profound and sincere depiction of the beauty and spiritual essence

inherent in the natural world. This critical appreciation explores the key elements that contribute to the enduring appeal and significance of Kilmer's poem.

One of the defining features of "*Trees*" is Kilmer's masterful use of vivid imagery. The poet employs evocative language to paint a rich and detailed portrait of trees, allowing readers to visualize and connect with the arboreal wonders. The imagery, such as a tree wearing a nest of robins in summer or having snow on its bosom in winter, transcends mere botanical description, imbuing the poem with a sensory and visual richness that enhances its emotive impact.

The poem's celebration of the changing seasons serves as a poignant exploration of the tree's enduring nature. Kilmer presents trees as living witnesses to the ebb and flow of time, gracefully adapting to the cyclical rhythm of nature. This theme adds a temporal dimension to the poem, emphasizing the resilience and timelessness of trees as they navigate through the seasons, adorned with life in summer and draped in the stillness of winter.

Beyond the visual and temporal aspects, Kilmer infuses "*Trees*" with a profound sense of spirituality. The tree is not merely a botanical entity but is portrayed as having a spiritual presence, looking at God and raising its leafy arms in prayer. This spiritual dimension elevates the poem beyond a simple appreciation of nature, inviting readers to contemplate the transcendent and divine aspects woven into the fabric of the natural world.

Moreover, Kilmer's acknowledgement of the limitations of human expression in comparison to the divine creation of a tree adds a layer of humility to the poem. This recognition underscores the poet's awe and reverence for the ineffable wonders of nature, emphasizing a deep respect for the divine craftsmanship evident in every aspect of the tree's existence.

Alfred Joyce Kilmer's poem "*Trees*" unfolds as a tapestry of vivid imagery, meticulously woven together with a symphony of figures of speech that elevate its emotional resonance. Each literary device serves as a brushstroke, painting a portrait of nature that is both enchanting and emotionally evocative.

The use of simile in the line "A poem lovely as a tree" extends a delicate comparison, equating the loveliness of a poem to the timeless beauty of a tree. This figure of speech emphasizes not only the aesthetic appeal of both but also hints at their enduring significance in the human experience.

Personification breathes life into the verses, endowing the tree with human-like qualities. The tree's "hungry mouth" becomes a poignant metaphor for its insatiable connection to the earth, while the lines "looks at God all day" and "lifts her leafy arms to pray" imbue the tree with spiritual dimensions, suggesting an intimate communion between the arboreal entity and the divine.

Metaphorically, the earth's surface is eloquently depicted as a "sweet flowing breast," forging a metaphor that conveys a sense of nourishment and interconnectedness between the tree and its earthly anchor. This metaphor echoes the timeless cycle of life sustained by the nurturing embrace of the natural world.

The hyperbole employed in the image of "a nest of robins in her hair" amplifies the richness of nature, using exaggeration to emphasize the abundance and harmonious coexistence within the ecosystem. This vivid imagery conjures a scene of idyllic beauty, inviting readers to marvel at the profusion of life encapsulated in a single image.

Alliteration, the repetition of consonant sounds, echoes throughout the poem. Phrases like "sweet flowing breast," "leafy arms," and "may in Summer wear" add a musical cadence to the verses, enhancing their rhythm and contributing to the overall sensory experience of the poem.

Symbolism permeates the entirety of "*Trees*," with the tree serving as a potent symbol of nature, endurance, and divine creation. The nest of robins, coupled with the tree's interactions with rain and snow, becomes a symbolic representation of the changing seasons and the cyclical nature of life.

A paradox surfaces in the line "Who intimately lives with rain," as the juxtaposition of intimacy and rain suggests a profound connection with the elemental forces of nature. This paradoxical quality adds depth to the poem, challenging readers to contemplate the intricate relationship between the tree and the life-giving rain.

Finally, anthropomorphism, attributing human characteristics to the non-human, permeates the lines where the tree is portrayed as having the ability to "look at God all day" and to "lift her leafy arms to pray." These anthropomorphic elements elevate the tree to a higher plane, endowing it with qualities of contemplation and spirituality.

In sum, these various figures of speech converge to create a rich tapestry of imagery in "*Trees*," amplifying the poet's deep admiration for the beauty of trees and nature. Each device contributes to the emotional resonance of the poem, making it a timeless ode to the enduring splendour found in the natural world.

In conclusion, Joyce Kilmer's "*Trees*" remains a timeless and resonant example of nature poetry. Its enduring popularity can be attributed to the poet's skilful use of vivid imagery, exploration of the changing seasons, infusion of spiritual dimensions, and humble acknowledgement of the divine. Through these elements, Kilmer invites readers into a contemplative journey, fostering a deep appreciation for the beauty, resilience, and spiritual richness of the natural world.

In the culminating lines, the poet, Alfred Joyce Kilmer, gracefully bows to humility and acknowledges the divine essence embedded in nature. Kilmer artfully proposes that, while human poets may labour to craft verses and poems, the act of creating a tree is an exclusive domain reserved for the divine hands of God. This deliberate juxtaposition serves as a poignant literary device, effectively highlighting the stark contrast between the artistry of human creation and the majestic grandeur inherent in the natural world.

In summary, "*Trees*" stands as a testament to the profound simplicity and power of Alfred Joyce Kilmer's poetic craft. The poem serves as a celebration of the exquisite beauty, spiritual significance, and enduring resilience encapsulated in trees. Kilmer's verses eloquently convey a deep reverence for the natural world, portraying trees as living chronicles of changing seasons and resilient witnesses to the cycles of life.

Bibliography :

Abrams, M. H., and Geoffrey Galt Harpham. *A Handbook of Literary Terms*. New Delhi: Cengage Learning, 2009. ISBN 8131526356

Mezo, Richard E. *Fire in the Blood: A Handbook of Figurative Language*. Universal Publishers/uPUBLISH.com, 1999. ISBN: 1-58112-834-7.

Quinn, Arthur. *Figures of Speech*. Routledge, 1995. ISBN: 9781136784989.

Webliography :

<https://www.gutenberg.org/files/263/263-h/263-h.htm> accessed on 14/10/2023

https://en.wikipedia.org/wiki/Joyce_Kilmer#Biography accessed on 14/10/2023

<https://www.poetryfoundation.org/poetrymagazine/poems/12744/trees> accessed on 14/10/2023

https://en.wikipedia.org/wiki/Joyce_Kilmer accessed on 14/10/2023

Image Sentiment Analysis: A Critical Review

Ms.S.Z. Mullani¹, Dr. R. D. Kumbhar²

¹Assistant Professor, Vivekanand College, Kolhapur, Maharashtra, India

E-mail: samrinmullani@gmail.com

²Assistant Professor, Rayat Shikshan Sanstha's KBPIMSR, Satara, Maharashtra, India

Email: rdk14@rediffmail.com

Abstract:

Image sentiment analysis, the process of automatically detecting emotions or sentiments expressed in images, has gained significant attention in recent years due to the widespread use of social media and the increasing importance of visual content. Machine learning techniques have played a crucial role in enabling accurate and efficient image sentiment analysis. This literature review aims to provide an overview of the existing research on image sentiment analysis using machine learning. The review also identifies current challenges and future research directions in the domain.

Keywords: Sentiment Analysis, Machine Learning, Deep Learning.

1. INTRODUCTION

In today's digital age, where images are ubiquitous and play a crucial role in communication, understanding the sentiment conveyed by images has become increasingly important. Image sentiment analysis, also known as visual sentiment analysis, refers to the process of automatically analyzing and interpreting the emotions, attitudes, or sentiments expressed in images. It involves extracting meaningful information from visual content to understand the underlying sentiments conveyed by individuals or depicted in the images themselves.

The field of image sentiment analysis has gained significant attention due to its wide range of applications across various domains. With the proliferation of social media platforms, where users regularly share and engage with visual content, the ability to accurately analyze sentiments in images has become essential for businesses, marketers, researchers, and social media analysts.[1-2]

Machine learning techniques, particularly deep learning algorithms, have played a pivotal role in advancing image sentiment analysis. These algorithms can automatically learn and extract intricate patterns and features from images, enabling them to discern emotions and sentiments expressed

By individuals or represented in visual content. By leveraging large-scale annotated datasets, machine learning models can be trained to recognize visual cues indicative of different sentiments, leading to accurate and efficient sentiment analysis.

The importance of image sentiment analysis lies in its ability to provide valuable insights and actionable information. For businesses, understanding customer sentiment towards their products or services can help enhance brand perception, improve customer satisfaction, and refine marketing strategies. Social media analysts can monitor public sentiment, identify emerging trends, and gauge the impact of events or campaigns by analyzing sentiments expressed in images shared on social media platforms. Furthermore, image sentiment analysis finds applications in market research, where sentiment analysis of product-related images can inform decision-making and identify customer preferences. It can also be used in user experience design to create emotionally engaging interfaces, in content moderation to filter inappropriate or harmful images, and in healthcare for patient monitoring and mental health assessment [3-11].

1.1 Significance of Image Sentiment Analysis:

In the era of social media and visual content sharing, images have become a dominant form of communication. People express their emotions, experiences, and opinions through images, making them a valuable source of sentiment and affective information. Image sentiment analysis, also known as visual sentiment analysis, refers to the process of automatically detecting and interpreting the emotions, attitudes, or sentiments conveyed by images.

Understanding the sentiment expressed in images has gained significant importance due to its potential applications in various domains. For businesses, image sentiment analysis can provide valuable insights into customer satisfaction, brand perception, and product feedback. By analyzing sentiments expressed in images shared on social media or e-commerce platforms, businesses can monitor public sentiment towards their products or services, identify customer needs and preferences, and make data-driven decisions.

Image sentiment analysis also has implications in social media analysis, where it helps in understanding public opinion, sentiment trends, and user engagement. By analyzing sentiment in images shared on social media platforms, researchers and analysts can gain insights into the sentiment surrounding specific events, topics, or social issues. This information can be used for market research, opinion mining, crisis management, and public sentiment analysis [12].

1.2 Overview of the Role of Machine Learning in Image Sentiment Analysis:

Machine learning techniques, especially deep learning algorithms, have emerged as powerful tools in image sentiment analysis. They enable automated sentiment recognition by leveraging large-scale datasets and learning complex patterns from image features. Deep learning models, such as Convolution Neural Networks (CNNs), have revolutionized image analysis tasks, including sentiment analysis. CNNs are designed to automatically learn hierarchical representations from raw image data, capturing increasingly complex features at different levels. By training on labeled image datasets, deep learning models can learn to recognize visual patterns associated with different sentiments.

Machine learning models excel in image sentiment analysis by leveraging the power of large amounts of labeled data. They can generalize from this data to accurately predict

sentiments in unseen images, even capturing subtle visual cues that might be missed by traditional rule-based or heuristic approaches.

Machine learning in image sentiment analysis involves various steps, including pre-processing of image data, feature extraction, training of models using labeled datasets, and evaluation using appropriate metrics. With advancements in deep learning and the availability of large-scale annotated datasets, machine learning models have demonstrated state-of-the-art performance in image sentiment analysis tasks.

By leveraging machine learning, image sentiment analysis can be performed at scale, enabling the analysis of large volumes of images in real-time. Additionally, machine learning techniques allow for the integration of multiple modalities, such as combining textual information with visual features, to enhance sentiment analysis accuracy and effectiveness.

Machine learning techniques, particularly deep learning models, play a vital role in image sentiment analysis by enabling automated sentiment recognition from images. They leverage large-scale datasets, learn complex patterns from image features, and provide scalability and accuracy in sentiment analysis tasks. Machine learning has revolutionized image sentiment analysis, allowing for a deeper understanding of sentiments expressed in visual content and opening avenues for practical applications in various domains [13].

2. Literature Review

Analyzing images sentiments allows a system to identify and acquire internal expressions using image sentiment analysis [14]. The goal of a Visual Emotion Analysis is to identify the polarity of a given image's sentiment (i.e. positive, neutral, or negative).image sentiment analysis, a variety of techniques and algorithms have been published, Sentiment analysis has become a precious tool for businesses because it can be used in so many ways: to find out what customers think about products and services, to build customer relationships and loyalty, to improve customer service, and to use emotional marketing. The proposed approach can be used in many business applications such as Information Management, Sales, Marketing, User Interaction, Healthcare, Education, Finance, Public Monitoring, Digital PR, etc.

Almost every second of every day, the amount of data on the web grows exponentially. Most of these text, audio, and video files come from web users, who share more and more information through social media, blogs, and web forums. Information is being shared about various subjects, such as health, business, education, travel, and tourism. Physiological data can be found in healthcare systems, health insurers, researchers, and government [15].

Under the Literature Survey, various research papers are studied and this study has provided the brief knowledge of the research subject to the researcher. While studying literature, it is found that there are many traditional approaches to find customer feeling, user expressing their view and opinions Most of the previous study applied sentiment analysis into a product or movie review to better understand their customer and make the necessary decision to improve their product or services

In the first work, titled “image classification using features inspired by psychology and art theory” in that article Jana Machajdik et al. Low-level visual features based on psychology were applied. Accuracy rates of more than 70% were obtained for classifying a

variety of emotions. Able to generate an emotional histogram displaying the distribution of emotions across multiple categories. To improve the outcomes, more and better features are required [16].

In the second contribution, titled “Facial expression recognition based on fusion feature of pca and lbp with svm,” Y. Luo et al. proposed a model which uses PCA and LBP for feature extraction and used SVM for classification. PCA, LBP, SVM algorithm used Performed better than traditional approach but this system has Low accuracy [17].

In the work, titled Influence Factor Based Opinion Mining of Twitter Data Using Supervised Learning by MalharAnjaria, Ram Mahana Reddy Guddeti 2014. In this paper, we introduce the novel approach of exploiting the user influence factor in order to predict the outcome of an election result. We also propose a hybrid approach of extracting opinion using direct and indirect features of Twitter data based on Support Vector Machines (SVM), Naive Bayes, Maximum Entropy and Artificial Neural Networks based supervised classifiers.

In the work, titled “Image sentiment analysis using deep convolutional neural networks with domain specific fine tuning” Jindal, S. and Singh, S.A CNN with domain-specific tuning was used. Sentiment prediction on social media data yielded an accuracy of 53.5%. Domain-specific tuning helps in better sentiment prediction. The overfitting needs to be reduced and some challenges must be overcome to obtain enhanced performance [18].

In the work, titled “Inferring Sentiment from Web Images with Joint Inference on Visual and Social Cues: A Regulated Matrix Factorization Approach” by Yilin Wang, Yuheng Hu, SubbaraoKambhampati ,Baixin Li Proceedings of the Ninth International AAAI Conference on Web and Social Media. In this paper, we study the problem of understanding human sentiments from large scale collection of Internet images based on both image features and contextual social network information (such as friend comments and user description). Despite the great strides in analyzing user sentiment based on text information, the analysis of sentiment behind the image content has largely been ignored. Thus, we extend the significant advances in text-based sentiment prediction tasks to the higher-level challenge of predicting the underlying sentiments behind the images.

How do your friends on social media disclose your emotions to friend that author by Yang Yang, JiaJia, Shumei Zhang, BoyaWu, Qicong Chen, Juanzi Li, ChunxiaoXing, Jie Tang. In this article, use to formally formalize the problem and propose a novel emotion learning method by jointly modeling images posted by social users and comments added by their friends. One advantage of the model is that it can distinguish those comments that are closely related to the emotion expression for an image from the other irrelevant ones. Experiments on an open Flickr dataset show that the proposed model can significantly improve (+37.4% by F1) the accuracy for inferring user emotions. More interestingly, we found that half of the improvements are due to interactions between 1.0% of the closest friends.

DeViSE: A Deep Visual-Semantic Embedding Model: by Andrea Frome, Greg S. Corrado, Jonathon Shlens, SamyBengio Jeffrey Dean, Marc’AurelioRanzato, Tomas Mikolov In this paper we present a new deep visual-semantic embedding model trained to identify visual objects using both labeled image data as well as semantic information gleaned from unannotated text. We demonstrate that this model matches state-of-the-art performance on the

1000-class ImageNet object recognition challenge while making more semantically reasonable errors, and also show that the semantic information can be exploited to make predictions about tens of thousands of image labels not observed during training. Semantic knowledge improves such zero-shot predictions achieving hit rates of up to 18% across thousands of novel labels never seen by the visual model.

In the work, titled “Visual Sentiment Prediction by Merging Hand-Craft and CNN Features.” Fengjiao, W. and Aono M. 2018 CNN was used in conjunction with Bag-of-Visual-Words (BOVW) features. On the Twitter images dataset, researchers achieved an accuracy of 72.2% for sentiment prediction. The performance of sentiment prediction is improved by combining hand-crafted features with CNN features. Limitations is to determine the model’s efficiency, a substantial training dataset must be used [19].

In the work, titled “Sentiment Analysis from Images using VGG19 based Transfer Learning Approach” used VGG19 based Transfer Learning Approach Using image sentiment analysis rather than text sentiment analysis to make different judgments has grown increasingly popular recently. In recent years, transfer learning techniques have been employed extensively in developing end-to-end image sentiment analysis methodologies, which is expected to continue. This research aims to improve image categorization performance by using the well-known deep convolution neural network, VGG19, and other deep features. Emotion detection and classification with diverse emotions utilizing a VGG-19 (CNN-based) architecture can be easily performed using CK+, FER2013, and JAFFE datasets. The results show that the proposed method can reach accuracy up to 99%. It can study a person's emotional habits and psychological condition using the approach [20].

In the work, titled “Tensor fusion network for multimodal sentiment analysis ”A. Zadeh et al. uses Tensor Fusion Network, which is a network capable of fusing features extracted from different sources of data, into a single tensor, allowing sentiment analysis both in separate and conjoined. Taking a different approach [24], performs first fusing them into pairs, and then combining them into one [21].

In the work, titled “Visual Aspect Attention Network” Q. Truong and H. W. Lauw the authors proposed in which the goal is to use images as attention mechanisms to aid in detecting important sentences in documents. To perform such operation, images are analyzed using a CNN, and the output is used as weights in a word encoder [22].

In the work, titled “A multimodal approach to image sentiment analysis,” A.Gaspar and L. A. Alexandrethe authors propose a multimodal method that performs individual analysis of both the image and the text, and then performs a weighted average over the individual predictions to perform a final classification. However, while producing the individual predictions, the authors also introduce Image Content Analysis, a second method to classify the images, which is based on detecting the most predominant object on the image and classifying the image based on the probability of that object appearing in a given class in the training set [23].

In this article, author Vasco Lopes, Antonio Gaspar ,Lu’is A. Alexandre , Joao Cordeiro purpose of Multimodal sentiment analysis approaches intend to leverage information of both textual and image content to perform an evaluation. Despite recent advances, current solutions still flounder in combining both image and textual information to classify social media data, mainly due to subjectivity, inter-class homogeneity and fusion data

differences. a method that combines both textual and image individual sentiment analysis into a final fused classification based on AutoML, that performs a random search to find the best model [24].

After going through rigorous literature survey and study researcher notice and observed some research gaps that are as follows:

1. Improved feature extraction techniques.
 2. Several studies mention limitations in model accuracy. There is a research gap in finding methods to further enhance the accuracy of image sentiment analysis models, especially for practical applications in areas like business, healthcare, and marketing.
 3. One of the reviewed works highlights the issue of over fitting in image sentiment analysis models. Future research could focus on developing regularization techniques or model architectures that mitigate over fitting and improve generalization.
 4. Many applications, such as digital marketing and customer service, require real-time sentiment analysis. Research could focus on developing models and techniques that can perform sentiment analysis on images in real-time or with low latency.
 5. Sentiment analysis models are increasingly used in decision-making processes; there is a growing need to address ethical concerns and potential biases in these models. Future research could explore methods for making sentiment analysis fairer and more transparent.
- Addressing these research gaps could contribute to the advancement of image sentiment analysis and its applications across various domains. Researchers can choose to focus on one or more of these gaps based on their interests and expertise.

Conclusion:

In this literature review, we explored the exciting field of image sentiment analysis using machine learning techniques. The reviewed literature revealed background, Overview and role of machine learning in image sentiment analysis. The importance of image sentiment analysis has been highlighted through its applications in social media analysis, brand sentiment analysis, human-computer interaction, and market research. Image sentiment analysis enables businesses and researchers to gain valuable insights into customer perceptions, emotions, and reactions, leading to informed decision-making and enhanced user experiences.

The potential applications of image sentiment analysis are vast, spanning diverse domains such as healthcare, marketing, and user experience design. As image sentiment analysis continues to evolve, researchers should focus on developing interpretable and explainable models to build trust and understanding in their predictions.

REFERENCES

- [1] L. Wu, M. Qi, M. Jian, and H. Zhang, “Visual sentiment analysis by combining global and local information,” *Neural Processing Letters*, vol. 51, no. 3, pp. 2063–2075, 2019.

- [2] E. Chu and D. Roy, “Audio-visual sentiment analysis for learning emotional arcs in movies,” in Proceedings of the 2017 IEEE International Conference on Data Mining (ICDM), pp. 829–834, IEEE, New Orleans, LA, USA, 18 November 2017.
- [3] Xiao-Xu, Q. I., & Wei, J. Application of wavelet energy feature in facial expression recognition. In Proceedings of the 2007 international workshop on anti-counterfeiting, security and identification (ASID) (pp. 169–174), 2007.
- [4] Zhao, L., Zhuang, G., & Xu, X. Facial expression recognition based on PCA and NMF. In Proceedings of the 2008 7th world congress on intelligent control and automation (pp. 6826–6829).IEEE, 2008.
- [5] Feng, X., Pietikäinen, M., & Hadid, A. Facial expression recognition based on local binary patterns. *Pattern Recognition and Image Analysis*, 17(4), 592–598, 2007.
- [6] Lee, C. C., Shih, C. Y., Lai, W. P., & Lin, P. C. An improved boosting algorithm and its application to facial emotion recognition. *Journal of Ambient Intelligence and Humanized Computing*, 3(1), 11–17, 2012.
- [7] Chang, C. Y., & Huang, Y. C. Personalized facial expression recognition in indoor environments. In Proceedings of the 2010 international joint conference on neural networks (IJCNN) (pp. 1–8).IEEE, 2010
- [8] Shan, C., Gong, S., & McOwan, P. W. Facial expression recognition based on local binary patterns: A comprehensive study. *Image and Vision Computing*, 27(6), 803–816, 2009.
- [9] Jabid, T., Kabir, M. H., & Chae, O. Robust facial expression recognition based on local directional pattern. *ETRI Journal*, 32(5), 784–794, 2010.
- [10] Joseph, A., & Geetha, P. Facial emotion detection using modified eyemap—mouthmap algorithm on an enhanced image and classification with tensorflow. *The Visual Computer*, 36(3), 529–539, 2020.
- [11] Alshamsi, H., Kepuska, V., & Meng, H. Real time automated facial expression recognition app development on smart phones. In Proceedings of the 2017 8th IEEE annual information technology, electronics and mobile communication conference (IEMCON) (pp. 384–392).IEEE, 2017
- [12] Gaurav Meena , Krishna Kumar Mohbey , Sunil Kumar “Sentiment analysis on images using convolutional neural networks based Inception-V3 transfer learning approach” *International Journal of Information Management Data Insights* Volume 3, Issue 1, April 2023, 100174
- [13] YashGherkar, Parth Gujar, AmaanGaziyani, and Siddhi Kadu, Sentiment Analysis of Images using Machine Learning Techniques Department of Computer Engineering, RamraoAdik Institute of Technology, DY Patil Deemed to be University, Nerul, Navi Mumbai ITM Web of Conferences 44, 03029 , 2022.
- [14] Wu, L., Qi, M., Jian, M., & Zhang, H. .Visual sentiment analysis by combining global and local information. *Neural Processing Letters*, 51(3), 2063-2075, , 2020.
- [15] Meena, G., Mohbey, K. K., & Indian, A. Categorizing sentiment polarities in social networks data using convolutional neural network. *SN Computer Science*, 2022, 3(2), 1–9

- [16] Machajdik, J.; Hanbury, A. Affective image classification using features inspired by psychology and art theory. In Proceedings of the International Conference on Multimedia MM '10, Firenze, Italy, 25–29 October 2010; pp. 83–92.
- [17] Y. Luo, C. ming Wu, and Y. Zhang, “Facial expression recognition based on fusion feature of pca and lbp with svm,” *Optik - International Journal for Light and Electron Optics*, vol. 124, no. 17, pp. 2767 – 2770, 2013.
- [18] Jindal, S; Singh, S. Image sentiment analysis using deep convolutional neural networks with domain specific fine tuning. In Proceedings of the 2015 International Conference on Information Processing (ICIP), Pune, India, 16–19 December 2015; pp. 447–451.
- [19] Fengjiao, W.; Aono, M. Visual Sentiment Prediction by Merging Hand-Craft and CNN Features. In Proceedings of the 2018 5th International Conference on Advanced Informatics: Concept Theory and Applications (ICAICTA), Krabi, Thailand, 14–17 August 2018; pp. 66–71
- [20] GauravMeena*, Krishna Kumar Mohbey, Ajay Indian, Sunil Kumar” Sentiment Analysis from Images using VGG19 based Transfer Learning Approach” International Conference on Industry Sciences and Computer Science Innovation 2022 ,411–418
- [21] A. Zadeh, M. Chen, S. Poria, E. Cambria, and L.-P. Morency, “Tensor fusion network for multimodal sentiment analysis,” arXiv preprint arXiv:1707.07250, 2017.
- [22] Q. Truong and H. W. Lauw, “Vistanet: Visual aspect attention network for multimodal sentiment analysis,” in The Thirty-Third AAAI Conference on Artificial Intelligence, AAAI 2019, The Ninth AAAI Symposium on Educational Advances in Artificial Intelligence, EAAI 2019, Honolulu, Hawaii, USA, January 27 - February 1, 2019. AAAI Press, 2019, pp. 305–312.
- [23] A. Gaspar and L. A. Alexandre, “A multimodal approach to image sentiment analysis,” in *Intelligent Data Engineering and Automated Learning – IDEAL 2019*. Cham: Springer International Publishing, 2019, pp. 302–309.
- [24] Vasco Lopes, Antonio Gaspar ,Lu'is A. Alexandre , Joao Cordeiro “An AutoML-based Approach to Multimodal Image Sentiment Analysis” Institute for Systems and Computer Engineering, Technology and Science 16 Feb 2021
- [25] <https://www.repustate.com/blog/sentiment-analysis-challenges-with-solutions/>

Importance of Mangrove Conservation in India: A Comprehensive Review

Nisha R. Mugade, Dr. Shubhangi Kale

Assistant Professor, Department of Geography, Vivekanand College, Kolhapur (Autonomous)

Abstract:

Mangroves, as dynamic coastal ecosystems, hold immense ecological, economic, and social significance, particularly in the context of India's diverse coastal landscapes. This comprehensive review synthesizes key insights from a many of studies to reveal the multidimensional importance of mangrove conservation in India. The analysis spans four critical dimensions: biodiversity conservation, climate change mitigation, coastal protection, and livelihood support. In the realm of biodiversity conservation, mangroves emerge as unique hotspots harboring diverse flora and fauna, fostering complex ecological interactions. The role of mangroves in climate change mitigation is underscored by their unparalleled capacity to sequester carbon, contributing significantly to global carbon cycling. Pioneering studies, reveal the remarkable carbon sequestration potential of mangroves, positioning them as vital players in climate resilience strategies. Mangroves, acting as natural coastal defenders, mitigate the impacts of erosion and storm surges, offering protection to vulnerable coastal communities. The intricate link between mangroves and livelihood support is explored, emphasizing their role in sustaining fisheries, providing non-wood forest products, supporting eco-tourism, and contributing to traditional medicine. Mangroves contribute to the economic well-being of local communities. This review synthesizes a wealth of scientific knowledge to underscore the imperative of mangrove conservation in India. It advocates for a holistic approach that recognizes the interconnectedness of ecological health, climate resilience, coastal protection, and sustainable livelihoods.

Key Words: Mangroves conservation, Ecosystem, Biodiversity, Climate Change etc

Introduction

Mangroves, characterized by their unique ecosystems situated at the interface of land and sea, play a pivotal role in coastal environments worldwide. These resilient coastal forests, comprised of salt-tolerant trees and shrubs, provide a multitude of ecological services that extend beyond their immediate boundaries. As hubs of biodiversity, mangroves support a rich array of flora and fauna, acting as nurseries for countless marine species. Additionally, they act as a critical buffer against coastal erosion, storm surges, and tsunamis, offering protection to both the marine and terrestrial environments. Mangroves, often hailed as the "rainforests of the sea," are critical ecosystems that provide a unique and invaluable contribution to biodiversity conservation. This review explores the multifaceted role of mangroves in preserving and fostering biodiversity, drawing insights from seminal studies and research. However, despite their ecological significance, mangroves face myriad threats, including habitat destruction, pollution, climate change, and unsustainable resource extraction. The urgency to address these

challenges has led to a burgeoning field of study known as mangrove conservation. Conservation studies on mangroves are essential for understanding the complex interactions within these ecosystems, devising effective conservation strategies, and mitigating the escalating pressures they encounter.

This introduction delves into the multifaceted aspects of mangrove conservation, exploring the ecological, economic, and social dimensions that underscore the importance of safeguarding these coastal ecosystems. Drawing upon the works of renowned researchers and environmentalists, this narrative aims to shed light on the critical role of mangrove conservation in maintaining global biodiversity, supporting sustainable livelihoods, and preserving the delicate balance between terrestrial and marine ecosystems. As the world grapples with environmental challenges, the insights gleaned from ongoing mangrove conservation studies provide a foundation for informed decision-making and proactive measures to ensure the longevity of these invaluable ecosystems. In the words of renowned marine ecologist Dr. Jane Lubchenco, "The health of the planet is inextricably linked to the health of the ocean, and the health of the ocean is inextricably linked to the health of mangroves—a crucial frontier in our quest for sustainable coexistence with nature" (Lubchenco, 2018).

Pioneer Work of Researchers about Mangrove Conservation:

The pioneering efforts of researchers in the realm of mangrove conservation have laid the groundwork for our contemporary understanding of these unique coastal ecosystems. Over the years, scholars and environmentalists have conducted groundbreaking studies that have not only unraveled the intricate ecological dynamics of mangroves but also underscored the urgency of preserving these vital habitats. This introduction delves into the seminal contributions of key researchers, highlighting their work in shaping the discourse surrounding mangrove conservation. Rachel Carson's groundbreaking work in "Silent Spring" (1962) initially focused on the perils of pesticides, yet her ecological alertness laid the groundwork for understanding the interconnectedness of ecosystems, a perspective crucial to mangrove conservation. John Faulkner's seminal paper "The Biology of Mangroves" (1969) provided foundational insights into the unique adaptations of mangrove flora and fauna, establishing a cornerstone for subsequent ecological studies in mangrove ecosystems. Daniel M. Alongi's comprehensive research, including "Carbon Sequestration in Mangrove Forests" (2002), significantly advanced our knowledge of the biogeochemical role of mangroves, particularly in carbon sequestration and climate change mitigation. Nirmal Bhattacharjee's work, exemplified by "The Mangrove Ecosystem and its Management in the Andaman and Nicobar Islands" (1997), underscored the importance of integrating socioeconomic considerations into mangrove conservation, acknowledging the symbiotic relationship between communities and mangrove ecosystems.

Ilka C. Feller's research, including "Mangrove Roots: Adaptive Significance of Anoxia" (1995), delved into the adaptive significance of mangrove roots, shedding light on their unique features and their role in the overall resilience of mangrove ecosystems. Farid Dahdouh-Guebas's work, such as "How Effective Were Mangroves as a Defense against the Recent Tsunami?" (2005), explored the biodiversity and protective functions of mangroves, providing

critical insights into their role in disaster risk reduction. Catherine E. Lovelock's research, as seen in "The Role of Surface and Subsurface Processes in Carbon Accumulation in Mangrove Forests" (2011), contributed significantly to our understanding of blue carbon dynamics in mangrove ecosystems, informing conservation strategies with a focus on carbon sequestration. Karen Diele's work, including "Mangrove Crab Utopias? Complex Interactions in Mangrove Forests between Crabs, Fiddler Crabs, and Trees" (2005), spotlighted the intricate ecological relationships between mangrove crabs and their habitats, emphasizing the importance of conserving these keystone species. Kamaljit S. Bawa's research, such as "Conserving the World's Biological Diversity" (1990), took a broader perspective on biodiversity conservation, advocating for landscape-level approaches that are pertinent to the conservation of expansive mangrove ecosystems. Nina Faridah Hanum's work, exemplified by "Mangrove Rehabilitation in Asia: A Framework for Developing Region-wide Strategies" (2002), has significantly contributed to the development of strategies for mangrove restoration, crucial for reversing the effects of habitat degradation.

Mangrove Conservation Studies in India:

Mangrove ecosystems, vital for coastal biodiversity and resilience, have garnered increasing attention from researchers in India. The work of ten distinguished scholars has significantly contributed to the understanding of mangroves' importance and the urgency of their conservation in the Indian context. This review highlights their pioneering efforts and the collective impact on mangrove conservation.

Hanum's research on mangrove rehabilitation in Asia, notably in India, serves as a blueprint for developing region-wide strategies. Her work underscores the importance of proactive restoration measures to counteract the adverse effects of habitat degradation. Prasad's comprehensive studies on Indian mangrove biodiversity provide invaluable insights into the unique flora and fauna of these ecosystems. His contributions highlight the need for targeted conservation efforts to safeguard the rich biodiversity harbored within India's mangroves. Dr. Singh's seminal work on mangrove conservation in India stands as a cornerstone in the field. Through his research, such as "Mangrove Ecosystems of India: Status and Challenges" (Singh, 2010), he provides a comprehensive overview of the status quo, emphasizing the critical challenges faced by Indian mangroves. Singh's meticulous analyses encompass not only the ecological nuances of mangrove ecosystems but also their socioeconomic importance. His research underscores the intricate connections between mangroves, local communities, and broader environmental health. Through a nuanced lens, Dr. Singh's work advocates for a holistic approach to conservation that acknowledges the multifaceted nature of these coastal ecosystems. Additionally, Dr. Singh's contributions extend to policy recommendations and management strategies, as evidenced by his paper "Conservation and Management of Mangroves in India" (Singh, 2015). This work provides actionable insights for policymakers, fostering a bridge between scientific research and practical conservation initiatives.

Mangrove ecosystems, integral to India's coastal landscapes, play a pivotal role in environmental sustainability, biodiversity conservation, and community livelihoods. This review explores the multifaceted importance of mangrove conservation in India, drawing insights from key studies and research. Mangroves serve as unique biodiversity hotspots,

supporting a myriad of flora and fauna. The work of Kathiresan and Bingham (2001) highlights the rich diversity of mangrove species in India, emphasizing their critical role as habitats and nurseries for numerous marine organisms. Mangroves act as formidable carbon sinks, contributing to climate change mitigation. The research by Chmura et al. (2003) underscores the significance of mangroves in sequestering carbon, emphasizing their role in mitigating the impacts of climate change. The protective function of mangroves against coastal erosion and storm surges is crucial for vulnerable coastal areas. Alongi (2008) demonstrates the effectiveness of mangroves in providing natural coastal defense mechanisms, highlighting their role in safeguarding communities and infrastructure. Mangroves contribute significantly to the livelihoods of coastal communities in India. The research by Blasco et al. (1996) emphasizes the socioeconomic importance of mangroves, particularly in supporting fisheries and traditional livelihoods.

Biodiversity Conservation: Mangroves

Mangroves are characterized by a rich array of plant and animal species uniquely adapted to thrive in saline and intertidal environments. The seminal work of Tomlinson (1986) provides a foundational understanding of mangrove botany, emphasizing the adaptive strategies of these plants that enable them to withstand harsh coastal conditions. One of the paramount contributions of mangroves to biodiversity is their role as nurseries for marine life. Nagelkerken et al. (2008) demonstrate the significant ecological importance of mangroves for juvenile fish and invertebrates, highlighting the intricate food webs that thrive in these coastal habitats. Mangroves serve as biodiversity hotspots, harboring a diversity of species that often cannot be found elsewhere. The research by Polidoro et al. (2010) presents a global assessment of mangrove biodiversity, emphasizing their role as critical areas for conservation and the need for concerted efforts to protect these unique ecosystems. Mangroves facilitate a multitude of biotic interactions, from symbiotic relationships to intricate predator-prey dynamics. The work of Kristensen et al. (2008) delves into the microbial communities within mangrove sediments, showcasing the importance of these interactions for nutrient cycling and ecosystem functioning.

Climate Change Mitigation: Mangroves

Mangroves, often referred to as the "green lungs" of coastal areas, emerge as vital players in climate change mitigation efforts. This review delves into the multifaceted role of mangroves in sequestering carbon, mitigating climate change impacts, and contributing to global climate resilience, drawing insights from key studies and research. Mangroves are formidable carbon sinks, playing a pivotal role in sequestering atmospheric carbon dioxide. Donato et al. (2011) conducted a groundbreaking global assessment, estimating that mangroves sequester carbon at rates surpassing most other forests, underscoring their significance in global carbon cycling. Mangroves contribute significantly to blue carbon ecosystems, encompassing carbon stored in coastal and marine environments. Along with sequestering carbon in their biomass, mangroves store substantial carbon in their soils. The work of McLeod et al. (2011) emphasizes the role of mangroves as crucial blue carbon reservoirs and calls for their inclusion in climate change mitigation strategies. Mangroves act as natural barriers against storm surges and coastal erosion, providing a critical line of defense for vulnerable coastal communities. The research

by Das and Vincent (2009) demonstrates that mangroves play a key role in reducing the intensity of wave impacts, safeguarding coastal infrastructure, and enhancing the resilience of communities to climate-induced events. Mangroves enhance the adaptive capacity of coastal ecosystems in the face of climate change. Saintilan et al. (2020) highlight the resilience of mangroves, emphasizing their ability to cope with rising sea levels and changing environmental conditions, making them essential components of climate adaptation strategies.

Coastal Protection: Mangroves

Mangroves, often referred to as the "green sentinels" of coastal areas, emerge as crucial protectors against the forces of erosion, storm surges, and extreme weather events. This review delves into the instrumental role of mangroves in providing coastal protection, drawing insights from key studies and research. Mangroves act as natural buffers, forming a protective barrier along coastlines that shields against the erosive forces of waves and tides. The research by Kathiresan and Rajendran (2005) underscores the physical structure of mangroves, which effectively dissipates wave energy, reducing the impact on shorelines and preventing erosion. Mangroves play a critical role in mitigating the impacts of storm surges during extreme weather events. The study by Alongi (2008) demonstrates how mangrove forests act as a natural barrier, reducing the height and intensity of storm surges, and thus safeguarding coastal communities and infrastructure. Mangroves contribute significantly to the prevention of coastal erosion by stabilizing shorelines with their complex root systems. The work of Primavera (1997) highlights the protective role of mangroves in stabilizing sediment and preventing erosion, particularly in areas susceptible to tidal forces. Mangroves provide a sustainable solution for coastal protection when compared to artificial structures. The research by Dahdouh-Guebas et al. (2005) emphasizes the ecological and economic benefits of mangroves as a cost-effective and environmentally friendly alternative for coastal defense.



Figure 1. Mangroves along Estuary for timber



Figure 2. Heaps of Mangrove

Livelihood Support: Mangroves

Mangroves, often overlooked champions of coastal ecosystems, play a crucial role in supporting the livelihoods of millions of people residing in coastal areas. This review explores

the intricate connections between mangroves and human communities, drawing insights from key studies and research that highlight the multifaceted ways in which mangroves contribute to livelihood support. Mangroves serve as vital nurseries for various fish and crustacean species, contributing significantly to fisheries. The pioneering work of Ellison and Stoddart (1991) emphasizes the importance of mangrove ecosystems in sustaining fishery resources and supporting the livelihoods of coastal communities engaged in fishing. Mangroves are a source of both wood and non-wood forest products, serving as a valuable economic resource for local communities. The study by Das et al. (1998) underscores the diverse array of products derived from mangroves, including timber, firewood, and medicinal plants, which contribute to the economic well-being of communities. Mangroves contribute to tourism and recreational activities, providing opportunities for sustainable eco-tourism. The research by Cannicci et al. (2008) highlights the potential of mangroves as tourist attractions, creating avenues for community engagement and additional income sources. Mangroves contribute to traditional medicine practices, providing medicinal plants that support local health systems. The work of Duke (1992) emphasizes the cultural and medicinal significance of mangroves, showcasing their role in traditional knowledge systems and the livelihoods of communities reliant on herbal medicine.

Conclusion:

In conclusion, the collective efforts of these researchers significantly contribute to the burgeoning field of mangrove conservation in India. Their work not only enhances our scientific understanding but also informs policies and practices crucial for the sustainable future of these invaluable coastal ecosystems. Mangrove conservation in India is not merely an ecological imperative; it is an essential component of sustainable development. The amalgamation of biodiversity conservation, climate change mitigation, coastal protection, and livelihood support underscores the intricate and invaluable role of mangroves in India's environmental tapestry. Mangroves stand as ecological powerhouses in the realm of biodiversity conservation. As showcased by the referenced studies, these ecosystems not only support a myriad of species but also play a pivotal role in the intricate balance of coastal ecosystems. A comprehensive understanding of mangroves' biodiversity contributions is crucial for informed conservation strategies, ensuring the resilience of these unique habitats in the face of environmental challenges. Mangroves, with their unparalleled ability to sequester carbon, protect coastlines, and enhance community resilience, stand as frontline warriors in the battle against climate change. The referenced studies collectively underscore the critical role of mangroves in climate change mitigation and adaptation, advocating for their preservation and incorporation into global climate action strategies. Mangroves stand as nature's frontline defenders, offering sustainable and effective coastal protection. The referenced studies collectively underscore the critical role of mangroves in mitigating erosion, reducing the impacts of storm surges, and providing resilient coastal ecosystems. As coastal areas face increasing vulnerabilities due to climate change, recognizing and preserving the protective services of mangroves becomes imperative for sustainable coastal management. Mangroves, often termed the "forests of the tide," emerge as indispensable to the livelihoods of coastal communities. The referenced studies collectively underscore the importance of mangroves in sustaining fisheries, providing economic resources, supporting tourism, and contributing to

traditional medicine. Recognizing the vital link between mangroves and human well-being is crucial for informed conservation strategies that balance environmental preservation with the needs of local communities.

References:

1. Alongi, D. M. (2002). Carbon Sequestration in Mangrove Forests. *Carbon Management*, 2(3), 225–232.
2. Alongi, D. M. (2008). Mangrove forests: Resilience, protection from tsunamis, and responses to global climate change. *Estuarine, Coastal and Shelf Science*, 76(1), 1–13.
3. Alongi, D. M. (2008). Mangrove forests: Resilience, protection from tsunamis, and responses to global climate change. *Estuarine, Coastal and Shelf Science*, 76(1), 1–13.
4. Bawa, K. S. (1990). Conserving the World's Biological Diversity. *BioScience*, 40(6), 393–401.
5. Bhattacharjee, N. (1997). The Mangrove Ecosystem and its Management in the Andaman and Nicobar Islands. *Journal of the Andaman Science Association*, 13(1), 95–108.
6. Blasco, F., Aizpuru, M., & Gers, C. (1996). Coastal lagoon typology: A comprehensive set of habitat types for conservation, management, and sustainable use. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 6(4), 383–419.
7. Carson, R. (1962). *Silent Spring*. Houghton Mifflin.
8. Chmura, G. L., Anisfeld, S. C., Cahoon, D. R., & Lynch, J. C. (2003). Global carbon sequestration in tidal, saline wetland soils. *Global Biogeochemical Cycles*, 17(4), 1111.
9. Dahdouh-Guebas, F. et al. (2005). How Effective Were Mangroves as a Defence Against the Recent Tsunami? *Current Biology*, 15(12), R443–R447.
10. Dahdouh-Guebas, F., Jayatissa, L. P., Di Nitto, D., Bosire, J. O., Lo Seen, D., & Koedam, N. (2005). How effective were mangroves as a defense against the recent tsunami? *Current Biology*, 15(12), R443–R447.
11. Das, S., & Vincent, J. R. (2009). Mangroves protected villages and reduced the death toll during the Indian super cyclone. *Proceedings of the National Academy of Sciences*, 106(18), 7357–7360.
12. Diele, K. et al. (2005). Mangrove Crab Utopias? Complex Interactions in Mangrove Forests Between Crabs, Fiddler Crabs, and Trees. *Oecologia*, 144(3), 456–465.
13. Donato, D. C., Kauffman, J. B., Murdiyarso, D., Kurnianto, S., Stidham, M., & Kanninen, M. (2011). Mangroves are among the most carbon-rich forests in the tropics. *Nature Geoscience*, 4(5), 293–297.
14. Faulkner, J. (1969). The Biology of Mangroves. *Annual Review of Ecology and Systematics*, 1(1), 335–364.
15. Feller, I. C. (1995). Mangrove Roots: Adaptive Significance of Anoxia. *Trends in Ecology & Evolution*, 10(11), 474–475.
16. Hanum, N. F. (2002). Mangrove Rehabilitation in Asia: A Framework for Developing Region-wide Strategies. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 12(2), 131–138.

17. Kathiresan, K., & Bingham, B. L. (2001). Biology of mangroves and mangrove ecosystems. *Advances in Marine Biology*, 40, 81–251.
18. Kathiresan, K., & Rajendran, N. (2005). Coastal mangrove forests mitigated tsunami. *Estuarine, Coastal and Shelf Science*, 65(3), 601–606.
19. Kristensen, E., Bouillon, S., Dittmar, T., & Marchand, C. (2008). Organic carbon dynamics in mangrove ecosystems: A review. *Aquatic Botany*, 89(2), 201–219.
20. Lovelock, C. E. et al. (2011). The Role of Surface and Subsurface Processes in Carbon Accumulation in Mangrove Forests. *Biogeosciences*, 8(11), 3587–3595.
21. McLeod, E., Chmura, G. L., Bouillon, S., Salm, R., Björk, M., Duarte, C. M., ... Sillanpää, M. (2011). A blueprint for blue carbon: Toward an improved understanding of the role of vegetated coastal habitats in sequestering CO₂. *Frontiers in Ecology and the Environment*, 9(10), 552–560.
22. Nagelkerken, I., Blaber, S. J. M., Bouillon, S., Green, P., Haywood, M., Kirton, L. G., ... Somerfield, P. J. (2008). The habitat function of mangroves for terrestrial and marine fauna: A review. *Aquatic Botany*, 89(2), 155–185.
23. Polidoro, B. A., Carpenter, K. E., Collins, L., Duke, N. C., Ellison, A. M., Ellison, J. C., ... Yong, J. W. H. (2010). The loss of species: Mangrove extinction risk and geographic areas of global concern. *PLoS ONE*, 5(4), e10095.
24. Primavera, J. H. (1997). Mangroves and brackishwater pond culture in the Philippines. *Hydrobiologia*, 347(1–3), 1–10.
25. Raghu Prasad, R., & Tampi, P. R. S. (1977). Accent on brackishwater fish farming. *Seafood Export Journal*, 9(1), 1-4.
26. Saintilan, N., Wilson, N. C., Rogers, K., Rajkaran, A., & Krauss, K. W. (2020). Mangrove expansion and salt marsh decline at mangrove poleward limits. *Global Change Biology*, 26(5), 2659–2672.
27. Tomlinson, P. B. (1986). *The Botany of Mangroves*. Cambridge University Press.

Analyzing the Geographical Dynamics of Religious Tourism Growth and Current State in Kolhapur District, Maharashtra, India

Dr. Shubhangi Kale¹ Dr. G. S. Ubale Kale¹, Dr. Nisha Mugade Kale¹

Dept. of Geography

Vivekanand College, Kolhapur (Autonomous)

Prof. Dr. Sambhaji Shinde²

Dept. of Geography

Shivaji University, Kolhapur

Introduction:

Tourism has been ingrained in societal structures since time immemorial, evolving from an age-old phenomenon into a contemporary social and economic force. In the present day, it stands as one of the globe's swiftest growing activities, emerging as a substantial industry with the capability to channel considerable exchanges, notably in foreign currencies, toward tourism destinations. Tourist destinations are comprehensively categorized based on five key elements: Attraction, access, accommodation, amenities and activities, encompassing religious-historical sites, wildlife centers, spectacular landscapes, and lake/river locations. The essence of tourism lies in individuals engaging in the act of traveling and residing in locations beyond their customary environment, driven by the pursuit of pleasure through avenues such as education, experiential learning, enrichment, and recreational activities. This paper endeavors to scrutinize the historical development of tourist activities in the Kolhapur district of Maharashtra, India.

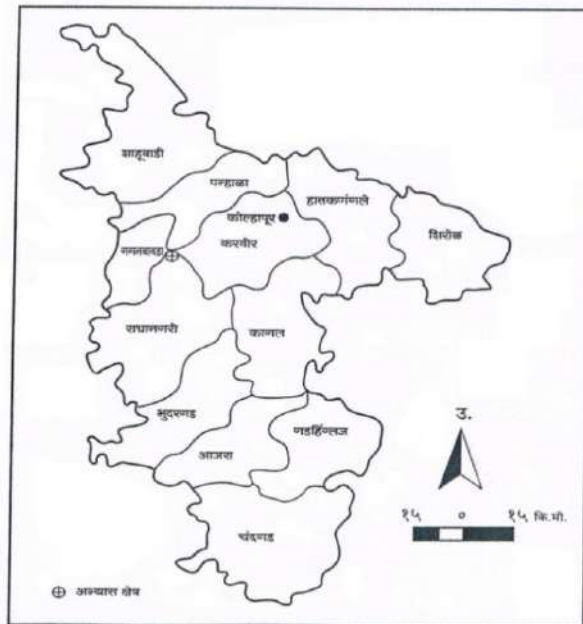
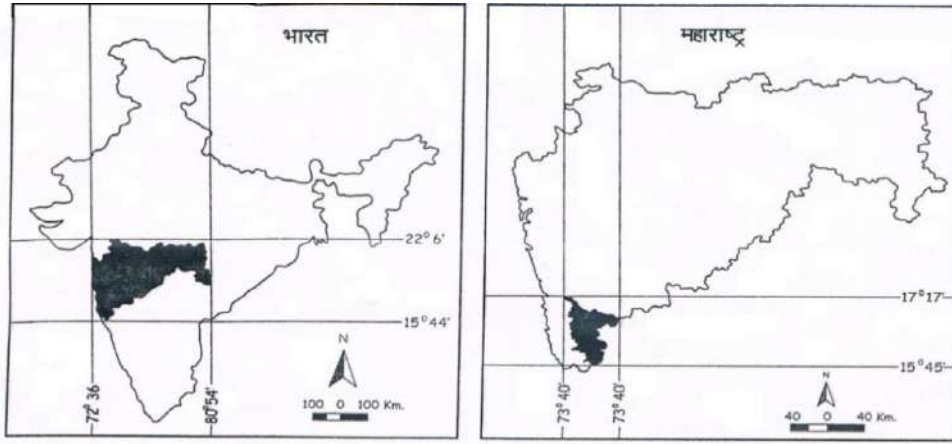
Religious tourism has been deeply embedded in societal structures since time immemorial, transforming from an ancient phenomenon into a contemporary social and economic powerhouse. Today, it stands out as one of the fastest-growing global activities, manifesting itself as a significant industry capable of directing substantial exchanges, particularly in foreign currencies, towards destinations with religious significance. Destinations for religious tourism are systematically classified based on five fundamental elements: Attraction, access, accommodation, amenities and activities. These encompass religious-historical sites, wildlife centers, breathtaking landscapes, as well as serene lake and river locations.

The essence of religious tourism lies in individuals embarking on journeys to reside in locations beyond their customary environment, motivated by the pursuit of spiritual pleasure. This involves engagement in activities such as education, experiential learning, enrichment, and recreational pursuits. In the context of this exploration, the paper aims to meticulously examine the historical evolution of religious tourism activities in the Kolhapur district of Maharashtra, India.

Objectives:

1. To analyze the current state of affairs in the established tourist hubs within Kolhapur District.
2. To identify shortcomings and gaps present in the existing tourist centers of Kolhapur District.
3. To assess the untapped potential of the tourist centers within the region.
4. To propose solutions for addressing challenges encountered by existing tourist centers.
5. To recommend the establishment of new tourist centers in Kolhapur District, based on identified needs and opportunities.

Study Area:



आकृती क्र. १

Location of study

Data Base”

This research relies on both Primary and Secondary data sources. The primary data for this study predominantly consists of Kolhapur Gazetteer Data and the results obtained from field surveys conducted in the Kolhapur district.

Primary Data: This study primarily hinges on data gathered through direct field work employing intensive observation and interviews with local residents. The firsthand information collected through these methods serves as a foundational element in our investigation.

Secondary Data: Complementary to the primary data, secondary data sources encompass a range of published reviews, the Kolhapur Gazetteer, census data from India, statistical abstracts, and pertinent unpublished records. Additionally, data will be sourced from various administrative offices, including Revenue offices at both district and taluka levels. The amalgamation of primary and secondary data aims to provide a comprehensive foundation for the research analysis.

Tourists Attractions of Kolhapur District:

"Sacred Sites and their Intersection with Tourism:"

1) Ambabai Temple:

The Ambabai or Mahalaxmi temple holds paramount significance among the various attractions in Kolhapur, earning its distinction as the most crucial site of interest. As the focal point of the old town, the city itself is often referred to as 'Daksin Kasi,' with the temple playing a pivotal role in shaping this nomenclature. The temple's construction is believed to have commenced in the 9th Century A.D. during the Rastrakuta Period, as indicated by archaeological findings [H. D. Sankalia and M. G. Dixit; Excavations at Brahmapuri (Kolhapur) 1945.]. Some assert that the earliest section of the existing shrine may have been crafted by the early Chalukyas (550 A.D. to 660 A.D.), with subsequent enhancements undertaken by the Silahara rulers of Kolhapur from the 9th Century A.D. onwards.

The primary structure comprises two stories, constructed using black stone sourced from local quarries. The spire and domes of the temple are attributed to a Sankaracarya of Sankesvar, although conflicting claims suggest that the temple originally served as a Jain temple dedicated to Padmavati. The architectural nuances further fuel this debate, as the spire and domes exhibit a stylistic disparity with the carved work below, reminiscent of the twelfth-century Jain temples in the Mysore State. The absence of the god Ganapati's image on the lintel, customary in Brahmanic temples, and the prevalence of seated cross-legged figures, many unclothed, add weight to the argument positing the temple's Jain origins.

Historical accounts by Major Graham shed light on a period of Muslim persecution in the fourteenth and fifteenth centuries, during which the image of Ambabai was concealed in a private residence. Around 1722 A.D., Sambhaji Maharaj (1712-1760) orchestrated the relocation

of the image to its present temple, employing Sidhoji Hindurao Ghorpade from Panhala for this purpose [An extent sanad or deed by Sambhaji assigning grants for the expense of the temple, states that though under the Bijapur Government (1489-1686) there existed many votaries well able to replace the image, Sambhaji Raja has alone the merit of re-establishing it in its ancient temple. Bombay Govt. Se. New Series VIII, 317.] The temple, designed in the form of a cross, exemplifies the Hemadpanti style, utilizing large mortarless stone blocks. Positioned facing west, the main entrance features the nagarkhana or drum chamber on the top, complemented by three additional gates to the north, east, and south.

The temple's interior houses the image of Ambabai under the big dome on the east, flanked by smaller domes enclosing the images of Mahakali and Mahasarasvati. The main structure also includes an entrance mandap, now designated as Garud mandap, and an upper storey with a linga directly above the image of Ambabai. Carvings on the exterior display polished black stone figures of musicians and dancing apsaras (Yoginis) in niches at regular intervals. The overall construction cost, inclusive of the spire and domes added by Sankaracarya, is estimated to be immense, with the Garud (Sabha) mandap added during the administration of Daji Pandit between 1838 and 1843.

Surrounded by additional shrines dedicated to Dattatraya, Vithoba, Kasi-Visvesvar, Ram, and Radha-Krsna, the main temple stands in an open space paved with stone slabs. Two pools of holy water, known as the Kasi and Mankarnika, once adorned the northern side of the temple but have since been filled up, with the images and stones relocated to the Museum or other locations. The temple's management transitioned from the Devasthan Mandal of the District Local Board to an individual claiming vahivatdar status in 1950. Subsequently, in 1955, the government assumed control, and the temple is currently managed by the district collector with the assistance of a small committee.

2) Jotiba:

The Jyotiba Temple, recognized as one of the revered 12 Jyotirlingas, also known as Kedarnath and Wadi Ratnagiri, holds significant mythological importance. According to mythology, Jotiba played a pivotal role in aiding Mahalaxmi in her battle against demons. Establishing his kingdom on this mountain, Jotiba, affiliated with the Nath cult, is believed to be the avatar of the fierce deity Bhairav. His birth, occurring in the hands of Vimalmbuja, the wife of the sage Pougand, is commemorated on Chaitra Shukla 6.

Jotiba's notable feat involves vanquishing the demon Ratnasur, tormentor of the local populace. This triumph led to the village being named Wadi Ratnagiri. However, owing to the impracticality of the extended name, the public embraced the simpler term 'Jotiba' as the divine appellation, and this name gained widespread recognition.

Situated north of Kolhapur, amidst lush green mountains and dark precipices, the temple, originally constructed in 1730 by Navajisaya, stands at an elevation of 330 feet above sea level. The temple's interior exudes an ancient charm, housing a four-handed idol of Jotiba along with additional temples and light towers. A significant annual event occurs on Chaitra Poornima (around March-April), marked by a grand fair drawing in hundreds of thousands of devotees, each carrying tall bamboo sticks known as SASAN KATHI. The scattering of 'Gulal' during the fair transforms the entire mountain into a pink spectacle.

The SASAN KATHI, intricately decorated bamboo sticks, constitute a major attraction during the fair. Traditionally, more than 2000 sticks are integral to the fair, and their sequence remains a steadfast convention. A vibrant procession featuring the SASAN KATHI takes center stage, drawing participation from devotees not only from the local area but also from diverse parts of the country and even abroad. Apart from the annual fair, the temple hosts various other celebrations, with Sundays being particularly crowded as a preferred visiting day. Devotees from the local regions tend to choose other weekdays over Sunday. On full moon days, a Palkhi procession, characterized by the ceremonial palanquin, adds to the religious fervor. Adjacent to the Jyotiba Temple, on the northern part of the hill, stands the temple of Goddess 'Yamai,' believed to be Jotiba's sister. Sundays are considered sacred to Jotiba, attracting a surge of devotees. Recent years have witnessed substantial improvements initiated by both the local community and the government, including the implementation of the Plaza Garden scheme.

3) Trambole (Temblai):

Located to the east of Kolhapur city, approximately three miles from the old city, lies the Trambole (Temblai) temple, nestled atop a small hill. The temple is dedicated to Temblai, also known as Tryambuli, believed to be the younger sister of Mahalaxmi. According to the Karvir or Kolhapur Furan, the temple's origin story dates back 1900 years when Tryambuli, following a quarrel with Mahalaxmi, retreated to this hill, positioning herself with her back turned towards her elder sister.

The legend unfolds with Mahalaxmi defeating the Daitya Kolla in a war between the devas and daityas. Seeking revenge, Kolla's son Kamaksa possessed the ability to transform beings and objects into sheep through magic. Utilizing this power, he converted Mahalaxmi and other deities into sheep. Tryambuli, absent at the time, escaped this fate. Upon learning of the situation, she cleverly killed Kamaksa and used his magic wand to restore the transformed beings to their original forms. However, during the subsequent celebrations, Tryambuli was inadvertently overlooked, leading to a rift. Despite efforts to reconcile, Tryambuli remained on the Tryambuli Hill.

Every 5th Asvin, a symbolic visit from Ambabai to her sister occurs. A procession carries an image of Ambabai with a "Kohala" or pumpkin, reminiscent of an incident in the

battle with Kolla. An unmarried girl later cuts the pumpkin to pieces, symbolizing the deity's victory over a giant named Kolhapur. The fair that ensues attracts 15,000 to 20,000 attendees, featuring offerings of sweets, edibles, toys, and a unique ritual involving a buffalo sacrifice every third year or during epidemics.

The temple, designed in the old Hemadpanti style, lacks intricate carvings but features a mandap in front of the main structure. On the same hill, two additional temples stand—one dedicated to Margai and another to Sivaji Maharaj, the latter being a recent construction. The picturesque Tryambuli hill offers a windswept landscape with sparse trees, providing a panoramic view of the city. Nearby, the Vikramsingh reservoir and its accompanying garden, maintained by the Water Works Department, offer a serene evening stroll. The hill also hosts the barracks of the former Rajaram Rifles, with the road to Hupari passing between this hill and Tryambuli hill.

4) Kashi Vishveshwar Temple:

The Kashi Vishveshwar Temple in Kolhapur city predates the compilation of the 'Karveer-Mahatmya' and is situated within the precincts of 'Ghati-Darvaja,' to the north of the Mahalaxmi Temple. The focal point of this sacred site is the 'Pinda,' a round-oblong stone known as Kashi Vishveshwar. According to the 'Karveer-Mahatmya,' sages Agasti, Lopamudra, King Pralhada, and King Indrasen visited this temple in ancient times. Prior to the construction of the present temple, the site housed two holy tanks—Kashi and Mani Kamika. Currently, Mani Kamika has been completely drained, and in its place, the corporation established a garden known as Mahalaxmi Udyana in 1962, although the current state of the Kund is lamentably poor.

Within the temple complex, an ancient cave designed for meditation is said to be located in the outer small Mandap. The entrance part of the temple features idols of Ganapati, Tulsi, and others. Adjacent to the main temple is a smaller shrine dedicated to Jotiba. The origin of this temple is believed to date back to 6-7 AD, with subsequent extensions carried out by King Gandvadix. Noteworthy structures such as Ghati Darwaja, Karti Swami, Shesha Varma, and Navagraha Mandir also belong to the same historical period. The rich historical tapestry of the Kashi Vishveshwar Temple unfolds through its ancient artifacts, meditative spaces, and the remnants of holy tanks that once graced its surroundings.

6) Bahuhali:

Established in 1935, the Celibacy Resort holds historical significance, deriving its name from the revered sage Bahubali, who engaged in meditation at this site approximately 300 years prior. The premises house the tomb of the sage, and owing to the guidance of Gurudeo 108 Samant Bhadra Maharaj, numerous resorts and educational institutions were erected on this sacred ground nearly 75 years ago.

Dominating the landscape is the awe-inspiring 850cms high, white-colored idol of Bhagawan Bahubali, depicted in the Khadgasana posture. This pilgrimage site is steeped in

the ascetic traditions, serving as the sacred land where many ascetics have undertaken rigorous penance. Over three and a half centuries ago, the venerable Digambar Acharya Samantabhadraji Maharaj Saheb embarked on an intense practice of penance on this very hill.

The antiquity of the hill is complemented by a recent installation of a new idol under the auspices of His Holiness, enhancing the spiritual ambiance of the temple. Within the enclosed space of this sacred haven, intricately crafted replicas of Siddhakshetras and a Samovasaran contribute to the temple's allure. Notably, the hill accommodates both a Shvetambar temple and a Digambar temple, symbolizing the harmonious coexistence of diverse religious traditions.

Nestled amidst hills and forests, this temple stands as a testament to beauty and delight. The splendid entrance adorned with two elephants accentuates the magnificence of the Bahubali idol. The construction of the Samovasaran showcases exquisite artistic skill, reflecting a rich tapestry of devotion. Devotees find solace and joy in the heartwarming ambiance of this temple, where the spirit of devotion flourishes.

7) Katyani Devi:

Kolhapur's distinctive cultural tapestry is intricately woven with the presence of ancient temples, and among them, the Katyani Devi Temple stands as a testament to the city's rich heritage. In the past, a strategic placement of deities encircled the central Mahalaxmi, each serving as a protective entity—Siddha Batukeshwar in the east, Tryamboli in the west, a jyotirling in the north, and Katyayani in the south. The significance of Katyayani is underscored in the 'Karveer-Mahatmya,' an ancient text referencing this revered deity.

Legend unfolds with the ancient Demon Kolhasur deploying Demon Raktabeej for the safeguarding of the region. In response, Mahalaxmi waged war against Kolhasur, dispatching Bhairava to subdue Raktabeej. However, upon striking Raktabeej, a multitude of demons sprang forth from his spilled blood, rendering Bhairava powerless. In a strategic move, Mahalaxmi swiftly sent Katyayani into action. Creating an 'Amrut Kund' (Nectar tank), she confined illusory demons born from the blood, revitalizing Bhairava's forces. With this renewed strength, Katyayani triumphed over Raktabeej, unraveling the mythological narrative.

Historical records reveal that notable figures such as Chhatrapati Shahu, Rajaram, and Akkasaheb Maharaj frequented the temple during hunting campaigns. For the weary denizens of Kolhapur, this temple serves as a respite from the monotony of daily life, offering a tranquil sanctuary amid the vibrant cultural landscape. The Katyani Devi Temple, with its mythological resonance and historical patronage, continues to be a cherished cultural landmark in the tapestry of Kolhapur's cultural and religious heritage.

8) Khidrapur:

Khidrapur (*Shirol T.*; 16° 40' N; 74° 35' E; p. 1,409), lies on the Krsna about Khidrapur, situated at coordinates 16° 40' N and 74° 35' E, unfolds its charm on the banks of the Krishna River, approximately twelve miles southeast of Shirol and eight miles south of

Jaisingpur railway station along the Miraj-Kolhapur meter gauge line. The village's foremost attraction is the Kopesvar temple, centrally positioned and boasting dimensions of 103½' x 65' x 52' up to the apex of its dome. Crafted from intricately carved black stone, the temple's dome is adorned with stucco detailing. Enhancing the main edifice are two elaborately sculpted mandaps or vestibules. Within the vestibule, a captivating arrangement unfolds with two concentric squares—twenty pillars in the outer ring and twelve in the inner, each exquisitely adorned. Adjacent to the temple stands the Svarga Mandap (Heavenly Hall), an open-roofed circular structure designed in the fashion of a twenty-rayed star, featuring four entrances within its plan. Surrounding the structure, a low screen wall accommodates thirty-six short pillars, while inside, a circle of twelve columns adds to the architectural allure. Further afield, a nagarkhana (drum-chamber) contributes to the site's cultural richness.

The temple's outer walls, akin to the Nilanga Hemadpanti temple, exhibit a distinct break at oblique angles. Adjacent to the south door, a Devgiri Yadav inscription by Sinhadev in Devnagari, dated sak 1135 (A.D. 1213), endows the village of Khandalesvar in Miraj for the worship of Kopesvar. Noteworthy is the presence of a smaller Jain temple, featuring a vestibule measuring twenty-one feet square inside, complete with a modest antechamber and shrine. The exterior wall of the shrine adheres to the star-shaped Hemadpanti plan, constructed from black stone with intricately carved pillars in the hall. Adding to the cultural landscape, the priests of Kopesvar are granted rent-free land valued at Rs. 109-6-0 annually. The allure of Khidrapur extends beyond its architectural marvels, drawing an annual gathering of about 3,000 people during the Magh fair in January-February.

8) Kaneri math: (Shiva's holy place)

Kaneri Math, identified as Shiva's sacred abode, stands quietly amidst the tranquility, away from the bustling limelight yet remarkably active. Located merely a mile from Kolhapur, historical narratives recount the installation of the Shiva-Pindi in the 14th century by a Lingayat priest atop a lofty hill, embraced by the enchanting embrace of natural beauty. The original temple, constructed in the Hemadpanti style, underwent significant development about 500 years ago, spearheaded by the Lingayat Priest Kadsiddheshwar. A profound testament to this spiritual haven is a 125-foot deep well that graces its surroundings.

Kaneri Math has garnered historical significance, with visits and donations from the esteemed Shivaji and Sambhaji Maharaja, signifying its cultural and regal relevance. Additionally, a tomb dedicated to the revered Muslim priest Mirasaheb, an ardent devotee of Lord Shiva, finds its place on this hill, akin to its counterpart in Miraj, and is revered with equal devotion.

The spiritual magnetism of Kaneri Math intensifies during the auspicious occasion of Shivaratri, drawing in tens of thousands of devotees from the states of Maharashtra and Karnataka. Their collective offerings during this sacred celebration contribute to the varied initiatives undertaken by the Kadsiddheshwar Institute, which endeavors to materialize numerous developmental plans. Noteworthy among these is the erection of a 42-foot tall idol of Shiva,

from which sanctified water is dispensed through the graceful conduit of an elephant's trunk, creating a unique and divine experience for the worshippers.

Accessibility to this sacred site is facilitated by a well-established bus service connecting it to Kolhapur. The confluence of historical resonance, religious veneration, and the serene natural backdrop renders Kaneri Math an indispensable destination for spiritual seekers and tourists alike. In its unassuming serenity, this spot unfolds a narrative of devotion, history, and cultural amalgamation, beckoning visitors to partake in an enriching and worthwhile experience.

9) Ramtirth, Ajara:

Nestled within the Ajara taluka, Ramtirth in Kohlapur is a picturesque haven encompassing ancient temples, a meandering river, time-honored coffee plantations, and a flourishing orchard. This locale exudes a captivating charm, blending elements of history and nature seamlessly.

Legend has it that the nomenclature of Ramtirth is rooted in the belief that Lord Rama, during his period of vanvaas or exile in the forest, sought refuge in this very place. The significance of this legend adds a layer of cultural and mythological richness to the site, elevating its appeal beyond its physical beauty.

What distinguishes Ramtirth is not only its historical associations but also its remarkable natural allure. The landscape is adorned with ancient temples, contributing to the cultural tapestry of the region. The presence of a meandering river adds a tranquil touch, enhancing the serene ambiance that envelops the entire area. The old coffee plantations, steeped in history, stand as a testament to the region's agricultural heritage, while the flourishing orchard adds a touch of vibrancy to the surroundings.

The blend of these elements creates a unique and unforgettable experience for visitors, making Ramtirth a sought-after destination for those seeking both historical enrichment and natural serenity. Its reputation as a scenic picnic spot is well-deserved, offering a respite from the hustle and bustle of everyday life. Ramtirth, with its ancient roots and breathtaking beauty, stands as a testament to the harmonious coexistence of history and nature in the realm of tourism in Kohlapur.

10) Binkhambi Ganapati

Nestled at the intersection of Mahadvar Road, the Binkhambi Ganapati Temple unfolds its architectural allure through two distinct segments—the inner sanctum and the frontal mandap. A distinctive characteristic of this temple is the absence of pillars supporting the ceiling, earning it the moniker 'Binkhambi,' signifying a pillar-less design.

The mandap, a square chamber measuring approximately 25' x 25', stands as a testament to architectural finesse, with no reliance on pillars for structural support. The inner sanctum is crowned by the customary tower adorned with a Kalas. Within, the divine presence of Lord Ganapati is manifested in a stone idol embellished with the application of Shendur.

Historically referred to as Josirao's Ganapati, the nomenclature possibly stems from the Josirao family's historical custodianship of the temple. Over time, the temple has become a beacon of cultural and religious significance, drawing devotees and visitors alike to witness its unique architectural composition and spiritual ambiance.

The strategic location at Mahadvar Road adds to the accessibility and prominence of the temple, making it a notable landmark within the cultural tapestry of Kolhapur. As a testament to the ingenuity of its design, the Binkhambi Ganapati Temple invites exploration and contemplation, providing a sacred space for spiritual reflection amidst its pillar-less marvel.

11)Bramheahwar Temple

Bramhesvar temple: This temple is near Varuntirth. It is like the Ambabai temple in construction but the spire or tower is missing. The temple is also half buried under the ground and presents a desolate appearance. It has a small original *mandap* in front and a big recent *mandap* of corrugated sheets. Inside the shrine there is a *linga* below the level of the ground and in the *mandap* there is a *Nandi*.

12)Khol Khandoba

The Khol Khandoba is a temple near the Burud Galli. From the outside one sees a big dome like that of a mosque. One has to go down about 20 to 25 feet. into the temple to reach the deity. The deity in the temple is the *Linga*. The temple is said to be ancient and the habitation round about is said to be even older than the habitation round the Mahalaxmi temple. The temple is not, however, in its original shape. It appears to have been partially demolished by an earthquake and have been rebuilt at a later date. The structure is rough and is without any embellishments.

13) Phirangai Mandir

Phirangai Mandir: The temple of Phirangai or Pratyangiras a favourite goddess of the lower classes, is near Varuntirth. This goddess receives offerings of flour, salt, turmeric, and oil and she is supposed to have the power of curing children suffering from itch. Formerly buffaloes were offered but now goats have taken the place of buffaloes.

The temple is simple. It is of slightly rough stones without any carvings or decorations. It appears to be a very old temple and perhaps it existed even before the Mahalaxmi temple was built because this habitation is said to have been prior to the habitation round the Mahalaxmi temple. It is now falling into a state of disrepair.

14) Radhakrishna Mandir.

Radhakrishna Mandir: This is an old temple near the Padmala or old race course. The temple is small and simple in style with a spire in the usual way. The idols are of white marble. There is an image of Krsna playing on the flute and an image of Radha standing beside him. There is a small cow in between and a small figure on the left hand possibly of another cowherd. These figures face north on the left hand side and facing west is the figure of another woman, possibly a *Gopi*.

The period of the temple is not known. But in 1857, some of the mutineers are said to have taken refuge here. This shows that the temple is an old one.

There is a *mandap* in front of the temple of fairly recent construction. Round the temple are hutments which were formerly used as stables for race horses. Now some people live in these buildings.

15) Sheshashayee temple.

Sesasyi temple: This temple is in the Subhas Cauk. The temple itself is of recent construction but the image of Visnu sitting on the coils of Sesa is an ancient one. It was found in the moat round the city wall south of Ravivar Vesa, and has been removed from there and installed at the present place during the reign of Sahu Maharaj. The image is carved in black stone and shows Visnu reclining on the coils of the serpent who has spread its many headed hood on him and a 'Das' and a 'Dasi' are pressing Visnu's feet. The work is exquisitely executed and is very interesting. The whole figure is about 10 to 12 feet in length.

16) Vithoba Mandir.

Vithoba Mandir: The temple of Vithoba, which was probably built about the same time as Ambabai temple, lies south-east near the Subhas, Cauk. A large space encloses five temples with a rest-house large enough for several hundred travellers. The chief temple of Vithoba to the right is built of stone and is similar in style to the great temple of Ambabai. In front of this temple, there is a double-storeyed wooden mandap which is of fairly recent construction. Another old temple to the left dedicated to Visvesvar is similar in style to Vithoba's temple. The entrance is grand and has spacious rooms on the top. On the bright eleventh of *Asadh* or June-July and *Kartik* or October-November fairs are held in honour of the god Vithoba when flowers and leaves of the *bel* or *Aegle marmelos* and the *tulsi* or basil plant are offered. The rooms on the entrance as well as the two buildings on either side of the entrance are now used by a school. Except the temple of Vithoba the other temples appear to be slightly neglected and signs of disrepair are visible in some of them.

17) Jain Mandir.

In Laxmipuri, near the Padma Talkies there is a temple of Munisuvrat, the 20th Tirthahkar of the Jains. Although the *mandir* was-built in 1947, it is a fine example of an attempt to build in the old Indian style of architecture. The mandir is modelled on the lines of

the old Jain *mandirs* and reminds one of the Jain *mandirs* at Abu. There are beautiful carvings both inside and outside the temple. The image of Munisuvrat is installed in the inner temple. There are also images of other Tirthahkars in marble, in the temple. Next to the inner temple there is a *mandap*. The *mandir* was built at a cost of Rs. 1,25,000.

18) Jain Swami Math.

Jain Swami Math.-This *math* is in Sukravar Peth a short distance from the Sukravar Dharmasala. The *math* is very old. The main gate or *Nagarkhana*, is very beautiful and is similar to the *nagarkhana* of the old Palace. It is, however, surmounted by a number of four-pillared towers. The main arched gateway is very beautiful. This *nagarkhana* or gate was built 80 years ago by Mathadhipati Laxmisen Maharaj at a cost of Rs. 61,000. It is built of black stone and is 65 ft. in height.

At present there is only an open space beyond the gate, except for a small structure at right angles to the main gate and joined to it. The old math building appears to have been destroyed and the upper storeys of the main gate and the other structure are at present being used as math.

19) Shankaracharya Math.

Sahkaracarya Math.-This *math* is in Sukravar Peth on the way to the Pancaganga Ghat. It is an old two storeyed structure without any embellishments or architectural points. It is, however, very old. The building is occupied by Sankaracarya of Sankeśvar. Although formerly it was a part of the Sankeśvar Math, the link was broken about 50 years ago and now the Kolhapur *math* is known as Karvir Pitha.

20) Babujamal Darga.

Babujamal Darga.-The Babujamal Darga is behind Saraswati Cinema theatre within a short distance of the Ambabal temple. This *darga* appears to have been built when the Muslims first conquered Kolhapur.

There is a big gate leading into the *draga* grounds. The top of the gate has, however, been removed. This gate was built in 1909 according to a tablet fixed there. The *darga* has a fairly extensive area with a garden and subsidiary building. The main *darga* stands in the middle of the ground. It is a typical Muslim structure with a big dome and four small domes at the four corners. The *darga* seems to have been built with stones of Hindu temples because the image of Ganapati appears on the lintel of the door. It is white washed.

This Darga is the most important Muslim shrine in the city. Many Hindus also go there for worship.

Conclusion:

We can experience magical agglomeration of History, Nature, Spirituality, and Culture all at one place. Facilities of comfortable accommodation, good network of air and road

transportation, well convergent guides, etc. will help speedy development of tourism in this district. Accessibility, amenities, accommodation, climate, attractive sites are the main aspects studied in this research work.

References:

1. Shinde, R. B., & Patil, S. A. (2022). *Cultural Tourism and its Economic Impact on Local Economy in Maharashtra*. *Journal of Tourism Studies*, 15(3), 120–134.
2. Tourism Department, Maharashtra State Government. (2021). *Tourism Development Plan for Kolhapur District 2021-2025*. Tourism Department, Maharashtra State Government.
3. Kale, S. P. (2020). *Religious and Cultural Heritage of Kolhapur District*. Mumbai: Heritage Publishers.
4. Kale, S. P. (2020). *Religious and Cultural Heritage of Kolhapur District*. Mumbai: Heritage Publishers.
5. Kale, S. P. (2020). *Religious and Cultural Heritage of Kolhapur District*. Mumbai: Heritage Publishers.

Echoes of Despair: Dasi and the Unforgiving Realities of Society in R.K. Narayan's *Dasi the Bridegroom*

Dr. Sanmati Vijay Dhanawade
Vivekanand College, Kolhapur (Autonomous)

Abstract:

R. K. Narayan's storytelling delves into more than just the tragedy of one person's unfulfilled dreams; it also prompts a thorough examination of the societal forces that lead to such outcomes. The narrative serves as a compelling testament to the fragile equilibrium between aspirations and the real world, encouraging readers to recognize the toll of societal judgments on individuals and emphasizing the need to cultivate compassion in the presence of diversity.

Key words: Societal judgments, dreams and reality, pathos, innocence and vulnerability

Rasipuram Krishnaswami Iyer Narayanaswami (10 October 1906 – 13 May 2001), widely recognized as R. K. Narayan, was an acclaimed Indian writer and novelist celebrated for his literary contributions set in the fictitious South Indian town of Malgudi. Alongside Mulk Raj Anand and Raja Rao, he held a prominent position among the early authors of Indian literature in English.

Graham Greene, a mentor and close associate of Narayan, played a crucial role in securing publishers for Narayan's initial four books, which included the semi-autobiographical trilogy comprising "Swami and Friends," "The Bachelor of Arts," and "The English Teacher." The fictional realm of Malgudi made its debut in "Swami and Friends." Noteworthy works such as "The Financial Expert," lauded as one of the most innovative pieces of 1951, and "The Guide," a recipient of the Sahitya Academy Award and later adapted into a film (earning a Filmfare Award for Best Film) and a Broadway production, added to Narayan's literary acclaim.

Narayan's narrative prowess lies in his exploration of the social milieu and the everyday existence of his characters. Drawing comparisons to William Faulkner, who similarly crafted a fictional town to delve into the vibrancy of ordinary life with humor and compassion, Narayan's short stories have been likened to those of Guy de Maupassant due to his adeptness at condensing a narrative.

Over a prolific career spanning six decades, Narayan garnered numerous accolades, including the AC Benson Medal from the Royal Society of Literature, the prestigious Padma Vibhushan and Padma Bhushan, India's second and third highest civilian honors, and the Sahitya Akademi Fellowship in 1994, the highest recognition from India's National Academy

of Letters. In addition, he received a nomination to the Rajya Sabha, the upper house of the Indian Parliament.

Dasi the Bridegroom, featured in R. K. Narayan's 'An Astrologer's Day and Other Stories' published in 1947 unfolds with dramatic narration in a clear and lucid style. The narrative subtly explores the profound gap that consistently exists between illusion and reality. What elevates the story's success is its adept fusion of humour and pathos, seamlessly interweaving smiles and tears.

The central theme of "*Dasi the Bridegroom*" revolves around the intricate interplay between the dreams harboured by the protagonist, Dasi, societal expectations imposed upon him, and the stark reality of unfulfilled desires. R.K. Narayan, through his nuanced storytelling, weaves a narrative that reflects the universal struggle of individuals caught between their aspirations and the constraints imposed by society.

The narrator portrays the character of Dasi with his dreams. His romantic desires are narrated by the writer in a very acute manner. Dasi, an uncouth and simple man, dreams of marriage and companionship. His romantic longing is a universal theme that resonates with readers, as it represents the basic human desire for love and connection. His dreamy character motivated him to imagine marriage. Dasi's vivid descriptions of his prospective bride and his anticipation of marriage illustrate the depth of his dreams. These dreams become a driving force, giving him purpose and hope.

On the contrary, there is the harsh and stark reality of society. The storey teller has done his job of caricaturing the marginalization and ridiculing nature of society. Dasi's physical appearance and speech make him a target for societal mockery. The Extension residents, including children and adults, subject him to ridicule, emphasizing the harsh reality of societal expectations and norms. The central character is often pressured to believe and conform to his imaginary wedding and wife. Dasi's participation in conversations about his marriage underlines the societal pressure to conform to traditional norms. The Extension residents, consciously or unconsciously, impose expectations on him, reinforcing the societal construct of marriage as a normative milestone.

The writer of the present story is successful in portraying the harsh reality of life and the unfulfilled desires of mankind. He has skilfully narrated the discrepancy between dream and Reality. The narrative skilfully portrays the stark contrast between Dasi's dreams of marital bliss and the harsh reality of his unfulfilled desires. The gap between his romantic imagination and the practical challenges he faces is a poignant commentary on the fragility of dreams. The emotional impact crumbled the leading character of the story. Dasi's emotional response to the rejection by Bamini Bai, the film star, highlights the profound impact of unattainable dreams on an individual's psyche. His descent into madness becomes a tragic consequence of societal cruelty and shattered dreams.

The central theme of dreams, societal expectations, and unfulfilled desires transcends cultural boundaries, making "*Dasi the Bridegroom*" a universally relatable narrative. Readers can empathize with the human condition depicted in the story, recognizing similar struggles in their own lives or the lives of those around them.

In essence, the central theme of "*Dasi the Bridegroom*" serves as a poignant exploration of the complexities inherent in the human experience. Through Dasi's character, R.K. Narayan invites readers to reflect on the impact of societal norms on individual aspirations and the often heart-wrenching consequences of dreams left unfulfilled. The story prompts contemplation on empathy, understanding, and the delicate balance between societal expectations and personal fulfilment.

Although the story is narrated in the third person, it adopts an observational perspective that closely follows Dasi's life and experiences. This narrative choice allows readers to witness the events from an external viewpoint while still gaining insight into Dasi's thoughts and emotions. The third-person perspective maintains a certain level of objectivity, allowing the narrator to present the events without being influenced by Dasi's subjective experience. This technique contributes to a more comprehensive understanding of the characters and their interactions. The dialogues in the story demand thoughtful consideration and play a significant role in shaping its narrative.

Dialogue is a central element in the story, serving as a tool to reveal the characters' personalities, especially Dasi's simplicity and the attitudes of the Extension residents. Through conversations, readers gain insight into Dasi's limited speech, innocence, and unwavering commitment to his dreams. The dialogue captures the societal attitudes toward Dasi, as seen in the interactions with the Extension residents. The mockery, jokes, and questions directed at Dasi highlight the collective mind-set and prejudices of the community.

The narrative employs flashbacks to delve into Dasi's routine and the longstanding nature of his unfulfilled desires. This technique provides context to Dasi's character, allowing readers to understand the routine nature of his life and the persistence of his dreams over an extended period. By incorporating flashbacks, the author creates a connection between the readers and Dasi's struggles. Understanding the routine of drawing water, chopping wood, and tending to the garden establishes a backdrop that accentuates the monotony and challenges in Dasi's life, fostering empathy among readers. Flashbacks contribute to the emotional impact of the story. Dasi's long-standing commitment to his dreams, despite societal ridicule, becomes more poignant as readers witness the repetitive nature of his daily life.

In "*Dasi the Bridegroom*," the narrative techniques employed by R.K. Narayan contribute to the depth and emotional resonance of the story. The observer's perspective, dialogue-driven character exploration, and strategic use of flashbacks collectively create a narrative that not only captures the essence of Dasi's experiences but also invites readers to reflect on the broader themes of societal expectations and unfulfilled desires.

The writer has employed a few symbols in the story. Dasi's mat serves as a powerful symbol throughout the story. It represents his only possession, emphasizing his humble and solitary existence. The mat becomes a tangible reflection of Dasi's simple life, devoid of material wealth or extravagance. The mat also functions as Dasi's place of solace. In a world where he faces mockery and societal ridicule, the mat becomes a symbolic refuge. It is a physical space where he can retreat, contemplate, and find comfort, highlighting the contrast between his inner world and the external challenges he faces.

The Trunk Road serves as a metaphor for the journey of life and, more specifically, Dasi's journey. It represents the path that he envisions leading to his dreams and desires. The road becomes a symbol of hope and aspiration as Dasi waits along its course, anticipating the fulfilment of his romantic fantasies. The Trunk Road also introduces an element of ambiguity and challenges. Dasi's wait along the road symbolizes the uncertainties and obstacles that one encounters on the journey towards one's dreams. The road becomes both a literal and figurative representation of the struggles inherent in pursuing one's aspirations.

The electric lamp is a symbol that represents the harsh reality that shatters Dasi's romantic illusions. When Dasi stands under the lamp in Bamini Bai's house, it illuminates not only his physical presence but also the stark contrast between his dreams and the reality of rejection. The harsh light exposes the truth, symbolizing the abrupt confrontation with an unattainable fantasy. The electric lamp introduces a dichotomy between light and darkness. While Dasi's dreams may have been illuminated by the romantic ideals he harboured, the harsh reality, represented by the lamp, casts shadows on those dreams. It underscores the theme of shattered illusions and the inevitability of facing the truth.

These symbols and images in "*Dasi the Bridegroom*" contribute to the depth of the narrative by adding layers of meaning and metaphor. Dasi's mat, the Trunk Road, and the electric lamp provide a rich tapestry that enhances the exploration of themes such as solitude, aspiration, and the clash between romantic ideals and the harshness of reality.

The main character of the story is Dasi. He is portrayed as an uncouth man with a narrow tapering head, bulging eyes, and a fat neck. His substantial physique, defined by robust muscles, juxtaposes with his restricted capacity for articulate speech, notable for gurgling and lisping.

The character of Dasi can be considered a specimen of social marginalization. Dasi's social status is a key aspect of his character. Despite his physical strength, he is socially marginalized and subject to ridicule from Extension residents. His inability to clearly articulate his age further complements to the mystery surrounding him. Dasi's character is defined by his deep yearning for love and companionship. His dreams of marriage and romantic aspirations form the emotional core of the narrative, eliciting empathy from readers. Dasi's innocence is evident in his straightforward and uncomplicated nature. He treats everyone seriously, showing resilience in the face of societal mockery. His lack of awareness regarding the jokes made at his expense highlights his simplicity.

The character of Bamini Bai, a film star from Madras, catalyses the unfolding events in the Extension. Her arrival triggers Dasi's infatuation and sets in motion a series of events that lead to both tragedy and societal ridicule. Bamini Bai represents Dasi's unattainable dreams. Her status as a film star embodies a distant and unachievable fantasy for Dasi. The stark contrast between his romantic imagination and the harsh reality of rejection contributes to the story's emotional depth. Bamini Bai's character is explored primarily through Dasi's perspective, and her role in the narrative is more symbolic than fully developed. Her rejection becomes a pivotal moment in Dasi's life, shaping the story's trajectory.

The Extension residents, including children and adults, collectively form a backdrop that represents societal norms and expectations. Their curiosity about Dasi's personal life and their tendency to mock him underscore prevailing attitudes toward those perceived as different. While some Extension residents display curiosity about Dasi's marriage and engage in light-hearted banter, others exhibit cruelty by taunting and making jokes at his expense. This dynamic reflects the spectrum of societal attitudes towards individuals who deviate from perceived norms. Though individually minor, the Extension residents collectively contribute to the story's atmosphere and play a crucial role in shaping Dasi's experiences. Their interactions with Dasi highlight the broader societal context in which the narrative unfolds.

In "*Dasi the Bridegroom*," R.K. Narayan masterfully crafts characters that serve both individual and symbolic roles. Dasi's character elicits empathy as a representation of the marginalized seeking love, while Bamini Bai symbolizes unattainable dreams. The Extension residents, though minor, collectively contribute to the societal backdrop, enhancing the narrative's exploration of human relationships and the consequences of societal judgments.

R.K. Narayan's characterization of Dasi is a masterful exploration of innocence and vulnerability. Dasi's physical appearance, speech limitations, and simple lifestyle evoke empathy from readers. The portrayal of his unwavering commitment to love and marriage, despite societal mockery, paints a poignant picture of a character who is both endearing and tragically misunderstood. Dasi's inability to articulate his age or express himself fluently adds to his charm and innocence. His communication challenges become a vehicle for readers to connect with him on a deeper emotional level. Through limited dialogue, Narayan crafts a character whose strength lies not in words but in the purity of his emotions.

The narrative serves as a subtle critique of societal norms and attitudes. Dasi, as a socially marginalized individual, becomes a lens through which Narayan examines the cruelty and indifference of a community towards those perceived as different. The Extension residents, representing society, mock Dasi, revealing the prejudices ingrained in societal expectations surrounding marriage, appearance, and communication.

The story underscores how collective behaviour can perpetuate societal norms and reinforce discrimination. The Extension residents collectively contribute to Dasi's isolation through mockery and jokes, reflecting the power dynamics within communities and the impact of societal judgment on individual lives.

Dasi's emotional turmoil is depicted with sensitivity and nuance. The narrative delves into his psyche, revealing the profound impact of rejection on his mental well-being. The juxtaposition of his dreams and the harsh reality of rejection adds layers to his character, making the psychological exploration a central element of the story.

Dasi's eventual breakdown and descent into madness provide a glimpse into the fragility of the human mind when faced with unrelenting societal pressure. Narayan portrays the psychological toll of societal cruelty, prompting readers to reflect on the consequences of collective indifference and the limits of an individual's resilience.

In conclusion, "*Dasi the Bridegroom*" stands as a literary gem that combines skilful characterization, incisive social commentary, and profound psychological insight. R.K. Narayan's storytelling prowess lies in his ability to create a character whose innocence and vulnerability resonate with readers, while simultaneously using Dasi's story to critique societal norms and explore the intricacies of the human psyche. The narrative transcends its specific cultural context, offering universal themes that prompt reflection on empathy, societal expectations, and the impact of collective behaviour on individual lives.

The moral of "*Dasi the Bridegroom*" lies in its exploration of the consequences of societal mockery and the profound impact of unattainable dreams on an individual's psyche. The narrative serves as a poignant commentary on human nature, empathy, and the repercussions of societal cruelty. The story vividly portrays the detrimental effects of societal mockery on Dasi, the protagonist. Dasi, a socially marginalized individual, becomes the target of jokes and ridicule from the Extension residents. The persistent teasing and taunting contribute to Dasi's isolation, highlighting the real-world consequences of societal indifference and cruelty.

Dasi's unattainable dreams, particularly his romantic aspirations, become a driving force in the narrative. The stark contrast between his dreams and the harsh reality of rejection by Bamini Bai, the film star, serves as a cautionary tale about the emotional toll of unfulfilled desires. The story underscores the psychological distress that can result from the clash between romantic ideals and the often unforgiving reality.

The narrative functions as a commentary on human nature, revealing the tendencies of individuals and communities to mock those who deviate from societal norms. The Extension residents, representing broader society, exhibit a range of attitudes from curiosity to cruelty. This commentary prompts readers to reflect on the inherent biases and judgments present in human interactions, encouraging a critical examination of collective behaviour.

The story serves as a call for empathy and understanding. Dasi's character, with his innocence and vulnerability, becomes a symbol of the marginalized and misunderstood. Through his experiences, the narrative encourages readers to empathize with individuals who face societal ridicule, challenging them to look beyond appearances and appreciate the humanity in each person.

The ultimate consequence of societal cruelty is depicted in Dasi's descent into madness. The story suggests that the relentless mockery and rejection take a severe toll on his mental well-being, highlighting the potential for long-lasting and devastating effects of societal cruelty on an individual's psyche.

In summary, the moral of "*Dasi the Bridegroom*" underscores the importance of empathy, warns against the consequences of societal mockery, and prompts readers to reflect on the delicate balance between individual dreams and societal expectations. The narrative serves as a poignant reminder of the impact that collective attitudes can have on individuals, urging society to cultivate understanding and compassion in the face of difference.

The conclusion of "*Dasi the Bridegroom*" marks a poignant and tragic resolution, highlighting the devastating impact of unfulfilled desires and the relentless pressure of societal ridicule on the protagonist, Dasi. R.K. Narayan's masterful storytelling crafts a conclusion that prompts reflection on the human condition, societal expectations, and the consequences of unrelenting social pressure.

The story concludes with Dasi's descent into madness, a heartbreaking outcome that symbolizes the culmination of his emotional turmoil. The rejection by Bamini Bai, the film star, and the incessant societal mockery take a severe toll on Dasi's mental well-being. His descent into madness becomes a tragic manifestation of the psychological impact of unattainable dreams and societal cruelty. Dasi's madness serves as a symbolic representation of the shattered dreams and the overwhelming psychological distress he experiences. It underscores the profound consequences of societal indifference and the toll that unrelenting social pressure can take on an individual's psyche.

The conclusion prompts readers to reflect on the broader human condition. Dasi's story becomes a lens through which the complexities of human emotions and vulnerabilities are explored. The narrative suggests that the human psyche is susceptible to the harsh realities of rejection and mockery, emphasizing the fragility of individuals when faced with societal judgment.

The story's conclusion serves as a commentary on societal expectations and their potential consequences. Dasi's breakdown highlights the destructive nature of societal norms that marginalize and mock individuals who deviate from perceived standards. The Extension community, with its collective attitudes, becomes a microcosm reflecting the broader societal tendencies to ostracize those who are different.

The conclusion prompts introspection into the complexities of human relationships. Dasi's story challenges readers to reconsider their attitudes and behaviours towards individuals who may be marginalized or perceived as different. It underscores the importance of empathy and understanding in navigating the intricacies of societal interactions.

In essence, the conclusion of "*Dasi the Bridegroom*" leaves readers with a deep sense of empathy and contemplation. The narrative concludes with the poignant line, 'He was then sent (with a warder) to the main gate where he stood for a whole hour looking down the road for the coming of his bride.' (43) This evokes a profound sense of Dasi as a casualty of societal cruelty, eliciting feelings of pathos and sympathy. Simultaneously, the lingering ray of hope is embodied in his patient wait and aspiration for a brighter future. Narayan's narrative not only explores the tragedy of an individual's shattered dreams but also invites a critical examination of the societal dynamics that contribute to such outcomes. The story stands as a powerful testament to the delicate balance between dreams and reality, urging readers to acknowledge the human cost of societal judgments and the importance of fostering compassion in the face of difference.

Bibliography:

Alter, S., and W. Dissanayake. *Modern Indian Short Stories*. Penguin India, 2001. ISBN 978-0143027751.

Bhattacharyya, Indradeep. *RK Narayan: The Compassionate Chronicler of Indian Life*. Niyogi Books Private Limited, 2023. ISBN 978-9391125561.

Cowasjee, Saros, and Shiv K. Kumar, editors. *Modern Indian Short Stories*. Oxford University Press, 1984. ISBN 195612027.

Singh, R.A. *Critical Essays on R.K. Narayan's Novels*. Book Enclave, 2020. ISBN 8181525221.

Webliography:

https://en.wikipedia.org/wiki/R._K._Narayan accessed on 26/12/2023

वाचनाभिरुची - एक विचार

प्रा. डॉ. एकनाथ आळवेकर, प्रा. स्वप्नील बुचडे

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

■ गोषवारा :

'वाचनाभिरुची : एक विचार' या निबंधातून वाचनाभिरुची म्हणजे काय हे समजावून घेण्याचा प्रयत्न केल्यानंतर वाचनाची परंपरा काय होती हे समजावून सांगितले आहे. वाचनसंस्कृती वृद्धिंगत होण्यासाठी मदत व्हावी या अनुषंगाने वाचनसंस्कृतीच्या अभावाची कारणे शोधण्याचा प्रयत्न केला आहे. तसेच वाचनसंस्कार, वाचन आचार संहिता काय असावी हे सांगितले आहे. वाचनाभिरुची वाढावी यासाठी कोणते उपाय करणे आवश्यक आहे याबद्दल सांगितले आहे. शाळा, महाविद्यालयातील अध्यापक, विद्यार्थ्यांचा वाचनाकडे बघण्याचा दृष्टिकोन कोणता याविषयीची मांडणी केली आहे.

■ की वर्ड :

वाङ्.मयीन अभिरुची, वाचन परंपरा, वाचनसंस्कृती, लोकप्रिय साहित्य, ग्रंथसमीक्षा, अध्यापन, नियतकालिके.

■ उद्दिष्टे :

- १) वाचनाभिरुची ही संकल्पना समजावून देणे.
- २) वाचनसंस्कृती म्हणजे काय याविषयी ज्ञान देणे.
- ३) वाचनसंस्कृती वृद्धिंगत होण्यास मदत होईल.

■ वाचनाभिरुची संकल्पना :

वाचनाभिरुची म्हणजे वाचनाबद्दलची आवड निवड जोपासणे होय. वाङ्.मयीन अभिरुची म्हणजे वाचकाच्या वाङ्मयाच्या स्वरूपा संबंधीच्या आणि चांगले वाईटपणाबद्दलच्या कल्पना असतात. वाचकांची अभिरुची ही भाषिक संस्कृतीच्या वाङ्.मयीन परंपरेने घडवलेली असते. वाङ्.मयीन परंपरेत लोकसाहित्यापासून ते अभिजात वाङ्.मयकृतीपर्यंतचे सर्वच वाङ्.मय समाविष्ट असते. वाचनाभिरुचीतून वाचन संस्कृती जोपासली जाते. वाचन संस्कृती म्हणजे वाचण्यासाठी पूरक परिस्थिती आणि त्या परिस्थितीचा लाभ घेणारा घटक त्यातून ज्ञान मिळवण्याची अपेक्षापूर्ती होणे. वाचनसंस्कृती आणि ज्ञान व वाङ्मय यांची निर्मिती यांचे आंतरिक नाते असते.

■ वाचन परंपरा :

कोणत्याही वाचकाची अभिरुची ही बालपणीच घडत असते. ऐकलेल्या गोष्टी, बडबड गीते, पाठ्यपुस्तकातील कविता, कथा आणि पुढे वाचनात येणारे वेगवेगळ्या प्रकारचे वाङ्मय या सर्वातून अभिरुची घडत असते. सामान्य माणसाच्या

वाङ्.मयीन अभिरुचीमध्ये काही प्रमाणात नैतिक मूल्ये असतात. निवड, आस्वाद आणि तिचे मूल्यमापन यामध्येही नैतिक मूल्य असतात.

वाचनसंस्कृतीचा विचार करता जुना काळ आणि आधुनिक काळ विचारात घेता जुन्या काळात सुशिक्षित संसारी स्त्रिया दुपारच्या फावल्या वेळात मनोरंजनपर कथा, कादंबऱ्या वाचत. पण आत्ताच्या काळात स्त्रिया वाचना ऐवजी दूरदर्शन मालिका पाहताना आढळतात. साहजिकच मनोरंजनपर कथा, कादंबऱ्यांच्या निर्मितीवर याचा परिणाम झाला आहे. जुन्या काळापासून आणि आजही काही प्रमाणात श्रावण महिन्यात अनेकांच्या घरी, देवळात व्रतवैकल्याच्या निमित्ताने ग्रंथांचे वाचन होत असते. वाचन परंपरेतला तो एक महत्त्वाचा दुवा म्हणता येईल.

■ वाचन संस्कृती अभाव-कारणे:

वाचन संस्कृतीपासून दूर राहणाऱ्या प्रवृत्ती बदल कारणे शोधली तर आधुनिक जगातील प्रलोभनांचा अधिक विचार करावा लागेल. आजच्या काळात साक्षरतेचे प्रमाण खूप वाढलेले असताना वाचकांच्या संख्येत मात्र वाढ झालेली नाही याचे कारण म्हणजे सध्याचे धावपळीची जीवन होय. कमी कालावधीत, कमी कष्टात अधिकाधिक मिळवण्याची चढाओढ, दूरदर्शन, केबल नेटवर्क, स्मार्टफोन, व्हिडिओ गेम, मनोरंजनाची इतर उपकरणे या सर्वांतून वाचनासाठी वेळ देणे कठीण होऊन बसले. मुळात आधुनिक जगातील या पिढीवर वाचनाचे संस्कार गांभीर्याने होतच नाहीत. त्या पिढीला वाचनाचे महत्त्व माहित नाही. त्यामुळेच वाचनापासून हा वर्ग दूर राहिलेला आहे.

कसदार साहित्य वाचकापर्यंत न पोचल्याने किंवा स्वप्रकाशित पुस्तकांचा दर्जा न राहिल्याने अशी पुस्तके वाचकांपुढे आली तर तो वाचक वाचनापासून कायमचा परावृत्त होऊ शकतो. बहुसंख्य प्रकाशित पुस्तकांचा दर्जा अतिशय सुमार असतो. या पुस्तकात प्रकाशकाची काही गुंतवणूक नसते. पुस्तक कमीत कमी खर्चात आणि घाईघाईने काढल्याने लेखकाचे दुर्लक्ष होते. अशी पुस्तके वाचन संस्कृतीला मारक ठरतात. स्वप्रकाशित पुस्तकांवर संपादकीय संस्कार करून घेणे, त्याची मुद्रणप्रत बनविणे, मुद्रित शोधकाची मदत घेणे, पैसा थोडा अधिक खर्च करून आणि थोडा वेळ करून उत्तम दर्जाचा आग्रह धरून ग्रंथ प्रकाशित केले तर वाचन संस्कृती जोपासण्यास, ती वाढविण्यास मदत होईल. लेखकालाही आपले अनुभवविश्व चांगल्या प्रकारे वाचकापर्यंत पोहोचविण्याचे समाधान मिळेल.

शिक्षण क्षेत्रात काम करणाऱ्या घटकांचा विचार केला तर असे दिसून येते की त्यांच्यामध्ये हवे तेवढे वाचन संस्कार आढळत नाहीत. वाढलेले पगार, भौतिक सुविधांचे प्राबल्य, मॉल संस्कृतीमुळे अनावश्यक वस्तूंची खरेदी, प्रदर्शन करण्याच्या हौसेतून झालेली खरेदी, भौतिक सुखामध्ये रममाण होण्याची वृत्ती, नोकरीच्या ठिकाणी वास्तव्यास न थांबणे, स्वतःला ज्ञानाने अद्यावत करण्याकडे केलेली डोळेझाक यातून वाचन प्रक्रियेवर परिणाम झाला आहे.

आधुनिक युगात वाचनाचे संस्कृतीपूर्ण वातावरण संपले आहे. ई-बुक्समुळे वाचता वाचता पुस्तकात होणाऱ्या खुणा गळून पडल्या. पानांचे कोपरे दुमटणे संपले. पुस्तक उघडे ठेवून कॉफी घेता घेता वाचकाला पूर्व वाचनात घेऊन जाणारा आनंद गमावला. ई बुक्समुळे वाचनासाठी डोळे नकोच कान असले की झाले. वाचनातला पुनःप्रत्ययाचा आनंद दूर गेला. अशारीतीने यंत्राने वाङ्. मयीन संस्कृती मारली गेली. वाचनसंस्कृतीला व्यत्यय आलेला आहे. याची जाणीव यातून होते.

■ वाचन संस्कार आचारसंहिता:

प्रत्येकाची अभिरुची वेगळी असते हे जरी मान्य केले तरी 'ज्याची त्याची अभिरुची' असे म्हणून काही बोलू नये, वाचू नये किंवा पाहू नये हे मात्र खरे आहे. वाचनाने संस्कार घडतात हे ज्यावेळी आपण म्हणतो त्यावेळी मात्र आपल्यावर 'काय वाचावे काय वाचू नये' यासंबंधीची बंधने येतात. अगदी बालवयापासून प्रौढांपर्यंत ही वाचन आचारसंहिता पाळायला हवी. जे आपण वाचतो त्याचा आपल्या मानसिकतेवर परिणाम होत असतो. वाचक म्हणून पदार्पण करणाऱ्याने केवळ मनोरंजन करणारी पुस्तके, हलकीफुलकी, झोप येण्यासाठी वाचली जातात अशी पुस्तके वाचायला हवीत. यालाच लोकप्रिय साहित्य म्हटले जाते. आजची तरुण पिढी आधुनिक जगाचे ज्यामधून चित्रण येते अशी पुस्तके वाचताना आढळतात. त्यांचा वर्तमानावर, वास्तवावर जास्त विश्वास आहे. म्हणूनच वाचकाने काय वाचावे आणि काय वाचू नये याबद्दलची प्रत्येकाने आचारसंहिता ठरवलेली असते.

■ वाचनसंस्कृती - उपाय :

वाचनाभिरुची वाढविण्यासाठी मुळात मानसिकता बदलायला हवी. आधुनिक तंत्रज्ञानाच्या माध्यमातून स्वतःला बाहेर काढून ग्रंथ या वाच्य माध्यमाकडे गांभीर्याने पहायला हवे. ग्रंथ हाताळण्यापासून त्याचे मुखपृष्ठ, मांडणी, आकार, त्यातील आशय याविषयी करावसं वाटणारा चिंतन याकडे आपण पाहिले तर वाचनाभिरुची वाढायला नक्कीच मदत होईल. त्याबरोबरच वाड्.मयीन वातावरणाने, चर्चा- संवाद, साहित्यिक -सांस्कृतिक कार्यक्रम यामुळेही वाचनाभिरुची अधिक संपन्न होते. ग्रंथालयाच्या मार्फत आयोजित केली जाणारी व्याख्याने,ग्रंथ प्रदर्शन, वक्तृत्व, निबंध, काव्यवाचन स्पर्धा या उपक्रमाद्वारे वाचनाभिरुची जोमाने वाढेल.

वाचनसंस्कृती प्रगल्भ होण्यासाठी ग्रंथ समीक्षा मार्गदर्शक ठरत असल्याने ग्रंथ समीक्षा आवर्जून वाचू जावू लागली. जाणकार वाचकांकडून वाङ्मयकृतीबरोबरच पुस्तक परीक्षणे, समीक्षा लेख असे साहित्य वाचले जावू लागले. त्यामुळेच वाचनसंस्कृतीत ग्रंथ समीक्षेला महत्त्व प्राप्त झाले. वाचकांच्या वाङ्मयीन अभिरुचीचा दर्जा एकसारखा असेल असे नाही. प्रत्येकजण आपल्या अभिरुचीच्या उंचीप्रमाणे वाड्.मयकृतीचा आस्वाद घेत असतो.

वाड्मयीन अभिरुची वाढवण्यासाठी आणि टिकवण्यासाठी नियतकालिकांचा वाटा मोठा आहे. तरीही मराठीत वाङ्मयाला वाहिलेली नियतकालिके अत्यंत अल्प प्रमाणात आहेत. वृत्तपत्रातून व साप्ताहिकातून नव्या पुस्तकांवर अत्यंत त्रोटक स्वरूपाचा अभिप्राय छापला जातो. समीक्षकांची संख्या कमी आहे याचा परिणाम पुस्तक समीक्षेवर होतो. सर्वच पुस्तके दर्जाहीन असे नाही पण जी पुस्तके दर्जा टिकवून आहेत, परिसरातील प्रश्न, विसंगत गोष्टी यासंबंधी मांडणी प्राधान्यक्रमाने ज्या कलाकृती मधून होत असते. त्या सर्वांची दखल घेतली जाते असे नाही. अनेक लेखकांना आपल्या पुस्तकांवर समीक्षा छापली जाते का यासंबंधी वाट पाहावी लागते.

समीक्षा ही वाचकसन्मुख असायला हवी. दरवर्षी प्रकाशित होणाऱ्या असंख्य पुस्तकांमधून वाड्मयीनदृष्ट्या मौलिक अशी पुस्तके निवडून त्याचे सौंदर्य उलगडून दाखविणे हे समीक्षेचे मूलभूत काम आहे. व्यक्तिगत संबंध बाजूला ठेवून केलेली चांगल्या पुस्तकांची चांगली पुस्तक परीक्षणे ही वाचकांची गरज आहे.

आज बहुतांश मराठी मुले इंग्रजी माध्यमाच्या शाळेत जातात. इंग्रजी माध्यमाच्या काही अभ्यासक्रमात मराठी भाषाभ्यासाचा समावेश नसतो. त्यामुळे त्यांच्या ठिकाणी मराठी वाङ्मयाविषयी अनभिज्ञता असते. यावर उपाय म्हणून मराठी भाषा आणि मराठी वाङ्मय यांचे शिक्षण देण्याची जबाबदारी शिक्षणसंस्था आणि साहित्यसंस्थांनी घेण्याची गरज आहे. तसेच पुस्तके विकत घेऊन वाचणाऱ्यांची संख्या वाढायला हवी. विकत घेतलेले पुस्तक बहुतेकवेळा वाचलेच जाते.

वाचनाभिरुची शिक्षक या घटकांनी अधिक जपली पाहिजे हे निर्विवाद सत्य आहे. कारण अध्यापन हे वाचन प्रक्रियेवरच अवलंबून असते. अधिक सक्षम, दर्जेदार आणि प्रभावी अध्यापनासाठी वाचन हे आवश्यक आहेच. न वाचणाऱ्या शिक्षकाला समाधानकारक अध्यापन करता येणार नाही. कारण 'अध्यापन हे नवसर्जन असते' असे डॉ. राजन गवस (पृ.३२, मुराळी, जून २०१४) म्हणतात. शिक्षकाचा प्रत्येक तास नवीन काहीतरी देणार असायला हवा. अभ्यासक्रम तोच असला तरी यावर्षीचा तास गेल्या वर्षीच्या तासापेक्षा वेगळा व्हायला हवा. यासंबंधी डॉ. राजन गवस पुढे म्हणतात, 'शिक्षक-अध्यापन यातील वाचनाचे योगदान अधोरेखित करावयास हवे.' (पृ.३२, मुराळी, जून २०१४) वाचन न करणाऱ्या शिक्षकाचा प्रत्येक तास हा एक सारखा साचेबंद आणि रटाळ होत असतो.

वाचनामध्ये पारंपरिक वाचन आणि डिजिटल म्हणजे संगणकीय साधनावर वाचन असे प्रकार पडतात. आज पारंपरिक वाचन जुन्या काळापेक्षा कमी झालेले आहे. वरवरच्या वाचनाबरोबर सखोल वाचनही करता येते. सखोल वाचनासाठी पुस्तके आवश्यक असतात. वाचताना पेन्सिलने खुणा करत, शब्दार्थ शोधत, विचार करत वाचन करणे म्हणजे सखोल वाचन असते. एखादी ललितकृती वाचताना सुद्धा पूर्ण मन त्या कलाकृतीत असण्याबरोबरच वर्णनाने भरलेले परिच्छेद, मागेपुढे त्यातला येणारा संदर्भ, एकेक पान उलगडत पुढे जात असताना पूर्व वाचनातील काही मनात रेंगाळलेल्या गोष्टी, त्या ग्रंथाला हाताचा झालेला स्पर्श या सर्वांतून गांभीर्याने सखोलपणे वाचन होते. कोणताही ज्ञानविषय विकसित होण्यासाठी प्रथम त्या विषयातील सखोल ज्ञान प्राप्त करून घ्यावे लागते.

थोडक्यात, वाचनाभिरुची व्यक्तीगणिक, पिढीगणिक बदलत असली तरी वाचन ही काळाची गरज आहे. वाचनाने ज्ञान वृद्धिंगत तर मन संस्कारित होत जाते. म्हणूनच वाचनाभिरुचीत सातत्य ठेवून वाचनसंस्कृती जोपासणे ही प्रत्येकाची जबाबदारी आहे.

संदर्भ -

- १) कुलकर्णी व. दि., मराठी साहित्य : विमर्श आणि विमर्शक पद्मगंधा प्रकाशन, पुणे २००१.
- २) रसाळ सुधीर, वाङ्.मयीन संस्कृती, मौज प्रकाशन गृह मुंबई २०१०.
- ३) गवस राजन, मुराळी, मे, जून २०१४.
- ४) बेडकिहाळ किशोर, साधना ३० एप्रिल २०१६.

Bridelia scandens Mucilage as a Antibacterial Coating for Grape Fruits

Dr. Alvikar Annapurna R., Dr. Priya Patil

Department of Botany, Vivekanand College Kolhapur, (Autonomous)

(416003), Maharashtra, India

Email: alvikar2112botany@gmail.com

Abstract

The antibacterial potential of the *Bridelia scandens* mucilage is evaluated with bacterial strain of *Bacillus cereus*, *Proteus vulgaris*, *Salmonella typhi* and *Staphylococcus aureus*. *Bridelia scandens* mucilage is extracted ethanolicly and used as a natural coater for grape fruits. *Staphylococcus aureus* bacteria exhibits the strongest antibacterial potential of any natural coater, according to an evaluation of their antibacterial potential. When the natural coater was applied to these grape fruits, their postharvest shelf life was extended. However, because the mucilage of these *Bridelia scandens* contains antibacterial properties, the further deterioration of the fruit during the postharvest period of grape storage helps to maintain the grapes' freshness and shelf life throughout the marketing process. Therefore, applying a mucilage layer of *Bridelia scandens* is advantageous for grape fruit postharvest in the future.

Keywords: Antibacterial Activity, Post Harvest Physiology

Introduction

The very therapeutic plant *Bridelia scandens* L. is a member of the Euphorbiaceae family. It is indigenous to Malaysia and India. This woody shrub can reach a height of 8 meters and has spreading branches. Fruits are tasty, juicy spheres that resemble berries. Compact axillary clusters of tiny greenish-yellow flowers. Bark varies from dark brown to gray; leaves are oblong, 3–12 cm long, bright green, and heavily velvety on both surfaces. Leaves alternate. Edible coatings are applied to a variety of fleshy fruits to increase their shelf life and shield them from external factors. The edible coating prolongs the fresh produce's shelf life and enhances food

quality. It works well to stop microbiological contamination.[1]. One possible strategy to prevent fruit losses during post-harvest handling has been proposed: edible coating technology.[2] Fruits and vegetables with natural polymer coatings have better structural integrity and are shielded from oxidative reactions and moisture loss.[2]

Material and Methods

Antibacterial activities - Preparation of media

One liter of distilled water, five grams of NaCl, twenty-three grams of agar, ten grams of beef extract, and ten grams of peptone were used to make the nutritional agar medium. One milliliter of the bacterial suspension was planted in sterile nutrient agar medium and then added to a petri dish to harden for a period of time that prevented the bacteria from dying from the heat. The agar well diffusion method, as described by [3], was used to determine the antibacterial activity. To examine the antibacterial activity, mucilage aqueous extracts at concentrations of 100 mg/ml, 50 mg/ml, 25 mg/ml, and 12.5 mg/ml were utilized. Four wells of 9 mm were bored on previously seeded nutrient agar plates. Each well was filled with 100 μ l plant extract with various concentrations same procedure was carried out for standard antibiotics Streptomycin and Cephalotoxin (25 μ g/ml) used for this activity. The plates were then incubated at 37°C for 24 hr prior for the observation of inhibition zone (mm). The statistical analysis of the data was carried out by “Analysis of Variance” method of [4].

Post harvest physiology

Raisins were coated using the procedure described in [5]. For 1, 2, 4, 8, and 12 days, the coated fruit was stored at ambient temperature and in a refrigerator at 100 C. The absorbance was measured on the first, fourth, eighth, and twelve days, and the results were utilized to determine the grape berries' post-harvest physiology.

Result and Discussion

Table No. 1 displays the antibacterial potential of *Bridelia scandens* obtained from the fruits of this plant. The zone of inhibition for 100% of the 100 μ g/ml extract concentration is seen to be between 5 and 10 mm, which is marginally lower than the concentrations of the commercial antibiotics streptomycin and cephalotoxin. When *Bridelia scandens* was diluted to 100% and the

ethanol extract of mucilage from different plant parts was added, the pathogenic bacterium *Bacillus cereus* showed a 7.53 mm zone of inhibition. The natural polymer of *Bridelia scandens* mucilage exhibited a zone of inhibition of 12.5 mm for *Proteus vulgaris*, while the zone of inhibition of *Salmonella typhi* was 9.53 mm. Regarding *Staphylococcus aureus*, the mucilage extract from *Bridelia scandens* exhibits 4.53mm, zone of inhibition.

Table No:1 Effect of different concentration of *Bridelia scandens* mucilage on bacterial growth

Sr. No.	Name of Species		Zone of Inhibition (mm)			
			100%	50%	25%	12.50%
1	<i>Bacillus cereus</i>	<i>Bridelia scandens</i>	7.533±0.058	6.467±0.153	6.500±0.100	4.600±0.100
		Streptomycin +ve control	14.553±0.006			
		Cephalotoxin +ve control	7.560±0.010			
2	<i>Proteus vulgaris</i>	<i>Bridelia scandens</i>	12.500±0.100	6.400±0.100	5.367±0.153	5.500±0.100
		Streptomycin +ve control	13.550±0.010			
		Cephalotoxin +ve control	42.553±0.06			
3	<i>Salmonella typhi</i>	<i>Bridelia scandens</i>	9.533±0.058	5.500±0.100	5.500±0.100	2.500±0.100
		Streptomycin +ve control	9.553±0.006			
		Cephalotoxin +ve control	25.560±0.010			
4	<i>Staphylococcus aureus</i>	<i>Bridelia scandens</i>	4.533±0.058	3.50±0.058	3.500±0.100	3.320±0.57
		Streptomycin +ve control	22.540±0.010			
		Cephalotoxin +ve control	38.550±0.010			

Table 1: Effect of different concentration of *Bridelia scandens* mucilage on bacterial growth.

*** All result show significant difference from control both at 5% and 1% level of significance for Streptomycin and Cephalotoxin.

Tables 2 and 3 illustrate the impact of mucilage's natural coating on grape storage after harvest. It has been shown that fresh grape fruits coated with mucilage that are maintained at room temperature and in a refrigerator have better water relations and turgidity than uncontrollably coated fruits. The natural polymer covering greatly increases the water content, relative water content, succulence, and osmotic potential.[6]

Table No: 2 Effect of Mucilage extract coating on Grape berries stored at room temperature.

Treatment EC (mS cm ⁻¹)	<i>Bridelia scandens</i>			
	Control	4	8	12
Water content (% of D.W.)	450	522	573	586
Relative Water Content (%)	65.35	78.01	80.11	89
Succulence	4.08	4.68	6.01	6.87
Osmotic potential	-14.30	-13.68	-13.49	-13.34

Table No: 3 Effect of Mucilage extract coating on Grape berries stored at refrigerator.

Treatment EC (mS cm ⁻¹)	<i>Bridelia scandens</i>			
	Control	4	8	12
Water content (% of D.W.)	358	432	496	545
Relative Water Content (%)	50.69	55.32	68.01	79
Succulence	3.78	4.59	5.72	5.94
Osmotic potential	-13.38	-13.02	-12.46	-12.52

Conclusion

The present study tested the antibacterial potential of mucilage isolated from *Bridelia scandens* (Roxb.). The results showed that mucilage of *Bridelia scandens* exhibited two times higher antibacterial potential against *Proteus vulgaris*. This suggests that mucilage of *Bridelia scandens*

can be used as a natural polymer for tablet coating to protect patients with renal track infections from bacterial infections [7]. *Bridelia scandens* mucilage exhibits excellent antibacterial activity against *Proteus vulgaris*, *Salmonella typhi*, and *Bacillus cereus*.

Therefore, the quality and distribution of the medication will be improved, and the adverse effects of synthetic polymers will be avoided, if this mucilage is utilized for tablet coating or as an emulsifier for antibacterial formulations. Because of the mucilaginous extract of *Bridelia scandens*, the current study showed good efficacy in terms of inhibitory zones against all tested bacterial strains, with this ability being particularly noticeable against *Bacillus cerus*, *Proteus vulgaris*, and *Salmonella typhi*.

References

1. Atik ID., et al. Journal of Thermal Analysis and Calorimetry 94 (2007): 687.
2. Linn Li, and Zhao, B., (2007). Scavenging effect of extracts of green tea and natural antioxidants on active oxygen radicals. *Cell Biochemistry*, **14**, p. 175
3. Linuma, M.; Tsuchiya, H.; Sato, M.; Yokoyama, J.; Ohyama, M.; Ohkawa, Y.; Tanaka, T.; Fujiwara, S. and Fujii, T.(1994). Flavanones with potent antibacterial activity against methicillin-resistant *Staphylococcus aureus*. *J. Pharmacol.*, **46**(11): 892-895.
4. Mungikar, A M (1997), An Introduction to Biometry. *Sarswati Printing Press*, Aurwagabad, India,.
5. Janardhan, K., P. V. Murthy, K. Giriraj and S. Panchakshariah (1975). A rapid method for determination of Osmotic potential of plant sap. *Curr.Sci.*, 44: 390.
6. Kalu VD, Odeniyi MA, Jaiyeoba KT. Matrix properties of a new plant gum in controlled drug delivery. *Pharm. Res.* **30**(7):884-889; 2007.
7. Srinivas, P. and Arun, T. (2012). Antibacterial Activity and Phytochemical Screening of *Mentha arvensis* Linn. against *Proteus mirabilis* from Urinary Tract Infected Patients. *International Journal of PharmTech Research.* **4**(4): 1735- 1744.

Antigenotoxic Potential of Mucilage Extracted from Medicinal Plants

Dr. Alvikar Annapurna R., Dr. Priya Patil

Department of Botany, Vivekanand College Kolhapur, (Autonomous)
(416003), Maharashtra, India

Abstract:

Due to the compounds' affinity for mammalian systems, the *Allium cepa* assay is frequently employed to assess the antigenotoxicity of the substances. Mucilage was extracted from the leaves of *Aegle marmelos* and the fruits of *Bridelia scandens* for this investigation. The antigenotoxic potential of the mucilage at various concentrations was evaluated in comparison to pure water as a negative control and mercuric chloride as a positive control. The *Allium cepa* root tips were treated with mercuric chloride and mucilage aqueous extracts pre-, post-, and simultaneously. Compared to mercuric chloride, it was found that pre-, post-, and simultaneous treatments of the mucilage aqueous extract stimulated the mitotic index. As a result, the mucilage extracts from the fruits of *Bridelia scandens* and the leaves of *Aegle marmelos* have the potential to be antigenotoxic against the chromosomal aberrations in *Allium cepa* caused by mercuric chloride. These extracts can also be safely used as a coating for different kinds of pharmaceutical tablets and as a tool to counteract the genotoxic effects of various hazardous chemicals and environmental pollutants.

Keywords: Fruits of *Bridelia scandens*, Leaves of *Aegle marmelos*, Chromosomal aberration, Mitotic index.

Introduction:

The term "genotoxicity" describes a substance's capacity to harm live cells' DNA, or genetic material. The DNA may undergo structural changes, chromosomal abnormalities, or mutations as a result of this damage. Chemicals, radiation, and some biological agents are examples of genotoxic agents. [1]. In survival scenarios, the impact on *Allium* chromosomal irregularity (CA) could serve as a useful test for the universal detection of genotoxin.[4,5] due to the greater connection of the *Allium cepa* test or experiment with mammalian systems. [4]. Additionally, mixed role oxidases like hepatocytes from mammals are present in the root cells of *A. cepa*, and they can drive promutagens to mutagens. [6]. Herbal remedies have been made from medicinal plants for ages, and these plants have been beneficial in treating and preventing various forms of human inflammation.[2]. In addition to their use in herbal medicine, medicinal plants are a rich source of biologically active compounds, some of which are utilized to make stock modish stimulants [3]. Flavonoids and organosulfur compounds, which are abundant in mucilaginous plants, may be able to counteract or lessen the harmful effects of genotoxic chemicals.

Material and Method:

The leaves of *Aegle marmelos* and the fruits of *Bridelia scandens* were gathered from several areas within the Kolhapur District. The procedure of [7] was followed to extract the mucilage content, and the amount of mucilage recovered was noted. The anti-genotoxic potential of a mucilaginous plant extract was assessed in four distinct trials conducted in identical settings. 30ml of distilled water was used to soak three grams of oven-dried mucilage powder from *Bridelia scandens* fruits and *Aegle marmelos* leaves for a whole day at room temperature (27–30°C). After being filtered via Whatman filter paper, the extract was used as a stock and

Sr. No	Concentration	Continue extract	I	II	III
--------	---------------	------------------	---	----	-----

refrigerated for storage. Onion (*Allium cepa*) bulbs of uniform size were purchased from the nearby market. Nine identically sized commercial bulbs (3–4 g) were utilized for each treatment. Antigenotoxicity of mucilaginous plant extract samples was carried out by using method of [8].

The mitotic index (MI) was determined by using formula,

$$\text{Mitotic index (MI)} = \frac{\text{Number of cells in mitosis}}{\text{Total number of cells analysed}} \times 100$$

Total number of cells analysed

Different chromosomal aberrations were characterized and percent chromosomal appearing frequency with and without extract in cells were calculated.

Result and discussion

In comparison to the positive control, the mitotic index increased before, after, and concurrently with mercuric chloride and mucilage extract treatment (Table No. 1). The effects of 0.5 and 1% mucilage extracts reduced the clastogenic and physiological abnormalities.(Table 2.). *Aegle marmelos* extract lowers physiological and clastogenic aberration in simultaneously treated roots, although pretreatment of *Bridelia scandens* mucilage resulted in a more significant percent suppression of chromosomal aberrations (Table No-3). A growing number of people are looking for and using universal plant items to counteract genotoxic or carcinogenic effects. Usually employed, the antigenotoxic assay can demonstrate the protective effect against reagent and additional material exchanges in the form of hereditary material. [9].

Antigenotoxicity activity

Table No 1. Effect of Pre, Post and Simultaneous treatments of Mercuric chloride and aqueous extracts of fruits of *Bridelia scandens*, Leaves of *Aegle marmelos* on Mitotic index in *Allium cepa*.

1	Negative control			68.18	
2	Posiive control			55.25	
1	0.50%	<i>Brideliascandens</i> (fruits) 75.93	56.84	83.86	80.41
2	1%	70.44	69.07	81.41	81.52
1	0.50%	<i>Aegle marmelos</i> (leaves) 83.19	86.49	92.49	86.32
2	1%	89.93	63.39	85.46	81.03

I-Pre, II-Post and III- Simultaneous treatments.

NC- Negative control (Distilled water)

PC- Positive control (0.75 ppm Mercuric chloride)

Table 2. Effect of Pre, Post and Simultaneous treatments of Mercuric chloride on extracts of fruits of *Bridelia scandens*, Leaves of *Aegle marmelos* on physiological and clastogenic aberrations in root tip cells of *Allium cepa*

	NC	PC	0.5% Treatment				1% Treatment			
			Contine extract	I	II	III	Contine extract	I	II	III
Physiological aberrations (PA) <i>Bridelia scandens</i>										
C-Mito	2	6	4	9	4	3	4	2	4	2
Delayed anaphase	3	3	2	5	-	2	1	4	2	1
Laggards	3	5	3	7	3	2	3	1	3	5
Stickiness	-	5	5	1	13	9	7	5	5	2
Vagrants	-	6	4	-	-	2	2	3	-	1
Total PA	8	25	18	22	20	18	17	15	14	11
Clastogenic aberrations (CA)										
Bridges	2	5	3	3	5	2	4	2	4	2
Rings	1	3	1	2	-	1	1	3	3	1
Breaks	2	9	4	5	3	3	3	4	2	3
Total CA	5	17	8	10	8	6	8	9	9	6
Total abberations	13	42	27	25	19	22	25	22	25	14
Physiological aberrations (PA) <i>Aegle marmelos</i>										

C-Mito	1	4	2	3	5	2	4	1	7	2
Delayed anaphase	2	2	2	2	-	1	1	-	5	3
Laggards	2	3	-	5	4	1	3	4	2	6
Stickiness	-	4	8	4	3	4	-	6	6	4
Vagrants	-	3	1	1	4	1	5	2	5	-
Total PA	5	16	13	15	16	9	13	13	25	15
Clastogenic aberrations (CA)										
Bridges	2	5	3	1	5	2	2	5	4	5
Rings	1	3	1	-	-	-	1	2	2	-
Breaks	2	9	2	6	1	4	2	5	5	1
Total CA	4	17	6	7	6	6	5	12	11	6
Total abberations	13	42	20	25	19	18	21	27	25	33

I-Pre, II-Post and III- Simultaneous treatments.

NC- Negative control (Distilled water)

PC- Positive control (0.75 ppm Mercuric chloride)

Table No-3 Effect of Pre, Post and Simultaneous treatments of ethanolic extracts of fruits of *Bridelia scandens*, Leaves of *Aegle marmelos* on percent inhibition of genotoxicity induced by Mercuric chloride in root tip cells of *Allium cepa*.

Sr No	Types of Abberent cells	NC	PC	0.5%			1%				
<i>Bridelia scandens</i>											
				Continue extract	I	II	III	Continue extract	I	II	III
1	No of cells with (PA)	8	25	18	21	19	17	16	14	13	10
2	PI of PA			41.17	17.64	29.41	41.17	47.05	58.82	64.70	82.35
3	No of cells with (CA)	5	17	9	12	14	18	10	11	7	8
4	PI of CA			66.66	41.66	25	-	58.33	50	83.33	75
5	(PA± CA)	13	42	27	34	34	36	37	26	21	19
6	PI of (PA± CA)			50.62	25.48	24.48	21.68	15.24	52.13	71.31	78.21
<i>Aegle marmelos</i>											
1	No of cells with (PA)	8	25	17	19	18	9	13	13	27	15
2	PI of PA			47.05	35.29	41.17	94.11	70.58	70.58	-	58.82
3	No of cells with (CA)	5	17	12	9	5	8	5	6	13	0

4	PI of CA			41.66	66.66	100	75	100	91.66	33.33	-
5	(PA± CA)	13	42	29	28	23	17	18	19	40	15
6	PI of (PA± CA)			42.82	46.27	60.41	31.27	81.60	80.21	6.89	90.10

I-Pre, II-Post and III- Simultaneous treatments, PI- Percent inhibition, PA-Physiological aberrations, CA- Clastogenic aberrations, $PI = \frac{a-b}{a-c} \times 100$. Where a - number of aberrant cells induced by Positive control, b– number of aberrant cells induced by mucilaginous plant extract and c – number of aberrant cells induced by negative control.

Conclusion

The results of this investigation showed that mucilage pre-, post-, and simultaneous treatments with aqueous extracts increased the mitotic index and decreased clastogenic and physiological abnormalities. This suggests that the mucilage of *Bridelia scandens* fruits and *Aegle marmelos* leaves exhibited antigenotoxic capability against *Allium cepa* mercuric chloride-induced aberration. This may be the result of chromosomal aberration correction. Consequently, mucilage, as a polymer, can be effectively utilized to coat pharmaceutical tablets, ideally for the treatment of cancer. Additionally, this mucilage might be employed as a tool to lessen the genotoxic effects of different dangerous substances and environmental contaminants.

References

1. S. U. Shah, IOSR Journal of Pharmacy and Biological Sciences. Volume 1, Issue 2 (2012) pp 43-54.
2. A. Al-Asmari, A. M. Al-Elaiwi, M. Tariq, A. AlEid and S.M. Al-Asmary, Evid. Based Complementary Altern., (2014) 1-22.
3. Ea. Palombo, ,Evid. Based Complementary Alternat Med., (2011) 1-15.
4. W. Grant, Mutation Research, 99 (1982) 273- 291.
5. D. Feretti, A. Zerbini, C. Ceretti, M. Monarca, Food Additives and Contaminants, 24 (2007) 561-572
6. P. Jaffery and H.S. Rathore, The Internet Journal of Toxicology, 4(1)(2007) 1-12.
7. S. B. Narkhede, G. Vidyasagar, A. G. Jadhav; A. R. Bendale and K. N. Patel, J. Chem.Pharm.Res. 2(6) (2010) 161-16.
8. S. Sharma and P.L. Vig, Scientific Research and Essays, 7(13)(2012) 1385-1392.
9. G. Rani, K. Kaur, R. Wadhwa, S. C. Kaul and A. Nagpal, Food Chem Toxicol 43 (2005) 95-98.

Synergistic effect of micronutrients on development of carbendazim resistance in *Phyllosticta zingiberi*

Ms. Gorule J. M.

Vivekanand College, Kolhapur (Autonomous)

E mail: jyotigorule5@gmail.com

Abstract

Leaf spot disease of ginger caused by, *Phyllosticta zingiberi* leads to heavy reduction in rhizome yield through the destruction of chlorophyllous tissue resulting 13 to 66 percent yield losses. Carbendazim was used to control the disease, but, there was increase in carbendazim resistance in the pathogen. Therefore, agrochemicals like fungicides, insecticides, herbicides, fertilizers, micro-nutrients, salts, antibiotics etc. are used by farmers in the management of Leaf spot of ginger. When these agro-chemicals used in combination can break the resistance or vice-versa. Therefore, synergistic effect of micronutrients on carbendazim resistance in *Phyllosticta zingiberi* were studied both in vitro and in vivo.

Key Words

Ginger, *Phyllosticta zingiber*, Sensitive, Resistant, Agrochemicals, micro-nutrients.

Introduction

Ginger (*Zingiber officinale* Rosc.) (Family: Zingiberaceae) is a herbaceous perennial plant. The rhizomes of ginger plant are used as a spice. India is a leading producer of ginger in the world and during 2012-13 the country produced 7.45 lakh tonnes of the spice from an area of 157839 hectares. Ginger is cultivated in most of the states in India. However, states namely Maharashtra, Karnataka, Orissa, Assam, Meghalaya, Arunachal Pradesh and Gujarat together contribute 65 % to the country's total production.

Ginger is known as sunthi in Ayurveda. It is also indicated in ointment form for local application in pains. It is commonly used to treat various stomach problems, diarrhea and nausea. Ginger is attacked by 24 different diseases caused by fungi, bacteria, viruses and mycoplasma. Among them, soft rot caused by *Pythium aphanidermatum* (Edson), yellows caused by *Fusarium oxysporum* f. sp. *Zingiberi* (Trijillo), bacterial wilt caused by *Pseudomonas solanacearum* (Smith), *Phyllosticta* leaf spot caused by *Phyllosticta zingiberi* (Ramkr.) and storage rot by many pathogenic, saprophytic fungi and bacteria has economic importance because they cause potential losses to ginger production (Dake, 1995). Among them *Phyllosticta* leaf spot caused by *Phyllosticta zingiberi* (Ramkr.) causes major loss to ginger plant (Sood and Dohroo, 2005 and Singh, 2015). It has been also reported in Himachal Pradesh (Sohi et al., 1973), Maharashtra (Kanware, 1974) and Kerala (Anonymous, 1974). Symptoms are observed on leaves as oval to elongate spots that later turn whitish spots surrounded by dark brown margin with yellowish halo (Brahma and Nambiar, 1982). Carbendazim was more effective in reducing the severity of the disease (Singh, 2015). Now-a-days there is increase in fungicide application for the controlling various diseases on plants.

By spraying carbendazim fungicide continuously, causes the fungicide resistance in *Phyllosticta zingiberi*. Therefore, the aim of the present investigation was to examine the synergistic effect of micronutrients on carbendazim resistance in *Phyllosticta zingiberi* in vitro and in vivo.

Material and Method

Synergistic effects of micronutrients on development of carbendazim resistance in *Phyllosticta zingiberi* were studied both in vitro and in vivo. The resistant isolate Pz-11 was selected for this study. Thirteen samples exhibiting leaf spot of ginger were collected from different districts of Maharashtra and their sensitivity to carbendazim was different both in vitro and in vivo. MIC on agar plates ranged from 2 to 9 % while it was 2 to 8 % on ginger plants. From the results of MIC, it was observed that isolate Pz-11 was highly resistant with resistance factor 4, hence synergistic effect of some micronutrients on isolate Pz-11 was carried out.

In vitro studies

For this, different micronutrients (Boron, iron, Manganese and zinc) were mixed in combination (0.1, 0.5 and 1 µg/ml) with carbendazim (8%) to find out their synergistic effect. Resistant isolate (Pz-11) was grown on the medium containing resistant dose of carbendazim (8%). Medium containing carbendazim alone was treated as control. An increase in radial mycelial growth over control was considered as increase in resistance, whereas decrease in growth was considered as decrease in resistance. (Waghmare, 2010).

In vivo studies

For in vivo studies, healthy ginger leaves were used. The micronutrients (Boron, iron, Manganese and zinc) were mixed in combination (0.1, 0.5 and 1 µg/ml) with carbendazim (8%). For this studies, wild resistant isolate Pz11 was selected. The fungicides at different concentrations were mixed with carbendazim having concentration of 8%. These solutions were sprayed on healthy ginger plants. After 24 hrs. 10 ml of mycelial suspension (331×10^{-4} spores/ml) made from actively growing mycelium of *Phyllosticta zingiberi* was inoculated on the ginger plants with sprayer. These plants were covered with polythene bags to maintain the relative humidity and to avoid other contamination. The plants which were sprayed with carbendazim 8% were considered as control. After 10 days of inoculation, results were taken by using 0-4 scale and compared with control.

Table 1:- Synergistic effect of micronutrients on the development of carbendazim resistance in *Phyllosticta zingiberi*. (In vitro)

Sr no.	Micronutrient with Carbendazim (8%)	Concentration of micronutrient (µg/ml)	Radial mycelial growth in mm
1	Zinc	0.1	9.00
		0.5	10.33
		1	12.33
2	Manganese	0.1	9.67

		0.5	9.33
		1	8.67
3	Boron	0.1	9.33
		0.5	10.00
		1	11.67
4	Iron	0.1	9.00
		0.5	8.33
		1	8.00
5	Carbendazim 8% alone		8.33

Fig. 1:- Synergistic effect of micronutrients on the development of carbendazim resistance in *Phyllosticta zingiberi*. (In vitro)

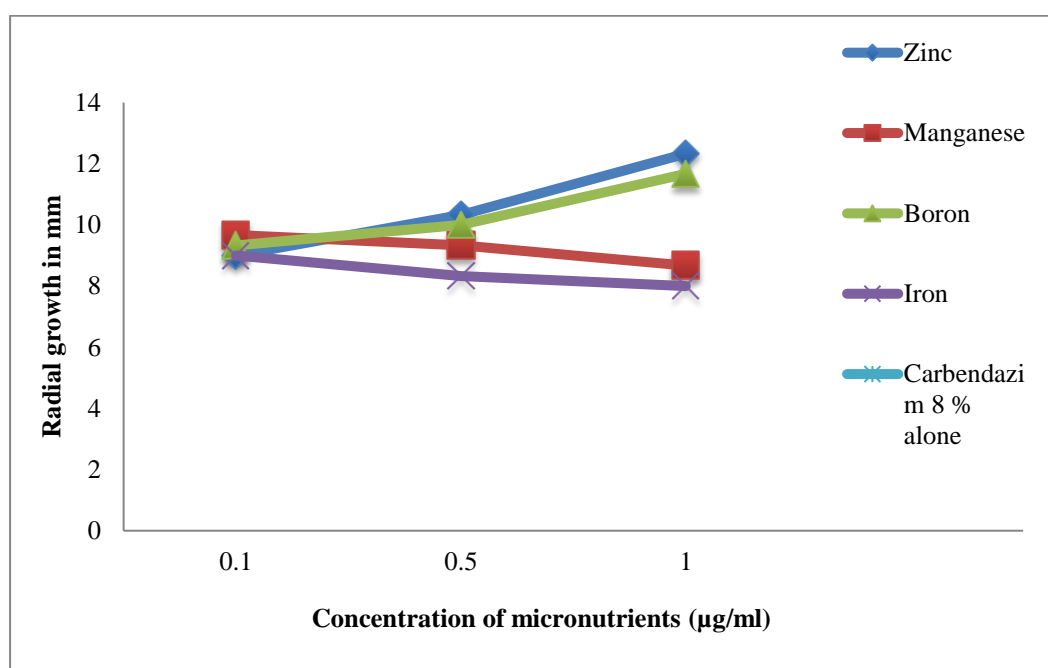


Table 2:- Synergistic effect of micronutrients on the development of carbendazim resistance in *Phyllosticta zingiberi*. (In vivo)

Sr. No.	Micronutrient with Carbendazim (8%)	Concentration of micronutrient (µg/ml)	Percentage of infection
1	Zinc	0.1	0
		0.5	1
		1	1
2	Manganese	0.1	0
		0.5	0
		1	0
3	Boron	0.1	0
		0.5	0
		1	1
4	Iron	0.1	0

		0.5	0
		1	0
5	Carbendazim 8% alone		0

Fig. 2:- Synergistic effect of micronutrients on the development of carbendazim resistance in *Phyllosticta zingiberi*. (In vivo)

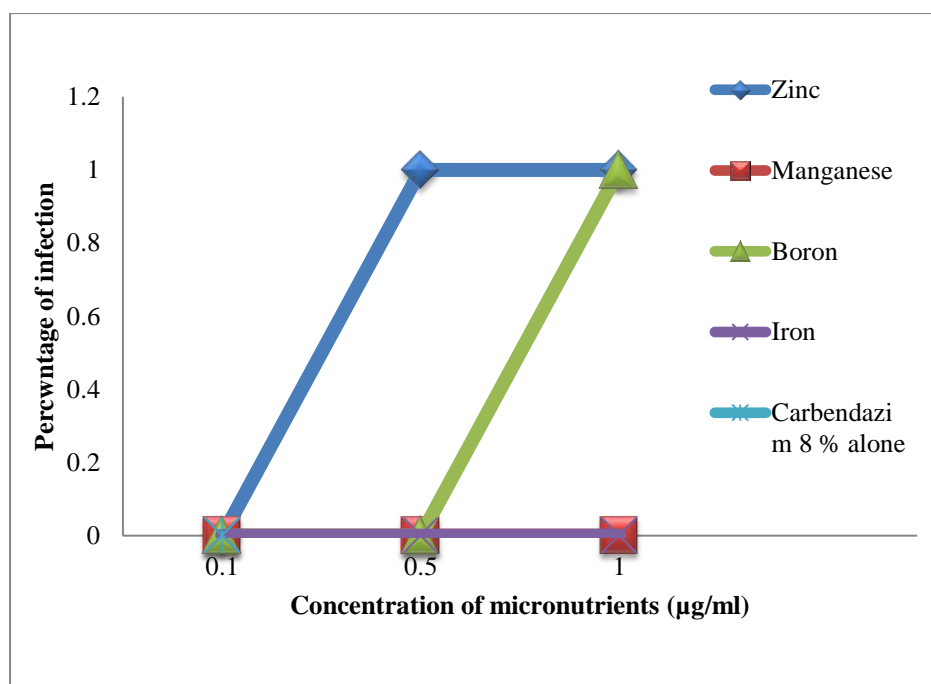


Table 3:- Percentage control efficacy (PCE) of micronutrient mixture in controlling the *Phyllosticta zingiberi*. (In vitro and In vivo)

Sr. No.	Micronutrient with Carbendazim (8%)	Concentration of micronutrient (µg/ml)	PCE in vitro	PCE in vivo
1	Zinc	0.1	90	100
		0.5	88.52	99
		1	86.3	99
2	Manganese	0.1	89.25	100
		0.5	89.63	100
		1	90.36	100
3	Boron	0.1	89.63	100
		0.5	88.88	100
		1	87.03	99
4	Iron	0.1	90	100
		0.5	90.74	100
		1	91.11	100
5	Carbendazim 8% alone		90.74	100

Results and discussion

Synergistic effect of micronutrients on the development of carbendazim resistance in *Phyllosticta zingiberi* was studied in both in vitro and in vivo. In case of micronutrients like zinc and boron, as the concentration increases the growth of pathogen increases and in case of iron, manganese as the concentration increases the growth of pathogen decreases.

According to Desai (2017), the growth of *Fusarium udum* causing wilt of pigeon pea was inhibited by benomyl when used in mixture with other micronutrients like Mg, Mn and Bo. The growth of fungicide resistant *Aspergillus flavus* was inhibited by using micronutrients in mixture with carbendazim (Gangavane and Reddy, 1987). *Macrophomina phaseolina* causing charcoal rot of potato inhibited by using carbendanzim with muriate of potash, Co, Bo, Zn and Mb (Kamble, 1991). According to Dalavi (2016), ridomil with micronutrients (boron, zinc, maganese and ferrous) reduced development of ridomil resistance in *Rhizopus artocapi* causing fruit rot of jackfruit.

Many workers reported same results in case of different pathogen both in vitro and in vivo (Bhale, 2002; Wadikar 2002; Telmore,2004; Patil, 2010; Jagtap, 2011; Ramteke, 2011; Waghmare, 2011, Mishrakoti, 2015 and Andoji, 2016).

Acknowledgement

We are highly thankful to Dr. R. R. Kumbhar Sir, Principal of Vivekanand College, Kolhapur (Empowered Autonomous) for encouragement during this research work. We are also thankful to all the Teaching and nonteaching staff of Vivekanand College, Kolhapur (Empowered Autonomous) for helping during entire research work.

References

- Andoji, Y. S. (2016) Management of chickpea root rot, Ph.d. Thesis, Shivaji University, Kolhapur.
- Anonymous (1974). Annual Report, Central Plantation Crops Research Institute, Kasargod India P. 183.
- Bhale, U. N. (2002). Studies on management of some important diseases of spinach in Maharashtra. Ph.D. Thesis, Dr. Babasaheb Ambedkar Marathawada University, Aurangabad.
- Brahma, R. N. and K. K. N. Nambiar, (1982): Survival of *Phyllosticta zingiberi* Ramakr., causal agent of leaf spot disease of ginger. In: Nair M. K., Premkumar t., Ravindra P. N.and Sarma Y. R. (Eds).
- Dake, G. N. (1995). Diseases of ginger (*Zingiber officinale* Rosce.) and their management, *Journal of Spices & Aromatic Crops* 4 (J): 40-48, 1995.
- Desai U. A. (2017). Studies on Fungicide Resistance in Pigeon pea Wilt. (Thesis Submitted to Shivaji University, Kolhapur)
- Gangawane, L. V. and Reddy, B. R. C. (1987). Development and management of carbendazim resistance in *Aspergillus flavus*. *Indian Phytopathology*. 40(2): 297.
- Jagtap, A. A. (2011). Studies on Rhizome rot of Turmeric, Ph.D. Thesis, Shivaji University, Kolhapur.
- Kanware, H. T. (1974). Studies on leaf spot of ginger caused by *Phyllosticta zingiberi*. M.Sc. Thesis, Punjab Rao Krishi Vidyapeeth, Akola P. 53.

- Mishrakoti, M. S. (2015). Studies on leaf blight management of Carrot, Ph.d. Thesis, Shivaji University, Kolhapur.
- Patil, V. B. (2010). Studies on management of charcoal rot of sweet potato. Ph. D. Thesis, Shivaji University, Kolhapur.
- Ramkrishnan, T. S. (1941): A leaf spot disease of *Zingiber officinale* caused by *Phyllosticta zingiberi* N. SP., Proceedings of the Indian Academy of Sciences - Section B.15(4), pp 167-171.
- Ramteke, P. K. (2011). Studies on management of rhizome rot of ginger, Ph.D Thesis, Shivaji University, Kolhapur.
- Sarma, Y. R., Anandaraj, M. and Venugopal, M. N. (1994). Diseases of Spice Crops. In: Advance in Horticulture - Plantation and Spice Crops, Part 2. (K.L. Chadha and P. Rethinam, eds.) Malhotra Publishing House, New Delhi, 10: 1015-1057.
- Singh, R. S. (2015). Efficacy of fungicides for the control of leaf spot disease of ginger under the field conditions of Chhattisgarh (India), African journal of Agricultural Research, Vol. 10(11), pp. 1301-1305.
- Sood, R. and Dohroo, N.P. (2005). Epidemiology and management of leaf spot of ginger in Himachal Pradesh. Indian Phytopathology. 58: 282-288.
- Sohi, H. S., Sharma, S. L., Varma, B. R. (1973). Chemical control of *Phyllosticta* leaf spot of ginger (*Zingiber officinale*). Pesticides 7:21- 22.
- Telmore, K. M. (2004). Studies on management of some important diseases of Betelvine. Ph. D. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M. S.).
- Waghmare, M. B., Waghmare, R. M. and Kamble, S. S. (2010). Effect of different carbon and nitrogen sources on growth of *Botrytis cinerea* causing leaf blight of rose. Bioinfolet, 7 (3): 222-224.
- Waghmare, M. B. (2010). Studies on management of some important diseases of rose. Ph. D Thesis, Shivaji University, Kolhapur.
- Wadikar, M. S. (2002). Studies on charcoal rot management of Pigeon pea. Ph. D. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- Kamble, S. S. (1991). Studies on fungicide resistance in late blight and charcoal rot of potato. Ph.D. Thesis, Marathwada University, Aurangabad.
- Dalavi, R. B. (2016). Studies on management of fruit rot of jackfruit, Ph.d. Thesis, Shivaji University, Kolhapur.

Physiology of Sensitive Isolate of *Fusarium udum*, Causal Organism of Wilt of Pigeon Pea

Mr. Desai Udaysingh Arjun

Vivekanand College, Kolhapur (Autonomous)

desaiudaysingh@gmail.com

Abstract:

Effect of various sources of carbon, nitrogen, phosphorus, sulphate, salts, micronutrients, vitamins and amino acids on the growth of *Fusarium udum* was carried out by incorporating them in Czapek Dox Agar medium. Sensitive isolate of *Fusarium udum* which was determined by taking the sensitivity test of *Fusarium udum* collected from various localities of Maharashtra and Karnataka were selected for this experiment. Plates without any source served as control.

Key words: Amino acids, Czapek Dox Agar medium, carbon, *Fusarium udum*, micronutrients, nitrogen, phosphorus, sulphate, salts, vitamins.

Introduction

Pigeon pea (*Cajanus cajan* (L.) Huth.) is a leguminous crop that belongs to the family Fabaceae and is widely grown in tropical and subtropical regions of the world, such as Madagascar, India, Myanmar, Philippines, and Australia. It is a major source of protein, amino acids, and vitamin B for human consumption and also improves soil fertility by fixing atmospheric nitrogen. However, pigeon pea production is threatened by various biotic stresses, especially the wilt disease caused by the fungus *Fusarium udum* Butler. This fungus belongs to a large and diverse group of ascomycetes that are responsible for severe losses in yield, quality, and quantity of many crops, including cereals, vegetables, ornamentals, and trees. Some *Fusarium* species also produce toxic metabolites called trichothecenes that can cause health problems in humans and animals. In this paper, we aim to review the current status of *Fusarium* wilt of pigeon pea, its epidemiology, management, and future prospects. We also discuss the molecular and genetic aspects of the interaction between *Fusarium* and pigeon pea, as well as the potential applications of biotechnology and genomics for improving the resistance of this crop.

Fusarium wilt of pigeon pea is one of the oldest and most destructive diseases of this crop, first reported by Butler in 1906 from Bihar State of India. The disease occurs in all the major pigeon pea-growing areas of the world, such as India, Myanmar, Malawi, Tanzania, Kenya, and Australia. The disease can cause up to 100% yield loss, depending on the stage of infection, environmental conditions, and cultivar susceptibility. The pathogen is soilborne and enters the plant through the roots, colonizes the xylem vessels, and interferes with the water and nutrient transport, leading to wilting, yellowing, and drying of leaves, followed by death of the whole plant. The pathogen can survive in the soil for several years as chlamydospores, which are resistant to adverse conditions. The disease is favoured by high soil moisture, high soil temperature, and low soil pH.

The management of *Fusarium* wilt of pigeon pea is challenging due to the soilborne nature of the pathogen and the lack of effective chemical and biological control agents. The

most promising and sustainable strategy is the development and cultivation of resistant cultivars, which can reduce the disease incidence and severity, as well as the inoculum density in the soil. Several sources of resistance have been identified and used in breeding programs, and some resistant cultivars have been released for commercial cultivation. However, the resistance is often influenced by environmental factors, such as temperature and soil moisture, and may break down due to the emergence of new races or strains of the pathogen. Therefore, there is a need to understand the genetic basis and molecular mechanisms of resistance, as well as the variability and evolution of the pathogen, to develop durable and broad-spectrum resistance in pigeon pea.

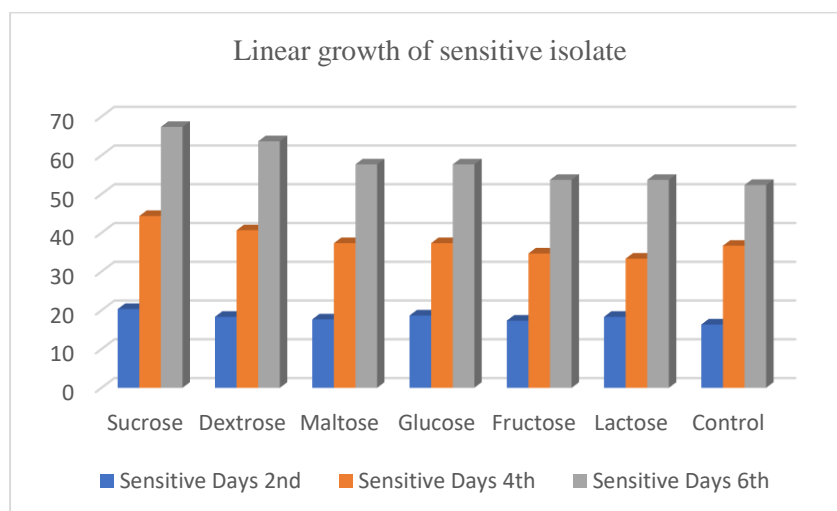
Recent advances in biotechnology and genomics have provided new tools and opportunities for enhancing the resistance of pigeon pea to *Fusarium* wilt. Molecular markers, such as simple sequence repeats (SSRs), single nucleotide polymorphisms (SNPs), and diversity arrays technology (DArT), have been used to map quantitative trait loci (QTLs) and genes associated with resistance, as well as to assess the genetic diversity and population structure of both the host and the pathogen. Transcriptome analysis, such as RNA sequencing (RNA-seq) and microarray, have been used to identify differentially expressed genes and pathways involved in the response of pigeon pea to *Fusarium* infection, as well as to discover candidate genes and molecular markers for resistance. Genetic engineering, such as CRISPR-Cas9 and RNA interference (RNAi), have been used to modify or silence target genes related to resistance or susceptibility, as well as to introduce novel genes from other sources that can confer resistance to *Fusarium*. These approaches have the potential to accelerate the development of improved pigeon pea cultivars with enhanced and stable resistance to *Fusarium* wilt.

Material and Methods

Fifteen isolates of *Fusarium udum* were obtained from symptomatic pigeon pea plants collected from Kolhapur and Sangli districts in Maharashtra, and Dharwad, Vijapura, and Belagavi districts in Karnataka, India. Infected plant material was transported to the laboratory in sealed polyethylene bags and aseptically processed. Stem, root, and leaf segments (0.5-1.0 cm) were excised from symptomatic regions, surface sterilized with 70% ethanol for 30 sec followed by 0.1% HgCl₂ for 1 min, rinsed in sterile distilled water, and plated on Czapek Dox agar (CDA) supplemented with 25 mg/L streptomycin. Plates were incubated at 25±2°C for 6 days and monitored for fungal emergence from plant tissues. White, cottony mycelial growth, observed after 5-6 days, was presumptively identified as *F. udum* based on visual morphology and microscopic characteristics. Single-spore isolation confirmed pure cultures of *F. udum*. Fungicidal sensitivity of *F. udum* was assessed using the Food Poisoning Technique (Dekker and Gielink, 1979) with various concentrations of benomyl, a systemic benzimidazole fungicide. Benomyl stock solution (1000 µg/mL) was diluted in sterile distilled water, mixed 1:1 with autoclaved CDA, and dispensed into Petri plates. Mycelial discs (8 mm diameter) from actively growing cultures were transferred onto benomyl-amended CDA and control plates lacking benomyl. Plates were incubated at 28-30°C in darkness, and radial growth was measured at regular intervals. The experiment was performed in triplicate. Following determination of the minimum inhibitory concentration (MIC) of benomyl, its impact on resistance development was evaluated in vitro under continuous, alternate, and mixed exposure regimes using different fungicides.

Result and Discussion: Carbohydrate nutrition

Different carbohydrate sources like sucrose, fructose, dextrose, maltose, lactose and glucose were amended in Czapek Dox agar at 3% and the linear mycelial growth of the sensitive isolate Fu – 1, was recorded. Observations showed that sugars are very much necessary for the growth of sensitive isolates. There was maximum increase in the growth of the isolates over the control. It was found that the sensitive isolate's growth rate was average in comparison to control. The sensitive showed a very good rate of growth on sucrose then followed by dextrose, maltose, glucose, fructose and lactose.

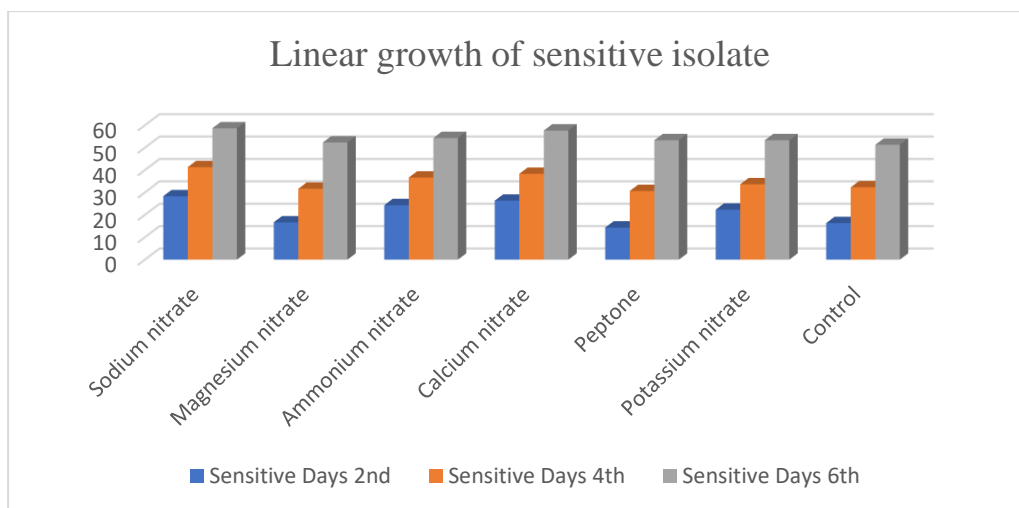


Graph1. Effect of Different carbon sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Nitrogen nutrition

To examine the impact of nitrogen on the growth of *Fusarium udum*'s sensitive isolate Fu-1, a variety of nitrogen sources were employed. Various nitrogen sources, including peptone and nitrates of ammonium, potassium, sodium, magnesium, and calcium, were used at 0.2 percent.

Variations in the development of sensitive isolates were noted across and among different nitrogen sources and incubation periods. When compared to the control isolate, the resistant isolate Fu-1's radial mycelial development was shown to be good. On the sensitive isolate Fu-1, sodium nitrate had the highest growth among the nitrogen sources supplied, followed by calcium nitrate, ammonium nitrate, potassium nitrate, magnesium nitrate, and peptone.

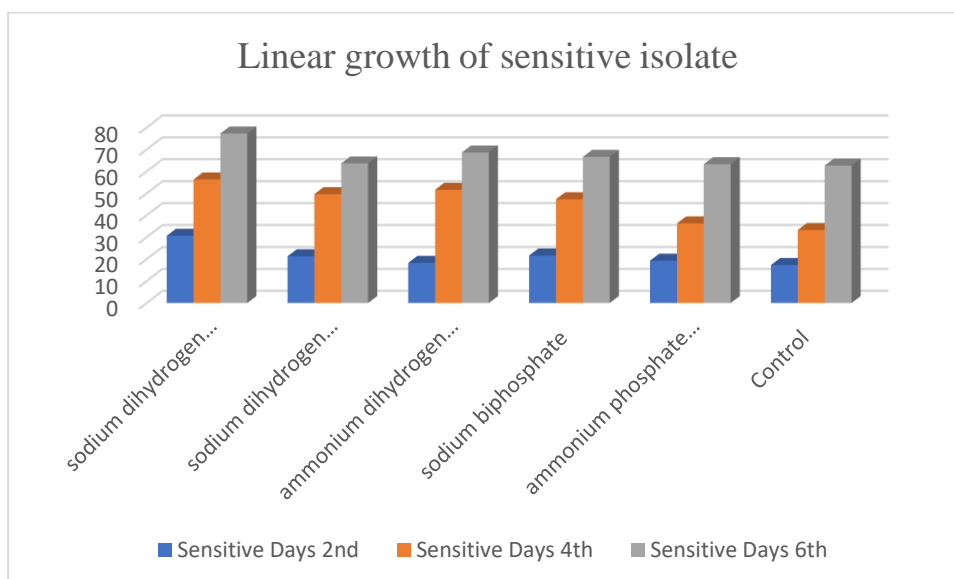


Graph 2: Effect of Different Nitrogen sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Phosphate nutrition

Various phosphate sources were utilised to check the effect on the development of sensitive isolate Fu- 1 of *Fusarium udum*. Different phosphate sources like ammonium phosphate dibasic, sodium dihydrogen phosphate, ammonium dihydrogen orthophosphate, sodium dihydrogen orthophosphate and sodium biphosphate were utilised in the study at 0.1%. The radial mycelial growth of sensitive isolate Fu – 1 was found to be good in comparison with the control isolate.

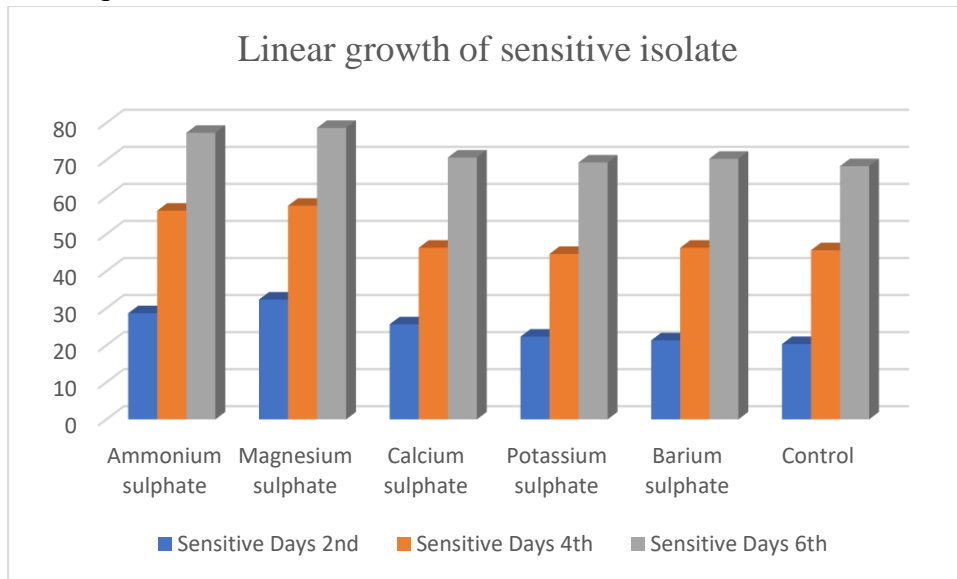
Significant variation was observed on the growth of *Fusarium udum* isolate at different periods of incubation and between various phosphate sources. A good response of growth was achieved on sodium dihydrogen phosphate followed by sodium dihydrogen orthophosphate, sodium biphosphate, ammonium dihydrogen orthophosphate and ammonium phosphate dibasic.



Graph 3: Effect of Different Phosphate sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Sulphate nutrition

The effect of how, various sulphate nutrition affects the growth of sensitive isolate Fu- 1 studied by amending different sulphate sources in Czapek Dox agar at 0.05 %. Various sulphate sources like calcium sulphate, magnesium sulphate, iron sulphate, ammonium sulphate, barium sulphate, potassium sulphate and zinc sulphate were utilised. It was seen that there was a significant difference in the development of sensitive isolate Fu- 1 of *Fusarium udum*. The growth of sensitive isolate Fu- 1 was found to be good compared to the control isolate of *Fusarium udum*. It was seen that magnesium sulphate helped in good development followed by ammonium sulphate, calcium sulphate, magnesium sulphate, potassium sulphate and barium sulphate.

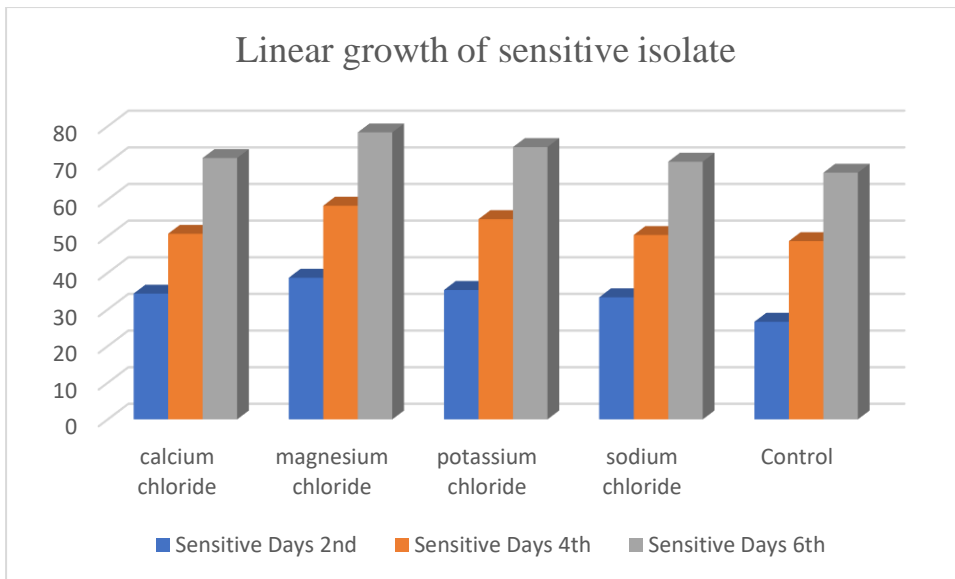


Graph 4: Effect of Different Sulphate sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Effect of salts

In total 4 different salts were selected to see the effect on sensitive isolates of *Fusarium udum*. For the study sodium chloride, calcium chloride, potassium chloride and magnesium chloride were used. They were incorporated at 0.05 % in Czapek Dox agar medium. Magnesium chloride was found to inhibit the growth of the isolates.

Growth of found to be normal as usual. It was found that mixture of benomyl along with calcium chloride proved to provide good growth in the sensitive isolate of *Fusarium udum* followed by sodium chloride, potassium chloride and magnesium chloride.

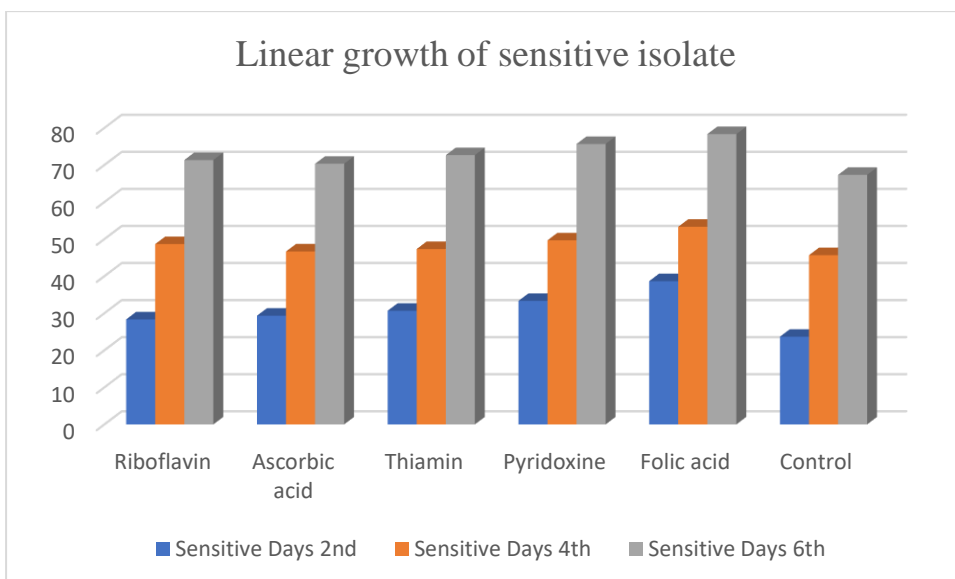


Graph 5: Effect of different salt sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Vitamin nutrition

Effect of vitamins was tested on the growth of the sensitive isolate Fu- 1. It was mixed in Czapek Dox agar medium at 0.01 %. It was observed that there was a significant difference on the growth of and sensitive isolate in the incubation period. On the contrary an insignificant variation in the growth was observed in case of vitamins in both isolates. Growth of sensitive isolate was normal as compared to the control plate. Plate without any source of vitamin was served as control.

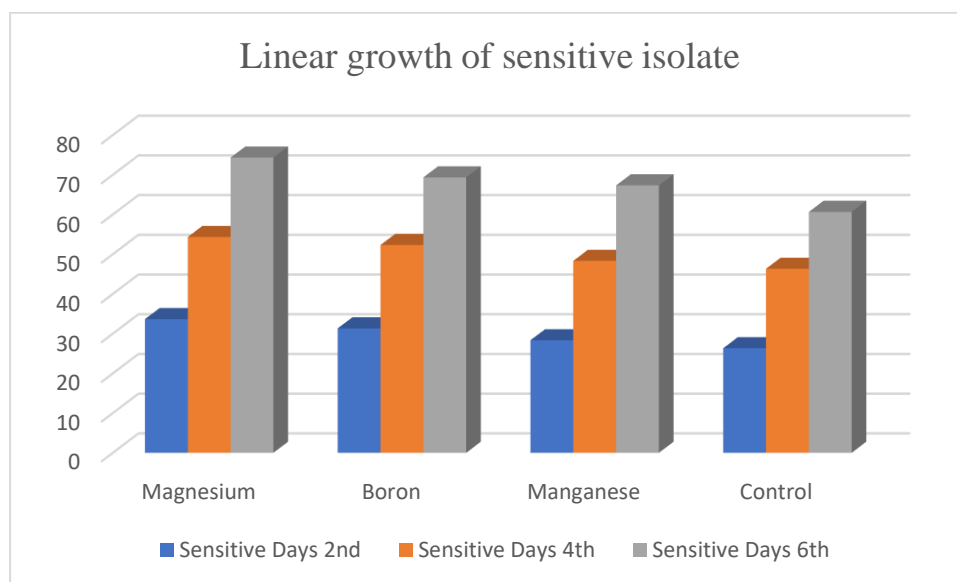
Various vitamins used during the study were riboflavin, ascorbic acid, thiamin, pyridoxine and folic acid. Among all vitamin sources used, ascorbic acid showed a good growth in both the isolates.



Graph 6: Effect of different vitamin sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Effect of Micronutrients

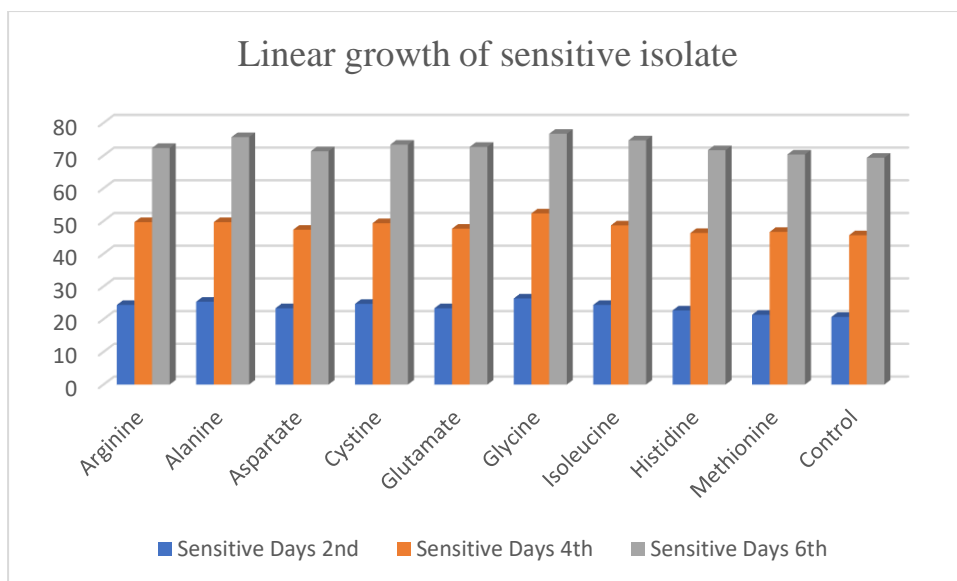
Effect of different micronutrients was tested on the growth of the sensitive isolate Fu- 1. It was mixed in Czapek Dox agar medium at 0.01 %. Magnesium, boron and manganese were used to study the effect when amended with Czapek Dox agar medium. Growth of sensitive isolate was observed to be good. Plate without any source of micronutrient was served as control. Magnesium source proved to be good for growth of both the isolates. Manganese and boron inhibited the growth of the sensitive fungal isolate.



Graph 7: Effect of different micronutrient sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Amino acid nutrition

Various amino acid nutrition were utilised for the study viz. Arginine, Alanine, Aspartate, Cystine, Glutamate, Glycine, Isoleucine, Histidine and Methionine. A significant variation in the growth was observed in sensitive isolate Fu- 1. It was mixed in Czapek Dox agar medium at 0.02 %. Growth of sensitive isolate good. Plate without any source of amino acid nutrition was served as control. It was interesting to note that almost all the amino acid nutrition showed a good growth of the isolates only methionine showed certain amount of inhibition.



Graph 8: Effect of different amino acid sources on the linear growth (mm) of *Fusarium udum* sensitive isolate on Czapek Dox agar.

Conclusion

A variety of agrochemicals, including fungicides, herbicides, insecticides, antibiotics, micronutrients, salts, fertilisers, and others, that farmers employ were suggested for investigation on their ability to combat wilt. Because of the possibility that these agricultural chemicals could affect the fungus's ability to develop Benomyl resistance, both in vitro and in vivo studies were carried out.

The aforementioned sources demonstrate differing outcomes when treating the *Fusarium udum* sensitive isolate, or F-1 in this instance. These sources either directly or indirectly raise the pathogen's resistance.

Acknowledgement:

The authors are thankful to Prof. Dr. R. R. Kumbhar, Principal Vivekanand college, (autonomous), Kolhapur for providing necessary facilities to perform the experiment. The authors are also thankful the non - teaching staff of department of botany Vivekanand college, (autonomous) Kolhapur for moral support.

References:

Biochemical and molecular evaluation of pigeon pea against *Fusarium* wilt
<https://link.springer.com/article/10.1007/s42360-021-00449-6>.

Management of *Fusarium udum* Causing Wilt of Pigeon Pea.
https://link.springer.com/chapter/10.1007/978-3-030-35947-8_11.

Diseases of pigeon pea ~ Plant diseases identification.
<https://www.plantsdiseases.com/p/diseases-of-pigeon-pea.html>.

Fusarium Wilts of Chickpea, Pigeon Pea and Lentil and Their ... - Springer.
https://link.springer.com/chapter/10.1007/978-981-32-9084-6_3.

Fusarium Wilt of Peas - Maine Organic Farmers and Gardeners.
<https://www.mofga.org/resources/plant-diseases/fusarium-wilt-of-peas/>.

Anonymous. (2010). Agriculture statistics at a glance, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, New Delhi, 108-109.

- Reddy, M. V. Nene, Y. L., Kannaiyan, J. Raju, T. N. Saka, V. N. Davor, A. T. Songa, W. P and. Omanga, P.** (1993). "Pigeonpea lines resistant to wilt in Kenya and Malawi", *International Pigeonpea News letter*, Vol 6, 1990, p. 34.
- Phatak, S. C., Nadimpalli, R. G., Tiwari S. C. and. Bharadwaj. H. L** (1993). Pigeon peas: potential new crop for the southeastern United States. In: Janick J. and Simon J. E, editors, *New Crops*. Wiley, Newyork. p. 597-599. <http://hort.purdue.edu/newcrop/proceedings1993/v2-597.html> (accessed 24 July 2012).
- Kannaiyan, J., Nene. Y. L and Raju, T. N.** (1985). Host Specificity of pigeonpea wilt pathogen *Fusarium udum*. *Indian Phytopath.* 38: 553.
- Nelson PE, Toussoun TA, and Marasas WFO** (1983) *Fusarium species: an illustrated manual for identification*. The Pennsylvania State University Press, University Park
- J. F. Leslie, B.A. Summerell (2006)**. *Fusarium laboratory workshops- A recent history* Mycotoxin Research Vol. 22, No. 2, 73-74.
- Mali A M, Patil V B, Ade A B, Chavan N S And Kamble S S** (2015) First Report Of *Fusarium* Sp. FIESC_17 On *Cucumis trigonus* In India. *Plant Disease*. 10.1094/PDIS-09-14-0881-PDN. <http://dx.doi.org/10.1094/PDIS-09-14-0881-PDN>.
- White D. G.** (1980). *Compendium of corn diseases*. APS, St. Paul, Minnesota.
- Parry, D., Jenkinson, P., McLeod, L.** (1995) *Fusarium ear blight (scab) in small grain cereals—a review*. *Plant pathology* 44:207-238.
- R. F. Nyvall, J. A. Percich and C. J. Mirocha.** (1999). *Fusarium head blight of cultivated and natural wild rice (Zizania palustris) in Minnesota caused by Fusarium graminearum and associated Fusarium spp.* *Plant Disease* 83: 159-164.
- R. S. GOSWAMI, H. C KISTLER** (1994): Heading for disaster: *Fusarium graminearum* on cereal crops. *Mol. Plant Path* Vol 5, 2004, 515-525.
- J. M. Kraft, D. W. Burke and W. A. Haglund.** (1981). *Fusarium diseases of beans, peas and lentils*. In: *Fusarium: Diseases, Biology and Taxonomy* (eds. Nelson PE, Toussoun TA and Cook RJ). The Pennsylvania State University Press, University Park: 142-156
- R. G. Linderman.** (1981). *Fusarium diseases of flowering bulb crops*. In *Fusarium: Diseases, Biology and Taxonomy* (eds. Nelson PE, Toussoun TA and Cook R J). The Pennsylvania State University Press, University Park: 129-141.
- W.J. Bloomberg.** (1981). *Diseases caused by Fusarium in forest nurseries*. In: *Fusarium: Diseases, Biology and Taxonomy* (eds. Nelson PE, Toussoun TA and Cook R J). The Pennsylvania State University Press, University Park: 178-187.
- L. D. Dwinell, E.G. Kuhlman and G.M. Blakeslee** (1981). *Pitch cancer of southern pines*. In: *Fusarium: Diseases, Biology and Taxonomy* (eds. Nelson PE, Toussoun TA and Cook R J). The Pennsylvania State University Press, University Park: 188-194
- L. D. Dwinell, S.W. Fraedrich and D. Adams.** (2001). *Diseases of pines caused by the pitch canker fungus*. In: *Fusarium: Paul E. Nelson Memorial Symposium* (eds. B.A. Summerell, J.F. Leslie, D. Backhouse, W.L. Bryden and L.W. Burgess). APS Press, St.Paul, Minnesota: 225-232.
- M. J. Wingfield, A. Hammerbacher, R. J. Ganley, E. T. Steenkamp, T. R. Gordon, B. D. Wingfield and T. A.Coutinho** (2008). *Pitch canker caused by Fusarium circinatum - a growing threat to pine plantations and forests worldwide*. *Australasian*.

Dekker, J. and Gielink, A. J. (1979). Acquired resistance to pimaricin in *Cladosporium* f. sp. *Narcissi* associated with decreased virulence. *Neth. J. Pl. Pathol.* 85: 67-73

Morphological, structural and Physico-chemical properties of starch extracted from Banana pseudo stem: A Novel Starch

Priya D. Patil, Dr. Annapurna Alvikar

Department of Botany, Vivekanand College, Kolhapur (Autonomous)

Abstract: The objective of the current study is to separate the starch from banana pseudostem of kokan local variety *Velachi* and characterize the isolated starch in order to investigate their functional qualities, granule morphology, crystalline pattern, amylose content and physical as well as chemical compositions. For characterization, a variety of methods were employed, including scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy (FT-IR). The amylose concentration of the banana pseudo-stem starch was determined to be 11.94 g/100g. According to SEM measurements, banana pseudo-stem starch had smooth surfaces and uniform, elongated, circular ridges between 15 to 65 μm in length. According to the data gathered from this study, the kokan local banana pseudo-stem isolated starch has a variety of applications, particularly in the food, drug, and cosmetics industries where they can be utilized as thickeners, edible coatings, fat substitutes, and other similar applications. Additionally, functional foods containing banana starch may be suggested for those with diabetes.

Keywords: Banana, Pseudo-stem, starch, food, amylose

Introduction:

The banana (*Musa paradisiaca* L.) is one of the important tropical fruit crops. India ranks second in banana production in the world, occupying about 3, 25858 ha. area under cultivation (Anonymous, 1992). The majority of the solid ingredients in grains and tubers are starch, which is found in nature as food that has been stored in the tissues of higher plants. Throughout the world, food grains, tubers and roots and sago are frequently utilized as raw materials for the production of starch. The interior soft core of banana is eaten as a cooked vegetable, and the stems are used to make fiber ropes and low-quality paper to some extent, but no significant industrial use for the stem has yet to be documented. The production of starch in this country has greatly decreased. Because there is a potential market for starch in the country, the novel starch - banana pseudo stem starch can be utilized advantageously to execute starch production.

When the plant reaches its maximum height, the lower portion of the midrib undergoes alteration, causing the tightly packed leaf sheaths that make up the pseudostem of a banana to thicken. It began at the onset of the reproductive organs formation. A delicate core that resembles a tube is located in the center of the pseudostem (Figure 1) with a diameter of roughly 5–6 cm.

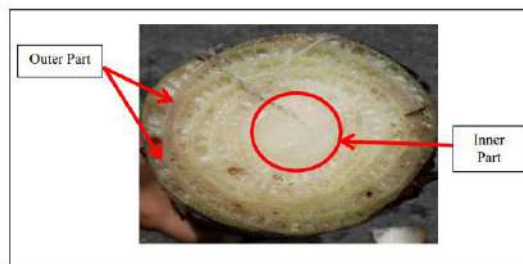


Figure 1: Cross section of Banana Pseudo-stem

Raw material commonly used for the manufacture of starch in different parts of world is: food grain (maize, wheat, jowar) tubers and roots (potato, sweet potato, tapioca) and sago. In countries suffering from shortage of food, the availability of these materials for starch manufacture is limited. The starch is present in the form of granules and can be demonstrated by pouring iodine solution over the cut stem. Banana stem is used to some extent in the preparation of fibre ropes and cheap quality paper, and the inner soft core is consumed as a cooked vegetable, but no important industrial use of the stem has so far been reported. The production of starch in this country has greatly decreased. Thus, the new starch, viz.: Banana stem starch can be used with advantages for implementing the production of starch in this country for which there is potential demand.

After harvesting the fruit, the felled plant is generally allowed to rot in the field. The stem is used to some extent in the preparation of fibre ropes and cheap quality paper, and the inner soft core is consumed as a cooked vegetable, but no important industrial use of the stem has so far been reported. The estimated output capacity of all the starch factories located in the country is about 73,000 tons per annum, but it is reported that these factories could hardly produce 1350 tons in 1947 and 3599 tons in 1998. This was because of the irregular supplies of maize, which occurred due to food shortage in the country and also its poor quality of as obtained by the manufactures. As a result, in comparison to the real demand, the production has been extremely low. This has led to the enormous increase in the imports of starch from foreign source from 1946- 47 onwards. According to figures available in seaborne trade for the year 1948-49, total quantity import of all starches amounted to about 8,76,000 cwts i.e. about 43,800 tons (Gholap *et al.*, 2011).

Though several researches are available where isolation of starch from banana and their functional properties were investigated but there is very few reports are available on isolation of starch from banana pseudo-stem starch and their potential use. Therefore, the present investigation is aimed to accomplish isolation of starch from banana pseudo-stem from Konkan variety 'Velachi' and to characterize isolated starch with their physico-chemical and micro-structural properties.

Material and Methods:

Sample Collection: Locally cultivated banana pseudo-stems were collected from Konkan region of Maharashtra.

Preparation of a sample: Banana Pseudo-stems with higher initial moisture content were selected. The whole pseudo-stem was cut into longitudinal pieces, which is suitable for crushing.

METHODS:

Starch Isolation: Starch was isolated from pseudo-stem of banana following the simple method. The Fresh banana pseudo-stems cut into pieces and these pieces were crushed into sugarcane crusher in presence of water. After crushing, liquid containing starch was obtained. It was kept for sedimentation for 10 hrs. Starch was allowed to settle at the bottom then upper liquid was removed and starch was separated. Starch granules were allowed to repeat washing of 70% ethanol to attain maximum purity. After evaporation drying to form starch powder.

ESTIMATION OF STARCH:

The extracted starch content was estimated by the method of Benesi *et al.*, (2004). The estimated starch was measured as follows:

$$\text{Starch content} = \text{Weight of isolated starch} / \text{Weight of dry powder} \times 100$$

CONFIRMATION OF STARCH:

Starch- I₂KI Test: Isolated starch was confirmed by potassium iodide (I₂KI) test, which is given by Daniel (1954). 1g starch sample was mixed with 5 ml of distilled water in a test tube. The mixture was heated in boiling water bath for 2-3 min. After heating, it was cooled and settles the starch powder for 6-8 hours. Neutralized the solution with 0.1% HCL drop by drop and then phenolphthalein indicator was added one drop extra. The solution was mixed properly and then 0.2% I₂KI solution was added drop by drop until the blue colour develops.

Fourier transform infrared spectroscopy (FT-IR) Study:

In order to determine the structure of both the starches, the FT-IR spectra were obtained using FT-IR (ALPHA, Bruker, Germany). The spectra were recorded in transmission mode from 5,000 to 400 cm⁻¹.

GRANULE MORPHOLOGY:

Photomicrography: Photomicrography of each starch was done by using compound microscope (10X & 40 X).

Scanning Electron Microscopy (SEM):

SEM analysis was done by using JEOL JSM-6360A Analytical Scanning Electron Microscope. A starch sample was mounted on a scanning electron microscope stub with a double-sided adhesive tape, and coated with gold by using an EDT-2000 ion sputter (2 × 10⁻⁴ MPa, 25 mA) for 30 s. Then, the coated samples were put into the SEM chamber and scanning electron micrographs were taken at 500 × magnifications with the signal electron type of SE1 and an accelerating voltage of 10 kV.

Physico-chemical properties of starch:

Starch sample was analysed for their physico-chemical properties (moisture, ash, protein, fat and fibre content) by Official Analytical Chemist (AOAC, 2005) standard procedures. A micro-Kjeldahl method was used to determine the crude protein contents.

Analysis of amylose and amylopectin:

A 40 mg mangrove flour was put in a tube, and then 1.0 ml 95 % ethanol and 9 ml 1 N NaOH were added. The next step was to heat the solution in a water bath at 100 °C for 10 min and cool it down for 1 h. The solution was diluted with distilled water to 100 ml. About 5 ml of the solution was placed into a 100 ml volumetric flask containing 60 ml of distilled water, then added with 1.0 ml of 1 N acetic acid and 2.0 ml of 2 % iodine solution, respectively. The final volume was shaken and allowed to stand for 20 min, and the absorbance was monitored using a spectrophotometer at a wavelength of 625 nm (Apriyantono *et al.*, 1989). Amylopectin content was obtained as follows:

Amylopectin content = Starch content - Amylose content

RESULTS AND DISCUSSIONS:

The starch obtained from banana pseudo-stem was white, crystalline, non-hygroscopic powder and a yield of about 36.96%, which is considered to be appreciable. Isolated starch was further confirmed by I₂KI test and microphotography (Fig. 2). The intrinsic quality of botanical starch is its granule microstructure, which is frequently the fundamental element influencing its physicochemical and functional characteristics.

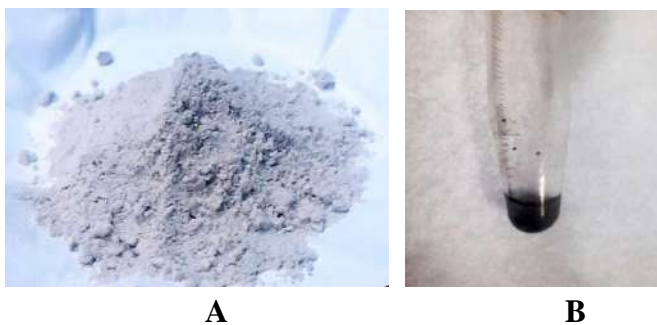


Figure 2: A- Isolated banana pseudo stem starch, B- Starch-I₂KI
FOURIER TRANSFORM INFRARED (FT-IR) SPECTROSCOPIC ANALYSIS:

Fourier transform infrared (FT-IR) offers quantitative and qualitative analysis for organic and inorganic samples. FT-IR identifies chemical bonds in a molecule by producing an infrared absorption spectrum (Chavan & Patil, 2019). The FT-IR spectrum for isolated starch was shown in figure 4. The information obtained from this technique is related to the short-range order in the starch molecule (Sevenou *et al.*, 2002)

The infrared (IR) spectrum of starch samples was described by seven main modes, with maximum absorbance peaks near 3,500, 3000, 1,600, 1,400, 1,000, 800 and 500 cm⁻¹ (Koksel *et al.*, 2008; Sitohy *et al.*, 2000). In present investigation, FT-IR spectra showed similar pattern for

the isolated starch, with seven main modes with maximum absorbance peaks near to 3,500, 3000, 1,600, 1,400, 1,000, 800 and 500 cm^{-1} (Fig. 3). The study was confirmed the observed spectra by FT-IR spectroscopy of starch sample. The peaks at 3389.77 cm^{-1} , 2925.67 cm^{-1} in starch of *H. littoralis* could be attributed to O-H and C-H bond stretching. The ratio between the absorbance obtained at a wavenumber of 1022 cm^{-1} , related to the amorphous component (Van *et al.*, 1995) and that obtained at 1016.60 cm^{-1} related to the ordered component (Smits *et al.*, 1998). The characteristic angular O-H bending vibration was found in the range of 1639.70 cm^{-1} . The band at 1,080 cm^{-1} in isolated starch was associated with the amorphous structures of starch. The bands at 928~8 cm^{-1} were attributed to D-glucopyranosyl ring vibrational modes and 766 \pm 10 cm^{-1} were attributed to D-glucopyranosyl ring stretching. The isolated starch was slightly less ordered in the external region of the granule.

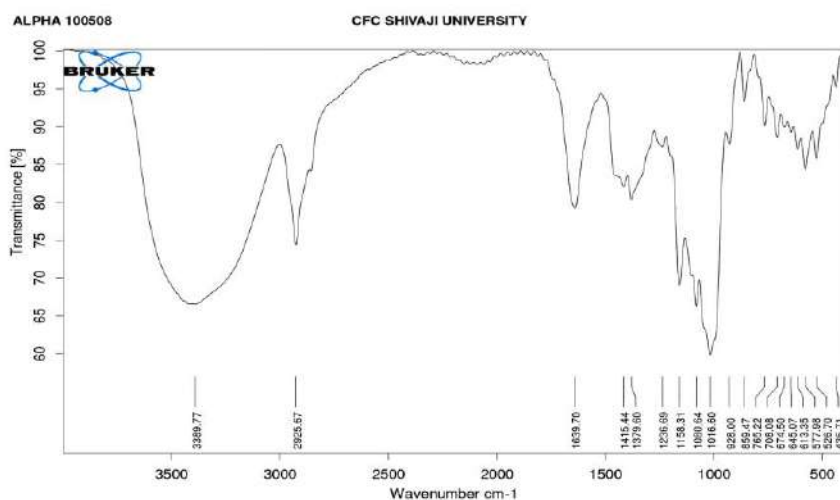


Figure 3: FT-IR Spectra of Banana Pseudo-stem Starchs

Granule Morphology:

Generally, banana starch granules from various banana varieties are irregular, elongated, and round/spheroidal in shape (Pelissari *et al.*, 2012). Variety affects the granule shape of banana starch (Marta *et al.*, 2016). Furthermore, the elongated shape is mainly found in the granules of Kapas cultivars, while the round shape is mostly found in the granules of Kepok, Ambon, and Nangka cultivars (Marta *et al.*, 2022). For present study, granule size was expressed as average length for oval and elongated shape of starch granules. The granule size of banana starch depends on the cultivar and the ripening state (Chávez-Salazar *et al.*, 2017). Based on the results of analysis using SEM, the size of starch granules from banana pseudo-stem starch average length of starch granules of was in between 15-65 μm which showed small to medium granules. SEM analysis was performed to determine the granule shape and shown in Fig. 4 (C). The magnification was used 450X to 500X. Starch granules of banana pseudo-stem were found in regular elongated with smooth surface. The results showed that granules were larger in size and shape. Previous studies reported that starch granule size has been affecting the physico-chemical properties of starch. The granule size of banana starch is larger than other starch, such

as breadfruit starch (<10 μm) (Tan *et al.*, 2017), wheat starch (2–20 μm) (Wei *et al.*, 2017) and sorghum starch (4–35 μm) (Zhu, 2014).

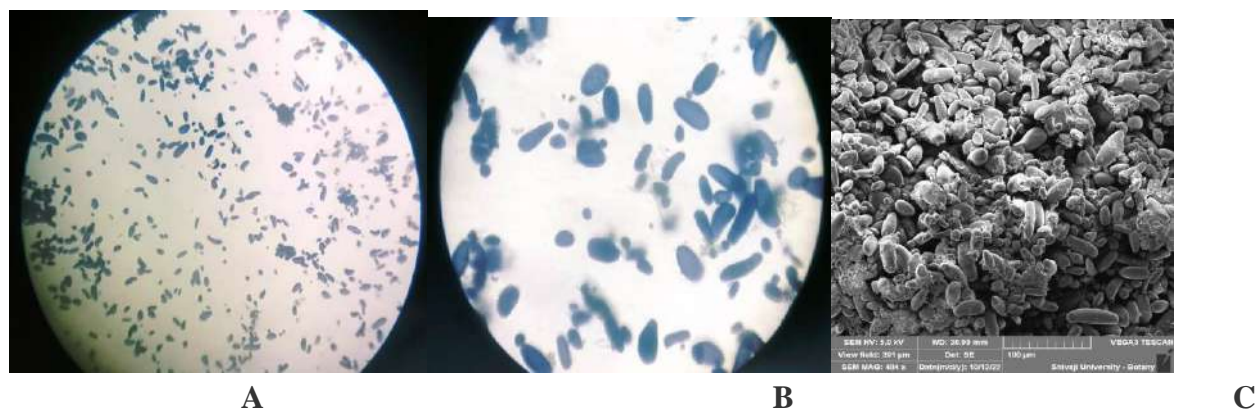


Figure 4: Granule morphology of banana pseudo-stem starch A) Starch granules at 10X B) Starch granules at 40X C) SEM image of starch granules

Physico-chemical Properties of banana pseudo-stem starch:

The chemical composition of starch extracted from banana pseudo stem is represented in Table 1. Starch extracted from banana pseudo-stem has 6.96% moisture content and 1.02% ash. It also contains 1.26% and 0.37% lipid and protein, respectively. The crude fiber content of banana pseudo-stem starch was found 2.47% .

Variety	Moisture (%)	Ash (%)	Lipid (%)	Protein (%)	Fiber (%)
<i>Musa</i> Var. Velachi Pseudo-stem starch	6.96	1.02	1.26	0.37	2.47

Table 1: Physico-chemical properties of isolated starch

Variety	Amylose (g/100g)	Amylopectin (g/100g)	Starch (%)
<i>Musa</i> Var. Velachi Pseudo-stem starch	11.94	25.02	36.96

Table 2: Amylose and amylopection analysis of isolated starch

Forming a gel will be more challenging the higher the amylose level. Due to the fact that, the amorphous structure that forms will raise the temperature during gelatinization, slowing down the process. Since, the amorphous structure that forms will raise the temperature during gelatinization, gelatinization process will run slowly.

CONCLUSION:

The isolated starch of banana pseudo-stem had oval to elongated shaped and large sized granules showed prominent structure showed in light as well as scanning electron microscopy, indicating that the isolation procedure yielded intact granules. Isolated starch contained similar amount of short-range order which could influence on some other physico-chemical properties. The results obtained in structural characterization provide information about the possible behaviour of the starch when being used in certain applications. The physico-chemical properties of the starch indicate their potential applications as thickener, stabilizer, emulsifier, and de-foaming agent in the food (confectionery, sauces, edible films, etc.), pharmaceutical (excipient, tablet/capsule disintegrant, binder, etc.).

Funding Statement: This research paper was supported by seed money for research minor project given by Vivekanand College, Kolhapur (Autonomous).

References:

- AOAC (2005). Official method of Analysis. 18th Edition, Association of Officiating Analytical Chemists, Washington DC, Method 935.14 and 992.24.
- Apriyantono, A., Fardiaz, D., NL, P., Sedarnawati, & Budiyanto, S. (1989). Food Analysis. Indonesia: IPB University
- AOAC, 2005
- Benesi, I.R.M., Labuschagne, M.T., Dixon, A.G.O. and Mahungu, N. M. (2004). Stability of native starch quality parameters, starch extraction and root dry matter of cassava genotypes in different environments. *Journal of science of food and agriculture*, 84: 1381-1388.
- Chavan N.S. and Patil Priya D. (2019). Determination of structural characteristics of starch extracted from seeds of *Heritiera littoralis* Dryand. *International Journal of Emerging technologies and Innovative Research*, 6(3): 590-599.
- Chávez-Salazar A., Bello-Pérez L.A., Agama-Acevedo E., Castellanos-Galeano F.J., Álvarez-Barreto C.I., Pacheco-Vargas G. (2017). Isolation and Partial Characterization of Starch from Banana Cultivars Grown in Colombia. *Int. J. Biol. Macromol.* 98:240–246.
- Daniel, M. (1991). *Methods in Plant Chemistry and Economic Botany*, Kalyani Publishers, New Delhi.
- Gholap, Babasaheb, Kannor, Dinesh, Gagare, Santosh and Mahajan, Jayshree (2011). Starch extraction from banana pseudostem, *Internat. J. Proc. & Post Harvest Technol.*, 2 (1): 12-16.
- Koksel, H.; Masatcioglu, T.; Kahraman, K.; Ozturk, S; Basman, A. (2008). Improving effect of lyophilization on functional properties of resistant starch preparations formed by acid hydrolysis and heat treatment. *J. Cereal Sci.*, 47: 275-282.

- Marta H., Cahyana Y., Djali M., Arcot J., Tensiska T. (2019). A Comparative Study on the Physicochemical and Pasting Properties of Starch and Flour from Different Banana (*Musa* spp.) Cultivars Grown in Indonesia. *Int. J. Food Prop.* 22:1562–1575.
- Marta H, Cahyana Y, Djali M, Pramañisi G. (2022). The Properties, Modification, and Application of Banana Starch. *Polymers (Basel)*. 14(15):3092.
- Pelissari F.M., Andrade-Mahecha M.M., Sobral P.J.d.A., Menegalli F.C. (2012). Isolation and Characterization of the Flour and Starch of Plantain Bananas (*Musa paradisiaca*) *Starch-Stärke*. 64:382–391.
- Sitohy, M. Z.; Labib, S. M.; El-Saadany, S. S.; Ramadan, M. F. (2000). Optimizing the conditions for starch dry phosphorylation with sodium mono- and dihydrogen orthophosphate under heat and vacuum. *Starch/stärke*, 52: 95-100.
- Sevenou, O., Hill, S.E., Farhat, I.A. & Mitchell, J.R. (2002). Organisation of the external region of the starch granule as determined by infrared spectroscopy. *International Journal of Biological Macromolecules*, 31: 79-85.
- Smits, A.L.; Ruhnau, F.C.; Vliegthart, J.F. and Van Soest, J.J. (1998). Ageing of starch based systems as observed with FT-IR and solid-state NMR spectroscopy. *Starch/Stärke*, 50: 478-483.
- Van Soest; J. J.; Tournois, H.; de Wit, D.; Vliegthart, J. F. (1995). Short-range structure in (partially) crystalline potato starch determined with attenuated total reflectance Fourier-transform IR spectroscopy. *Carbohydrate Research*, 279: 201-214.
- Tan X., Li X., Chen L., Xie F., Li L., Huang J. (2017). Effect of Heat-Moisture Treatment on Multi-Scale Structures and Physicochemical Properties of Breadfruit Starch. *Carbohydr. Polym.* 161:286–294.
- Wei M., Andersson R., Xie G., Salehi S., Boström D., Xiong S. (2017). Properties of Cassava Stem Starch Being a New Starch Resource. *Starch-Stärke*. 70:1700125.
- Zhu F. (2014). Structure, Physicochemical Properties, Modifications, and Uses of Sorghum Starch. *Compr. Rev. Food Sci. Food Saf.* 13:597–610.

Cynometra Iripa: A Potential Mangrove

Dr. Mrunalini Nilesh Desai,

Department of Botany, Vivekanand College, Kolhapur (Autonomous)

mndesai2306@gmail.com

Abstract:

Cynometra iripa Kostel. is a typical mangrove species that occur along west coast of Maharashtra. Present paper describes essential oil composition of the seeds, leaves and stem Cynometra iripa. The analysis of essential oil was performed following extraction in methanol and investigated with thin layer chromatographic technique (TLC). This analysis reveals that seeds, stem and leaves of Cynometra iripa serves as source of essential oil. The terpene and phenyl propane, sesquiterpens, benzoin, balms and monoterpene were detected. Myristic in has common occurrence in seeds, leaves and stem of Cynometra iripa. Major components of seed oil are myristicin, anethole, polyines, THC, farnesene, benzoic acid. While thymol, myristicin, borneol, anethole, THC, farnesene, benzoic acid, cinnamic acid are major components of stem oil. However, major components found in the leaves are thymol, myristicin, azulene, THC, farnesene, benzoic acid, cinnamic acid and linalyl acetate. The piece of work suggests that Cynometra iripa is a potential source of essential oil and serve as a potential coastal bioresource. There are very few individuals of Cynometra iripa along the coast of Maharashtra. It is very essential to conserve the potential coastal plant. Immediate action is needed to conserve the habitat.

Keywords: Cynometra iripa, TLC, Essential Oil, Maharashtra

Introduction:

Mangrove ecosystem is the most productive ecosystem on the earth. The mangrove Cynometra iripa, a member of fabaceae is critically endangered species along coast of Maharashtra. Bhosale et al., (2002) have reported the species both in Sindhudurg and Ratnagiri districts of Maharashtra. An oil is "essential" in the sense that it carries a distinctive scent, or essence, of the plant. Essential oils do not form a distinctive category for any medical, pharmacological, or culinary purpose. Various essential oils have been used medicinally at different periods in history. Medical application proposed by those who sell medicinal oils range from skin treatments to remedies for cancer, and often are based on nothing better than historical accounts of use of essential oils for these purposes. Claims for the efficacy of medical treatments and treatment of cancers in particular, are now subject to regulation in most countries, and to avoid criminal liability, suppliers of fringe remedies are becoming increasingly vague in what they promise. In the present work, the chemical composition of the essential oils from leaves, stem, and seeds of Cynometra iripa are reported.

Material and Methods:

The powdered material of seeds, stem and leaves were analyzed to investigate composition and screening of essential oil with the help of thin layer chromatographic technique (TLC) according to the method described by Somchai et al., (2008). Accurately

weighed one g. of seed, stem and leaves powder was mixed in 20 ml. methanol and refluxed for 20 min. Then the solution was transferred to evaporating dish to evaporation at RT. Afterwards the concentrate remained in the dish was dissolved in 0.5 ml methanol and used as source of extract for TLC. The synthetic aluminium sheet used and 20 ml extract was loaded with micropipette at equivalent points. This TLC plate was developed into toluene: ethyl acetate (90: 10) solvent system for sufficient period in glass jar. When the chromatogram was sufficiently developed, taken out, air dried and then sprayed with vanillin-sulphuric acid spraying reagent, in segmental manner i.e. first solution A (1% ethanolic vanillin) was sprayed, this was followed by spraying of solution B (10% ethanolic sulphuric acid). Then this TLC was dried in oven for few minutes at 105°C to develop spots. The R_f values of detected spots were then compared with standard values of the authentic standard (Wagner and Bladt, 2003).

Results and Discussion:

An essential oil is concentrated liquid containing volatile aroma compound from plants. They are also known as volatile, ethereal oils or aetherolae or simply oil of plant from which they were extracted eg. - Oil of clove, Khus oil or Vetiver oil. Essential oil is produced in varied type of plant parts eg. leaves, reproductive structures, stem and roots etc. the contents of essential oil is mainly terpenoids but other chemicals like phenylpropanoids are also present in some oil plants. Present observation with *C. iripa* essential also indicates a similar trend. The essential chemical components are broadly categorized into two groups-terpenoids and phenyl propanoids but the terpenoids are very common and give characteristic flavour and odour to the oils.

The essential oil composition of leaves, stem and seeds of *Cynometra iripa* is determined. From the Plate and Table it reveals that, terpene, phenyl propanoids, sesquiterpenes, benzoin, balsams and monoterpene were found to be present. Myristicin is commonly found in seed, leaves and stem of *C. iripa*. Major component of seeds oil are myristicin, Anethole, polyenes, THC, Farnesene, Benzoic acid-cinnamic acid are major components of stem oil. However, the components of leaves are thymol, myristicin, azulene, THC, farnesene, Benzoic acid - cinnamic acid, Linalyl acetate. This analysis reveals that seeds, stem and also leaves of *Cynometra iripa* may serve as source of essential oil.

Conclusion:

This is the first attempt to analyze essential oil from different parts of *Cynometra iripa*. The compounds found are likely to be responsible for the special odour. The comparison will lead to identification of novel flavour and odour compounds and be a step towards understanding the chemistry behind the *Cynometra iripa* leaves, stem and seeds.

The results of this attempt have proved the resource value of *Cynometra iripa* as cosmetics and pharmaceuticals. The identified compounds are already in use as flavouring substance. Composition of essential oil has proved the potential of *Cynometra iripa* as a "Bioresource." Further value based attempts are under progress.

Table1 Composition of essential oil from leaves, stem and seeds of C.iripa

Sr. No.	Compounds	Rf-value	Leaves	Stem	Seed
I	Terpene and	0.58	++	++	-
	Phenyl propane	0.75	+++	+++	+++
	1. Thymol	0.24	-	+++	+
	2. Myristicin	0.92	-	+	++
	3. Borneol				
4. Anethole					
II	Sesquiterpens	0.53	-	-	++
	1. Polyines	0.93	++	-	-
	2. Azulene	0.99	+++	+++	++
	3. THC, farnesene				
III	Benzoins	0.11	+++	+++	+++
	1. Benzoic acid cinnamic acid				
IV	Balms	0.81	-	+	-
	1. Cinnamoyl benzoate caumaroyl benzoyl				
V	Monoterpene	0.69	+++	-	-
	1. Linalyl acetate				

- = not detected + = Present (via) ++ = Present in greater quantities +++ = Prominent



Fig.1. Oil composition from leaf, stem and seed by TLC

References:

- 1 Bhosale L.J., Banik S., Gokhale M.V. and Jayappa M.A. (2002). Occurance of *Xylocarpous granatum* Koen and *Cynometra iripa* Kostel. along the west coast of Maharashtra. *J. Econ. Taxon. Bot.* 26(1), 82-87.
- 2 Somchai J., Chanida P., Tanasorn T., Anusorn R., Niran V., Anchake C. and Nijisiri R. (2008). Pharmacognostic specification of *Vetiveria zizanioides* roots in Thailand *J. Health Res.* 22(1): 9-14.
- 3 Wagner H. and Bladt S. (2003). *Plant drug Analysis, A thin layer chromatography*, (Ed.) Wagner, H. and Bladt., (Pub.) Springer (Ed.)2.

Effect of salt stress on lipid peroxidation activity in *Amaranthus gangeticus* L.

Priyanka P. Jadhav

Department of Botany,
Vivekanand College Kolhapur (Autonomous)

Abstract

Salinity stress is one of the most vital abiotic stresses which results in significant damages in plant growth and productivity. Plant growth regulators are widely used to overcome a biotic stresses including salinity stress in plants. The exogenous applications of plant growth regulators like Putrescine, S.A., GABA, and Biotonic under the NaCl salinity stress (50, 100 mM) on the lipid peroxidation of *A. gangeticus* was studied. lipid peroxidation is decreased at 50 and 100 mM NaCl salinity stress as compared to unstressed control plants. It is also noticed that the lipid peroxidation is reduced due the foliar applications of Putrescine, GABA, SA and Biotonics formulation under salt stressed condition as well as stressed and unstressed condition and this reduction is significantly higher than the unsprayed control. While in stem tissue the lipid peroxidation showed similar pattern except in plant treated with 50 mM NaCl treated plant sprayed with Putrescine, GABA, SA and Biotonics formulation. This decrease in lipid peroxidation might be associated with their membrane stabilization or this might be to due to accumulation of the quaternary ammonium compound glycinebetain which helps to reduce the generation of free radicals followed by reduction in lipid peroxidation.

Keywords:- Salinity, lipid peroxidation ,GABA, Biotonics putrescine, SA.

1. Introduction:

lipid peroxidation is an indicator of extend of oxidative damage under salinity stress (Bor et al. 2003). Increase in MDA content was due to an accumulation of OH⁻ ion which oxidized membrane lipids and leads to leaky membrane (Katsuhara et al., 2005). Lipid peroxidation is caused by hydroxyl ion (OH⁻) which damage to organelles and cell integrity and leads to an accumulation of degradation compounds which is in the form of malondialdehyde (MDA (Gill and Tuteja, 2010).

Amaranthus is a sturdy double duty crop with its edible leaves, stem and grain which provide the critically essential amino acids, lysine and methionine, also it is a rich source of omega 3 fatty acids. *A. gangeticus* is originated from tropical Asia. The domestication of *A. gangeticus* took place in prehistoric times. It is rare exotic vegetable in several countries. It is introduced by Indian immigrant and occasionally cultivated in big cities of east and southern Africa. In Asian countries *A. gangeticus* is eaten raw in salads, in India its soft stems are eaten like moringa fruits.

In this study, we hypothesized that this decrease in lipid peroxidation might be associated with their membrane stabilization or this might be to due to accumulation of the quaternary ammonium compound glycinebetain which helps to reduce the generation of free radicals followed by reduction in lipid peroxidation.

2. Material Methods:

Salinity treatments and foliar application of plant growth regulators and Biotonic formulation

A. gangeticus Seeds were sown in earthen pots filled with garden soil containing farm yard manure in the proportion of 3:1. Pots were watered twice a week and every care was taken to raise healthy and vigorously growing plants in each pot. 30 days old seedlings were irrigated with equal volume of the saline water (50 and 100 mM NaCl) twice a week alternating with water. After two successive salinity treatments spray of respective plant growth regulators such as SA (50 ppm), Putrescine (10 ppm), GABA (10 ppm) and Biotonic formulation was given. (Biotonic formulation is a compound mixture of amino acids (Cystein, Methionine, Lysine, Valine and GABA), vitamins (Riboflavin B2 and Nicotinic acid B3), Saccharides (Myo-inositol), cytokinin (6BA) and protein (albumin), each compound dissolved separately and then all the compounds were mixed together to make the final volume 100 ml with DW to achieve 100 ppm concentration. This is the stock solution of biotonic formulation. 0.5 ml of stock solution was added in 1000 ml DW and used for foliar application) were applied and spraying was repeated after one week from the first spray. After such two sprays the plants were used for analysis. The weed control of plant was done by hand weeding.

Lipid Peroxidation

The thiobarbituric acid assay for lipid peroxidation was carried out by the method of Heath and Packer, (1968). Five hundred mg of leaf and stem tissue of each treatment and control of *A. gangeticus* were homogenised in 10 ml 0.5% Thiobarbituric acid in 20% Trichloro acetic acid. The mixture was incubated at 90°C in a shaking water bath for 30 minutes and reaction was stopped by placing the reaction tubes in ice bath. After centrifugation at 10,000 rpm for 30 minutes, the amount of MDA TBA complex in the supernatant was determined by recording its absorbance at 535 nm and corrected for the non-specific absorbance by subtracting the absorbance value obtained at 600 nm. The final values were expressed as μ moles of MDA g^{-1} fresh tissue.

Table no. 1 Effect of foliar application of plant growth regulators on Lipid peroxidation in the leaves and stem of *A. gangeticus* L. grown under NaCl salinity stress.

Plant parts	Treatments NaCl (mM)	control	SA	PUT	GABA	BF
Leaves	0	4.14	2.48 (-40.10)	3.56 (-14.01)	3.00 (-27.54)	3.22 (-2.22)
	50	2.48	1.50 (-39.52)	2.00 (-19.35)	1.80 (-27.42)	2.44 (-1.61)
	100	3.60	1.32 (-63.33)	3.14 (-12.78)	2.00 (-44.44)	2.82 (-21.67)
Stem	0	2.00	0.78 (-61.00)	1.28 (-36.00)	0.90 (-55.00)	1.04 (-8.00)

	50	0.58	0.34 (-41.38)	0.86 (+48.28)	0.62 (+6.90)	0.64 (+10.34)
	100	1.34	0.78 (-41.79)	0.94 (-29.85)	0.72 (-46.27)	0.84 (-37.31)

Each value is mean of three determinations.

Each value is expressed as μ mole MDA g^{-1} fresh tissue.

Values in parenthesis indicate percent increase (+) or decrease (-) over the control.

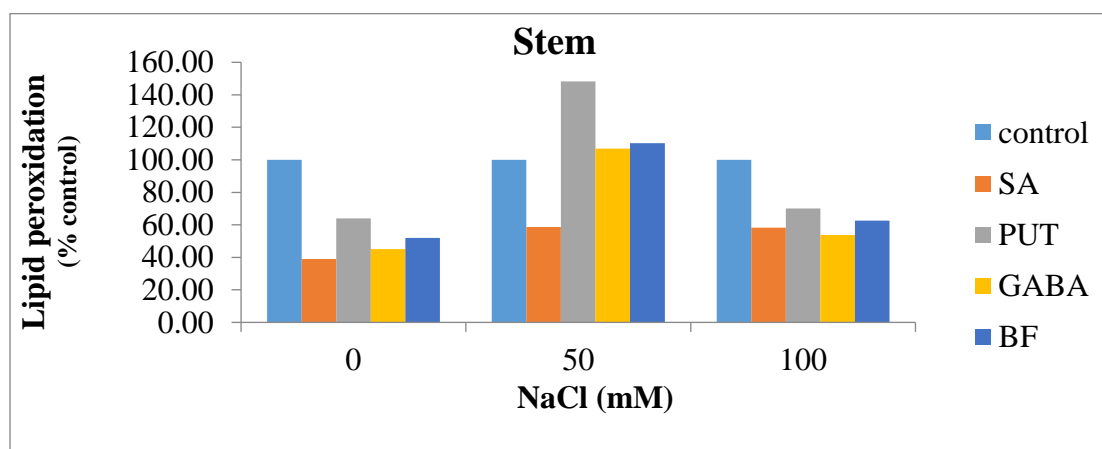
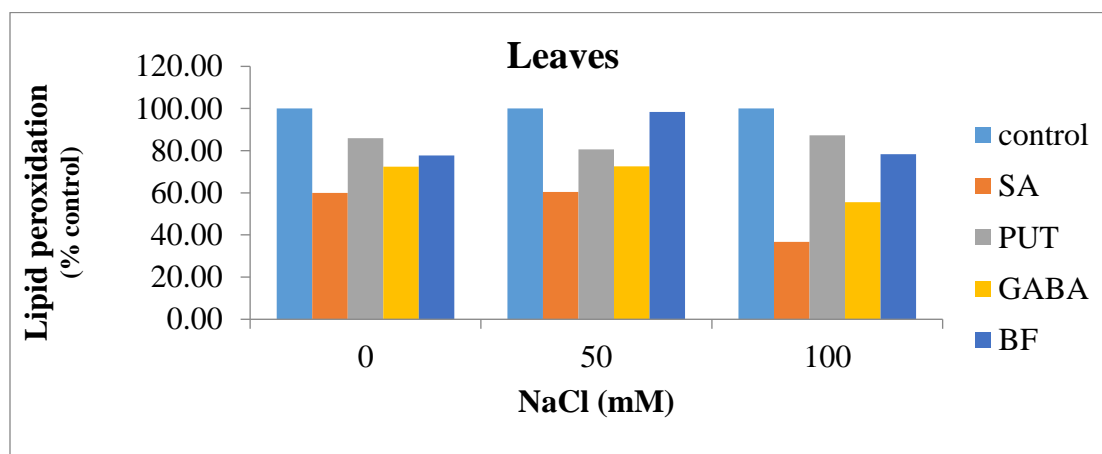


Fig 1. Effect of foliar application of plant growth regulators on Lipid peroxidation in the leaves and stem of *A. gangeticus* L. grown under NaCl salinity stress.

3. RESULT AND DISCUSSION:

Effect of foliar application of SA, Putrescine, GABA and Biotic formulation on lipid peroxidation content of the leaf and stem tissue of *A. gangeticus* grown under saline condition is

shown in Figure 1. It is evident from the results that the content of lipid peroxidation is decreased at 50 and 100 mM NaCl salinity stress as compared to unstressed control plants. It is also noticed that the lipid peroxidation is reduced due the foliar applications of Putrescine, GABA, SA and Bionics formulation under salt stressed condition as well as stressed and unstressed condition and this reduction is significantly higher than the unsprayed control. While in stem tissue the lipid peroxidation showed similar pattern except in plant treated with 50 mM NaCl treated plant sprayed with Putrescine, GABA, SA and Bionics formulation.

Salinity stress did not causes any change in malondialdehyde indicating the membrane integrity even under high level of salinity (Mishra and Das 2004). In *Crithmum maritimum* rate of lipid peroxidation was low in both leaves and stem tissue under 50 mM NaCl (Ben-Amor et al. 2005). In halophyte H_2O_2 content and lipid peroxidation decreased under salinity stress which is responsible for protection from oxidative stress induced by salinity (Pang et al. 2005).

In the present study the reduction in lipid peroxidation under stressed condition as well as due to the application of PGR`s was noticed in leaf and stem tissue of *A. gangeticus*. This decrease in lipid peroxidation might be associated with their membrane stabilization or due to accumulation of the quaternary ammonium compound glycinebetain which helps to reduce the generation of free radicals followed by reduction in lipid peroxidation.

4. Conclusion :

The reduction in lipid peroxidation under stressed condition as well as due to the application of PGR`s was noticed in leaf and stem tissue of *A. gangeticus*. This decrease in lipid peroxidation might be associated with their membrane stabilization or this might be to due to accumulation of the quaternary ammonium compound glycinebetain which helps to reduce the generation of free radicals followed by reduction in lipid peroxidation.

Reference:

1. Bor, M., Ozdemir, F. and Turkan, I. E. (2003). The effect of salt stress on lipid peroxidation and antioxidants in leaves of sugar beet *Beta vulgaris* L. and wild beet *Beta maritima* L. *Plant Sci.*, **164**(1): 77-84.
2. Katsuhara, M., Otsuka, T. and Ezaki, B. (2005). Salt stress-induced lipid peroxidation is reduced by glutathione S-transferase, but this reduction of lipid peroxides is not enough for a recovery of root growth in *Arabidopsis*. *Plant Sci.*, **169**: 369-373.
3. Gill, S. S. and Tuteja, N. (2010). Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. *Plant Physiol. Biochem.*, **48**: 909-930.
4. Heath, R.L. and Packer, L. (1968). Photoperoxidation in isolated chloroplast I. Kinetics and stoichiometry of fatty acid peroxidation. *Arch. Biochem. Biophys.*, **125**: 189-198
5. Mishra, S. and Das, A. (2004). Effect of short-term exposure to NaCl on photochemical activity and antioxidant enzymes in *Bruguiera parviflora* a non-secretor mangrove. *Acta Physiol. Plant.*, **26**(3): 317-326.
6. Ben-Amor, N., Ben-Hamed, K., Debez, A., Grignon, C. and Abdelly, C. (2005). Physiological and antioxidant responses of the perennial halophyte *Crithmum maritimum* to salinity. *Plant Sci.*, **168**(4): 889-899.

7. Pang, C. H., Zhang, S. J., Gong, Z. Z. and Wang, B. S. (2005). NaCl treatment markedly enhances H₂O₂ –scavenging system in leaves of halophyte *Suaeda salsa*. *Physiol. Plant.*, **125**(4): 490-499.

छत्रपती राजर्षी शाहू महाराज यांचा आंतरजातीय विषयक दृष्टिकोन एक समाजशास्त्रीय अभ्यास

प्रा. डॉ. डी. के. घाडगे¹

समाजशास्त्र विभाग,

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

devanandghadge071@gmail.com

प्रा. डॉ. स्वप्निल बुचडे²

मराठी विभाग,

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

swapnilsopan88@gmail.com

● प्रस्तावना :

राजर्षी शाहू महाराज हे समाजसुधारक आणि सामाजिक विचारवंत होते. समाजातील अनेक वाईट चाली-रीतीला त्यांनी कडाडून विरोध केला. स्त्री विषमता जातीभेद, अस्पृश्यता नष्ट झाली पाहिजे असे त्यांचे मत होते. तसेच त्यांनी अस्पृश्यता आणि जातीभेद नष्ट करण्यासाठी आपल्या संस्थानामध्ये राखीव जागा तसेच स्त्रियांना मानाचे स्थान मिळवून देण्यासाठी प्रयत्न केले.

● अभ्यासाचा उद्देश:

१. राजर्षी शाहू महाराज यांचा आंतरजातीय विषयक दृष्टिकोन जाणून घेणे.

२. राजर्षी शाहू महाराज यांचा अस्पृश्यता, जातीभेद आणि स्त्री सुधारणावादी विषयक दृष्टिकोन जाणून घेणे.

● संशोधन पद्धती:

प्रस्तूत अभ्यास हा राजर्षी शाहू महाराज यांचा आंतरजातीय विषयक दृष्टिकोन हा असून या संशोधनासाठी दुय्यम स्रोताचा वापर करून संशोधनासाठी लागणाऱ्या साहित्याचा आढावा घेण्यासाठी वर्तमानपत्रे, संदर्भग्रंथ, रोजनिशी, दैनंदिनी, मासिके तसेच इंटरनेटचा वापर करून संशोधनासाठी उपयुक्त माहिती जमा केली गेली आहे.

● छत्रपती राजर्षी शाहू महाराज यांचा आंतरजातीय विषयक दृष्टिकोन :

आधुनिक महाराष्ट्राच्या जडणघडणीत शाहू महाराजांचा बहुमोल वाटा आहे. बहुजन समाजाचा उद्धार करणाऱ्या महात्मा फुले यांचा वारसा चालविणारा राजा म्हणून महाराष्ट्राच्याच नव्हे तर हिंदुस्थानच्या इतिहासात त्यांचे अलौकिक स्थान आहे. तत्कालीन इतर संसृष्टानिका प्रमाणे राज वैभवाच्या आणि सुखोपभोगाच्या गराड्यामध्ये न रमता राजसत्ता हे समाजसेवेचे साधन आहे असे मानून या तत्त्वाने जगणारा हा राजा बहुजन समाजाच्या उन्नतीसाठी प्राथमिक शिक्षणाचा प्रसार, अस्पृश्यता निवारण, जातीभेद निवारण, आंतरजातीय विवाह, इत्यादी अनेक सुधारणा आपल्या राज्यात घडवून आणण्यात सातत्याने आघाडीवर राहिला. आपल्या समाज सुधारणेच्या कार्यात शाहू महाराजांनी विशेष प्राधान्य दिले. जातीभेद व अस्पृश्यता या बाबी हिंदू समाजावरील कलंक असून सामाजिक विषमता व अनिष्ट प्रथाच समाजाच्या मागासलेपनास कारणीभूत आहेत असे त्यांचे मत होते. जातीभेद मोडण्याची सुरुवात खालून वर अशी न होता ती वरून खाली झाली पाहिजे म्हणजे वरच्या जातीतील लोकांनी प्रथम प्रारंभ केला पाहिजे असे प्रतिपादन करताना शाहू महाराज म्हणतात की, जपानमध्ये जाती वादाचा विमल होण्यासाठी मोठे कारण म्हणजे उच्च वर्गाच्या सामुराई लोकांनी सुरुवात केली. तसे झाले नसते तर जपानची स्थिती सुधारली

नसती.जातीभेद नष्ट होण्यासाठी समाजातील सर्व स्तरातील लोकांनी प्रयत्न केले पाहिजे तेव्हाच समाजातील विषमता,जातीभेद,अस्पृश्यता नष्ट होईल असे शाहू महाराजांचे मत होते. शाहू महाराजांनी जातिभेद नाहीसे व्हावेत म्हणून केलेले कार्य प्रसिद्ध आहे. कायदे करून आणि मागास जातीला सर्वतोपरी मदत करून शाहू महाराजांनी हे कार्य केले. १९२० मधील एका व्याख्यानात महाराज म्हणाले की, जातीभेद असू द्या पण जाती द्वेष मात्र नको. कारण जातीभेदाचे कारण जाती द्वेष हे आहे.अर्थात जातीभेद तीव्र होऊ नयेत याची दक्षता घेण्याची गरजही त्यांना मान्य होते. मागास जातींना सवलती व सोयी देताना त्याचा परिणामी जाती भेद तीव्र होऊ नयेत अशीच त्यांची भूमिका होती. या जाती भेदास कमी करण्यासाठी त्यांनी विविध कार्य केलेले आहेत.

राजर्षी शाहू महाराजांनी स्त्रियांना धार्मिक रूढी आणि परंपरा यामुळे होणाऱ्या त्रासाची दखल घेऊन तो त्रास दूर करण्याच्या दृष्टीने प्रयत्न केले होते स्वतःच्या सुनेला त्यांनी उच्च शिक्षण दिले राजाराम कॉलेजात मुलींना फी माफ केली स्त्री शिक्षणास प्रोत्साहन दिले परंतु यापेक्षाही महाराजांनी स्त्रिया आणि विवाह यासंबंधी केलेले कायदे त्यांच्या पुरोगामी आणि कर्त्या समाज सुधारकत्वाची खरी ओळख आहे विवाह विषयक प्रचलित रूढी आणि जुने धर्मावर आधारित व इतर कायदे यामुळे स्त्रियांचे जीवन कष्टमय होते अजूनही आहे शाहू महाराजांनी १८२० च्या कालखंडामध्ये म्हणजे आज पासून ७५ वर्षांपूर्वी केलेले कायदे पाहिले म्हणजे त्यांचे पुरोगामी विचार आणि कार्य अधिकच उजळून दिसते आंतरजातीय विवाहाला त्यांनी महत्त्व दिलेले आहे परंतु छत्रपती राजर्षी शाहू महाराजांच्या काळात आंतरजातीय व आंतरधर्मीय विवाह संमती नसल्याने ते बेकायदेशीर ठरवले जात विवाह ही एक धार्मिक बाब मानण्यात येई राजर्षी शाहू महाराजांनी धर्मातील रूढींना फाटा देऊन ज्यांना नोंदणी पद्धतीने विवाह करायचा असेल त्यास तसे कायदेशीर स्वातंत्र्य देणारा कायदा अमलात आणला स्त्रीविषयक समाज सुधारणेच्या क्षेत्रातील हे एक क्रांतिकारक पाऊल होते आंतरजातीय व आंतरधर्मीय विवाह व नोंदणी पद्धतीस मान्यता देणारा कायदा शाहू महाराजांनी १२ जुलै १९१९ रोजी पास करून आपल्या संस्थानात लागू केला याच सुमारास म्हणजे सण १९१८ मध्ये मध्यवर्ती कायदेमंडळात विठ्ठलभाई पटेल यांनी आंतरजातीय विवाह कायदेशीर ठरविणारे बिल मानले होते हे बिल भारतीय इतिहासात पटेल बिल या नावाने प्रसिद्ध पावले या बिलास सनातन्याचे पुढारी लोकमान्य टिळक, शंकराचार्य, डॉ कुर्तकोटी यानी कडवा विरोध केला शिवाय पंडित मदन मोहन मालविया या सारख्यानीही आपली प्रतिकूलता दर्शविली मात्र रवींद्रनाथ यांनी त्यास पाठिंबा दिला महाराष्ट्रात सत्यशोधक आणि ब्राह्मणेतर पक्षाच्या मंडळींनी हे बिल उचलून धरले पटेल बिलाच्या रूपाने सनातनी सुधारक यांच्यातील संघर्ष पराकोटीस पोहोचला होता या पार्श्वभूमीवर शाहू महाराजांचा हा कायदा अनेक दृष्टीने लक्षणीय ठरतो. पटेल बिलाच्या पार्श्वभूमीवर राजर्षी शाहू महाराजांनी १९१९ मध्ये विवाह नोंदणी कायदा केला या कायद्यामध्ये १८ वर्षे वराचे व १४ वर्षे वधूचे वय ग्राह्य धरले गेले निर्धारित वय पूर्ण वधू वरास पालकांच्या संमतीची आवश्यकता राहिली नाही १८९१ च्या संमती बिलात विवाहाच्या वेळी वधूचे वय कमीत कमी बा १२ वर्षे असले पाहिजे असा निर्बंध होता या संमती वयाच्या कायद्याविरुद्ध हा हिंदू धर्मावर हल्ला आहे असा जोरदार आक्षेप त्यावेळी लोकमान्य टिळकांनी आणि इतर पुढाऱ्याने घेतला होता. राजर्षी शाहूच्या या कायद्यामधील वधूच्या वयाची १४ वर्षे पूर्ण करण्याची अट म्हणजे संमती वयाच्या कायद्याच्या पुढचे पाऊल होते या कायद्यात २३ नियम आणि तीन परिशिष्ट होते या कायद्यातील ठळक बाबी पुढील प्रमाणे आहेत.

१. हा कायदा कोल्हापूर इलाख्यास लागू आहे.
२. हा कायदा जैन हिंदू आर्य समाजास लागू होता.
३. परीतक्ता, घटस्फोटीत महिला यांना हा कायदा लागू नव्हता पण विधवांना हा कायदा लागू होता.
४. वराचे वय १८ वर्ष वधूचे वय १४ वर्षे ग्रेगरियन कॅलेंडर प्रमाणे पूर्ण असल्यास त्यांना आंतरजातीय आंतरधर्मीय विवाह करता येईल त्याची नोंद होण्यासाठी १४ दिवस अगोदर वधू वराने सरकारास नोटीस देणे आवश्यक आहे.
५. आंतरजातीय आंतरधर्मीय विवाह नोंदणी कायद्यात स्वजातीय रक्त संबंधातील विवाह त्याज ठरविला होता.

६. कायद्यान्वये नवरा नवरी तीन साक्षीदार आणि विवाह नोंदणी करणारा अधिकारी विवाहाच्या वेळी हजर असे व तसे प्रतिज्ञापत्र वधू वरास नोंदणी अधिकाऱ्यास द्यावे लागेल.

७. निर्धारित वय पूर्ण केलेल्या वधू वरास पालकाच्या संमतीची गरज नव्हती.

या कायद्यान्वये निर्बंध क्षिथिल होण्यास हातभार लागला विवाहाची नोंद ठेवल्याने पुढे त्या त्या विवाहित स्त्रीला नवऱ्याच्या स्थावर मालकीचा हिस्सा मिळण्यास अवकाश निर्माण झाला बाल विवाहास आळा बसण्यास मदत झाली प्रौढ विवाहास प्रोत्साहन मिळाले राजानेच अध्यादेश जारी केल्याने आंतरजातीय विवाह करू इच्छिणाऱ्या स्त्री-पुरुषास नैतिक बळ मिळाले. पटेल बिलाच्या समर्थनार्थ वि. रा. शिंदे ही उभे राहिले. या बिलाच्या विरोधी भूमिका घेणारे टिळक विलायतेहून परत आल्यावर त्यांना द्यावयाच्या मानपत्रास विरोधी भूमिका घेऊन महर्षी शिंदे नी सनातण्यास विरोध करून पटेल बिलास समर्थन दिले पुढे ब्राह्मणेतर व सत्यशोधक चळवळीच्या प्रसाराने खेड्यात आंतरजातीय विवाह व मिश्र विवाह होत राहिले वर्धा जिल्ह्यात ब्राह्मणेतर व सत्यशोधक चळवळीच्या तत्त्वाचा प्रसार करणारे अमृतराव कोरमकर व ग्वाल्हेरचे सदाशिवराव शिंदे यांची कन्या गोदुताई यांचा विवाह वर्धा येथे ठरला मराठा बोर्डिंग मध्ये शनिवार दिनांक १२ जानेवारी १९२८ रोजी झाला. या अनुकरणीय विवाहाचा महाराष्ट्रातील तरुणांनी आवश्यक विचार करावा त्याप्रमाणे अनेक मिश्र विवाह घडून आणण्याचा प्रयत्न करावा असे आवाहन 'विजय मराठा' पत्राने केल्याचे दिसून येते. आंतरजातीय विवाह समर्थन देणारे भाषण छत्रपती राजर्षी शाहू महाराज यांनी २०मे १९२० रोजी नागपूर येथे केले.

या भाषणात त्यांनी स्पष्ट केले की खरोखर आंतरजातीय विवाह सामाजिक समता व ऐक्य यांच्याकडे जाण्यासाठी फार महत्त्वाची पायरी आहे पण त्या ऐक्याचा उद्योग करणाऱ्यापैकी किती जणांनी तिच्याकडे लक्ष दिले याचा आढावा घेतल्यास निराशाच पदरी येथे सामाजिक कार्यकर्त्यांनी या महत्त्वाच्या मुद्याकडे आजवर दुर्लक्ष केले आहे असे दुर्दैवाने म्हणावे लागेल सत्यशोधक चळवळीचे जनक महात्मा फुले यांनी अशा प्रकारचे आंतरजातीय विवाह घडवून आणले होते. त्यांचा मुलगा यशवंत चा विवाह असाच आंतरजातीय विवाह होता. राजर्षी शाहूंनी ही इंदूरच्या धनगर राज घराण्याशी आपल्या घराण्याचे लमन संबंध जोडून आंतरजातीय विवाह चा पांयडा पाडला हे अर्थपूर्ण होय यावर महर्षी वि. रा. शिंदेंनी छत्रपती राजर्षी शाहू विषयी काढलेले उद्गार महत्त्वाचे आहेत. हिंदुस्थानातल्या निरनिराळ्या राजघराण्यात मिश्र विवाह व्हावेत असे राजर्षी शाहू महाराज यांचे मतच नव्हे तर प्रयत्नही होते हे मला माहित आहे या विषयाच्या आधारे राजर्षी शाहू महाराज यांनी आंतरजातीय विवाह घडवून आणण्यासाठी आपल्या संसस्थानामध्ये सातत्याने प्रयत्न केल्याचे आपल्याला दिसून येते.

● **संदर्भ सूची :**

१. गोविंद पानसरे- १९ ८२ ' राजर्षी शाहू: वसा आणि वारसा ' श्रमिक प्रतिष्ठान कोल्हापूर पृष्ठ क्रमांक १४.
२. तत्रैव. पृष्ठ क्रमांक १५.
३. क्रांती सुक्ते : राजर्षी छत्रपती शाहू छत्रपती शाहू. संपादक- एस एस भोसले .२००६ शासकीय मुद्रणालय कोल्हापूर
४. नारायण भोसले २००८ 'महाराष्ट्रातील स्त्रीविषयक सुधारणा वादाचे सत्ताकारण', तदाई प्रकाशन पुणे पृष्ठ क्र.२५६, २५७, २५८, २५९.
५. राजर्षी शाहू गैरव ग्रंथ.(सुधारित तिसरी आवृत्ती २०१६) संपादक प्रा डॉ रमेश जाधव. महाराष्ट्र शासन राजर्षी शाहू चरित्र साधने प्रकाशन समिती मंत्रालय मुंबई.
६. राजर्षी शाहू महाराज यांची अर्थनीती : (२०१८) संपादक -प्राचार्य डॉ जे. के.पवार. राज प्रकाशन कोल्हापूर.

मराठवाड्यातील शेतकऱ्यांच्या समस्या : एक समाजशास्त्रीय अभ्यास.

प्रा. डॉ. डी. के. घाडगे

समाजशास्त्र विभाग,

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

devanandghadge071@gmail.com

● प्रस्तावना:

भारत हा शेतीप्रधान देश म्हणून ओळखला जातो एकूण लोक संख्येपैकी जवळपास 70 टक्के लोक हे ग्रामीण भागात राहतात. भारतीय अर्थव्यवस्था ही शेतीवर आधारित आहे एकूण लोकसंख्येच्या जवळपास 68 टक्के लोकसंख्या ही शेतीवर अवलंबून आहे भारतीय शेती ही निसर्गावर अवलंबून आहे भारताच्या काही भागांमध्ये प्रचंड मोठ्या प्रमाणावर पाऊस पडतो तर काही भागांमध्ये पाऊस पडतच नाही त्यामुळे काही भागात शेतकऱ्यांना ओल्या तर काही भागात कोरड्या दुष्काळांना सामोरे जावे लागते.

● संशोधनाचा उद्देश :

- १) मराठवाड्यातील शेतकऱ्यांच्या समस्या जाणून घेणे.
- २) मराठवाड्यातील शेतकऱ्यांच्या समस्यांची कारणे शोधणे.
- ३) मराठवाड्यातील शेतकऱ्यांच्या समस्यांवर उपाययोजना सुचवणे.

● संशोधन पद्धती :

प्रस्तुत शोधनिबंधाकरिता दुय्यम तथ्य संकलन पद्धतीचा अवलंब करण्यात येईल तसेच संशोधनासाठी लागणारे साहित्य हे शोध पत्रिका, संदर्भग्रंथ, इंटरनेट इत्यादींच्या माध्यमातून संकलित केले जाईल. तसेच प्रत्यक्ष पाहणी करून माहितीचे संकलन आणि विश्लेषण केले.

● मराठवाड्यातील शेतकऱ्यांच्या समस्या एक समाजशास्त्रीय अभ्यास :

पश्चिम महाराष्ट्रामध्ये मोठ्या प्रमाणावर पाऊस पडतो तर विदर्भ आणि मराठवाड्यामध्ये पाऊस हा अतिशय कमी प्रमाणात पडतो तर काही मराठवाड्याच्या काही भागांमध्ये मध्यम ते हलक्या तर काही भागांमध्ये तुरळक पाऊस पडतो त्यामुळे मराठवाड्यातिला शेतकऱ्यांची परिस्थिती अतिशय बिकट स्वरूपाची असलेली दिसून येते मराठवाड्यातील शेती ही पावसावर अवलंबून असल्यामुळे मराठवाड्यातील उस्मानाबाद, लातूर, जालना बीड नांदेड परभणी औरंगाबाद हिंगोली या ठिकाणी मध्यम स्वरूपाचा पाऊस पडतो त्यामुळे मराठवाड्यात शेती ही पावसावर आधारित असल्यामुळे शेतकऱ्यांना पावसा अभावी निर्माण होणाऱ्या अनेक समस्यांना तोंड द्यावे लागते मराठवाड्यातील शेतकऱ्यांचे दरडोई उत्पन्न हे तुटपुंजे असल्यामुळे त्यांना त्यांच्या मूलभूत गरजा ही भागवता येत नाहीत त्यांना निसर्गाच्या लहरीपणामुळे शेतकऱ्यांना अनेक प्रसंगाला तोंड द्यावे लागते कधी कधी वेळी अवेळी पडलेल्या पावसामुळे हाताशी आलेला घास हिरावून घेतला जातो त्यामुळे शेतकऱ्यांचे मोठ्याप्रमाणात नुकसान होते त्यातच शेतकऱ्यांच्या पिकांना शासनाकडून योग्य हमीभाव दिला जात नाही त्यामुळे मराठवाड्यातील शेतकरी हा कर्जबाजारी झालेला दिसून येतो त्याला अनेक वेळा त्याच्या गरजा भागवण्यासाठी सावकाराकडून कर्ज घ्यावे लागते कर्ज घ्यावे लागते सावकाराकडून व्याजाने घेतलेले कर्ज तो सावकाराचे घेतलेले कर्ज वेळेवर परत करू शकत नाही त्यामुळे त्यातच सावकाराचा जाच या आशा अनेक कारणांमुळे त्याच्यासमोर आत्महत्या करण्याशिवाय पर्याय शिल्लक राहत नाही त्यामुळे मराठवाडा आणि विदर्भातील अनेक शेतकऱ्यांनी आत्महत्या केल्याचे आढळून येते.

भारताचे माजी पंतप्रधान लालबहादूर शास्त्री यांनी एक नारा दिला होता तो म्हणजे "जय जवान जय किसान" मात्र आज ती भावना शेतकऱ्यांच्या बाबतीत सरकारची असलेली दिसून येत नाही. सरकारने शेतकऱ्यांच्या बाबतीत जर योग्य पाऊल उचलले तर शेतकऱ्यांना आत्महत्या करण्यापासून शासन वाचू शकतो पण शासकीय दरबारी देखील शेतकऱ्यांच्या विषयी चांगली भूमिका घेतलेली दिसून येत नाही अनेक वेळा शेतकऱ्यांच्या शेती मालाला योग्य हमीभाव दिला जात नाही त्यामुळे शेतकरी वर्षभर शेतात राब राब राबूनही शेवटी त्यांच्या पदरात निराशा पडते अशा निराश परिस्थितीत शेतकरी हवालदिल होतो आणि आत्महत्या सारखे पाऊल उचलतो मराठवाड्यातील शेतकऱ्यांची परिस्थिती ही तर अतिशय दयनीय असलेली दिसून येते मराठवाड्यातील शेती ही पावसावर आधारित असल्यामुळे अनेक वेळा निसर्गाच्या लहरीपणामुळे शेतकऱ्यांना मोठा फटका बसतो मराठवाड्यातील शेती ही आजही पारंपारिक पद्धतीने केली जाते त्यामुळे उत्पादन हे केलेल्या खर्चा इतके ही मिळत नाही त्यामुळे शेतकरी हा कर्जबाजारी झालेला दिसून येतो.

पूर्वीच्या काळी असं म्हटलं जात असे की, उत्तम शेती मध्यम व्यापार आणि कनिष्ठ श्रेणीची नोकरी मात्र सध्याचे चित्र बदललेले दिसून येते शेतीकडे बघण्याचा कल हा निम्न स्वरूपाचा असल्याचे दिसून येते त्याचं मुख्य कारण म्हणजे शेती ही निसर्गाच्या लहरीवर आधारित केली जाते कधी जास्तीचा पाऊस पडतो तर कधी कोरडा दुष्काळ पडतो अशावेळी शेतकरी हा हवालदिल होतो त्यामुळे त्याला आर्थिक समस्यांना सामोरे जावे लागते त्यामुळे तो हलाखीचे जीवन जगत असल्याचे दिसून येते मराठवाड्यातील शेतकऱ्यांची परिस्थिती ही अत्यंत बिकट स्वरूपाची असल्याचे दिसून येते त्याच्यासमोर त्याच्या मुलांचे शिक्षण मुलींचे विवाह घर प्रपंच हे भागवणे देखील त्याला आजच्या परिस्थितीत कठीण झाल्याचे दिसून येते शेती व्यवसाय हा न परवडणार असा झालेला आहे त्यामुळे मराठवाड्यातील शेतकरी कामाच्या शोधात शहराकडे स्थलांतर करत असल्याचे चित्र मोठ्या प्रमाणावर दिसून येते. मराठवाड्यातील शेतकऱ्यांच्या शेतीतून उदरनिर्वाह होईल एवढे ही उत्पन्न निघत नसेल तर तो शेतकरी कशाला शेती करेल अशा स्वरूपाची परिस्थिती आज मराठवाड्यात निर्माण झालेली आहे.

बीड, उस्मानाबाद, लातूर, जालना, नांदेड या भागामध्ये पावसाचे अल्प प्रमाण असल्यामुळे शेतीत केलेला खर्च देखील निघत नसल्यामुळे आज शेतकऱ्यांचा शेतीकडे बघण्याचा दृष्टिकोन दिवसेंदिवस खालावत चाललेला दिसून येत आहे शेतीमध्ये असलेली छुपी बेकारी दिवसेंदिवस वाढत चाललेली असून नवीन तंत्राचा वापर भांडवलाच्या अभावामुळे सर्व शेतकरी करू शकत नाहीत. अपेक्षित भांडवल पुरवठा कमी व्याज दरामध्ये भारतातील बँक करू शकत नाहीत पर्यायाने शेतकऱ्याला खाजगी सावकाराकडून भांडवलासाठी अवलंबून राहावे लागते या सावकाराच्या प्रचंड मोठ्या व्याजदरामुळे शेतकरी हा सतत आर्थिक आणि मानसिक तणावाखाली आपले जीवन जगतो सततचा दुष्काळ दुबारा पेरणी रासायनिक खते व बी बियाणे यांचे वाढलेले दर तसेच महागडे कीटकनाशके शेती अवजारे, मुलां- मुलींचा शिक्षणाचा वाढता खर्च मुलींच्या लग्नाची काळजी, सततची वीज लोड शेडिंग, कागद पत्रासाठी तलाठी महाशयाची नको त्या कुरापाती या आणि आशा अनेक कारणामुळे भारतातील शेतकरी तणावाखाली जगत असलेला दिसून येतो हे आपल्याला शेतकऱ्यांच्या दैनंदिन जीवनावरून सहजपणे लक्षात येऊ शकते भारतातील शेतकऱ्यांची दयनीय अवस्था ही फार वर्षा पूर्वीपासूनच असलेली आपल्याला दिसून येते "शेतकऱ्यांचा आसूड" यामध्ये देखील महात्मा ज्योतिबा फुले यांनी शेतकऱ्यांची होणारी पिळवणूक याचे वर्णन केलेले दिसून येथे शेतकऱ्यांच्या ज्या समस्या आहेत. त्यामध्ये शेतीमध्ये असलेली छुपी बेकारी, आणि अर्थ बेकारी दिवसेंदिवस वाढत चाललेली असून नवीन शेती तंत्राचा अभाव, भांडवला अभाव, अपेक्षित भांडवल पुरवठा, कमी व्याजदरामध्ये बँका शेतकऱ्यांना कर्ज पुरवठा करत नाहीत त्यामुळे शेतकऱ्यांना सावकाराकडून कर्ज घ्यावे लागते सावकाराचं घेतलेले भाग भांडवल शेतकऱ्यांना न परवडणारे असते तरी देखील शेतकऱ्यांना सावकारावरच अवलंबून राहावे लागते. त्यांच्या प्रचंड मोठ्या व्याज दरामुळे शेतकरी सतत आर्थिक आणि मानसिक तणावाखाली जगत असतो मागच्या काही वर्षांपासून मराठवाड्यामध्ये पावसाचं बे भरवशाचं चक्र निर्माण झाल्यामुळे शेतकरी हवालदिल झालेला दिसून येतो शेतकऱ्यांचा शेतीकडे पाहण्याचा कल हा हळूहळू बदलत असलेला दिसून

येत आहे लोड शेडिंग, अवेळी पडलेल्या पावसामुळे हाताशी आलेले पीक हे ही नष्ट होऊन जाते,शेतमालाला हमीभाव योग्य पद्धतीने दिला जात नाही त्यामुळे त्याच्यासमोर कर्जाचा मोठा डोंगर उभा राहतो या सर्व परिस्थितीत शेतकरी हा आर्थिक कमकुवत झालेला दिसून येतो मराठवाडा तसेच विदर्भातल्या अनेक शेतकऱ्यांनी या नापिकीला कंटाळून आत्महत्या केल्याचे चित्र आपल्याला दिसून येते.

● **संदर्भ ग्रंथ :**

- १) देशमुख, येळणे - "योजना". जागतिकीकरण कृषी क्षेत्रातील बदल व शेतकऱ्यांच्या आत्महत्या.
- २) शरद जोशी - "शेतकरी संघटना विचार आणि कार्यपद्धती" जनशक्ती वाचक चळवळ,औरंगाबाद.
- ३) नाईकवाडे अशोक(२०१०) - "शेतकऱ्यांच्या आत्महत्या चिंता आणि चिंतन" औरंगाबाद कीर्ती प्रकाशन.
- ४) शिंदे विनायक (२०१५) "शेतकरी आत्महत्या" नांदेड सूर्य मुद्रा प्रकाशन.
- ५) विष्णू ढोबळे (२००९) " शेतकऱ्यांच्या आत्महत्या जागतिकीकरणातील शोकांतिका ,पुणे .सुगावा प्रकाशन.

Drought stress in plants and possible methods of alleviation: Mini Review

Dr. Komal K. Bhise, Dr. Savita D. Mali

Department of Microbiology,
Vivekanand College, Kolhapur
416003, Maharashtra, INDIA.
komalbhise7@gmail.com

Abstract

Increasing drought stress is alarming constraint to agricultural crop productivity. Several mitigation strategies are required to cope with drought stress. drought condition results in inhibited germination, photosynthesis, oxidative stress and osmotic stress, The present review highlights the effects of drought condition on plant growth at physiological, biochemical and molecular level and its alleviation using plant growth promoting bacteria (PGPB), Silicon (Si) and Super absorbent polymer (SAP).

Keywords: Drought stress, Plant growth promoting bacteria, Silicon, Superabsorbent polymer.

Introduction

The increase in worldwide population and drastic climatic changes haunt the food security (Lesk et al. 2016). The present scenario shows that plants are continuously getting bare to several stress conditions. Water is essential factor in agriculture field however it is limited resource (Wang et al, 2012). Drought stress is major abiotic stress affecting food security for worldwide increasing population and is predicted to severely affect plant growth by 2050 for more than 50 % of land (Vinocur and Altman 2005; Kasim et al. 2013 Hashem et al., 2017). As per WHO affects around 55 million people worldwide (WHO 2020). Drought stress may be short, moderate, severe and extremely prolonged, affecting overall crop growth and yield (Bottner et al. 1995). The main cause of drought stress is changed pattern of rainfall and decreased precipitation (Lobell et al., 2011). The plant water relationship is affected at whole plant and cellular level thus leads to specific plus nonspecific physiological response (Beck et al. 2007). Drought stress results in reduction in leaf expansion, stem elongation ((Engelbrecht et al., 2007), water potential, photosynthesis (Yang et al. 2010; Alcazar et al. 2011), ionic and nutrient imbalance (Engelbrecht et al., 2007). Drought stress induced elevated level of reactive oxygen species (ROS) affect redox status of plants resulting in damages due to oxidation of proteins, lipids, nucleic acid and photosynthetic pigment (Nahar et al., 2017). Drought stress reduces growth of several important crops such as wheat, maize, barley, potato, pigeon pea and rice (Rampino et al. 2006; Kamara et al. 2003; Samarah 2005; Lafitte et al. 2006; Hijmans, 2003; Nam et al., 2001).

Effect of drought stress on plant growth

Drought stress induces several morphological, physiological and biochemical changes in plants thus affect overall plant growth and productivity (Noman et al. 2015; Ye et al. 2012). Drought stress affects cell membrane hence maintenance of cell membrane integrity and stability is vital for development of drought tolerance in plants (Bajji et al., 2002). Drought stressed plants have altered elasticity of cell wall, excessive toxic metabolites and reduced photosynthesis consequent in plant death. Drought stressed plants have altered proteomic and biochemical status due to changes in gene expression (Caruso 2009, Alvarez 2008, Li 2008, Carmo 2009).

Presence of sufficient water level is essential for plant survival in drought condition. Drought stressed plants maintains high water level through osmotic adjustment (Osakabe et al. 2014). However reduced water potential and water contents under drought stress have been reported in several plants (Ali et al. 2013b; Noman et al. 2015). Plants requires sufficient amount of essential nutrients for growth and development. Drought condition affects soil nutrients availability and its transport in plant as water carries the nutrients to plant root. Drought stress reduces diffusion and mass flow of nutrients, which are water soluble such as calcium, magnesium, nitrate and sulfate (Selvakumar et al. 2012).

The main response to drought condition is arrest of plant growth. Under drought stress the cell growth is severely impaired due to reduced turgor pressure (Taiz and Zeiger, 2006). Drought stress inhibits cell division and enlargement (Jaleel et al, 2009), reduces plant height (Bunnag and Pongthai, 2013) and tillers number (Bunnag and Pongthai, 2013). Maize plant growing under water limiting condition showed decreased height and leaf size (Khan et al. 2015). Under water limiting conditions fresh and dry weight of plants gets significantly decreased (Zhao et al. 2006).

Seed germination is most important step in the formation of seedling. Drought condition is major stress which delays or prevents process of seed germination (Hubbard et al. 2012; Shi et al. 2014). The acclimatization of germination and establishment of seedling to environmental condition is necessary for plant propagation (Zhang et al. 2005). The drought stress originated reduced germination and seedling growth has been reported in important crops such as *Oryza sativa* L., *Pisum sativum* L. and *Medicago sativa* L. (Okcu et al., 2005; Manikavelu et al., 2006; Zeid and Shedeed, 2006). Plants subjected to drought stress have inhibited shoot growth which decreases plant requirement of metabolites and mobilize them for production of compounds needed for osmotic adjustment (Hsaio and Xu 2000). Okcu et al. (2005) reported impaired germination and seedling growth of pea subjected to drought stress. These results corroborates with Zeid and Shedeed (2006) who reported reduced germination, length and weight of alfalfa (*Medicago sativa*) grown under water deficit conditions.

Drought stress affects photosynthesis, an important process of plant growth and productivity. Drought stress induced decrease in chlorophyll content has been reported in *Carthamus tinctorius* (Siddiqi et al., 2009), *Paulownia imperialis* (Ayala-Astorga and Melendez, 2010), *Jatropha curcas* (Evandro N. Silva 2010) and bean (Beinsan et al., 2003). The decrease in rate of photosynthesis in drought condition is due to the decrease in photosynthetic enzymes

activity, decreased efficiency of photosystem II, stomatal closure (Centritto et al, 2009), reduced leaf expansion and leaf senescence (Wahid et al., 2007). Drought stress makes the plants more vulnerable to photo damages due to stomatal closure, which decreases availability of CO₂ (Lawlor and Cornic, 2002).

Drought stress results in oxidative stress in plants because of the amassed synthesis of ROS due to disruption in photosynthesis, increased rate of photorespiration which alters cell homeostasis. ROS such as hydroxyl radicals, hydrogen peroxide and super oxide radicals are normally generated in very less amount under non stress conditions in several plant organelles (Apel and Hirt 2004). Accumulated ROS increases lipid peroxidation, resulting in DNA, proteins and lipid damages (Pompelli et al. 2010). Elimination of ROS and prevention of drought stress originated oxidative stress is effective strategy for development of drought tolerance in plants (Bartels 2001) Plants are equipped with enzymatic (catalase (CAT), glutathione reductase (GR), superoxide dismutase (SOD), ascorbate peroxidase (APX)) and non-enzymatic (ascorbic acid, glutathione and cysteine) defense system which scavenge ROS thus protects them against drought stress induced elevated level of ROS (Miller et al. 2010).

The most common response of plant to drought condition is osmotic stress because of the imbalance in water level (Vinocur and Altman 2005). Osmotic stress results in different effects in drought stressed plants at cellular level. It limits plant growth due to reduced rate of photosynthesis, resulting in increasing production of ROS that damages cell components. Severe drought stress reduces volume of cytosole and vacuole because of the cell dehydration (Bartels and Sunkar 2005). Drought stress stimulated osmotic stress is mediated by osmolytes synthesis thus reestablishes homeostasis (Zhu 2002). Plants adapt to drought stress condition by accumulating osmolytes such as trehalose, glycine betaine and proline (Vendruscolo et al. 2007; Rodriguez et al. 2009). Drought tolerance in plants is indicated by an increased level of amino acids (Zhu 2002) which is reported in drought stressed plants including wheat, sorghum and pepper (Yadav et al. 2005). Increased level of proline gives indication of presence of drought stress in plants (Valentovic et al. 2006).

Plants tolerate drought stress condition by multiple mechanisms such as antioxidant production and osmolytes synthesis (Umezawa et al. 2006). Abscisic acid is hormone, produced by drought stressed plants which coordinates several strategies of plants for protection against drought condition (Hubbard et al. 2010). Plants may increase root growth by improving plant water acquisition (Gowda et al. 2011) or reduce use of water by closing stomatas and slowing growth (Lopes et al. 2011) or may accelerate flowering stage before beginning of stress (Neumann 2008).

Strategies to alleviate drought stress

Plant growth promoting bacteria

Bioinoculants improves quality of soil as compared to chemical based fertilizers (Kumar et al., 2016). PGPB are potential candidates which modulates physiological response to drought hence ensures survival of drought stressed plants (Manjunatha et al. 2022, Marasco et al. 2012).

Ethylene is plant hormone involved in plant growth and development plus defense against several abiotic stress conditions at low level (Kazan 2015). When plants are exposed to stressful condition an elevated level of ethylene is produced (Abdelaal et al. 2021) hence this hormone is widely known as stress ethylene, which hinders overall growth of plant. After the exposure of plants to stress condition, the stress ethylene synthesis occurs in two peaks, small first peak of ethylene is responsible for expression of plant defense genes while the large second peak known as stress ethylene is deleterious to plant growth and development (Glick et al. 2007). PGPB have ability to produce ACC deaminase enzyme which metabolize ACC, an immediate precursor of ethylene into ammonia and α -ketobutyrate hence reduces stress ethylene level in plants (Shaharoon et al. 2006). The inhibitory effects of drought stress on growth and yield of pea are eliminated by ACC deaminase expressing PGPB (Arshad et al., 2008). Mayak et al. (2004) examined reduced ethylene level and improvement in weight of drought stressed tomato and pepper plants bacterized with ACC deaminase producing *Achromobacter piechaudii* ARV8. Similarly inoculation of drought stressed *pisum* with ACC deaminase producing PGPB *Pseudomonas* spp. results in longer root development which increases plant water uptake from soil (Zahir et al. 2008). Similarly, drought stress suffering wheat plants inoculated with ACC deaminase producing PGPB have increased shoot biomass and increased root length (Magnucka and Pietr 2015).

PGPB involves some biochemical and physiological changes in plants hence induce drought resistance such as antioxidants defense, production of plant hormones such as indole-3-acetic acid (IAA), gibberellic acid, abscisic acid (ABA) and cytokinins, synthesis of ACC deaminase enzyme, exopolysaccharides and induced systematic tolerance (IST) (Fig. 1) (Khalid et al. 2006, Kim et al. 2012; Timmusk et al. 2014).

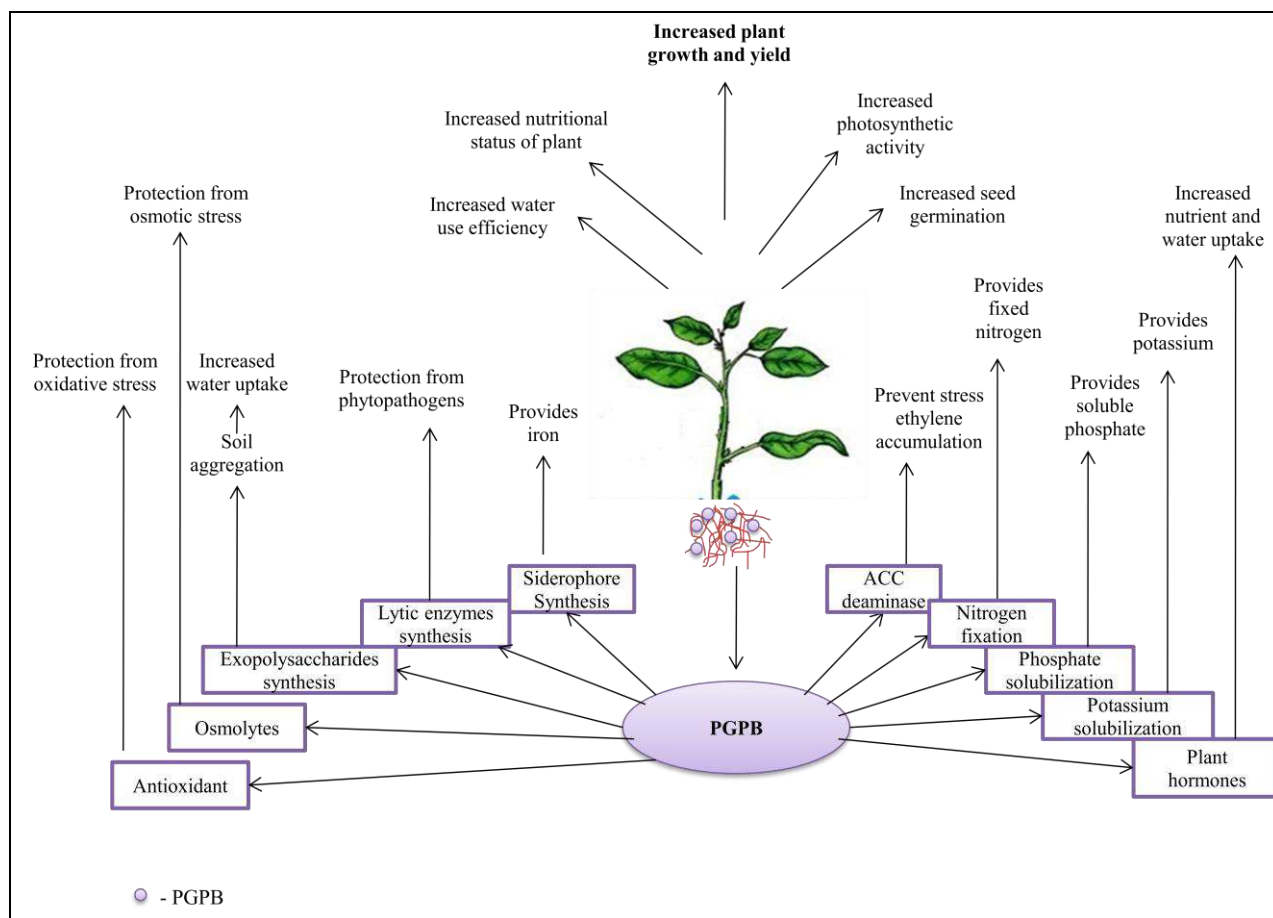


Fig. 1- Role of PGPB in promotion of growth of drought stressed plants

IST is microorganism originated physicochemical changes in plant, which ensures improved tolerance to abiotic stress conditions (Yang et al., 2009).

Plant hormones such as IAA, gibberellic acid, cytokinins and ABA are essential for plant growth and development (Egamberdieva, 2013) and helps the plants to survive under stress conditions (Fig. 1) (Fahad et al., 2015). PGPB have an ability to synthesize plant hormones which stimulates growth and division of plant cells to develop tolerance against stress conditions (Glick and Pasternak, 2003). Reduced ethylene level by ACC deaminase and promotion in plant growth by bacterial auxin has been reported by Belimov et al. (2015) when potato plants exposed to drought conditions were inoculated with PGPB. Furthermore, *Azospirillum lipoferum* producing gibberellic acid and ABA, mitigates drought stress in maize plants (Cohen et al., 2009). Furthermore *P. putida* H-2-3 with gibberellic acid producing ability when inoculated to drought stressed soyabean plants improves plant growth (Kang et al., 2014). IAA producing PGPB mediates interaction between producing bacteria and plant plus protects bacteria from stressful environmental conditions. In an experiment carried by Bianco et al. (2006) about 50 % of bacterial cells gets died when exposed to osmotic stress, while treatment of IAA showed 30 % death of bacterial cells. The exopolysaccharides produced by PGPB increases soil aggregation, maintains high water potential around bacterized plant roots which leads to increase plant

nutrient uptake hence increases plant growth and helps the drought stressed plants for survival (Selvakumar et al., 2012). Bacterization of drought affected maize plant by exopolysaccharide producing *Pseudomonas aeruginosa*, *Proteus penneri* and *Alcaligenes faecalis* exhibited increase in proteins, sugar, proline level and decrease in antioxidant enzyme activity (Naseem and Bano, 2014). Exopolysaccharide protects PGPB and plants from desiccation as it holds the water in microenvironment and releases water slowly in surrounding soil hence dries up very slowly (Hepper, 1975). Exopolysaccharide production also increases rhizospheric competence of PGPB which results in direct effect of plant growth promoting properties of organism on plant growth and productivity (Bhise et al. 2017). Some PGPB produces phytase enzyme which solubilize phytate compounds thus make the soluble phosphate available to plants which again help the plants for their growth under stress conditions (Kumar et al. 2016b). Abdelaal et al. (2021) reported improved height and weight in drought stressed soyabean plants added with *Pseudomonas*. Plants suffering from drought condition respond by increasing abscission and senescence of older leaves, the process also called as leaf area adjustment (Gepstein and Glick 2013), however elongation in plant roots occurs to reach ground water for plant need (Brunner et al. 2015). For continuous growth of plant under drought stress, maintenance of water potential is necessary and this can be achieved by accumulation of compatible solute such as proline, organic acids and glycine betaine, which plays a vital role in osmotic adjustment. Osmolytes produced by PGPB maintains osmotic balance of plants thus help the plant to grow in drought stress (Vanderlinde 2010). Inoculation of drought stressed maize plants by *Pseudomonas putida* GAP-P45 showed accumulation of proline which improved relative water content and plant biomass (Sandhya et al., 2010). Furthermore inoculation of drought exposed tomato plant by *Bacillus polymyxa* exhibited increased proline to mitigate stress (Shintu and Jayaram, 2015). PGPB activates antioxidant defense which improves cell membrane stability hence increases drought resistance in plants (Gusain et al. 2015). Reduced activity of antioxidant enzymes such as GPX and APX in *Bacillus* species inoculated maize plants has been observed by Vardharajula et al. (2011), developing protection against drought condition. In soil environment plant and bacteria communicates with each other by producing volatile organic compounds (VOC). These VOC activates plant gene synthesis encoding ROS scavenging enzymes such as CAT, SOD and GR, which in turn protects the plants against drought stress (Timmusk et al. 2014). Significantly reduced melondialdehyde (MDA) contents has been observed by (Chandra et al. 2018) in drought stressed finger millet (*Eleusine coracana* (L.) when supplemented with ACC deaminase producing PGPB *pseudomonas* sp. Furthermore author has also reported increased fresh and dry weight of shoot and root and photosynthetic pigment content in finger millet exposed to drought stress applied with *pseudomonas* sp. inoculum. Batool et al. (2020) also reported improved chlorophyll, total soluble sugar and protein contents in drought stressed potato plants inoculated with *B. subtilis* HAS31

Silicon

Silicon (Si) is second mainly abundant element of earth crust accounting for 28 % of total earth crust (Sommer et al. 2006). Si considered as nonessential for plant growth and development

(Luyckx et al., 2017). However Si plays a key role in plant growth, enzyme functioning, gene expression (Vatansever et al., 2017), activates many processes of physiologically and metabolically important (Parveen and Ashraf, 2010).

Plants growing in soil have Si in their tissue (Ma and Yamaji, 2008) which gets varied based on plant genotype and species (Ma and Yamaji, 2008). The uptake and transport of Si in plants is classified as active, passive or rejective. It has been reported that Si mitigates dangerous effects of abiotic stresses such as drought, salinity and metal toxicity (Ali et al. 2012a, 2013a; Ahmed et al. 2014a; Keller et al. 2015). Inoculation of Si mitigates adverse effects of drought stress on sorghum (Yin et al. 2014), potato (Crusciol et al. 2009) and wheat (Gong et al. 2005).

Si inoculation to drought stress suffering plants increases plant water contents and decreases loss of water by stimulating synthesis of silica cuticles double layer under leaf epidermis (Luyckx et al., 2017). Increase in water uptake by plant root inoculated with Si is because of the activation in amino acids and sugar accumulation (Sonobe et al. 2011). Under drought stress Si increases hydraulic conductance of plant root which increases plant water uptake and transport thus results in up regulation of transcription of several aquaporin genes (Liu et al. (2014). Si plays a vital role in maintenance of plant mineral balance under stress condition due to increased water conservation and nutrient absorption in plants (Zhu and Gong, 2014). In addition, Si increases membrane stability and reduces cell membrane permeability and inorganic leakage of stressed plant cell (Merwad et al., 2018). Si application to stressed plants maintains plant function and integrity of cell membrane and, improves plant growth hence mitigates stress condition (Merwad et al., 2018).

Plant uptake of essential nutrients is reduced in drought condition (Emam et al. 2014). Si addition in drought stressed wheat increases P level (Gong and Chen 2012). Furthermore Emam et al. (2014) reported improved P and K in drought stressed rice straw when provided with Si over non provided Si plants.

Application of calcium silicate to drought stressed maize improved seed germination (Zargar and Agnihotri 2013). Si application under drought stress increases plant growth. Ahmed et al. (2011b) reported improved dry weight of root and shoot of drought stressed *Sorghum bicolor* L. inoculated with Si. Furthermore Hamayun et al. (2010) examined increased fresh plus dry weight and shoot length of *Glycine max* L. when applied with Si. Similarly Si inoculated drought affected rice showed increased rice grain yield over control (Nolla et al. 2012) and increased level of phenolics and flavonoids (Emam et al. 2014) over uninoculated plant. Si application increases chlorophyll contents of drought stressed plants such as soybean (Shen et al. 2010), wheat (Pei et al. 2010) and sorghum (Yin et al. 2014). Si induced increase in photosynthetic pigment contents in drought stress suffering plants might be due to the Si originated reduced oxidative stress and increased water potential and gas exchange. Drought affected wheat plants added with Si showed increased rate of photosynthesis, relative water contents and stability of cell membrane (Maghsoudi et al., 2016).

Si regulates overproduction of ROS in plants suffering from abiotic stress conditions. Kim et al. (2017) elucidated that the Si supplementation to stressed plants induces stress

resistance in plants by decreasing ROS overproduction by improving antioxidant enzymes activity mainly ascorbate peroxidase and catalase. Reduced lipid peroxidation and H₂O₂ has been reported in wheat (Pei et al. 2010), sunflower (Gunes et al. 2008), chickpea (Gunes et al. 2007) and *G. uralensis* (Zhang et al. 2017) when added with Si.

Si application may increase drought tolerance in plants by adjusting osmotic status of plants and increasing osmolyte level (Zhang et al. (2017)). Inoculation of drought stressed *Cucumis sativus* L. by Si has improved tolerance in plant by improving water content and regulating proline level (Ouzounidou et al., 2016).

Superabsorbent polymer

Soil is dynamic material of great importance, playing an important role in ecosystem hence need to restore for sustainable agriculture (Smith et al. 2015). A soil management practice plays a vital role in maintaining soil quality and crop productivity (Diacono and Montemurro 2011). In order to ameliorate drought stress and maintain agriculture productivity, use of water absorbing soil amendments such as superabsorbent polymers is effective strategy (Yazdanpanah et al. 2016).

Superabsorbent polymers (SAPs) are cross-linked macromolecules capable of absorbing and retaining high amount of water compared to its own weight, with difficulty to remove absorbed water even under pressure (Devine and Higginbotham 2005; Zohuriaan-Mehr et al. 2008). Due to high water retention ability SAP reduces time requirement of plant watering hence acts as energy saving soil conditioner (Bai et al., 2010). In addition, SAPs might retain organic nutrients present in soil and has property to acclimatize to drought condition (Arbona et al., 2005; Bai et al., 2010). Inoculation of SAPs in drought stressed soil improved water use efficiency of crops and decreased amount of water needed for irrigation (Bettoni et al. 2014). SAPs are used in agriculture field in the form of seed coating, additives and root dips (Zohuriaan-Mehr and Kabiri, 2008). Supplementation of SAPs can improves properties of soil such as water holding capacity (Akhter et al. 2004; Yu et al. 2012; Yang et al. 2014) thus increases soil water content, water potential (Bhardwaj et al. 2007) and nutrients retention thus helps the plants to mitigate drought stress (Abedi-Koupai and Asadkazemi, 2006; Orikiriza et al., 2009).

Yang et al. (2017) showed enhanced water consumption in maize exposed to water deficit condition when provided with SAPs. Authors has explained this with two mechanisms, first is increased water holding capacity of soil (Yu et al. 2011) and second is absorption of water from rhizosphere which is then translocated to shoot and transpired via stomata, resulting in growth of maize. Similarly Chehab et al. (2017) reported highest total yield of olive fruits and oil in arid region of Tunisia, when olive plants were inoculated with SAPs (Stockosorb@660) under field condition. The author has correlated these observations with improved water status of soil due to addition of SAPs.

Plant growth is directly related to water contents, when water is added to soil, it transferred to plant for its growth. When water supply to plant is limited it results in restricted plant metabolism (Lee et al. 2001). Supplementation of SAPs to drought stress promotes efficiency in the use of rainwater hence confirms drought resistance in crops (Heschel et al.,

2002). Supplementation of SAP to maize plants exposed to water deficit conditions showed improved photosynthesis, transpiration rate and stomatal conductance (Islam et al. 2011b). Furthermore Hou et al. (2018) confirmed improvement in soil properties, water use efficiency and increased yield of potato tuber when inoculated with SAPs.

Conclusion:

Drought stress is severe constraint on worldwide agricultural production affecting plant growth and productivity resulting in economic loss. Plant growth promoting bacteria, Silicon and Superabsorbent polymers significantly contribute for development of drought tolerance in plants. The use of novel approach combining PGPB, Si and SAP will help to open up new and powerful option to mitigate drought stress and increase agricultural productivity.

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Abdelaal, K., AlKahtani, M., Attia, K., Hafez, Y., Király, L., & Künstler, A. (2021). The role of plant growth-promoting bacteria in alleviating the adverse effects of drought on plants. *Biology*, *10*(6), 520.
- Abedi-Koupai, J., & Asadkazemi, J. (2006). Effects of a hydrophilic polymer on the field performance of an ornamental plant (*Cupressus arizonica*) under reduced irrigation regimes. *Iranian Polymer Journal*, *15*(9), 715-725.
- Ahmed, M., Asif, M., & Hassan, F. U. (2014a). Augmenting drought tolerance in sorghum by silicon nutrition. *Acta physiologiae plantarum*, *36*(2), 473-483.
- Ahmed, M., Qadeer, U., & Aslam, M. A. (2011b). Silicon application and drought tolerance mechanism of sorghum. *African Journal of Agricultural Research*, *6*(3), 594-607.
- Akhter, J., Mahmood, K., Malik, K. A., Mardan, A., Ahmad, M., & Iqbal, M. M. (2004). Effects of hydrogel amendment on water storage of sandy loam and loam soils and seedling growth of barley, wheat and chickpea. *Plant Soil and Environment*, *50*(10), 463-469.
- Alcázar, R., Bitrián, M., Bartels, D., Koncz, C., Altabella, T., & Tiburcio, A. F. (2011). Polyamine metabolic canalization in response to drought stress in *Arabidopsis* and the resurrection plant *Craterostigma plantagineum*. *Plant signaling & behavior*, *6*(2), 243-250.
- Ali, A., Basra, S. M., Hussain, S., & Iqbal, J. (2012a). Increased growth and changes in wheat mineral composition through calcium silicate fertilization under normal and saline field conditions. *Chilean journal of agricultural research*, *72*(1), 98-103.
- Ali, A., Tahir, M., Amin, M., Basra, S. M. A., Maqbool, M., & Lee, J. D. (2013). Si induced stress tolerance in wheat (*Triticum aestivum* L.) hydroponically grown under water deficit conditions. *Bulgarian Journal of Agricultural Science*, *19*(5), 952-958.
- Ali, M. A. M., Ramezani, A., Far, S. M., Asilan, K. S., Moradi-Ghahderijani, M., & Jamian, S. S. (2013). Application of silicon ameliorates salinity stress in sunflower (*Helianthus annuus* L.) plants. *International Journal of Agriculture and Crop Sciences*, *6*(20), 1367-1372.

- Alvarez, S., Marsh, E. L., Schroeder, S. G., & Schachtman, D. P. (2008). Metabolomic and proteomic changes in the xylem sap of maize under drought. *Plant, Cell & Environment*, 31(3), 325-340.
- Apel, K., & Hirt, H. (2004). Reactive oxygen species: metabolism, oxidative stress, and signal transduction. *Annu. Rev. Plant Biol.*, 55, 373-399.
- Arbona, V., Iglesias, D. J., Jacas, J., Primo-Millo, E., Talon, M., & Gómez-Cadenas, A. (2005). Hydrogel substrate amendment alleviates drought effects on young citrus plants. *Plant and Soil*, 270(1), 73-82.
- Arshad, M., Shaharouna, B., & Mahmood, T. (2008). Inoculation with *Pseudomonas* spp. containing ACC-deaminase partially eliminates the effects of drought stress on growth, yield, and ripening of pea (*Pisum sativum* L.). *Pedosphere*, 18(5), 611-620.
- Ayala-Astorga, G. I., & Alcaraz-Meléndez, L. (2010). Salinity effects on protein content, lipid peroxidation, pigments, and proline in *Paulownia imperialis* (Siebold & Zuccarini) and *Paulownia fortunei* (Seemann & Hemsley) grown in vitro. *Electronic Journal of Biotechnology*, 13(5), 13-14.
- Bai, W., Zhang, H., Liu, B., Wu, Y., & Song, J. (2010). Effects of super-absorbent polymers on the physical and chemical properties of soil following different wetting and drying cycles. *Soil use and management*, 26(3), 253-260.
- Bajji, M., Kinet, J. M., & Lutts, S. (2002). The use of the electrolyte leakage method for assessing cell membrane stability as a water stress tolerance test in durum wheat. *Plant growth regulation*, 36(1), 61-70.
- Bartels, D. (2001). Targeting detoxification pathways: an efficient approach to obtain plants with multiple stress tolerance?. *Trends in plant science*, 6(7), 284-286.
- Bartels, D., & Sunkar, R. (2005). Drought and salt tolerance in plants. *Critical reviews in plant sciences*, 24(1), 23-58.
- Batool, T., Ali, S., Seleiman, M. F., Naveed, N. H., Ali, A., Ahmed, K., ... & Mubushar, M. (2020). Plant growth promoting rhizobacteria alleviates drought stress in potato in response to suppressive oxidative stress and antioxidant enzymes activities. *Scientific Reports*, 10(1), 16975.
- Beck, E. H., Fettig, S., Knake, C., Hartig, K., & Bhattarai, T. (2007). Specific and unspecific responses of plants to cold and drought stress. *Journal of biosciences*, 32(3), 501-510.
- Beinsan, C., Camen, D., Sumalan, R., & Babau, M. (2003). Study concerning salt stress effect on leaf area dynamics and chlorophyll content in four bean local landraces from Banat area. *Faculty of Horticulture*, 119, 416-419.
- Belimov, A. A., Dodd, I. C., Safronova, V. I., Shaposhnikov, A. I., Azarova, T. S., Makarova, N. M., ... & Tikhonovich, I. A. (2015). Rhizobacteria that produce auxins and contain 1-amino-cyclopropane-1-carboxylic acid deaminase decrease amino acid concentrations in the rhizosphere and improve growth and yield of well-watered and water-limited potato (*Solanum tuberosum*). *Annals of Applied Biology*, 167(1), 11-25.

- Bettoni, M. M., Mogor, Á. F., Pauletti, V., & Goicoechea, N. (2014). Growth and metabolism of onion seedlings as affected by the application of humic substances, mycorrhizal inoculation and elevated CO₂. *Scientia Horticulturae*, *180*, 227-235.
- Bhardwaj, A. K., Shainberg, I., Goldstein, D., Warrington, D. N., & J Levy, G. (2007). Water retention and hydraulic conductivity of cross-linked polyacrylamides in sandy soils. *Soil Science Society of America Journal*, *71*(2), 406-412.
- Bianco, C., Imperlini, E., Calogero, R., Senatore, B., Amoresano, A., Carpentieri, A., ... & Defez, R. (2006). Indole-3-acetic acid improves *Escherichia coli*'s defences to stress. *Archives of Microbiology*, *185*(5), 373-382.
- Bottner, P., Couteaux, M. M., & Vallejo, V. R. (1995). Soil organic matter in Mediterranean-type ecosystems and global climatic changes: a case study—the soils of the Mediterranean Basin. In *Global Change and Mediterranean-Type Ecosystems* (pp. 306-325). Springer, New York, NY.
- Brunner, I., Herzog, C., Dawes, M. A., Arend, M., & Sperisen, C. (2015). How tree roots respond to drought. *Frontiers in plant science*, *6*, 547.
- Bunnag, S., & Pongthai, P. (2013). Selection of rice (*Oryza sativa* L.) cultivars tolerant to drought stress at the vegetative stage under field conditions. *American Journal of Plant Sciences*, *4*(09), 1701-1708.
- Carmo-Silva, A. E., Keys, A. J., Beale, M. H., Ward, J. L., Baker, J. M., Hawkins, N. D., ... & Parry, M. A. (2009). Drought stress increases the production of 5-hydroxynorvaline in two C₄ grasses. *Phytochemistry*, *70*(5), 664-671.
- Caruso, G., Cavaliere, C., Foglia, P., Gubbiotti, R., Samperi, R., & Laganà, A. (2009). Analysis of drought responsive proteins in wheat (*Triticum durum*) by 2D-PAGE and MALDI-TOF mass spectrometry. *Plant Science*, *177*(6), 570-576.
- Centritto, M., Lauteri, M., Monteverdi, M. C., & Serraj, R. (2009). Leaf gas exchange, carbon isotope discrimination, and grain yield in contrasting rice genotypes subjected to water deficits during the reproductive stage. *Journal of Experimental Botany*, *60*(8), 2325-2339.
- Chandra, D., Srivastava, R., Glick, B. R., & Sharma, A. K. (2018). Drought-Tolerant *Pseudomonas* spp. Improve the Growth Performance of Finger Millet (*Eleusine coracana* (L.) Gaertn.) Under Non-Stressed and Drought-Stressed Conditions. *Pedosphere*, *28*(2), 227-240.
- Chehab, H., Tekaya, M., Mechri, B., Jemai, A., Guiaa, M., Mahjoub, Z., ... & Hammami, M. (2017). Effect of the Super Absorbent Polymer Stockosorb® on leaf turgor pressure, tree performance and oil quality of olive trees cv. Chemlali grown under field conditions in an arid region of Tunisia. *Agricultural Water Management*, *192*, 221-231.
- Cohen, A. C., Travaglia, C. N., Bottini, R., & Piccoli, P. N. (2009). Participation of abscisic acid and gibberellins produced by endophytic *Azospirillum* in the alleviation of drought effects in maize. *Botany*, *87*(5), 455-462.

- Crusciol, C. A., Pulz, A. L., Lemos, L. B., Soratto, R. P., & Lima, G. P. (2009). Effects of silicon and drought stress on tuber yield and leaf biochemical characteristics in potato. *Crop science*, 49(3), 949-954.
- Devine, D. M., & Higginbotham, C. L. (2005). Synthesis and characterisation of chemically crosslinked N-vinyl pyrrolidinone (NVP) based hydrogels. *European polymer journal*, 41(6), 1272-1279.
- Diacono, M., & Montemurro, F. (2011). Long-term effects of organic amendments on soil fertility. . A review, *Agron. Sustain. Dev.* 30 (2010) 401e422.
- Egamberdieva, D. (2013). The role of phytohormone producing bacteria in alleviating salt stress in crop plants. *Biotechnological techniques of stress tolerance in plants. Studium, Houston, TX*, 21-39.
- Emam, M. M., Khattab, H. E., Helal, N. M., & Deraz, A. E. (2014). Effect of selenium and silicon on yield quality of rice plant grown under drought stress. *Australian Journal of Crop Science*, 8(4), 596-605.
- Engelbrecht, B. M., Comita, L. S., Condit, R., Kursar, T. A., Tyree, M. T., Turner, B. L., & Hubbell, S. P. (2007). Drought sensitivity shapes species distribution patterns in tropical forests. *Nature*, 447(7140), 80-82.
- Fahad, S., Hussain, S., Bano, A., Saud, S., Hassan, S., Shan, D., ... & Tabassum, M. A. (2015). Potential role of phytohormones and plant growth-promoting rhizobacteria in abiotic stresses: consequences for changing environment. *Environmental Science and Pollution Research*, 22(7), 4907-4921.
- Gepstein, S., & Glick, B. R. (2013). Strategies to ameliorate abiotic stress-induced plant senescence. *Plant molecular biology*, 82(6), 623-633.
- Glick, B. R., & Pasternak, J. J. (2003). Plant growth promoting bacteria. *Molecular Biology-Principles and Applications of Recombinant DNA*, 436-54.
- Glick, B. R., Cheng, Z., Czarny, J., & Duan, J. (2007). Promotion of plant growth by ACC deaminase-producing soil bacteria. In *New perspectives and approaches in plant growth-promoting Rhizobacteria research* (pp. 329-339). Springer, Dordrecht.
- Gong, H., & Chen, K. (2012). The regulatory role of silicon on water relations, photosynthetic gas exchange, and carboxylation activities of wheat leaves in field drought conditions. *Acta Physiologiae Plantarum*, 34(4), 1589-1594.
- Gong, H., Zhu, X., Chen, K., Wang, S., & Zhang, C. (2005). Silicon alleviates oxidative damage of wheat plants in pots under drought. *Plant Science*, 169(2), 313-321.
- Gowda, V. R., Henry, A., Yamauchi, A., Shashidhar, H. E., & Serraj, R. (2011). Root biology and genetic improvement for drought avoidance in rice. *Field Crops Research*, 122(1), 1-13.
- Gunes, A., Pilbeam, D. J., Inal, A., & Coban, S. (2008). Influence of silicon on sunflower cultivars under drought stress, I: Growth, antioxidant mechanisms, and lipid peroxidation. *Communications in Soil Science and Plant Analysis*, 39(13-14), 1885-1903.

- Gunes, A., Pilbeam, D. J., Inal, A., Bagci, E. G., & Coban, S. (2007). Influence of silicon on antioxidant mechanisms and lipid peroxidation in chickpea (*Cicer arietinum* L.) cultivars under drought stress. *Journal of Plant Interactions*, 2(2), 105-113.
- Gusain, Y. S., Singh, U. S., & Sharma, A. K. (2015). Bacterial mediated amelioration of drought stress in drought tolerant and susceptible cultivars of rice (*Oryza sativa* L.). *African Journal of Biotechnology*, 14(9), 764-773.
- Gusain, Y. S., Singh, U. S., & Sharma, A. K. (2015). Bacterial mediated amelioration of drought stress in drought tolerant and susceptible cultivars of rice (*Oryza sativa* L.). *African Journal of Biotechnology*, 14(9), 764-773.
- Hamayun, M., Sohn, E. Y., Khan, S. A., Shinwari, Z. K., Khan, A. L., & Lee, I. J. (2010). Silicon alleviates the adverse effects of salinity and drought stress on growth and endogenous plant growth hormones of soybean (*Glycine max* L.). *Pak. J. Bot*, 42(3), 1713-1722.
- Hashem, A., Abd_Allah, E. F., Alqarawi, A. A., Radhakrishnan, R., & Kumar, A. (2017). Plant defense approach of *Bacillus subtilis* (BERA 71) against *Macrophomina phaseolina* (Tassi) Goid in mung bean. *Journal of Plant Interactions*, 12(1), 390-401.
- Hepper, C. M. (1975). Extracellular polysaccharides of soil bacteria. *Soil Microbiology*. N. Walker, ed. Wiley, New York, pp. 93–111.
- Heschel, M. S., Donohue, K., Hausmann, N., & Schmitt, J. (2002). Population differentiation and natural selection for water-use efficiency in *Impatiens capensis* (Balsaminaceae). *International Journal of Plant Sciences*, 163(6), 907-912.
- Hijmans, R. J. (2003). The effect of climate change on global potato production. *American journal of potato research*, 80(4), 271-279.
- Hou, X., Li, R., He, W., Dai, X., Ma, K., & Liang, Y. (2018). Superabsorbent polymers influence soil physical properties and increase potato tuber yield in a dry-farming region. *Journal of Soils and Sediments*, 18(3), 816-826.
- Hsiao, T. C., & Xu, L. K. (2000). Sensitivity of growth of roots versus leaves to water stress: biophysical analysis and relation to water transport. *Journal of experimental botany*, 51(350), 1595-1616.
- Hubbard, K. E., Nishimura, N., Hitomi, K., Getzoff, E. D., & Schroeder, J. I. (2010). Early abscisic acid signal transduction mechanisms: newly discovered components and newly emerging questions. *Genes & development*, 24(16), 1695-1708.
- Hubbard, M., Germida, J., & Vujanovic, V. (2012). Fungal endophytes improve wheat seed germination under heat and drought stress. *Botany*, 90(2), 137-149.
- Islam, M. R., Hu, Y., Mao, S., Mao, J., Eneji, A. E., & Xue, X. (2011). Effectiveness of a water-saving super-absorbent polymer in soil water conservation for corn (*Zea mays* L.) based on eco-physiological parameters. *Journal of the Science of Food and Agriculture*, 91(11), 1998-2005.
- Jaleel C A, Manivannan P, Wahid A, Farooq M, Al-Juburi H J, Somasundaram R, Panneerselvam R. (2009). Drought stress in plants: a review on morphological characteristics and pigments composition. *Int. J. Agric. Biol*, 11(1), 100-105.

- Ji, K., Wang, Y., Sun, W., Lou, Q., Mei, H., Shen, S., & Chen, H. (2012). Drought-responsive mechanisms in rice genotypes with contrasting drought tolerance during reproductive stage. *Journal of plant physiology*, *169*(4), 336-344.
- Kamara, A. Y., Menkir, A., Badu-Apraku, B., & Ibikunle, O. (2003). The influence of drought stress on growth, yield and yield components of selected maize genotypes. *The journal of agricultural science*, *141*(1), 43-50.
- Kang, S. M., Radhakrishnan, R., Khan, A. L., Kim, M. J., Park, J. M., Kim, B. R., ... & Lee, I. J. (2014). Gibberellin secreting rhizobacterium, *Pseudomonas putida* H-2-3 modulates the hormonal and stress physiology of soybean to improve the plant growth under saline and drought conditions. *Plant physiology and biochemistry*, *84*, 115-124.
- Kasim, W. A., Osman, M. E., Omar, M. N., El-Daim, I. A. A., Bejai, S., & Meijer, J. (2013). Control of drought stress in wheat using plant-growth-promoting bacteria. *Journal of plant growth regulation*, *32*(1), 122-130.
- Kazan, K. (2015). Diverse roles of jasmonates and ethylene in abiotic stress tolerance. *Trends in plant science*, *20*(4), 219-229.
- Keller, C., Rizwan, M., Davidian, J. C., Pokrovsky, O. S., Bovet, N., Chaurand, P., & Meunier, J. D. (2015). Effect of silicon on wheat seedlings (*Triticum turgidum* L.) grown in hydroponics and exposed to 0 to 30 μ M Cu. *Planta*, *241*(4), 847-860.
- Kim, Y. C., Glick, B. R., Bashan, Y., & Ryu, C. M. (2012). Enhancement of plant drought tolerance by microbes. In *Plant responses to drought stress* (pp. 383-413). Springer, Berlin, Heidelberg.
- Kim, Y. H., Khan, A. L., Waqas, M., & Lee, I. J. (2017). Silicon regulates antioxidant activities of crop plants under abiotic-induced oxidative stress: a review. *Frontiers in plant science*, *8*, 510.
- Kumar, A., Chanderman, A., Makolomakwa, M., Perumal, K., & Singh, S. (2016b). Microbial production of phytases for combating environmental phosphate pollution and other diverse applications. *Critical reviews in environmental science and technology*, *46*(6), 556-591.
- Kumar, A., Sharma, S., & Mishra, S. (2016a). Evaluating effect of arbuscular mycorrhizal fungal consortia and *Azotobacter chroococcum* in improving biomass yield of *Jatropha curcas*. *Plant Biosystems-An International Journal Dealing with all Aspects of Plant Biology*, *150*(5), 1056-1064.
- Lafitte, H. R., Yongsheng, G., Yan, S., & Li, Z. K. (2006). Whole plant responses, key processes, and adaptation to drought stress: the case of rice. *Journal of experimental botany*, *58*(2), 169-175.
- Lawlor, D. W., & Cornic, G. (2002). Photosynthetic carbon assimilation and associated metabolism in relation to water deficits in higher plants. *Plant, cell & environment*, *25*(2), 275-294.
- Lesk, C., Rowhani, P., & Ramankutty, N. (2016). Influence of extreme weather disasters on global crop production. *Nature*, *529*(7584), 84.

- Li, W. X., Oono, Y., Zhu, J., He, X. J., Wu, J. M., Iida, K., ... & Zhu, J. K. (2008). The Arabidopsis NFYA5 transcription factor is regulated transcriptionally and posttranscriptionally to promote drought resistance. *The Plant Cell*, 20(8), 2238-2251.
- Liu, P., Yin, L., Deng, X., Wang, S., Tanaka, K., & Zhang, S. (2014). Aquaporin-mediated increase in root hydraulic conductance is involved in silicon-induced improved root water uptake under osmotic stress in Sorghum bicolor L. *Journal of experimental botany*, 65(17), 4747-4756.
- Lobell, D. B., Schlenker, W., & Costa-Roberts, J. (2011). Climate trends and global crop production since 1980. *Science*, 1204531.
- Lopes, M. S., Araus, J. L., Van Heerden, P. D., & Foyer, C. H. (2011). Enhancing drought tolerance in C4 crops. *Journal of Experimental Botany*, 62(9), 3135-3153.
- Luyckx, M., Hausman, J. F., Lutts, S., & Guerriero, G. (2017). Silicon and plants: current knowledge and technological perspectives. *Frontiers in plant science*, 8, 411.
- Ma, J. F., & Yamaji, N. (2008). Functions and transport of silicon in plants. *Cellular and molecular life sciences*, 65(19), 3049-3057.
- Maghsoudi, K., Emam, Y., & Pessarakli, M. (2016). Effect of silicon on photosynthetic gas exchange, photosynthetic pigments, cell membrane stability and relative water content of different wheat cultivars under drought stress conditions. *Journal of Plant Nutrition*, 39(7), 1001-1015.
- Magnucka, E. G., & Pietr, S. J. (2015). Various effects of fluorescent bacteria of the genus Pseudomonas containing ACC deaminase on wheat seedling growth. *Microbiological research*, 181, 112-119.
- Manickavelu, A., Nadarajan, N., Ganesh, S. K., Gnanamalar, R. P., & Babu, R. C. (2006). Drought tolerance in rice: morphological and molecular genetic consideration. *Plant Growth Regulation*, 50(2-3), 121-138.
- Manjunatha, B. S., Nivetha, N., Krishna, G. K., Elangovan, A., Pushkar, S., Chandrashekar, N., ... & Paul, S. (2022). Plant growth-promoting rhizobacteria Shewanella putrefaciens and Cronobacter dublinensis enhance drought tolerance of pearl millet by modulating hormones and stress-responsive genes. *Physiologia Plantarum*, 174(2), e13676-e13676.
- Marasco, R., Rolli, E., Ettoumi, B., Vigani, G., Mapelli, F., Borin, S., ... & Zocchi, G. (2012). A drought resistance-promoting microbiome is selected by root system under desert farming. *PloS one*, 7(10), e48479.
- Martínez, J. P., Silva, H. F. L. J., Ledent, J. F., & Pinto, M. (2007). Effect of drought stress on the osmotic adjustment, cell wall elasticity and cell volume of six cultivars of common beans (Phaseolus vulgaris L.). *European Journal of Agronomy*, 26(1), 30-38.
- Mayak, S., Tirosh, T., & Glick, B. R. (2004). Plant growth-promoting bacteria that confer resistance to water stress in tomatoes and peppers. *Plant Science*, 166(2), 525-530.

- Merwad, A. R. M., Desoky, E. S. M., & Rady, M. M. (2018). Response of water deficit-stressed *Vigna unguiculata* performances to silicon, proline or methionine foliar application. *Scientia Horticulturae*, 228, 132-144.
- Miller, G. A. D., Suzuki, N., Ciftci-Yilmaz, S. U. L. T. A. N., & Mittler, R. O. N. (2010). Reactive oxygen species homeostasis and signalling during drought and salinity stresses. *Plant, cell & environment*, 33(4), 453-467.
- Mostajeran, A., & Rahimi-Eichi, V. (2009). Effects of drought stress on growth and yield of rice (*Oryza sativa* L.) cultivars and accumulation of proline and soluble sugars in sheath and blades of their different ages leaves. *Agric. & Environ. Sci*, 5(2), 264-272.
- Nahar, K., Hasanuzzaman, M., Alam, M. M., Rahman, A., Mahmud, J. A., Suzuki, T., & Fujita, M. (2017). Insights into spermine-induced combined high temperature and drought tolerance in mung bean: osmoregulation and roles of antioxidant and glyoxalase system. *Protoplasma*, 254(1), 445-460.
- Nam, N. H., Chauhan, Y. S., & Johansen, C. (2001). Effect of timing of drought stress on growth and grain yield of extra-short-duration pigeonpea lines. *The Journal of Agricultural Science*, 136(2), 179-189.
- Naseem, H., & Bano, A. (2014). Role of plant growth-promoting rhizobacteria and their exopolysaccharide in drought tolerance of maize. *Journal of plant interactions*, 9(1), 689-701.
- Neumann, P. M. (2008). Coping mechanisms for crop plants in drought-prone environments. *Annals of Botany*, 101(7), 901-907.
- Nolla, A., Faria, R. J., Korndorfer, G. H., & Silva, T. R. B. (2012). Effect of silicon on drought tolerance of upland rice. *Journal of Food, Agriculture & Environment*, 10(1), 269-272.
- Noman, A., Ali, S., Naheed, F., Ali, Q., Farid, M., Rizwan, M., & Irshad, M. K. (2015). Foliar application of ascorbate enhances the physiological and biochemical attributes of maize (*Zea mays* L.) cultivars under drought stress. *Archives of Agronomy and Soil Science*, 61(12), 1659-1672.
- Okçu, G., Kaya, M. D., & Atak, M. (2005). Effects of salt and drought stresses on germination and seedling growth of pea (*Pisum sativum* L.). *Turkish journal of agriculture and forestry*, 29(4), 237-242.
- Orikiriza, L. J., Agaba, H., Tweheyo, M., Eilu, G., Kabasa, J. D., & Hüttermann, A. (2009). Amending Soils with Hydrogels Increases the Biomass of Nine Tree Species under Non-water Stress Conditions. *Clean–Soil, Air, Water*, 37(8), 615-620.
- Ouzounidou, G., Giannakoula, A., Ilias, I., & Zamanidis, P. (2016). Alleviation of drought and salinity stresses on growth, physiology, biochemistry and quality of two *Cucumis sativus* L. cultivars by Si application. *Brazilian Journal of Botany*, 39(2), 531-539.
- Parveen, N. U. S. R. A. T., & Ashraf, M. U. H. A. M. M. A. D. (2010). Role of silicon in mitigating the adverse effects of salt stress on growth and photosynthetic attributes of two maize (*Zea mays* L.) cultivars grown hydroponically. *Pak J Bot*, 42(3), 1675-1684.

- Pei, Z. F., Ming, D. F., Liu, D., Wan, G. L., Geng, X. X., Gong, H. J., & Zhou, W. J. (2010). Silicon improves the tolerance to water-deficit stress induced by polyethylene glycol in wheat (*Triticum aestivum* L.) seedlings. *Journal of Plant Growth Regulation*, 29(1), 106-115.
- Pompelli, M. F., Barata-Luís, R., Vitorino, H. S., Gonçalves, E. R., Rolim, E. V., Santos, M. G., ... & Endres, L. (2010). Photosynthesis, photoprotection and antioxidant activity of purging nut under drought deficit and recovery. *biomass and bioenergy*, 34(8), 1207-1215.
- Rampino, P., Pataleo, S., Gerardi, C., Mita, G., & Perrotta, C. (2006). Drought stress response in wheat: physiological and molecular analysis of resistant and sensitive genotypes. *Plant, Cell & Environment*, 29(12), 2143-2152.
- Rodríguez-Salazar, J., Suárez, R., Caballero-Mellado, J., & Iturriaga, G. (2009). Trehalose accumulation in *Azospirillum brasilense* improves drought tolerance and biomass in maize plants. *FEMS Microbiology Letters*, 296(1), 52-59.
- Samarah, N. H. (2005). Effects of drought stress on growth and yield of barley. *Agronomy for sustainable development*, 25(1), 145-149.
- Selvakumar, G., Panneerselvam, P., & Ganeshamurthy, A. N. (2012). Bacterial mediated alleviation of abiotic stress in crops. In *Bacteria in Agrobiolgy: Stress Management* (pp. 205-224). Springer, Berlin, Heidelberg.
- Shaharoon, B., Arshad, M., & Zahir, Z. A. (2006). Effect of plant growth promoting rhizobacteria containing ACC-deaminase on maize (*Zea mays* L.) growth under axenic conditions and on nodulation in mung bean (*Vigna radiata* L.). *Letters in applied microbiology*, 42(2), 155-159.
- Shen, X., Zhou, Y., Duan, L., Li, Z., Eneji, A. E., & Li, J. (2010). Silicon effects on photosynthesis and antioxidant parameters of soybean seedlings under drought and ultraviolet-B radiation. *Journal of plant physiology*, 167(15), 1248-1252.
- Shi, Y., Zhang, Y., Yao, H., Wu, J., Sun, H., & Gong, H. (2014). Silicon improves seed germination and alleviates oxidative stress of bud seedlings in tomato under water deficit stress. *Plant physiology and biochemistry*, 78, 27-36.
- Shintu, P. V., & Jayaram, K. M. (2015). Phosphate solubilising bacteria (*Bacillus polymyxa*)-An effective approach to mitigate drought in tomato (*Lycopersicon esculentum* Mill.). *Tropical plant research*, 2, 17-22.
- Siddiqi, E. H., Ashraf, M., Hussain, M., & Jamil, A. (2009). Assessment of intercultivar variation for salt tolerance in safflower (*Carthamus tinctorius* L.) using gas exchange characteristics as selection criteria. *Pak J Bot*, 41(5), 2251-2259.
- Silva, E. N., Ribeiro, R. V., Ferreira-Silva, S. L., Vieira, S. A., Ponte, L. F., & Silveira, J. A. (2012). Coordinate changes in photosynthesis, sugar accumulation and antioxidative enzymes improve the performance of *Jatropha curcas* plants under drought stress. *Biomass and bioenergy*, 45, 270-279.
- Smith, P., Cotrufo, M. F., Rumpel, C., Paustian, K., Kuikman, P. J., Elliott, J. A., ... & House, J. I. (2015). Biogeochemical cycles and biodiversity as key drivers of ecosystem services provided by soils. *Soil Discussions*, 2(1), 537-586.

- Sommer, M., Kaczorek, D., Kuzyakov, Y., & Breuer, J. (2006). Silicon pools and fluxes in soils and landscapes—a review. *Journal of Plant Nutrition and Soil Science*, 169(3), 310-329.
- Sonobe, K., Hattori, T., An, P., Tsuji, W., Eneji, A. E., Kobayashi, S., ... & Inanaga, S. (2010). Effect of silicon application on sorghum root responses to water stress. *Journal of Plant Nutrition*, 34(1), 71-82.
- Taiz, L., & Zeiger, E. (2006). *Plant physiology*. 4th. Sinauer Associate, Sunderland, Mass., EUA. Sinauer Associates: 7–64.
- Timmusk, S., El-Daim, I. A. A., Copolovici, L., Tanilas, T., Kännaste, A., Behers, L., & Niinemets, Ü. (2014). Drought-tolerance of wheat improved by rhizosphere bacteria from harsh environments: enhanced biomass production and reduced emissions of stress volatiles. *PloS one*, 9(5), 1-13.
- Umezawa, T., Fujita, M., Fujita, Y., Yamaguchi-Shinozaki, K., & Shinozaki, K. (2006). Engineering drought tolerance in plants: discovering and tailoring genes to unlock the future. *Current opinion in biotechnology*, 17(2), 113-122.
- Usman, M., Raheem, Z., Ahsan, T., Iqbal, A., Sarfaraz, Z. N., & Haq, Z. (2013). Morphological, physiological and biochemical attributes as indicators for drought tolerance in rice (*Oryza sativa* L.). *European Journal of Biological Sciences*, 5(1), 23-28.
- Valentovic, P., Luxova, M., Kolarovic, L., & Gasparikova, O. (2006). Effect of osmotic stress on compatible solutes content, membrane stability and water relations in two maize cultivars. *Plant Soil and Environment*, 52(4), 184-191.
- Vanderlinde, E. M., Harrison, J. J., Muszyński, A., Carlson, R. W., Turner, R. J., & Yost, C. K. (2010). Identification of a novel ABC transporter required for desiccation tolerance, and biofilm formation in *Rhizobium leguminosarum* bv. *viciae* 3841. *FEMS microbiology ecology*, 71(3), 327-340.
- Vardharajula, S., Zulfikar Ali, S., Grover, M., Reddy, G., & Bandi, V. (2011). Drought-tolerant plant growth promoting *Bacillus* spp.: effect on growth, osmolytes, and antioxidant status of maize under drought stress. *Journal of Plant Interactions*, 6(1), 1-14.
- Vatansver, R., Ozyigit, I. I., Filiz, E., & Gozukara, N. (2017). Genome-wide exploration of silicon (Si) transporter genes, *Lsi1* and *Lsi2* in plants; insights into Si-accumulation status/capacity of plants. *BioMetals*, 30(2), 185-200.
- Vendruscolo, E. C. G., Schuster, I., Pileggi, M., Scapim, C. A., Molinari, H. B. C., Marur, C. J., & Vieira, L. G. E. (2007). Stress-induced synthesis of proline confers tolerance to water deficit in transgenic wheat. *Journal of plant physiology*, 164(10), 1367-1376.
- Vinocur, B., & Altman, A. (2005). Recent advances in engineering plant tolerance to abiotic stress: achievements and limitations. *Current opinion in biotechnology*, 16(2), 123-132.
- Wahid, A., Gelani, S., Ashraf, M., & Foolad, M. R. (2007). Heat tolerance in plants: an overview. *Environmental and experimental botany*, 61(3), 199-223.
- Wang, J. H., Geng, L. H., & Zhang, C. M. (2012). Research on the weak signal detecting technique for crop water stress based on wavelet denoising. In *Advanced Materials Research*(Vol. 424, pp. 966-970). Trans Tech Publications.

- Yadav, S. K., Lakshmi, N. J., Maheswari, M., Vanaja, M., & Venkateswarlu, B. (2005). Influence of water deficit at vegetative, anthesis and grain filling stages on water relation and grain yield in sorghum. *Indian Journal of Plant Physiology*, *10*(1), 20-22.
- Yang, J., Kloepper, J.W., Ryu, C.M., 2009. Rhizosphere bacteria help plants tolerate abiotic stress. *Trends Plant Sci.* *14*, 1–4.
- Yang, L., Yang, Y., Chen, Z., Guo, C., & Li, S. (2014). Influence of super absorbent polymer on soil water retention, seed germination and plant survival for rocky slopes eco-engineering. *Ecological Engineering*, *62*, 27-32.
- Yang, S., Vanderbeld, B., Wan, J., & Huang, Y. (2010). Narrowing down the targets: towards successful genetic engineering of drought-tolerant crops. *Molecular plant*, *3*(3), 469-490.
- Yang, W., Li, P., Guo, S., Fan, B., Song, R., Zhang, J., & Yu, J. (2017). Compensating effect of fulvic acid and super-absorbent polymer on leaf gas exchange and water use efficiency of maize under moderate water deficit conditions. *Plant Growth Regulation*, *83*(3), 351-360.
- Yazdanpanah, N., Mahmoodabadi, M., & Cerdà, A. (2016). The impact of organic amendments on soil hydrology, structure and microbial respiration in semiarid lands. *Geoderma*, *266*, 58-65.
- Ye, T., Shi, P., Liu, L., Fan, Y., & Hu, J. (2012). China's drought disaster risk management: Perspective of severe droughts in 2009–2010. *International Journal of Disaster Risk Science*, *3*(2), 84-97.
- Yin, L., Wang, S., Liu, P., Wang, W., Cao, D., Deng, X., & Zhang, S. (2014). Silicon-mediated changes in polyamine and 1-aminocyclopropane-1-carboxylic acid are involved in silicon-induced drought resistance in Sorghum bicolor L. *Plant physiology and biochemistry*, *80*, 268-277.
- Yu, J., Shainberg, I., Yan, Y. L., Shi, J. G., Levy, G. J., & Mamedov, A. I. (2011). Superabsorbents and semiarid soil properties affecting water absorption. *Soil Science Society of America Journal*, *75*(6), 2305-2313.
- Yu, J., Shi, J. G., Dang, P. F., Mamedov, A. I., Shainberg, I., & Levy, G. J. (2012). Soil and polymer properties affecting water retention by superabsorbent polymers under drying conditions. *Soil Science Society of America Journal*, *76*(5), 1758-1767.
- Zahir, Z. A., Munir, A., Asghar, H. N., Shaharouna, B., & Arshad, M. (2008). Effectiveness of rhizobacteria containing ACC deaminase for growth promotion of peas (*Pisum sativum*) under drought conditions. *J Microbiol Biotechnol*, *18*(5), 958-963.
- Zargar, S. M., & Agnihotri, A. (2013). Impact of silicon on various agro-morphological and physiological parameters in maize and revealing its role in enhancing water stress tolerance. *Emirates Journal of Food and Agriculture*, 138-141.
- Zeid, I. M., & Shedeed, Z. A. (2006). Response of alfalfa to putrescine treatment under drought stress. *Biologia Plantarum*, *50*(4), 635-640.
- Zhang, W., Xie, Z., Wang, L., Li, M., Lang, D., & Zhang, X. (2017). Silicon alleviates salt and drought stress of *Glycyrrhiza uralensis* seedling by altering antioxidant metabolism and osmotic adjustment. *Journal of plant research*, *130*(3), 611-624.

- Zhang, Y., Xue, L. G., Gao, T. P., Jin, L., & An, L. Z. (2005). Research advance on seed germination of desert plants. *Journal of Desert Research*, 25(1), 106-112.
- Zhu, J. K. (2002). Salt and drought stress signal transduction in plants. *Annual review of plant biology*, 53(1), 247-273.
- Zhu, Y., & Gong, H. (2014). Beneficial effects of silicon on salt and drought tolerance in plants. *Agronomy for Sustainable Development*, 34(2), 455-472.
- Zohuriaan-Mehr, M. J., & Kabiri, K. (2008). Superabsorbent polymer materials: a review. *Iranian polymer journal*, 17(6), 451-477.

गर्भवती महिलांच्या पोषणाच्या दर्जाचा अभ्यास

प्रा. सई स. पाटील, डॉ. उर्मिला खोत

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

saipatil1972@gmail.com

गोषवारा :

गरोदर अवस्था ही एक नैसर्गिक अवस्था आहे. या काळात स्त्रीला स्वतःचे व गर्भाशयात वाढणाऱ्या गर्भाचे पोषण करावे लागते म्हणून स्त्रीचा आहार हा तिचे व गर्भाचे योग्य प्रकारे पोषण होईल अशा प्रकारे समतोल असावा. ज्या स्त्रियांचा आहार योग्य व पुरेसा असतो त्यांची प्रकृती गर्भावस्थेत चांगली राहते. त्यामुळेच या काळात निर्माण होणाऱ्या गर्भपात, अकाली प्रसूती, रक्तक्षय या समस्या निर्माण होत नाहीत. गर्भाची योग्य वाढ व विकास होऊन सुलभ प्रसूती सह सुदृढ अर्भकाचा जन्म होतो. यासाठी गर्भवती महिलांना प्रत्यक्ष भेटून स्वतः तयार केलेल्या अनुसूचित द्वारे माहिती घेतली. गर्भवती महिलांची कौटुंबिक माहिती, शिक्षण, त्या घेत असलेल्या दैनंदिन आहारातील पोषक घटक, त्यांना असलेल्या आरोग्य समस्या याचा अभ्यास केला असता मांसाहार घेणाऱ्या गर्भवती महिलांमध्ये हिमोग्लोबिनचे प्रमाण जास्त आहे. गर्भवती महिला आहारात दुधाचा समावेश घेतात तसेच गर्भवती महिलांना गर्भावस्थेत घेतल्या जाणाऱ्या आहाराबद्दल जाणून घेण्याची इच्छा आहे.

मुख्य शब्द - गर्भवती, आहार, पोषण

प्रस्तावना -

“जो आरोग्य संपन्न आहे तो आशा करू शकतो आणि जो आशावादी आहे त्याच्याकडे सर्व काही आहे. “

दुसऱ्या शब्दात याचा अर्थ असा आहे की, ज्या व्यक्तीचे जीवन आरोग्यदायी आहे त्या व्यक्तीकडे जीवन जगण्यासाठी सर्व काही आहे. दुदैवाने ज्या व्यक्तीकडे आरोग्यदायी जीवन नाही त्या व्यक्तीच्या जीवनात काहीतरी कमतरता आहे हे निश्चित. मनुष्य हा सतत आशेवर जगत असतो व अशा जीवनाला प्रेरणा, प्रोत्साहन देणारा आरोग्य हा महत्त्वाचा घटक आहे. त्यामुळे निकोप प्रकृती उत्तम राखणे ही कुटुंबाची, समाजाची व पर्यायाने देशाची जबाबदारी आहे.

कोणत्याही देशाच्या प्रगतीचा सर्वात महत्त्वाचा घटक म्हणजे त्या देशातील नागरिकांचे आरोग्य होय. कारण जेथे उत्तम स्वास्थ्य तेथे प्रगती हे जगमान्य समीकरण आहे. भारतातील आरोग्य क्षेत्राचा विचार केला तर अजूनही अपेक्षित विकास झालेला नाही. विशेषतः नवजात अर्भक, बालक व माता यांच्याकडे दुर्लक्ष झाल्याचे दिसून येते. त्यामुळे जनतेच्या आरोग्याची काळजी घेण्यासाठी शासनाने सर्वतोपरी प्रयत्न करणे गरजेचे असते. देशाच्या भविष्याचा विचार केला तर देशातील वाळके महत्त्वाची असून त्यांच्याकडे दुर्लक्ष करून चालणार नाही. देशातील बालकांचे आरोग्य देशासाठी खूप महत्त्वाचे आहे. यासाठी देशातील बालके ही आरोग्यदृष्ट्या सद्दृढ असणे अत्यंत महत्त्वाचे आहे. देशातील बालके निरोगी, सद्दृढ नसतील तर तरुण पिढी निरोगी असणार

नाही. परिणामी देशाची भावी पिढी कमकुवत होऊन देशाच्या प्रगतीत तेच अडथळा ठरतील. त्यामुळेच देशातील भावी पिढीला घडविण्यासाठी गर्भवती स्त्रीचे सदृढ असणे, निरोगी असणे अत्यंत महत्वाचे आहे.

जागतिक आरोग्य संघटनेच्या एका अहवालानुसार मातेकडून बालकाला रोगाची लागण होण्याचे सर्वाधिक प्रमाण भारतात आहे. त्यामुळे बालकांमधील कुपोषण व अर्भक, बालमृत्यूचे प्रमाण कमी करण्यासाठी फक्त बालकावर लक्ष देऊन चालणार नाही तर त्यासाठी मातांचे आरोग्य ही महत्वाचे आहे.

जगभरातील एकूण ४५% बालमृत्यू प्रत्यक्ष अप्रत्यक्ष अपुऱ्या पोषणा मुळेच होतात शिवाय निरोगी मुलांपेक्षा कमी वजनाच्या मुलांमध्ये मृत्युदराचे प्रमाण दुप्पट आहे. पोषक घटकांमध्ये गर्भवती स्त्रीमध्ये लोहाची व फॉलिक ऍसिडची कमतरता अर्भकामध्ये जन्मतः दोष निर्माण करते, जीवनसत्व 'अ' ची कमतरता प्रतिकारशक्ती दुर्बल करते तर आयोडीनच्या कमतरतेमुळे अर्भक कमी बुद्ध्यांकाची असलेली आढळून येतात.

१९९२ साली पहिल्यांदा आईकडून एका पिढीकडून दुसऱ्या पिढीकडे निकोप वाढीतील त्रुटी कशा पुढे जातात हे स्पष्ट झाल्याने स्त्रियांचे आरोग्य आणि हित यांचे महत्त्व अधोरेखित झाले. आणि कुपोषणग्रस्त स्थितीबदलण्याची गरज लक्षात येऊ लागली. गरोदरपणातील कमी अंतर, वारंवार गर्भधारणा या जोडीने कष्टाची शारीरिक कामे, अपुरा आहार, अपुरी आरोग्य निगा आणि भेदाभेद यामुळे स्त्रियांच्या पोषणावर दुष्परिणाम संभवतात. ज्याचे परिणाम फक्त मातेच्या नव्हे तर मुलांच्या आरोग्यावर व पोषणावर ही होतात. (जागतिक आरोग्य संघटना अहवाल १९९७)

संबंधित साहित्यांचा आढावा

या विषयावरील इतर संशोधने

शीर्षक : बाळंतपणाच्या वयातील महिलांमध्ये गर्भधारणे दरम्यान पोषणाच्या महत्त्व विषयी जागरूकता : शहरी महिलांमध्ये एक परिमाणात्मक अभ्यास.

जर्नल : प्रगत फार्मासिटिकल विज्ञान आणि तंत्रज्ञान जर्नल

ISSN - 2328-0182

अबे मुल्ला खान, मालि सालेम, तस्नीम मोहम्मद

- मूल होण्याच्या वयातील महिलांमध्ये गर्भधारणेदरम्यान पोषण विषयक जागृकता जाणून घेण्यासाठी हा अभ्यास करण्यात आला. या अभ्यासातून असे दिसून आले की इतर महिलांच्या तुलनेत गरोदर महिलांमध्ये गर्भधारणेदरम्यान पोषणाच्या महत्वा बाबत अधिक जागरूकता असते. त्यांना गर्भधारणेदरम्यान दुग्धजन्य पदार्थ, भाज्या आणि फळे यांचे महत्त्व माहित होते परंतु त्यांना योग्य आहार आणि गर्भधारणेदरम्यान त्यांच्या प्रभावाशी संबंधित अचूक माहितीचा अभाव होता. काही सहभागींना पौष्टिक त्याची आवश्यकता आणि आणि त्याचे गर्भाच्या वाढीवर होणारे परिणाम याविषयी किमान माहिती नव्हती. २५ ते ३५ वयोगटातील महिलांनी तसेच नोकरदार महिलांनी पोषणाच्या महत्वा बाबत जागरूकता दाखविली.

२) शीर्षक : गरोदरपणातील आहार

जर्नल : बाल रोग शास्त्र युरोपियन जर्नल (३ नोव्हेंबर २०१७)

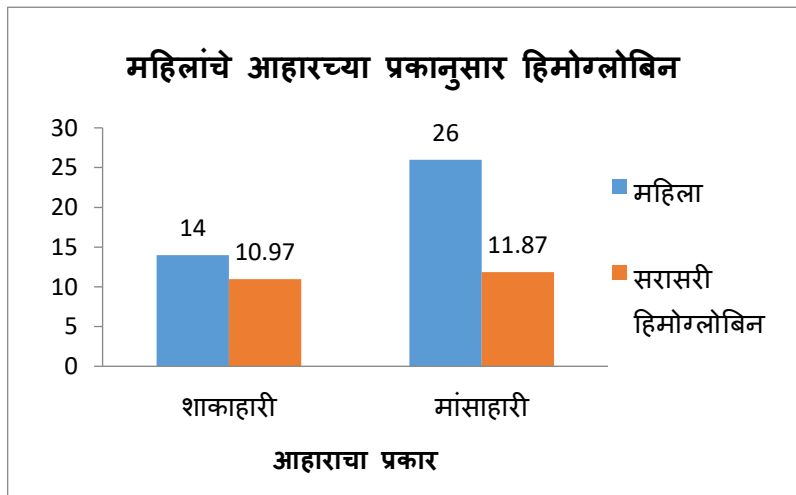
एच डॅनी एविलझ

- या अभ्यासातून गर्भधारणेचे संबंधित प्रश्नांची उत्तरे देण्याच्या प्रयत्न केला जसे काय खावे? किती खावे? ते महत्त्वाचे का आहे? वेगवेगळ्या प्राधिकरणाद्वारे प्रस्तावित केलेल्या शिफारशी ठोस ज्ञानावर आधारित आहेत. फोलेट सप्लीमेंटेशन, आयोडीनच्या योग्य डोस साठी काही चिंता आहेत. तरीही सामान्य गरोदर स्त्रीला योग्य आहाराची रचना करणे कठीण असल्याचे दिसते. नवीन इलेक्ट्रॉनिक अनुप्रयोग उपयुक्त ठरू शकतात. तथापि ते स्थानिक आरोग्य अधिकाऱ्यांनी मंजूर केले पाहिजेत.
- संशोधनाची उद्दिष्टे -
 - १) गर्भवती महिलांच्या आहाराच्या पोषण दर्जाचा अभ्यास करणे.
 - २) गर्भवती महिलांच्या आरोग्याचा अभ्यास करणे.

मर्यादा - कोल्हापूर जिल्यातील आसुर्ले व पोर्ले या दोन गावांतील गर्भवती महिला पुरता

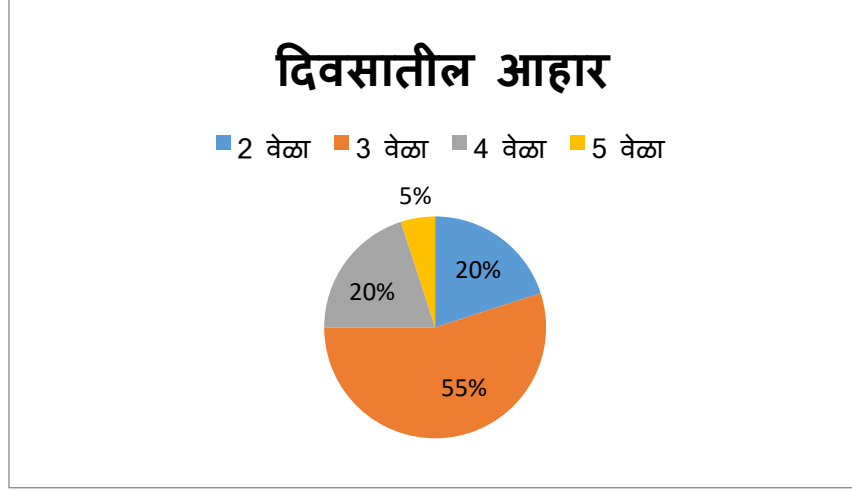
संशोधन कार्यपद्धती :

- अ) माहितीचे संकलन : गर्भवती महिलांच्या पोषणाच्या दर्जाचा अभ्यास करण्याकरिता २५ गर्भवती स्त्रियांना प्रत्यक्ष भेटून स्वतः तयार केलेल्या अनुसूची द्वारे माहिती घेतली ही माहिती घेताना त्यांची कौटुंबिक माहिती, शिक्षण, त्या घेत असलेल्या दैनंदिन आहारातील घटक, त्यांना असलेल्या आरोग्य समस्या यासंदर्भात माहिती संकलित केली.
- ब) माहितीचे विश्लेषण : प्रस्तुत अभ्यास विषयांमध्ये अनुसूची द्वारे संकलित केलेल्या माहितीचे खालील उद्देशानुसार विभागणी करून त्याचे विश्लेषण करण्यात आले.



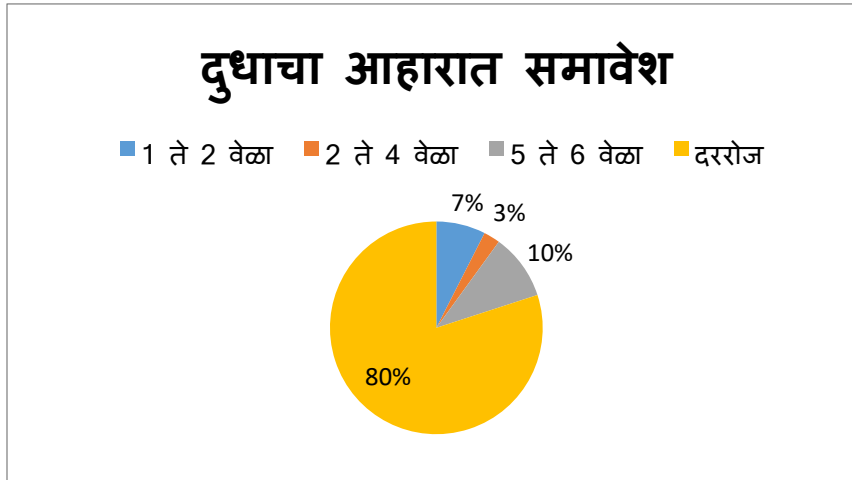
आकृती क्र. १

आकृती क्र. १ नुसार महिलांच्या आहाराच्या प्रकारानुसार हिमोग्लोबिन हे मांसाहारी आहार असलेल्या महिलांचे सरासरी हिमोग्लोबिन प्रमाण हे शाकाहारी आहार असलेल्या महिलांपेक्षा जास्त आहे मांसाहारी पदार्थांमध्ये लोहाचे प्रमाण जास्त असते त्यामुळे मांसाहार करणाऱ्या गर्भवती स्त्रियांमध्ये लोहाचे प्रमाण जास्त दिसून येते.



आकृती क्र. २

आकृती क्र. २ नुसार सर्वेक्षणामध्ये घेतलेला गर्भवती महिलांपैकी ५५% महिला या दिवसातून ३ वेळा, २०% महिला या दिवसातून २ वेळा, २०% महिला या दिवसातून ४ वेळा, गर्भावस्थेत गर्भाची वाढ योग्य रीतीने होण्याकरता गर्भवती स्त्रीने दिवसभरात पाच वेळा थोड्या थोड्या अंतराने आहार घेणे आवश्यक असते आलेल्या सर्वेक्षणात ५% महिलाच दररोज दिवसभरात पाच वेळा आहार घेतात सर्व गर्भवती महिलांनी पाच वेळा आहार घेणे गरजेचे आहे.



आकृती क्र. ३

आकृती क्र. ३ नुसार सर्वेक्षणामध्ये घेतलेल्या गर्भवती महिलांपैकी ८०% महिला आठवड्यात दररोज दुधाचा आहारात समावेश करतात. १०% महिला ५ ते ६ वेळा, ८% महिला १ ते २ वेळा, ३% महिला २ ते ४ वेळा आठवड्यात दररोज

आहारात दुधाचा समावेश करतात ८०% गर्भवती महिला दररोज आहारात दुधाचा समावेश करतात पण दुधातील पोषक घटक पाहता सर्वच गर्भवती महिलांनी दररोज आहारात दुधाचा समावेश करावा.

सर्वेक्षणातून केलेल्या अभ्यासात असे आढळून आले

- गर्भवती महिलांपैकी ४५% महिला ग्रॅज्युएट आहेत. ३८% महिलांचे १२ वी पर्यंत, १०% महिलांचे १० वी पर्यंत शिक्षण व ८% महिलांनी इतर शिक्षण घेतलेले आहे.
- ५२% महिला आठवड्यात दोन ते तीन वेळा तृणधान्यांचा आहारात समावेश करतात. २८% महिला दररोज, १३% महिला आठवड्यातून एक ते दोन वेळा, ८% महिला तीन ते चार वेळा तृणधान्यांचा आहारात समावेश करतात.
- सर्वेक्षणामध्ये घेतलेल्या गर्भवती महिलांपैकी ४०% महिला आठवड्यात २ ते ४ चार वेळा, १८% ५ ते ६ वेळा, १३% महिला १ ते २ वेळा तर ३०% महिला दररोज आहारामध्ये पालेभाज्यांचा समावेश करतात. ३०% गर्भवती महिला दररोज आहारामध्ये पालेभाज्यांचा समावेश करतात परंतु पालेभाज्यांमध्ये असणारी खनिजे, जीवनसत्व, तंतुमय पदार्थ इत्यादी पोषक घटक मिळवण्यासाठी सर्व गर्भवती महिलांनी आहारामध्ये दररोज पालेभाज्यांचा समावेश करावा केला पाहिजे .
- ३८% महिला आठवड्यात ४ ते ५ वेळा डाळींचा समावेश करतात. ३८% महिला आठवड्यात २ ते ३ वेळा, १३% महिला १ ते २ वेळा, १३% महिला दररोज आहारात डाळींचा समावेश करतात.
- ४८% महिला आठवड्यात २ ते ४ वेळा कडधान्यांचा समावेश करतात. २०% महिला ५ ते ६ वेळा, १३% महिला १ ते २ वेळा, २०% महिला दररोज आहारात कडधान्यांचा समावेश करतात.
- ३३% महिला आठवड्यात २ ते ४ वेळा, २५% महिला ५ ते ६ वेळा, १३% महिला १ ते २ वेळा इतर भाज्यांचा आहारात समावेश करतात तर ३०% महिला दररोज आहारामध्ये इतर भाज्यांचा व कंदमुळांचा समावेश करतात.
- सर्वेक्षणामध्ये घेतलेला गर्भवती महिलांपैकी ६३% महिला दररोज फळांचा आहारात समावेश करतात. तर २ ते ४ वेळा २०%, ५ ते ६ वेळा १०%, १ ते २ वेळा ८% महिला आठवड्यात फळांचा आहारात समावेश करतात.
- ३५% महिला दररोज तुपाचा आहारात समावेश करतात. तर २ ते ४ वेळा ४८%, १ ते २ वेळा १०%, ५ ते ६ वेळा ८% महिला आठवड्यात तुपाचा समावेश करतात.
- ५५% आठवड्यातून २ ते ४ वेळा गोड पदार्थांचा आहारात समावेश करतात. आठवड्यातून १ ते २ वेळा २०%, ५ ते ६ वेळा १८% तर ८% महिला दररोज गोड पदार्थांचा आहारात समावेश करतात.
- ३५% महिला मांसाहारी पदार्थांचा आहारात कधीच समावेश करत नाहीत. आठवड्यातून १ ते २ वेळा २७.५%, २ ते ४ वेळा २२.५%, ५ ते ६ वेळा १०% महिला तर ५% महिला दररोज मांसाहारी पदार्थांचा आहारात समावेश करतात.
- ६०% महिलांना गर्भावस्थेत घेतल्या जाणाऱ्या आहाराबद्दल जाणून घेण्याची इच्छा आहे तर ४०% महिलांना आहाराबद्दल जाणून घेण्याची इच्छा नाही.

निष्कर्ष :

१. शाकाहारी गर्भवती महिलांपेक्षा मांसाहार घेणाऱ्या गर्भवती महिलांमध्ये हिमोग्लोबिनच प्रमाण जास्त आहे.
२. ८०% गर्भवती स्त्रिया या दररोज आहारात दुधाचा समावेश करतात.
३. ६३% गर्भवती महिला दररोज आहारात फळांचा समावेश करतात.
४. ३०% गर्भवती महिला दररोज आहारामध्ये पालेभाज्यांचा समावेश करतात
५. ६० % गर्भवती महिलांना गर्भावस्थेत घेतल्या जाणाऱ्या आहाराबद्दल जाणून घेण्याची इच्छा आहे.
६. गर्भवती महिलांनी गर्भावस्थेत घेतल्या जाणाऱ्या आहाराबद्दल माहिती जाणून घेऊन त्याप्रमाणे आहार घेतल्यास गर्भावस्थेत निर्माण होणाऱ्या समस्या कमी होऊ शकतात.

संदर्भ ग्रंथ :

- वाघमारे नाईक शोभा (२०१४) ‘ पोषण आणि आहार ‘ विद्या बुक्स पब्लिशर्स, औरंगाबाद.
- फराकडे त्रिवेणी व गोंगे सुलभा (२००७) ‘पोषण आहारशास्त्र ’ पिंपळापुरे अँड कंपनी पब्लिशर्स, नागपूर.
- मोळवणे मंजुषा (२०१०) ‘ पोषणशास्त्र ‘ कैलास पब्लिकेशन औरंगाबाद.
- महाजनी स्नेहा (२००९) ‘ शास्त्रशुद्ध आहारशास्त्र ‘ श्री मंगेश प्रकाशन, नागपूर.
- Gopalan C. (2009) ‘ Nutritive Value of Indian Foods ‘ NIN, ICMR, Hyderabad.

LCMS Studies of Ethanolic Extract of *Amaranthus Cruentus*

Ms. Wadkar Snehal S.

Department of Botany, Vivekanand College (Autonomous), Kolhapur

E mail: snehalwadkar.bhosale@gmail.com,

Abstract

Untargeted phytochemical profiling from plant extracts would aid in the investigation of multiple groups of compounds and the identification of new bioactive compounds, eliminating duplication in compound identification. This study investigated and evaluated the possible bioactive phytochemicals found in *Amaranthus cruentus*, is leaf and grain vegetable crop which are cultivated while some of *Amaranthus* species which are weedy and wild. Liquid chromatography coupled to electrospray ionisation and quadrupole time-offlight mass spectrometry were used to analyse the untargeted phytochemical composition of active ethanolic leaf extracts. Preliminary screening results revealed that ethanolic extract has a high efficiency as an amino acid, plant hormone, effective antioxidant, and anti-inflammatory agent, as well as a significant amount of total phenolics and flavonoid content. Thus, ethanolic extracts of *Amaranthus cruentus* leaves were submitted to untargeted metabolite profiling to identify its chemical contents. The analysis of liquid chromatography-mass spectrometer spectra revealed the identification of 16 key therapeutically relevant common components, including leaves, p-Aminobenzoic acid, Pentoxifylline, Phyllanthin, Primaquine, Simvastatin, Tamsulosin, Tegafur, and Trichodermin.

Keywords

Amaranthus cruentus, LCMS, antioxidant, anti-inflammatory.

Introduction

Amaranthus is a large taxonomic group with a varied range of species that share traits such as tolerance to biotic and abiotic stressors, high yield, nutritional value, and economic value^[3]. Amaranth is composed of 60-70 different species, 40 of which are indigenous to South America. Over 400 variations of such species can be found worldwide in temperate and tropical regions, and are classed as grain, vegetable, ornamental, or weed types^[14]. *Amaranthus* is a very narrow annual plant that had rapid growth, is drought resistant, and is adaptive to different surroundings. Its various species have unisexual flowers and seeds that are compact, black in colour with shiny lustre. Multiple raised in captivity aspects are grown up in Tamil Nadu, Andhra Pradesh, Karnataka and Kerala in India^[8]. Amaranth is also commonly known as Rajgira (king seed) and Ramdana (God's seed). It is a pseudo-cereal with high protein and nutritious value when compared to cereal crops. The plant's various parts are used to treat respiratory infections, visual issues, tuberculosis, fleshy tumours, liver disorders, and inflammations. Ayurvedic leaf decoction is used to treat chest ailments and gastroenteritis. Seeds can also help with sores. The seeds and leaves are used as an astringent to treat diarrhoea,

bloody stool, hematuria, and heavy menstruation^{[10][16][17]}. Potentially, amaranth species are receiving a lot of attention in developing nations as a way to combat protein deficiency. Tocopherols in Amaranth seeds contain c- and d tocotrienols, which are both unsaturated forms of vitamin E. Both have high antioxidant properties and are being researched as hypocholesterolemic medications^[5].

The most widely used method for separating, identifying, and quantifying secondary metabolites is LC-MS. The current study's goal was to use LC-MS/MS analysis to examine the phytochemical components. For every compound that is extracted from the sample, this analysis yields a clear spectrum result.

Material and Method

Collection of Plant Material

Leaves of *A. cruentus* were collected from different localities in Kolhapur district. The collected plant was identified by department of Botany, Shivaji University, Kolhapur.

Extraction of plant material:

The plant was shade dried and it was ground into powder using a normal method and an electronic blender. Ethanolic extract of selected plant powder was made by a maceration procedure in which the powder was immersed in analytical grade ethanolic and allowed to macerate for 24 hours. After 24 hours, the macerated powder extract was filtered using Whatman. filter No.1. The prepared extract was then used for LC-MS investigation of various *A. cruentus* components.

LC-MS/MS analysis:

The alcoholic extracts of *Amaranthus cruentus* leaves were analyzed using an LC-MS device. Precursor ions were chosen and fragmented in a collision cell with a collision energy slope of 5–45 eV. Accurate mass spectra were obtained in the m/z range of 50–1000. Mass Hunter Workstation software (Qualita) was used to handle raw HPLC–QTOFMS data, as well as data gathering based on molecular formulas estimates and fragment patterns. Molecular features extraction was used to extract ions with identical eluted patterns and associated m/z values, indicating various isotopes of the same chemical^[12].

Result and Discussion

Table 1. Phytocomponents identified in ethanolic leaf extract of *Amaranthus cruentus* by LCMS

Sr. No.	Name	Formula	Mass	RT	Properties
1.	p-Aminobenzoic acid	$C_7 H_7 N O_2$	137.048	1.061	● Gastrointestinal tract
2.	Pentoxifylline	$C_{13} H_{18} N_4 O_3$	278.138	2.8435	● Breast Cancer
3.	Phyllanthin	$C_{24} H_{34} O_6$	418.235	15.961	● Liver cancer
4.	Primaquine	$C_{15} H_{21} N_3 O$	259.169	6.467	● Antimalarial hits, ● Breast adenocarcinoma
5.	Simvastatin	$C_{25} H_{38} O_5$	418.272	16.693	● Human breast cancer, ● Hypercholesterolemic, ● Hypertensive Patients
6.	Tamsulosin	$C_{20} H_{28} N_2 O_5 S$	408.1722	18.021	● Prostatic Hyperplasia Therapy
7.	Tegafur	$C_8 H_9 F N_2 O_3$	200.06	18.937	● Colorectal Cancer, ● Gastric Cancer Cell Apoptosis
8.	Trichodermin	$C_{17} H_{24} O_4$	292.169	16.889	● Antimicrobial activity

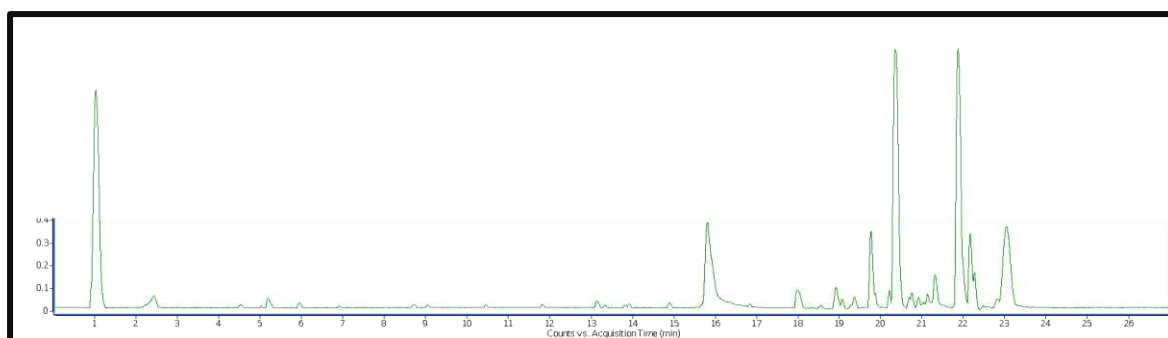


Figure 1: LCMS chromatograph of *Amaranthus cruentus* ethanolic leaf extract

The LC-MS chromatogram of *Amaranthus cruentus* ethanolic leaf extract is shown in fig (1) It was observed that the different peaks were obtained at different retention times. In this the highest peak is at the retention time of 18.9 followed by, 18.0, 16.8, 16.6 belonging to the compound Tegafur, Tamsulosin, Trichodermin and Simvastatin.

With the standard reference graphs, the compounds are elucidated using the molecular weight. The highest peak at the particular retention time is found out and the compounds with the highest peak are given in Table(1). The compound p-Aminobenzoic acid inhibition gastrointestinal tract^[1]. Pentoxifylline showing Breast Cancer activity^[6]. Phyllanthin exhibits Liver cancer^[11]. Primaquine activity against antimalarial hits, Breast adenocarcinoma^[7]. Simvastatin show Human breast cancer, Hypercholesterolemic, Hypertensive Patients^{[2][9]}. Tamsulosin used in Prostatic Hyperplasia Therapy ^[4].Tegafur showing activity against Colorectal Cancer, Gastric Cancer Cell Apoptosis^{[15][13]}. Trichodermin show antimicrobial activity^[16].

Conclusion

The various bioactive compounds were detected by the LC-MS/MS analysis of the *Amaranthus cruentus*. These bioactive compounds exhibit the activity against gastric cancer cell apoptosis, human breast cancer, they are also used in prostatic hyperplasia therapy, hypercholesterolemic, antimicrobial activity. Further research and studies is needed to determine the exact mechanism and potential applications of these compounds in advance drug manufacturing.

References

1. Akberova SI. Novye biologicheskie svoïstva paraaminobenzoïnoi kisloty [New biological properties of p-aminobenzoic acid]. *Izv Akad Nauk Ser Biol.* 2002 Jul-Aug;**(4)**:477-81.
2. Akbarzadeh I., Poor A. S., Yaghmaei S., Norouzian D., Noorbazargan H., Saffar S., Cohan R. A. and Bakhshandeh H., (2020).Niosomal delivery of simvastatin to MDA-MB-231 cancer cells. *Drug Development and Industrial Pharmacy.* **46(9)**.
3. Brenner DM, Baltensperger DD, Kulakow PA, Lehman JW, Myers RL, et al. (2000) Genetic resources and breeding of *Amaranthus*. In Janick Jules (Ed.), *Plant breeding reviews* **19**: 227-285.

4. Ciríaco S. L., Carvalho I., Neto A. T., J., de Sousa Lima Neto J., de Oliveira D., Cunha A., Cavalcante Y., da Silva D., da Silva J. A., Mineiro A., de Lima Chagas Moreno Fernandes M. Z., & Carvalho A. (2020). Development of microemulsion of tamsulosin and dutasteride for benign prostatic hyperplasia therapy. *Colloids and surfaces. B, Biointerfaces*. **185**:110573.
5. Escudero N. L., Zirulnik F., Gomez N. N., Mucciarelli S. I., Giménez M. S. (2006). Influence of a Protein Concentrate from *Amaranthus cruentus* Seeds on Lipid Metabolism. *Experimental Biology and Medicine*. **231**(1):50-9.
6. Fan, S., Smith, M. L., Rivert, D. J., Duba, D., Zhan, Q., Kohn, K. W., and O'Connor, P. M. (1995). Disruption of p53 function sensitizes breast cancer MCF-7 cells to cisplatin and pentoxifylline. *Cancer research*, **55**(8), 1649-1654.
7. Ferraz, R., Noronha, J., Murтинheira, F., Nogueira, F., Machado, M., Prudêncio, M., ... & Gomes, P. (2016). Primaquine-based ionic liquids as a novel class of antimalarial hits. *RSC advances*, **6**(61), 56134-56138.
8. Khurana, D.S., Singh, J. and Kaur, B. (2014). Genetic variability, correlation and path coefficient analysis in *Amaranthus*, *Veg. Sci.*, **40** (2): 238-240.
9. Koh K. K., Son J. W., Ahn J. Y., Kim D. S., Jin D. K., Kim H. S., Han S. H., Seo Y. H., Chung W. J., Kang W. C. and Shin E. K. (2004). Simvastatin combined with Ramipril treatment in Hypercholesterolemic patients. *Hypertension*. **44**(2): 180–185.
10. Kopka J, Fernie A, Weckwerth W, Gibon, Y, Stitt M. Metabolite Profiling in Plant Biology: Platforms and Destinations. *Genome Biology*. 2004; **5**(6): 109.
11. Krithika, R., Mohankumar, R., Verma, R. J., Shrivastav, P. S., Mohamad, I. L., Gunasekaran, P., & Narasimhan, S. (2009). Isolation, characterization and antioxidative effect of phyllanthin against CCl₄-induced toxicity in HepG2 cell line. *Chemico-biological interactions*, **181**(3), 351-358.
12. Narayankar, C., Mane, M., Patil, R., Magdum, A., Satpute, M., Gaikwad, S & Gaikwad, D.K. (2021). Inhibition of Proliferation of K-562 Human Blood Cancer Cell Due To *Opuntia Elatior* Fruit Extract. *Journal of Science and Technology*. **6**. 32-38.
13. Qi J., Xie F., Liu S., Yao C., Liu W., Cai G., and Liao G. (2020). Huaier Granule Combined with Tegafur Gimeracil Oteracil Potassium Promotes Stage IIB Gastric Cancer Prognosis and Induces Gastric Cancer Cell Apoptosis by Regulating Livin: *Biomed Research International*. Article ID 2403595.
14. Rana JC, Pradheep K, Yadav S K, Verma VD, Sharma PC (2007) Durga: A new variety of grain amaranth for cultivation in hill regions. *Indian Farming* **57**: 27-28.
15. Sadahiro S., Suzuki T., Tanaka A., Okada K., Kamijo A., Nagase H. and Uchida J. (2013). Reduction in γ -glutamyl hydrolase expression is associated with response to uracil and Tegafur/Leucovorin chemotherapy in patients with colorectal cancer. *Anticancer research*. **33**(8): 3431–3438
16. Sumner, C. J., Sheth, S., Griffin, J. W., Cornblath, D. R., & Polydefkis, M. (2003). The spectrum of neuropathy in diabetes and impaired glucose tolerance. *Neurology*, **60**(1), 108-111.
17. Tijerino A., Cardoza R. E., Moraga J., Malmierca M. G., Vicente F., Aleu J., Collado I. G., Gutierrez S., Monte E. and Hermosa R. (2011). Overexpression of the trichodiene synthase gene *tri5* increases Trichodermin production and antimicrobial activity in

Trichoderma brevicompactum. *Fungal genetics and biology: FG and B.* **48(3)**:285–296.

18. Weckwerth W. Metabolomics in System Biology. *Annual Review Plant Biology* 2003; **54**: 669-689. 7.

सत्यशोधक लहूजी साळवे : एक कृतीशील क्रांतिकारक

प्रा. खवळे अश्विनी रामचंद्र, डॉ. एस. आर. कट्टीमनी

इतिहास विभाग

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

प्रस्तावना

“ इतिहास म्हणजे एका व्यक्तीची शौर्यगाथा नव्हे, तर सामान्य माणसांनी असामान्य कर्तृत्व दाखवून घडवून आणलेले व्यवस्था परिवर्तन होय.” एकोणिसाव्या शतकामध्ये जे स्वातंत्र्ययोध्ये, क्रांतिकारक होऊन गेले. त्यांच्यापैकीच महाराष्ट्राच्या इतिहासातील एक जबरदस्त लढवय्ये क्रांतिकारक व्यक्तिमत्व म्हणजे लहूजी राघोजी साळवे होय. खालील उक्तीप्रमाणे आपणास त्यांच्या कार्याचे वर्णन करता येईल.

पेटविला यज्ञकुंड स्वातंत्र्याचा | तेजस्वी अन प्रखर

धगधगला विस्तव क्रांतीचा | अशी मारली फुंकर

स्वराज्य मिळवण्या घडवले | हजारो क्रांतिवीर

आद्यक्रांतीगुरू लहूजीचा ऐसा | इतिहास अजरामर ||

भारतातील दलित समजल्या जाणाऱ्या मातंग समाजातील एक स्वातंत्रप्रेमी, शूरवीर घराणे म्हणजे वस्ताद लहूजी साळवे यांचे घराणे होय. स्वातंत्र्याची ज्योत, मशाल, अग्निकुंड धगधगते ठेवण्यात साळवे घराण्याचे योगदान सुवर्णअक्षरांनी लिहावे लागेल. मानवतावादाचा ध्यास घेऊन त्याचप्रमाणे कृतीशील असलेले सशस्त्र क्रांतीचे आद्यजनक म्हणजेच सत्यशोधक वस्ताद लहूजी साळवे होय. सनातनी काळात त्यांनी अनिष्ट रूढी, प्रथांचा, जातिभेद, धर्मभेद, लिंगभेद, राष्ट्रभेद यांसारख्या गोष्टींचा नाश करून मानवतावादी विचारांचा स्वीकार करून त्यांनी जनमानसात आपला विचार रुजवण्याचा प्रयत्न आयुष्यभर केला. मानवतावादावर विश्वास ठेऊन कृती करणारा एक समाजशास्त्रज्ञ तसेच एक सच्चा राष्ट्रभक्त म्हणून लहूजी साळवे यांना ओळखता येईल.

प्रा. डॉ. शरद गायकवाड यांनी आपल्या ‘प्रबोधन चळवळीतील मातंगांची शौर्यगाथा’ या पुस्तकामध्ये मत मांडताना म्हटले आहे की, इतिहास घडविला बहुजनांनी परंतु लिहिला महाजनांनी, अगदीच अलंकारिक भाषेत सांगायचे तर "इतिहास घडविला मांग- महारांसारख्या दलितांनी, तंट्या भिल्ल, बिरसामुंडा यासारख्या आदिवासींनी, परंतु लिहिला म्हशी राखा तुम्ही आणि तूप खातो आम्ही' म्हणणाऱ्या ऐतखाऊ कलमकसाई यांनी. खरे तर ज्यांच्या हाती शस्त्र होती, ढाल- तलवारी होत्या, भाला आणि दांडपट्टा होता त्यांनी त्या-त्या शस्त्राने लढाया लढत राहिले, पराक्रम गाजवत राहिले, वेळप्रसंगी शहीद झाले, हुतात्मा झाले, काहीजण फासावर चढले, तोफेच्या तोंडी दिले गेले अशा दलित, भटके- विमुक्त, आदिवासींनी, मराठ्यांनी आपल्या प्राणांची पर्वा न करता मानवतेच्या रक्षणासाठी, भारतमातेच्या स्वातंत्र्यासाठी स्वतःच्या रक्ताने इतिहास घडविला. बहुजनांचे क्रांतिवीर, स्वातंत्र्यवीर, राष्ट्रवीर स्वतःच्या प्राणांची आहुती देऊन स्वतःच्या रक्ताने भारतमातेचे औक्षण केले ते काळाच्या ओघात इतिहासजमा झाले. कित्येक पिढ्या लढणाऱ्यांच्या अनुल्लेखाने गारद केल्या गेल्या. इतिहासात अशा नररत्नांचा, भारतरत्नांचा खरा इतिहास लपविला गेला, दडपला गेला, दडवला गेला हीच खरी खंत आहे, शोकांतिका आहे.

सशस्त्र क्रांतीचे आद्य जनक - सत्यशोधक क्रांतियोद्धा लहूजी साळवे, आद्य क्रांतिकारक उमाजी नाईक भारतमातेचे सुपुत्र तंट्या भिल्ल बिरसा मुंडा, झाशीसाठी प्राणपणाने लढलेली झलकारीबाई, मल्हारराव होळकर, यशवंतराव होळकर आणि क्रांतीवीरांगना, थोर देशभक्त, राष्ट्रमाता अहिल्याबाई होळकर हे भारताच्या इतिहासातील उपेक्षित क्रांतियोध्ये आहेत, क्रांतिसूर्य आहेत. त्यांचे हे मत रास्तच आहे कारण ज्या पद्धतीने लोकमान्य टिळक, भगतसिंग, सावरकर यांची दखल राष्ट्रीय पातळीवर घेतली गेली तशा पद्धतीने यांची नोंद घेतली गेलेली दिसून येत नाही.

श्री. सचिन गरुड यांनीसुद्धा आपल्या 'मुक्ता साळवे, फातिमा शेख आणि लहूजी वस्ताद' या पुस्तकामध्ये उल्लेख केलेला आहे की, पुण्यातील दलित जातीजमातींचा इतिहास कथन करणाऱ्या एका लेखात डॉ. एलिनॉर झेलियट यांनी लिहिले आहे की, "विसाव्या शतकाच्या आरंभापर्यंत ऐतिहासिक नोंदीमध्ये पुण्याच्या केवळ लहूजीराव मांग या एकमात्र दलित व्यक्तीचे नाव सापडते." यावरून आपल्या लक्षात येते की, वरीलप्रमाणे डॉ. शरद गायकवाड यांनी मांडलेले मत योग्यच आहे.

भारतीय समाजावर धर्मसंस्थेचा,जातीय व्यवस्थेचा पगडा आजही आपणास पहावयास मिळतो. आजही गावकुसाबाहेर राहणाऱ्या मातंग समाजात लहूजी साळवे सारख्या क्रांतियोध्याचा जन्म झाला ही मातंग समाजासाठी अभिमानास्पद गोष्ट मानली जाते. वस्ताद लहूजी साळवे यांनी सर्व जातीधर्मांच्या लोकांसाठी इ. स. १८२२ साली विजयादशमीच्या दिवशी पुण्यातील गंजपेठ येथे मल्लविद्या व युद्धकलेचे प्रशिक्षण देणारी देशातील पहिली क्रांतिशाळा सुरु केली व ही तालीम फक्त तालीम नव्हती तर स्वातंत्र्य प्राप्तीसाठी स्वराज्य भक्तीने पेटवलेला क्रांतीचा यज्ञकुंडच होता. महात्मा फुले यांनी त्यांच्या गंजपेठेतील तालिमीत दांडपट्टा, तलवारबाजी, गोळीबार आदि शारिरीक शिक्षण घेतले. व लहूजी साळवे हे त्यांना तालिमीतील शिक्षण देणारे त्यांचे गुरु होते, त्याचबरोबर त्यांनी लोकमान्य टिळक, वासुदेव बळवंत फडके यांसारख्या समाजसुधारक क्रांतीकारकांनासुद्धा शस्त्रात्रांचे प्रशिक्षण दिले होते, हे तथ्य सर्वपरिचित आहे. लहूजींच्या तालिमीत तयार झालेल्या क्रांतीकारकांना इंग्रजांनी साताऱ्याच्या गेंडामाळावर वडाच्या झाडाला बांधून फाशी दिली, तोफेच्या तोंडी डागले व हे क्रांतिकारक राष्ट्राच्या संरक्षणासाठी शहीद झाले.

तसेच लहूजींचे समाज एकोप्याचे व समाजाला ज्ञानी करून मातृभूमीला अज्ञानाच्या गुलामीतून मुक्त करण्याचे सत्यशोधक विचार ऐकून महात्मा ज्योतिबा फुले भारावून गेले व लहूजींचे क्रांतिकारी विचार ऐकून मुलींसाठी शाळा सुरु करण्याचा ऐतिहासिक निर्णय घेतला. जातीस्त्रीदास्यमुक्तीसाठी स्त्रीशुद्रातिशुद्रांच्या ज्ञानबंदीविरोधात राष्ट्रपिता महात्मा फुले व सावित्रीबाई फुले यांनी उभारलेल्या शैक्षणिक चळवळीतील त्यांचा सहकारी म्हणून महार-मांगांच्या मुलांना घरी जाऊन त्यांना शिक्षणाचे महत्व सांगून शाळेत पाठवायच्या सक्त सूचना केल्या, एवढेच नव्हे तर स्वतःच्या भावाची मुलगी मुक्ता साळवे हिला फुले दांपत्यांच्या शाळेत दाखल करून सत्यशोधक संस्कारात जडणघडण होण्यास मदत केली. त्यांच्या या योगदानामुळे त्यांची पुतणी मुक्ता साळवे वयाच्या १४ व्या वर्षी महार-मांगांच्या दुःखाविषयी निबंध लिहून ब्राह्मणीव्यवस्थेविरुद्ध विद्रोह पुकारला. महार-मांगांच्या मुलांना व मुलींना सावित्रीबाई शिक्षण देण्यासाठी जात आहेत म्हणून काही कर्मठ व सनातनी लोकांनी त्यांना त्रास देण्यास सुरुवात केली. या लोकांचा बंदोबस्त लहूजी साळवे यांनी तालिमीतील पैलवानांच्या मदतीने केला व फुले दांपत्यांच्या पाठीशी खंबीरपणे उभे राहिले.

इ.स. १८२६ मध्ये उमाजी नाईक यांनी इंग्रजांविरुद्ध पुकारलेल्या बंडाला लहूजी साळवे यांनी पाठींबा दिला होता. तसेच त्यांनी इ. स. १८३० मध्ये झालेल्या कोळ्याच्या बंडाला तसेच १८५७ च्या उठावामध्ये रंगोबापूला पाठींबा देऊन त्यांचे

मनोबल वाढवले होते. तसेच लहुर्जीच्या शिष्यांपैकी धर्मा मांग, कनय्या मांग, बाब्या मांग, मोरीया मांग, नाथ्या मांग, यशवंत मांग, मल्ल्या मांग यांना इंग्रजांनी फाशी दिली. देशाच्या स्वातंत्र्यासाठी उठावामध्ये सहभागी होत या शूर क्रांतीकारांनी स्वतःच्या प्राणांचे बलिदान दिले आहे. स्वतः पडद्यामागे राहून लहूजी साळवे यांनी मोठे क्रांतिकार्य केलेले दिसते. व यांची व यांच्यासारख्या अनेक क्रांतीकारकांची ज्यांनी देशाच्या स्वातंत्र्यासाठी स्वतःच्या प्राणांची आहुती दिली यांची साधी दखल ही घेतली जाऊ नये ? हीच तर खरी खेदजन्य बाब आहे.

भारतीय स्वातंत्र्यलढ्याचा सशक्त क्रांतिकारक, आद्यक्रांतीगुरू तसेच एक दलित समाजसुधारक म्हणून ओळखल्या जाणाऱ्या लहूजी साळवे यांच्या कार्याविषयी महात्मा फुले यांनासुद्धा अभिमान होता. लहूजी साळवे फुलेप्रणीत सत्यशोधक चळवळीचे निष्ठावंत कार्यकर्ता म्हणून कार्यरत राहिले. व त्यांच्या सत्यशोधक विचारांचा वारसा आजही तरुण पिढीला प्रेरणादायी ठरणारा आहे. क्रांतीची मशाल हाती घेऊन समाजक्रांती घडवणाऱ्या व ब्रिटीश साम्राज्याला सुरंग लावून उध्वस्त करणाऱ्या या अजिंक्य वीर योद्ध्याला, त्यांच्या असीम राष्ट्रभक्तीला त्रिवार अभिवादन...!!!

संदर्भसूची :

१. श्री. फडके यशवंत दिनकर, महात्मा फुले समग्र वाङ्मय, महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ, मुंबई, १९९१.
२. प्रा. डॉ. गायकवाड शरद, प्रबोधन चळवळीतील मातंगांची शौर्यगाथा, नाग-नालंदा प्रकाशन, इस्लामपूर, प्रथमावृत्ती २०२१.
३. श्री.गरुड सचिन, मुक्ता साळवे, फातिमा शेख आणि लहूजी वस्ताद, नाग-नालंदा प्रकाशन, इस्लामपूर, द्वितीयावृत्ती २०२२.
४. श्री. कसबे आसाराम, महाराष्ट्राचे शिल्पकार आद्यक्रांतीगुरू लहजी वस्ताद साळवे, महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ, मुंबई, प्रथमावृत्ती २०२२.
५. डॉ. श्रावस्ती दीपा रवींद्र, स्त्री स्वातंत्र्य आणि बुद्ध-फुले-आंबेडकर, नाग-नालंदा प्रकाशन, इस्लामपूर, द्वितीयावृत्ती २०१५.
६. प्रा. डॉ. गायकवाड शरद, मातंग समाज साहित्य आणि संस्कृती, स्नेहवर्धन प्रकाशन, पुणे, प्रथमावृत्ती २०१५.
७. श्री. घोडे अनंत, सशत्रु क्रांतीचे जनक लहूजी वस्ताद, मुक्ताई प्रकाशन, कोल्हापूर, २०००

The Impact of social media on Interpersonal Relationships: A Comprehensive Review

Dr. D. V. Patil, Dr. G. S. Ubale

Department of Geography

Vivekanand College Kolhapur (Autonomous)

Abstract:

Social media's introduction and broad use have had a significant impact on interpersonal interactions, changing the dynamics of human connection. These platforms present complicated obstacles in addition to previously unheard-of chances for contact, information sharing, and connection maintenance. Social media can increase the volume and frequency of interactions, creating virtual relationships that cut over national borders. However, the simplicity of online communication could unintentionally reduce the richness of in-person conversations, which would affect the caliber of interpersonal bonds. Furthermore, the selective nature of social media information may exacerbate problems with self-worth and inflated expectations, which may strain relationships as people contrast their real-life experiences with meticulously constructed online identities. Finding a balance between social media's advantages and disadvantages becomes essential for navigating the complex web of modern interpersonal relationships. McDaniel, B. T., & Coyne, S. M. (2016).

Introduction:

The ubiquitous impact of social media on interpersonal interactions has gained significant attention in this era of unparalleled technical innovation. This thorough analysis explores the complex effects that social media platforms have on the dynamics of interpersonal relationships. The complex relationship between virtual and in-person contacts has drawn more attention as these digital channels continue to change the communication landscape. This review looks at how social media affects interpersonal interactions and considers both the advantages and disadvantages of this effect. Amidst shifting societal paradigms, the complex interplay between social media and interpersonal dynamics plays out, from promoting the establishment of new social norms to facilitating global connectivity. The ubiquitous impact of social media on interpersonal interactions has gained significant attention in this era of unparalleled technical innovation. This thorough analysis explores the complex effects that social media platforms have on the dynamics of interpersonal relationships. The complex relationship between virtual and in-person contacts has drawn more attention as these digital channels continue to change the communication landscape. This review looks at how social media affects interpersonal interactions and considers both the advantages and disadvantages of this effect. Amidst shifting

societal paradigms, the complex interplay between social media and interpersonal dynamics plays out, from promoting the establishment of new social norms to facilitating global connectivity. (Hertlein, K. M)

Social Media and Relationship Formation:

The first part of the article looks into how social media makes it easier to start a relationship. It explores studies looking at how people with similar interests, attitudes, and aspirations might connect through internet platforms. It also closely examines how social media affects the development of other kinds of relationships, including as friendships, romantic partnerships, and business ties.

Social Media and Relationship Maintenance:

This section evaluates social media's contribution to long-term relationship maintenance. Critical analysis is done on research results about the usage of digital communication to uphold intimacy, settle disputes, and offer emotional support. Concerns about social media's possible detrimental impacts on the stability and quality of relationships are also covered in this research.

Social Media and Identity Construction:

Social media gives people a forum to express and exhibit who they are, which is crucial in forming their identities. Users choose to disclose parts of their lives through well-maintained profiles, postings, and interactions, helping to create a digital identity that may or may not correspond with their offline persona. Identity negotiation is a dynamic process that is facilitated by the feedback loop of likes, comments, and shares as well as the ongoing exposure to well-chosen content. Social media platforms facilitate the exhibition of individuals' interests, values, and affiliations, thereby cultivating a feeling of inclusivity within particular virtual communities. On the other hand, performative actions and a skewed self-image can also result from the pressure to fit in with society's expectations and the quest of validation through measurements. Social media acts as both a reflecting mirror and a molding force, affecting how people see themselves and are seen by others in the digital sphere as users negotiate the challenges of creating an online identity. Identity construction and presentation are crucial components of interpersonal relationships. This section examines the ways in which social media affects how people view and portray themselves. It looks into how carefully constructed online personas affect in-person encounters and how they shape self-identity.

Challenges and Controversies:

Unquestionably, social media has changed human communication, but it also brings with it a host of new issues and debates. The distortion of real human relationships is one of the main problems; people tend to value virtual contacts more than in-person interactions, which results in a reduction of real emotional connections. Social media sites' carefully controlled content

frequently encourages exaggerated depictions of users' lifestyles, which makes users feel inadequate and envious. Furthermore, the immediate dissemination of information can cause misinterpretation, a rapid escalation of conflicts, and a degradation in privacy. Relationships are further strained by the "social media envy" phenomena and the pressure to maintain a positive online image. Users may place more value on online feedback than they do on the quality of their real interactions. Research and debate on the effects of these difficulties on relationships in the real world, mental health, and self-esteem are still ongoing. Miller, E. (2017). The review critically looks at the issues and debates regarding the effects of social media on interactions between people. To provide a comprehensive view, topics including cyberbullying, online harassment, privacy issues, and the addictive qualities of social networking platforms are examined. Kraemer, E. (2016).

Future Directions and Recommendations:

It is crucial to take into account how social media is changing the way that interactions with others are shaped as we move forward. Taking into account its dual position as a connection-maker and a possible connection-breaker, it is imperative to put policies in place that encourage constructive engagement. Prioritizing features that promote genuine conversation, empathy, and meaningful involvement can help platforms avoid the dangers of online toxicity and false information. In addition, a holistic strategy ought to entail cooperative endeavors among social media corporations, mental health experts, and users to enhance cognizance regarding digital well-being, encourage virtuous online behaviors, and create a digital milieu that places emphasis on the caliber of connections rather than their quantity. In order to manage the complex junction of technology and human connections in a way that strengthens rather than weakens the fabric of interpersonal interactions, this necessitates continuing research, policy creation, and education. Potential directions for further social science research are suggested in the paper's conclusion. It makes recommendations for how to research new technologies, how online communities are changing, and how to create remedies to lessen unfavorable effects.

Conclusion:

In summary, social media's effect on interpersonal interactions is a complicated and multidimensional issue. On the one hand, these platforms provide never-before-seen chances to build relationships, communicate, and engage with others even when they live far away. Social media's widespread use has brought about several drawbacks, too, including the possibility of shallow relationships, the intensification of social comparison, and the decline in in-person communication abilities. In the end, how social media affects interpersonal interactions depends on individual usage habits and society's capacity to weigh the advantages and disadvantages of these technological resources. In order to maintain the richness and genuineness of our interpersonal relationships, it is imperative that we foster thoughtful and meaningful online interactions as we navigate this dynamic environment.

Reference

Primack, B. A., Shensa, A., Sidani, J. E., Whaite, E. O., Yi Lin, L., Rosen, D., ... & Miller, E. (2017). Social media use and perceived social isolation among young adults in the US. *American journal of preventive medicine*, 53(1), 1-8.

Antheunis, M. L., Schouten, A. P., & Kraemer, E. (2016). The role of social networking sites in early adolescents' social lives. *The Journal of Early Adolescence*, 36(3), 348-371.

McDaniel, B. T., & Coyne, S. M. (2016). "Technoference": The interference of technology in couple relationships and implications for women's personal and relational well-being. *Psychology of Popular Media Culture*, 5(1), 85.

Hertlein, K. M., & Rajaei, A. Technology's Role in sexual Relationships. *"This well established and highly respected text has been revised with excellent con-temporary references, resources, and several new chapters. For many years it has been my preferred and recommended text offering the complete resource to the clinician who intends to both understand the theory and to practice in a truly systemic manner."* Professor Kevan Wylie, MD, FRCP, FRCPsych, FRCOG, president, 258.

Agro residue formulated potassium solubilizing *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP bio-inoculant positively enhances growth of mung bean (*Vigna radiata*)

Savita D. Mali

Department of Microbiology,

Vivekanand College, Kolhapur, 416003, Maharashtra, India

savitadmali23@gmail.com

Abstract

The results of mung bean pot trials exhibited nearly 4.5 times extra yield (w. r. t. number of seeds per plant) in *Enterobacter hormaechei* 1110BP + *Klebsiella variicola* 1004BP inoculated seedlings over uninoculated control. Further the pot with consortium bio-inoculant and potassium was found to give still higher yield of mung bean (4.67 times) than control. At the same time *Enterobacter hormaechei* 1110BP + *Klebsiella variicola* 1004BP bio-inoculant conferred 1.5 times increase in the yield of mung bean in comparison with commercial bio fertilizer. The pot trial studies on mung bean also revealed that *E. hormaechei* 1110BP and *K. variicola* 1004BP have biocontrol activity.

Keywords - Mung bean, Bioinoculant, *Enterobacter hormaechei* 1110BP, *Klebsiella variicola* 1004BP Agro residue,

Introduction

Mung bean (*Vigna radiata*) also known as green gram is an important pulse cash crop of India (Savaliya A. et al., 2018). It is high in proteins and vitamins (Pooja S. and Bhat S., 2019). It contains antioxidants hence useful in prevention of diseases such as cancer. It also exhibits antimicrobial and insecticidal activities (Sheteawi S. and Tawfik K, 2007). In India, it contributes nearly 75% of the world's mung bean production area (Taunk J. et al., 2012). The lower productivity in mung bean is attributed to biotic stress, among which powdery mildew caused by *Erysiphe polygni* is the major fungal disease of mung bean. The disease induces forced maturity in plants causing heavy yield losses.

Nitrogen, phosphorous, and potassium are three major nutrients essential for growth of plants. Mung bean is a leguminous pulse crop, hence yield of mung bean is mostly dependent on adequate availability of phosphorous, and potassium. The application of these nutrients in the form of chemical fertilizers is hazardous to mankind. The overuse of chemical fertilizers causes number of problems such as pollution of water resources, reduction in soil fertility, increase in soil salinity, global warming (Vejan P., 2016), development of acid rain and health problems (Adesemoye A. & Kloepper J., 2009). Moreover, chemical fertilizers are uneconomical because of the cost of the production process or because of the need for their importation. Different rhizospheric bacteria have ability to enhance the quality and yield of crop directly or indirectly (Gouda S. et al., 2018). Hence the usage of such bacteria as

bioinoculant is an environment friendly alternative for chemical fertilizers. Thus in the present study the effect of *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP bio-inoculants on the growth of mung bean was evaluated by performing pot trials. Simultaneously, a comparative study between agro residue bioinoculant and commercial bio fertilizer was also done.

Materials and methods

Potassium and phosphorous solubilizing bacterial and fungal strains

The two potassium and phosphorous solubilizing bacterial strains previously isolated from rhizospheric soil and identified based on morphological, biochemical, and 16S rRNA gene sequence analysis were used in the study.

Enterobacter hormaechei 1110BP (NCBI GenBank accession number - MH057393)

Klebsiella variicola (NCBI GenBank accession number - MN515153)

In the study, bacterial fungal consortium was also analysed for its effect on the growth of mung bean. *Penicillium* spp. isolated from soil was used in the study.

Production of agro residue bacterial inoculant

Two flasks of bio-inoculant production medium formulated by response surface methodology (24.793% jowar bran hydrolysate, 14.882% wheat bran hydrolysate, and 6.66% molasses) were prepared (Mali S. and Attar Y., 2021). Both the flasks were sterilized by autoclaving. One flask was then inoculated with *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP (1:1) consortium and another flask with *Enterobacter hormaechei* 1110BP, *Klebsiella variicola* 1004BP, and *Penicillium* spp (1:1:1) consortium. Both inoculated media were incubated at 28±2°C on a rotary shaker at 120 rpm for 7 days.

Pots preparation

The pot trial studies for mung beans were carried out for 5 pots. The earthen pots of size 11-inch surface diameter and 10-inch height were used in the study. All the pots were filled with an equal quantity of soil and labelled according to the treatment (Table 1).

Table 1 Different treatments given to mung bean

Pot label	Treatment
Contol	Uninoculated seeds
CB	Seeds coated with commercial bio fertilizer (CB)*
JWM+CA:	Seeds coated with <i>Enterobacter hormaechei</i> 1110BP and <i>Klebsiella variicola</i> 1004BP (CA) bio-inoculant prepared in jowar bran hydrolysate (J), wheat bran hydrolysate (W), and molasses (M)
JWM+CA+K	Seeds coated with <i>Enterobacter hormaechei</i> 1110BP and <i>Klebsiella variicola</i> 1004BP (CA) bio-inoculant prepared in jowar bran hydrolysate (J), wheat bran hydrolysate (W), molasses (M), and 100 mg potassium aluminosilicate (K) per kg soil was added

JWM+CA+F	Seeds coated with <i>Enterobacter hormaechei</i> 1110BP and <i>Klebsiella variicola</i> 1004BP (CA) and <i>Penicillium</i> spp. (F) bio-inoculant prepared in jowar bran hydrolysate (J), wheat bran hydrolysate (W), molasses (M)
----------	--

*Commercial bio fertilizer: Abtec bio-potash (liquid)

Mung bean seeds were obtained from the local market of agro products. Seeds were treated with 1 % sodium hypochlorite solution for 2 min (Kumar K. et al., 2011) for surface sterilization. Further, seeds were rinsed with distilled water 5 times to get rid of sterilizing agent.

Seed inoculation and sowing

Surface sterilized seeds were then added into both bio-inoculant flasks. Seeds to be sown into a ‘Control’ pot were added into sterile distilled water. Seeds to be sown into CB pot were dipped into commercial biofertilizer. Treatment for all seeds was given for 30 minutes. All inoculated and uninoculated seeds in equal numbers were sown in respective pots and pots were placed under natural conditions. Germination of seeds in all pots was monitored daily and seedlings were observed periodically for changes in the growth. On the 96th day, mung bean plants were harvested from pots and different growth and yield parameters were recorded.

Analysis of mung bean growth w. r. t. different parameters

Germination index

A germination index (G. I.) is computed by using the following formula as described in Equation 1 (Duarah I. et al., 2011)

$$\text{Germination index} = n/d \dots\dots\dots \text{Equation 1}$$

Where n = number of seedlings emerging on day ‘d’; d = day after planting.

It is based on seeds germinating daily from the day of sowing till the time germination is complete.

Shoot length

The length of the seedling was measured from the surface of the soil to the primordial leaf node.

Number of pods per trait

The number of total pods (green and black) of each seedling was counted for all treatments.

Length of pod

The length of mature pods was measured with scale and represented as average length.

Number of seeds per pod

After harvesting pods from plants, seeds per pod were counted and the average number was calculated.

The dry weight of the plant

On the 96th day, harvested plants were dried in the oven till constant weight was obtained and the average dry weight of plants was recorded.

Disease incidence

The seedlings from all pots were inspected periodically for disease occurrence and observations were noted down. Percent disease incidence (PDI) for powdery mildew was calculated with the help of the formula given in Equation 2 (Korra T. and Kumar V., 2018).

PDI= (Number of infected plants / Total number of plants) x100 Equation 2

3.0. Results and discussion

3.1. Growth and yield analysis

The results depicted in Table 2 showed that the bacterial consortium, as well as the bacterial-fungal consortium, have improved the growth of plants concerning the height of seedlings, length of pods, disease percentage, and yield of seeds as compared to uninoculated control and commercial biofertilizer. High germination index in the seeds inoculated with consortium than the uninoculated seeds and seeds inoculated with commercial biofertilizer, revealed that *E. hormaechei* 1110BP and *K. variicola* 1004BP promote the seeds germination and help the seedlings to emerge earlier.

Table 2 Effect of bio-inoculants on mung bean growth

Treatment	C	CB	CA	CAK	CAF
Growth parameters					
Germination index	0.5	1.1	1.95	1.95	1.95
Plant height (cm)	26.07±0.78	29.42±0.53	31.38±0.67	32.88±0.51	29.11±0.38
Length of the pod (cm)	6.0±0.2	9.5±0.85	8.5±0.5	8.8±0.16	8.6±0.31
Percent disease Incidence (PDI)	100	100	0	0	0
Dry wt. of plant (gm)	1.02±0.46	2.04±0.3	2.79±0.42	3.53±0.8	2.65±0.3
Yield parameters					
Number of pods /plant	9.1±0.7	15.2±0.7	22.7±0.42	28.6±0.4	20.6±0.7
Number of seeds /pod	5.8±0.6	10.2±0.7	11.3±0.16	11.8±0.2	11.1±0.8
Number of seeds /plant	52.78±0.41	167.20±0.53	237.3±0.52	246.24±0.17	228.66±0.48

C: Uninoculated seeds; CB: Seeds coated with commercial biofertilizer; CA: Seeds coated with *E. hormaechei* 1110BP and *K. variicola* 1004BP bio-inoculant prepared in jowar bran hydrolysate, wheat bran hydrolysate, and molasses; CAK: Seeds coated with *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP bio-inoculants prepared in jowar bran hydrolysate, wheat bran hydrolysate, molasses, and pot soil is amended with 100mg/kg potassium aluminosilicate; CAF: Seeds coated with *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP and *Penicillium* bio-inoculant prepared in jowar bran hydrolysate,

wheat bran hydrolysate, and molasses.



Figure 1 Pot trials of Mung bean

The highest pod number and seed number were recorded in the pot consisting of bio-inoculant of *E. hormaechei* 1110BP and *K. variicola* 1004BP with potassium. The seedlings in the pot recorded a nearly 214.3% and 88.2% increase in the number of mature pods in comparison with un-inoculated ‘control’ and commercial biofertilizer respectively. Simultaneously there was a 103.5% and 15.7% increase in the number of seeds per pod over uninoculated control and commercial biofertilizer respectively. Similarly, seeds inoculated with *E. hormaechei* 1110BP and *K. variicola* 1004BP only also reported a 149.5% and 49.3% increase in the number of pods per plant over un-inoculated control and commercial biofertilizer respectively as well as 94.8% and 10.8% increase in the number of seeds per pod over control and commercial biofertilizer respectively (Figure 1). The seeds treated with *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP and *Penicillium* bio-inoculant showed 126.4% and 35.5% increase in the number of pods per plant over un-treated ‘control’ and commercial biofertilizer respectively as well as 91.38% and 8.8% increase in the number of seeds per pod over control and commercial biofertilizer. Thus seeds inoculated with *E. hormaechei* 1110BP and *K. variicola* 1004BP cultivated in presence of potassium were found to grow more efficiently than the seeds of the other four treatments. This summarises the positive role of *E. hormaechei* 1110BP and *K. variicola* 1004BP and potassium in the growth of mung bean plants.

3.2. Disease incidence

The interesting fact observed during the study on the effect of bio-inoculant on plant growth was decreased disease incidence in plants in correlation with the uninoculated control.

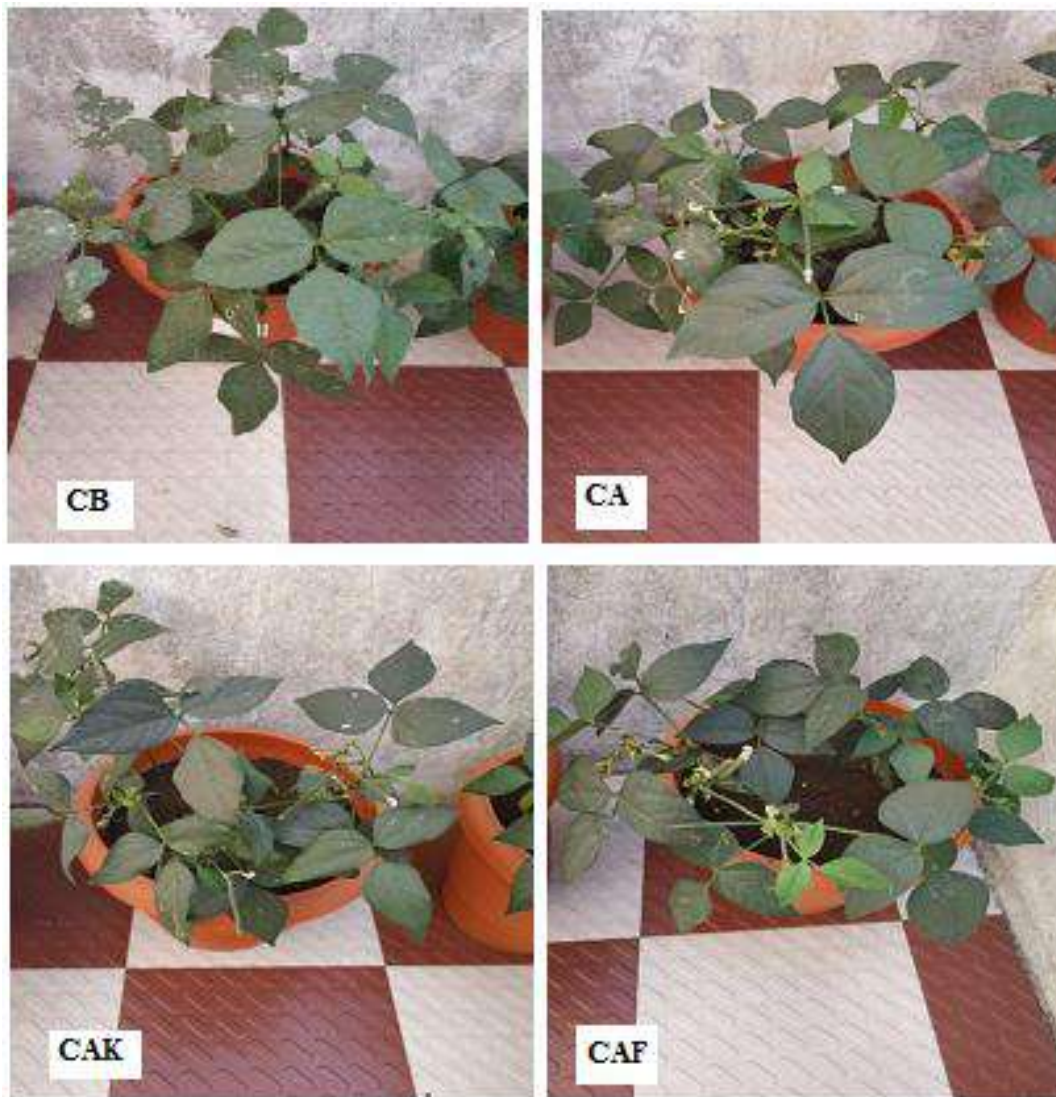


Figure 2 Different treatments of mung bean- CB: Commercial biofertilizer inoculated seedling; CA: Seedling inoculated with *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP; CAK: Seedling inoculated with *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP and potassium aluminosilicate; CAF: Seedling inoculated with *Enterobacter hormaechei* 1110BP, *Klebsiella variicola* 1004BP, and *Penicillium* spp.



Figure 3 Disease incidence in mung bean (a) and (b) Diseased ‘control’ seedling; (c) Powdery mildew leaves of uninoculated ‘control’ seedling; (d) Disease-free leaves of bioinoculant treated mung bean

In the case of the mung bean experiment, the plants in the uninoculated ‘control’ pot (Figure 3a, b, and c) and commercial biofertilizer pot (Figure 2 CB) showed a white powdery surface of leaves indicating infection with *Erysiphe polygoni* DC. It is a fungus and a causative agent of powdery mildew in plants (Figure 3c) (Savaliya A. et al., 2018). The disease starts from the seedling stage with the development of small, circular slightly darker areas on the leaves. Later these areas convert into small white powdery patches. Further, these areas enlarge, unite and completely coat the upper surface of the leaves, stem, and pods giving a white powdery appearance.

In case of severe infection, it spreads all over the plant causing loss of leaves. This leads to decreased photosynthetic activities in plants and hence a reduction in the yield of mung beans (Pooja S. and Bhat S., 2019). In susceptible varieties of mung bean, the disease has reported a maximum of 40% yield losses at the reproductive stages and damage becomes serious if the epidemic starts at the reproductive stages (Savaliya A. et al., 2018). However, mung bean plants inoculated with *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP displayed no such symptoms of this disease (Figure 2 CA, CAK, CAF, and Figure 3 d).

Figures 3a, 3b and 3c clearly show the disease incidence in the uninoculated mung bean seedling. The percent disease incidence (PDI) (Korra T. and Kumar V., 2018) of powdery mildew was calculated as shown in Equation 2, for each treatment and represented in Table 2. The overall enhancement in the growth characteristics, yield, and nutritional value of groundnut seeds are all attributed majorly to the synergistic effect of the bio-inoculants strains.

Conclusion

Thus the overall conclusion of the research is that the application of *Enterobacter hormaechei* 1110BP and *Klebsiella variicola* 1004BP consortium in agriculture is a very promising approach for the enhancement of the yield of mung bean. The consortium bioinoculant may be responsible for fulfilling potassium and phosphorous requirement of mung bean. Thus field study of this bioinoculant with mung bean and other crops could give promising results to be useful to exploit these cultures as a good economical and eco-friendly alternative for potash and phosphorous chemical fertilizers. Moreover as these bacterial isolates showed protection of plants from pathogen, these could also be exploited as biocontrol agent after further studies.

References

- Adesemoye, A. O., & Kloepper, J. W. (2009). Plant–microbes interactions in enhanced fertilizer-use efficiency. *Applied microbiology and biotechnology*, 85(1), 1-12.
- Duarah, I., Deka, M., Saikia, N., & Boruah, H. D. (2011). Phosphate solubilizers enhance NPK fertilizer use efficiency in rice and legume cultivation. *3 Biotech*, 1(4), 227-238.
- Gouda, S., Kerry, R. G., Das, G., Paramithiotis, S., Shin, H. S., & Patra, J. K. (2018). Revitalization of plant growth-promoting rhizobacteria for sustainable development in agriculture. *Microbiological Research*, 206, 131-140.
- Korra, T. & Kumar, V. M. (2018). Survey for the Occurrence of Powdery Mildew and Its Effect of Weather Factors on Severity of Powdery Mildew in Guntur District. *Int. J. Curr. Microbiol. App. Sci*, 7(11), 949-964.
- Kumar, K. V. K., Reddy, M. S., Kloepper, J. W., Lawrence, K. S., Yellareddygar, S. K. R., Zhou, X. G., & Miller, M. E. (2011). Screening and selection of elite plant growth-promoting rhizobacteria (PGPR) for suppression of *Rhizoctonia solani* and enhancement of rice seedling vigor. *J. Pure Appl. Microbiol*, 5(2), 1-11.
- Mali, S. D., & Attar, Y. C. (2021). Formulation of cost-effective agro residues containing potassium solubilizing bacterial bio-inoculants using response surface methodology. *Biocatalysis and Agricultural Biotechnology*, 35, 10211.
- Pooja, S. K. & Bhat, S. (2019). Diversity among Greengram Germplasm to Powdery Mildew Resistance Caused by *Erysiphe polygoni* DC. *Int. J. Curr. Microbiol. App. Sci*, 8(7), 2765-2771.
- Savaliya, A., Chopada, G., Sekhada, M., & Bhimani, A. (2018). Survey of the Powdery Mildew of Mungbean (*Vigna radiata* (L). Wilczek) in Selected Districts of South Gujarat. *Trends in Biosciences* 11(21), Print: ISSN 0974-8431, 3004-3009.

- Sheteawi, S. and Tawfik, K. (2007). Interaction Effect of some Biofertilizers and Irrigation Water Regime on Mung bean (*Vigna radiata*) Growth and Yield. *Journal of Applied Sciences Research*, 3(3): 251-262.
- Taunk, J., Yadav, N. R., Yadav, R. C., & Kumar, R. (2012). Genetic diversity among green gram [*Vigna radiata* (L.) Wilczek] genotypes varying in micronutrient (Fe and Zn) content using RAPD markers.
- Vejan, P., Abdullah, R., Khadiran, T., Ismail, S. & Nasrulhaq Boyce, A. (2016). Role of plant growth-promoting rhizobacteria in agricultural sustainability—a review. *Molecules*, 21(5), 573.

सत्यशोधक समाज : एक दृष्टिक्षेप

प्रा. अजय प्रभाकर पाटील, प्रा. समीक्षा फराकटे

सहाय्यक प्राध्यापक, राज्यशास्त्र विभाग

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

गोषवारा :-

२४ सप्टेंबर २०२३ रोजी सत्यशोधक समाजाच्या स्थापनेला १५० वर्षे पूर्ण झाली यानिमित्ताने सत्यशोधक समाजाचा आढावा घेण्याचा संशोधकाचा मानस आहे. सत्यशोधक समाजाने त्या वेळी अस्तित्वात असणारी सदोष समाजव्यवस्था नष्ट करण्यासाठी एक संघटना म्हणून कशाप्रकारे कार्य केले हे व त्याचे समाजव्यवस्थेवर काय परिणाम झाले याचा थोडक्यात अभ्यास प्रस्तुत शोध निबंधात करण्याचा प्रयत्न संशोधकाने केलेला आहे.

पारिभाषिक शब्द:- सत्यशोधक समाज, महात्मा ज्योतिबा फुले, ब्राम्हणेतर, शूद्रातिशूद्र, हक्क इ.

प्रस्तावना :-

इंग्रजांच्या अंमलाखालील भारतात एकोणिसाव्या शतकात भारतीय लोकांचे प्रश्न, गरजा यांकडे इंग्रज सरकारचे लक्ष वेधून घेण्यासाठी अनेक संस्था, संघटनांची स्थापना झाली. परमहंस सभा, प्रार्थना समाज, आर्य समाज यांसारख्या अनेक संघटना स्थापन झाल्या. ब्राह्मणांसोबत अनेक ब्राम्हणेतर कार्यकर्ते या संघटनांमध्ये कार्यरत होते तरीही वरील संघटनांमध्ये वर्चस्व मात्र पांढरपेशी वर्गातील कार्यकर्त्यांचे होते ही गोष्ट नाकारता येणार नाही. आणि हे उच्चवर्गीय लोक आपले अधिकार, सुखसोयी, वर्चस्व नाकारून शूद्र, पददलित लोकांना त्यांचे अधिकार देतील ही बाब शंका उत्पन्न करते. म्हणूनच वरील बाबींचा विचार करून शेतकरी, कामगार, कनिष्ठ समजल्या जाणाऱ्या लोकांचा समावेश असेल अशा एका संघटनेची गरज महात्मा ज्योतिबा फुले यांना वाटल्याने त्यांनी सत्यशोधक समाजाची स्थापना केली.

उद्देश :-

- १) सत्यशोधक समाजाच्या स्थापनेवेळच्या परिस्थितीचा अभ्यास करणे.
- २) सत्यशोधक समाज आणि तत्कालीन इतर संघटनांचा थोडक्यात तुलनात्मक अभ्यास करणे.
- ३) सत्यशोधक समाजाच्या योगदानाचा अभ्यास करणे.

संशोधन पद्धती :-

प्रस्तुत अभ्यास हा महात्मा फुले यांनी स्थापन केलेल्या सत्यशोधक समाजाच्या कार्याच्या आढावा घेण्यासाठी असून या संशोधनासाठी दुय्यम स्रोतांचा वापर करून संशोधनासाठी लागणाऱ्या साहित्याचा आढावा घेण्यासाठी संदर्भ ग्रंथ, वर्तमानपत्रे, मासिके तसेच संकेतस्थळांचा वापर करून संशोधनासाठी उपयुक्त माहिती जमा केली गेली आहे.

सत्यशोधक समाज

महात्मा ज्योतिबा फुले यांनी २४ सप्टेंबर १८७३ रोजी पुणे येथे भरलेल्या बैठकीत सत्यशोधक समाजाची स्थापना केली. उच्चवर्णीय लोकांकडून होणारी शूद्रांची पिळवणूक बंद करणे, वेद, शास्त्र यांच्या गुलामगिरीतून त्यांना मुक्त करणे व शूद्रांना त्यांच्या मानवी हक्कांची जाणीव करून देणे याप्रकारचे कार्य करण्याचा मानस ठेवूनच सत्यशोधक समाजाची स्थापना झाली होती. सत्यशोधक म्हणजेच सत्याचा शोध करणारा समाज या अर्थाने महात्मा फुले यांनी नाव ठेवले होते. जे शूद्र, दलित लोक सत्यापासून वंचित आहेत त्यांना सत्यापर्यंत नेणे, हा सत्यशोधक समाजाचा उद्देश त्यांच्या नावातून दिसून येतो. धार्मिक आणि सामाजिक गुलामगिरी समूळ नष्ट करणे हे सत्यशोधक समाजाचे मुख्य उद्दिष्ट होते. सत्यशोधक समाजाचे पहिले अध्यक्ष आणि कोषाध्यक्ष म्हणून महात्मा फुलेची निवड करण्यात आली.

'सर्वसाक्षी जगत्पती । त्याला नकोच मध्यस्ती ॥' हे या समाजाचे घोषवाक्य होते. पुरोहितांकडून सामान्य जनतेची होणारी पिळवणूक थांबवण्यासाठी, शास्त्र, व्रत-वैकल्प यांच्या नावाखाली होणारी फसवणूक थांबवण्यासाठी सत्यशोधक समाजाने मध्यस्था शिवाय धार्मिक विधी कश्याप्रकारे करावेत हे सांगणारी एक पुस्तिका प्रकाशित केली. साध्या सोप्या पद्धतीने विवाह संपन्न व्हावेत यासाठी 'सत्यशोधक विवाह पद्धती' अशी एक नवीन, कमी खर्चिक विवाह पद्धती अस्तित्वात आणली. सत्यशोधक समाजाचा प्रचार करण्यासाठी महात्मा फुले यांनी 'सार्वजनिक सत्यधर्म' हे पुस्तक लिहिले. महर्षी वि. रा. शिंदे यांनी या पुस्तकाला सत्यशोधक समाजाचे 'बायबल' असे म्हटले आहे.

सत्यशोधक समाजाचे ध्येय धोरण पुढील प्रमाणे होते :-

- अ) शूद्रातिशूद्र यांची ब्राम्हण पुरोहितांकडून होणारी पिळवणूक बंद करणे.
- ब) शूद्रांना त्यांच्या मानवी हक्कांची आणि अधिकारांची शिकवणूक देणे.
- क) शूद्रांना ब्राह्मणी शास्त्रांच्या मानसिक आणि धार्मिक गुलामगिरीतून मुक्त करणे.

सभासदत्व :-

सत्यशोधक समाजाचे सभासदत्व सर्व जातीतील लोकांना घेता येत होते. ज्याला सभासद व्हायचे आहे त्याला पुढील प्रार्थना म्हणावी लागे. आणि प्रार्थना म्हटल्यानंतर खंडोबाच्या भंडान्याची तळी उचलावी लागे.

प्रतिज्ञा :-

“सर्व मानव प्राणी एकाच देवाची लेकरे आहेत. त्यामुळे ती माझी भावंडे आहेत, अशा बुद्धीने मी त्यांच्याशी वागेन. परमेश्वराची पूजा, भक्ती अगर ध्यानधारणा करतेवेळी अगर धार्मिक विधीचे वेळी मी मध्यस्थाची मदत घेणार नाही. मी माझ्या मुला-मुलींना सुशिक्षित करीन. मी नेहमी राजनिष्ठेने वागेन. परमेश्वरास साक्ष ठेवून मी ही प्रतिज्ञा करित आहे.”

त्या काळात कार्यरत असणाऱ्या सर्व संघटनांमध्ये कोणी सभासद व्हावे यावर कोणतेही बंधन नव्हते. पण सत्यशोधक समाजाने एका प्रार्थनेचा आधार घेऊन कोणत्याही जातीतील व्यक्तीला सभासद होता येते याचा स्पष्ट उल्लेख केलेला आपल्याला दिसून येतो. ऐक्याची भावना निर्माण होईल अशी प्रार्थनेची रचना आपल्याला आढळेल.

सत्यशोधक समाजाची तत्वे :-

महात्मा फुले यांच्या निधनानंतर १९११ साली सत्यशोधक समाजाने जो ठराव केला होता त्यामध्ये पुढील तीन तत्वे स्पष्ट केली होती.

अ) सर्व माणसे एकाच देवाची लेकरे आहेत व देव त्यांचा आईबाप आहे.

ब) आई वडिलांना भेटण्यासाठी जशी मध्यस्थाची गरज नसते त्याप्रमाणे देवाची प्रार्थना करताना पुरोहितांची गरज नाही.

क) वरील तत्वे कबूल असल्यास कोणालाही सभासद होता येते.

प्रार्थना समाजाची धर्मतत्त्वे :

(१) परमेश्वराने हे सर्व ब्रह्मांड निर्माण केले. तोच एक खरा ईश्वर. तो नित्य, ज्ञानस्वरूप, अनंत, कल्याणनिधान, आनंदमय, निरवयव, निराकार, एकमेवाद्वितीय, सर्वांचा नियंता, सर्वव्यापी, सर्वज्ञ, सर्वशक्तिमान, कृपानिधी, परमपवित्र व पतितपावन असा आहे.

(२) केवळ त्याच्याच उपासनेच्या योगे इहलोकी व परलोकी शुभ प्राप्त होते.

(३) त्याच्या ठायी पूज्यबुद्धी व अनन्यभाव ठेवून त्याचे मानसिक भजन-पूजन करणे व त्यास प्रिय अशी कृत्ये करणे, हीच त्याची खरी उपासना.

(४) प्रतिमा व इतर सृष्ट पदार्थ यांची पूजाअर्चा किंवा आराधना करणे हा ईश्वरोपासनेचा खरा प्रकार नव्हे.

(५) परमेश्वर सावयव रूपाने अवतार घेत नाही आणि कोणताही ग्रंथ साक्षात ईश्वरप्रणीत नाही.

(६) सर्व मनुष्ये एका परमेश्वराची लेकरे आहेत, म्हणून भेदभाव न राखता परस्परांशी त्यांनी बंधुभावाने वागावे, हे ईश्वरास प्रिय आहे.

सत्यशोधक समाज आणि प्रार्थना समाज यांच्या तत्वांचा विचार केला तर त्यामध्ये बरेच साम्य आढळते. जसे की सर्व माणसे एकाच परमेश्वराची लेकरे आहेत, ईश्वर एकच आहे, मूर्तिपूजा करणे चुकीचे आहे, सर्व धार्मिक ग्रंथ हे मानवानेच लिहिलेले आहेत. बऱ्याच तत्वांमध्ये साम्यता आढळते पण प्रार्थना समाज तळागाळापर्यंत पोहोचून काम करू शकला नाही याउलट सत्यशोधक समाजाने तत्कालीन समाजात तळागाळातील लोकांपर्यंत पोहोचून काम केले. शूद्रातिशूद्र, शेतकरी, कामगार या लोकांचा प्रामुख्याने विचार करणारी आणि महाराष्ट्रात व्यापक सुरुवात झालेली पहिली संघटना म्हणून सत्यशोधक समाजाकडे पहिले जाते.

सत्यशोधक समाज स्थापनेच्या काही वर्षे आधी दादोबा पांडुरंग तखडकर यांनी ३१ जुलै, १८४९ मध्ये मुंबई येथे परमहंस सभा सुरू केली. या सभेच्या स्थापनेत भिकोबादादा चव्हाण, रामचंद्र बाळकृष्ण जयकर या ब्राम्हणेतर कार्यकर्त्यांची देखील मदत झाली. मुंबई मध्ये स्थापन झालेली परमहंस सभा ही गुप्त संघटना असल्याने त्याचा प्रभाव जनमानसावर पडला नाही आणि इंग्रज सरकारला सदस्यांची माहिती मिळाल्या कारणाने या संघटनेचे काम थांबले. पण सत्यशोधक समाज ही संघटना लोकांमध्ये जाऊन प्रश्न, अडचणी समजून त्यावर काम करणारी संघटना होती. जे लोक हक्कांपासून वंचित आहेत त्यांना त्यांच्या हक्काची जाणीव करून देण्याचे काम या संघटनेकडून महात्मा फुले यांच्या मृत्यूनंतरही झालेले दिसून येते. यातूनच पुढे महाराष्ट्रभर ब्राम्हणेतर चळवळ मोठ्या प्रमाणात विस्तारलेली दिसेल.

महात्मा ज्योतिबा फुलेंच्या मृत्यूनंतर सत्यशोधक समाजाचे कार्य विस्कळीत झाले. प्रभावी नेतृत्व नसल्यामुळे चळवळीचा जोम ओसरला; पण सत्यशोधक समाजाच्या रूपाने महात्मा फुलेंनी केलेल्या बीजारोपणामुळे अनेक चळवळींना प्रेरणा मिळाली. कृष्णराव भालेकर यांनी सुरु केलेले 'दीनबंधू' हे वृत्तपत्र महात्मा फुले व त्यांनी स्थापन केलेल्या सत्यशोधक समाजाच्या प्रेरणेने सुरु केले होते. नारायण मेधाजी लोखंडे यांनी स्थापन केलेली भारतातील पहिली कामगार संघटना 'मिल हॅन्ड असोसिएशन' या संघटनेच्या स्थापनेमागे महात्मा फुलेंचीच प्रेरणा होती. १९११ मध्ये कोल्हापुरात राजर्षी छत्रपती शाहू महाराजांनी सत्यशोधक चळवळीचे पुनरुज्जीवन केले. याचेच रूपांतर पुढे ब्राम्हणेतर चळवळीत झाले.

महेश जोशी यांनी 'सत्यशोधक समाजाचा इतिहास' या पुस्तकामध्ये असे मत मांडले आहे कि, “जुनी समाजव्यवस्था मोडून पडली आहे याविषयी ज्योतीबांच्या मनात कोणतीही शंका न्हवती. म्हणूनच त्यांनी 'जाळुनी टाका मनुग्रंथ ।' असा उपदेश खुद्द ब्राम्हणांनाच केलेला आढळतो. ब्राम्हणांनी मनुस्मृती जाळण्याचे टाळले म्हणून अखेर ५० वर्षांनंतर डॉ. बाबासाहेब आंबेडकर यांनी ती जाळली.” आंबेडकर हे महात्मा फुल्यांना आपले गुरु मानत होते. महात्मा ज्योतिबा फुले यांच्या पुरोगामी विचारांचा त्यांच्यावर खोलवर परिणाम झाला ही उल्लेखनीय बाब आहे.

१९७० साली पुणे येथे प्रागतिक विचारांच्या मुस्लिम नेत्यांनी हमीद दलवाई यांच्या नेतृत्वाखाली मुस्लिम सत्यशोधक समाज नावाच्या संस्थेची स्थापना केली. या संस्थेची मूळ प्रेरणा सत्यशोधक चळवळ आहे हे नावातूनच स्पष्ट होते.

निष्कर्ष :-

महात्मा फुले यांनी सत्यशोधक समाजाची स्थापना करून शिक्षण आणि अधिकारांपासून वंचित असणाऱ्या शूद्रातिशूद्र, शेतकरी आणि कामगार लोकांना त्यांच्या हक्कांची जाणीव करून दिली. त्याचा महाराष्ट्राच्या तत्कालीन परिस्थितीवर खूप मोठा

प्रभाव पडलेला दिसून येतो. यातूनच महाराष्ट्रात ब्राम्हणेतर चळवळ सुरू झाली ज्याचा परिणाम म्हणजेच पुढील काळात हक्कांपासून वंचित असणाऱ्या लोकांचा त्यांचे हक्क, अधिकार मिळाले. महात्मा फुले यांच्या प्रेरणेने पुढे नारायण मेधाजी लोखंडे यांनी भारतातील पहिली कामगार संघटना स्थापन केली. कोल्हापुरात राजर्षी छत्रपती शाहू महाराज व त्यांच्या कार्यकर्त्यांनी शिवाजी सत्यशोधक समाजाची स्थापना करून वंचितांना त्यांचे हक्क मिळवून देण्यासाठी एक चळवळ उभी केली. पुण्यात हमीद दलवाई यांच्या अध्यक्षतेखाली स्थापन झालेल्या आणि मुस्लिम समाजात शिक्षणाप्रती जागृती करणाऱ्या 'मुस्लिम सत्यशोधक समाजाचा' प्रेरणास्रोत महात्मा फुले आणि त्यांचा सत्यशोधक समाज होता. डॉ. बाबासाहेब आंबेडकर यांनी चालू केलेल्या दलितोद्धारक चळवळीचा प्रेरणास्रोत महात्मा फुले आणि त्यांचा सत्यशोधक समाज होता. अशा या महान क्रांतिकारी समाजसुधारकाला विनम्र अभिवादन !

संदर्भ :-

- १) मुठाळ राम,(१९९८) भारतीय आणि पाश्चिमात्य राजकीय विचार,द्वितीय आवृत्ती, अंशुल पब्लिकेशन्स, नागपूर.
- २) बाचल वि.मा.,(२००२) भारतीय राजकीय विचारवंत, अनिरुद्ध पब्लिशिंग हाऊस, पुणे.
- ३) पाटील बी.बी., चव्हाण उर्मिला,(२०१९) भारतीय राजकीय विचार भाग १,प्रथम आवृत्ती, फडके प्रकाशन, कोल्हापूर.
- ४) नरके हरी,(२००६) महात्मा फुले साहित्य आणि चळवळ,प्रथम आवृत्ती, शासकीय फोटोझिंको मुद्रणालय, पुणे.
- ५) नरके हरी,(२०१३) महात्मा फुले समग्र वांडमय,प्रथम आवृत्ती, शासकीय फोटोझिंको मुद्रणालय, पुणे.
- ६) गाठाळ साहेबराव,(१९९९) आधुनिक भारतीय विचारवंत,प्रथम आवृत्ती, कैलास पब्लिकेशन्स, औरंगाबाद.
- ७) देशपांडे श्री.वि.,(२००९) भारतीय राजकीय विचारवंत,प्रथम आवृत्ती, श्री.मंगेश प्रकाशन, नागपूर.
- ८) पाटील वा. भा.,(२००९) आधुनिक भारतीय राजकीय विचारवंत भाग २,प्रथम आवृत्ती प्रशांत पब्लिकेशन्स, जळगाव.
- ९) जोशी महेश,(२००२) सत्यशोधक समाजाचा इतिहास, द्वितीय आवृत्ती, महाराष्ट्र राज्य साहित्य आणि सांस्कृतिक मंडळ, मुंबई.

१०) कुंभोजकर श्रद्धा, सत्यशोधक समाज दीडशे वर्षांची शोधयात्रा,
https://www.researchgate.net/publication/371508778_satyasodhaka_samaja_didase_varsanci_sodhayatra

११) <https://www.bbc.com/marathi/india-58639131>

Cultivation And Phytonutrient Analysis Of *Spirulina platensis* And Development Of Prebiotics

Ms.Nikita R. Jadhav

Department of Microbiology, Vivekanand College, Kolhapur, 416003

Abstract-

Spirulina plays crucial role in human nutrition. *Spirulina platensis* was cultivated in Zarrouk medium with intermittent agitation and aeration for proper sunlight and oxygen respectively. The biomass is harvested by filtration method. The present study was undertaken to access the nutritional composition of *spirulina platensis* powder and development of prebiotics products like *Spirulina* chocolate candies which may provide the necessary protein content to the vulnerable population. *Spirulina* powder is high in protein, antioxidants, vitamins and other useful nutrients. The *spirulina* chocolate candies were prepared along with other ingredients having delicious taste. The analysis indicated that fortified candies were significantly high in protein and other nutrients.

Key words:- *Spirulina platensis*, Zarrouk medium, prebiotics, nutritional composition

Introduction:

It is a Gram-negative, spiral-shaped, blue-green microalga. It contains high amounts of protein, carbohydrates, essential fatty acids, vitamins, minerals, and pigments like carotene Chlorophyll and phycocyanin. It is excellent food, lacking toxicity, and has anticancer, antiviral, and antioxidant property (Turpin, 1892).

Microalgae are a group of fast-growing unicellular or simple multicellular micro-organisms that offer several advantages, including higher photosynthetic efficiency, higher growth rates, and higher biomass production compared to other energy crops. Photosynthetic microorganisms are one of the most promising sources of energy as they are renewable and CO₂ neutral (Li *et al.*, 2008; Gouveta *et al.*, 2009).

Spirulina was named Tecuilatl by Aztecs, this means stones excrement during the 16th century. Later due to the outbreak of contagious disease, new customs were adopted by people such as new foods, and religious- political and social changes and the topic of Tecuilatl came to an end. It was not known till when man began to use microalgae, but at present these resources can be so-called, "green tendency" (Henrikson *et al.*, 1994). In the 9th century, during Kanem Empire, only *Spirulina* had a long history in Chad. In the early 1970s, the First large-scale production plant by Sosa Texcoco was established (Ciferri *et al.*, 1983).

Species belonging to the genus *Spirulina*, now called *Arthospira*, are among the photosynthetic micro-organisms of commercial importance (Salunke *et al.*, 2016). *Spirulina* is a multicellular and filamentous blue-green alga that has gained considerable attention in the health care and food sector as a protein and vitamin Supplement. It grows in water and can be harvested and processed easily. It also contains a very high amount of micro and macronutrients (Platt and

Jassby 1976; Eppley 1972; Goldman and Carpenter, 1974, Yoder 1949). The mass cultivation of *Spirulina* depends on several factors, including the availability of nutrients, temperature, and light. *Spirulina* also requires a relatively high pH, which inhibits the growth of other algae in the system. To maintain high pH and avoid fluctuations, a high amount of Sodium bicarbonate must always be there in the culture medium (Yoder 1979; Sont *et al.*, 2016; Sudhakar and Premalatha 2012, 2015; Coles and Jones, 2000; Montagnes and Frankin 2001).

Mineral elements, sunlight and CO₂ are directly used by alga cells for their growth. Environmental Stresses affect the growth and pigment accumulation of microalgae, including nutrients availability, high pH, light, salinity, and temperature (Pandey *et al.*, 2011). Although *Spirulina* possesses a simple prokaryotic cell Structure, the absence of a plant cell wall, photosynthetic ability, and glycogen-containing cellular membrane is similar to the bacteria, plant, and animal kingdoms respectively. (Usharant *et al.*, 2014).

The optimal temperature for *Spirulina* growth is 15 in the range of 35°C - 38°C. In addition, *Spirulina* requires a relatively high pH, which effectively inhibits the growth of other algae in the culture medium to sustain the high pH and prevent fluctuation. Zarrouk medium which is rich in bicarbonate has successfully served as a common culture medium in *Spirulina* culture for years (Tolga *et al.*, 2007).

Spirulina has been cultivated commercially for its valuable nutrition and is also used as a dietary supplement. Although alterations were made in the basic composition the media so developed commercially were inorganic in nature and not economical. Zarrouk medium is not feasible for commercial production due to its high production cost. Hence, many investigators tried to cultivate *Spirulina* on cheap resources, and also various supplementations have been made to achieve enhanced biomass Yield and bio-products. (Murugan and Manikandavel 2007).

Spirulina is a microalga that has a unique set of biological characteristics which are very useful for a broad range of applications. It has been certified by the FDA (USA Food and Drug Administration) as GRAS (Generally Recognized as Safe). It can be used as a nutritive supplement or pharmaceutical additive with no risks to health. *Spirulina* is useful for human nutrition, because of the high quality and quantity (60-70% of its dry weight) of protein and amino acids. (Ciferri *et al.*,1983).

The current environmental conditions such as deterioration, mental, physical stress and changes in the diet causes serious factor for human, increased the death rate and civilization diseases. These are obvious reason why new progressive trends are developed in modern medicine and biotechnology to treat and prevent various diseases. One of the trend in biotechnology is associated with Blue green microalgae *Spirulina platensis* which have been widely employed as food and feed additives in agriculture, food industry, pharmaceuticals, medicine and science characterized by a 70% protein content and by presence of minerals, vitamins, amino acids, essential fatty acids etc.

Joshi *et al.*, (2018) concluded various microalgae species have a high amount of protein and lipid levels which is why this is nowadays considered one of the main reasons for an unconventional source of this compound. *Spirulina platensis* is one of the richest protein sources of microbial

origin, having similar protein levels when compared to pulse and animal protein sources. The use of *Spirulina platensis* in food can bring benefits to human health owing to its chemical composition, as it has high levels of vitamins, minerals, secondary metabolites, essential fatty acids, amino acids, and pigments. Furthermore, the development of new protein sources to supply the shortage of this nutrient is an urgent need and protein from *Spirulina platensis* plays an important role in such a scenario. This investigation was carried out for growth parameter optimization of *Spirulina platensis* cultivating in a laboratory-scale photobioreactor.

Murugan and Rajesh (2014) reported that *Spirulina*, a valuable source of natural pigments and dietary supplements, thrives in temperatures between 35°C and 38°C. Its growth is aided by a high pH, inhibiting the growth of other algae. The use of sodium bicarbonate in the culture medium helps maintain a stable pH. Zarrouk medium, rich in bicarbonate, has been widely employed but is cost-prohibitive for commercial production. Researchers have explored alternative resources like swine dung, spent-wash, and cow dung to cultivate *Spirulina* economically.

Materials and Methods:

Sample collection, pre-culturing and microscopic identification-

Spirulina platensis culture was obtained from Geeta-Maruti Natural food, Islampur, Sangli. The starter inoculum and culture was maintained in the traditional medium at 25-30°C with regular aeration and agitation. The cultures were identified using morphological characters (spiral shape) of blue-green algae *Spirulina platensis* through a light microscope at 10x and 40x for taxonomic Identification.



Cultivation of *Spirulina*:

Spirulina platensis was cultured in crude medium (NaCl, NaHCO₃, MgSO₄, NPK) in a 5-liter polycarbonate bottle under a controlled condition and Zarrouk medium as control. The cell concentration was analyzed at OD 670 nm (Costa *et al.*, 2004). The pH of the medium was measured by using a pH meter. *Spirulina platensis* grows at a pH range of 8.5-9.5 as it is maintained at the alkaline point. The temperature provided was 25-30°C the room temperature and also sunlight was provided. Aerator was used to provide aeration. Agitation was done manually 2-3 times a day to enable all of the *Spirulina* exposure to light.

The culture was allowed to grow for 30 days, and the biomass was harvested by filtration method, and washed with distilled water to remove impurities and neutralize the pH.

Phytonutrient analysis of *Spirulina*:

Estimation of protein and nitrogen content-

The protein and nitrogen content of *Spirulina platensis* was determined using the Kjeldahl's method for that a representative sample of *Spirulina* was prepared and homogenized it was then digested with sulfuric acid, and the evolved ammonia was titrated. The nitrogen content was calculated using a conversion factor. Finally, the protein content was obtained by multiplying the nitrogen content by the appropriate conversion factor.

$$\text{Nitrogen content} = \text{Burette reading} \times 0.56$$

$$\text{Protein content} = \text{Nitrogen content} \times 6.25 \text{ (conversion factor) (Wang et al., 2019)}$$

Total Carbohydrate estimation-

Carbohydrate estimation was done to determine the total carbohydrate content in the algal species, *Spirulina platensis* by the phenol-sulphuric acid method. The dry biomass of *Spirulina* was hydrolyzed in boiling water for 3 hours with 1N HCL. A final volume of 100ml of distilled water was added after filtering and neutralizing the resultant solution. In the test tubes 0.1 ml and 0.2ml sample was taken and 1ml of phenol solution, 5 ml of 96% Sulphuric acid was added in each test tube respectively. The sample was then incubated for 10 minutes and placed in a water bath for 25-30°C for 20 minutes. The O.D was recorded at 490 nm and the amount of total carbohydrates present in the sample was calculated using the standard graph.

Absorbance corresponds to 0.1 ml of the test = x mg of glucose

100 ml of the sample solution contains = $x/0.1 \times 100$ mg of glucose

= % of total carbohydrates present (Merchez, 1994).

Total Lipid Extraction Method-

Total lipid extraction was done by Folch method. The Folch method employs the use of chloroform-methanol (2:1) for extraction of lipids from endogenous cells. Briefly, the homogenized cells were equilibrated with one fourth volume of saline solution and mixed well. The resulting mixer was allowed to separate into two layers and lipid settle in upper layer (Ranjit Kumar et al.,2015).

Determination of Calcium-

Determination of calcium by EDTA titration is done by adding 2-3 drops of EBT indicator. Titrate the Ca²⁺ standard solution with EDTA solution until color change.

Extraction of chlorophyll-a, chlorophyll-b and total carotenoids-

The estimation of chlorophyll-a, chlorophyll-b and total carotenoids was done by using a Spectrophotometer. 10 ml samples of *Spirulina platensis* from depth were collected in a 15 ml Falcon tube and centrifuged at 6000 rpm for 10 min at 4°C. The supernatant was discarded and the

pellet was washed with distilled water twice. Then mix the pellet with pure methanol and vortexes for 4 min. Then the mixture was kept at 45°C for 24 hrs in a shaking incubator. Then the mixture was centrifuged and the supernatant was taken for analysis of pigments. The absorbance was measured at 470 and 652.4 nm. Pigments were measured using the following formulas (1)-(3)

$$\text{Chlorophyll a } (\mu\text{g/ml}) = 16.72 \times A_{665.2} - 9.16 \times A_{652.2} \dots \dots \quad (1)$$

$$\text{Chlorophyll b } (\mu\text{g/ml}) = 34.09 \times A_{652.4} - 15.28 \times A_{665.2} \dots \dots \quad (2)$$

$$\text{Total carotenoids } (\mu\text{g/ml}) = 1000 \times A_{670} - 1.63 \times \text{chl(a)} - 104.9 \times \text{chl(b)} / 221 \dots \quad (3)$$

(Lichtenthaler *et al.*, 2001).

Extraction of phycocyanin-

Phycocyanin estimation was done by the Freeze-thawing method by hydrating *Spirulina platensis* biomass into sodium phosphate buffer (0.1M) with pH 6.5-7.0. A UV-VIS spectrophotometer was used to measure the absorbance of the extracts at wavelengths 280, 615, 620, and 632nm, respectively. The concentration of phycocyanin (mg/ml) and the yield were determined by the following formula:-

$$\text{C-PC (mg/ml)} = A(615) - 0.474 \times A(652) / 5.34$$

Phycocyanin yield (mg/g) = C-PC × solvent volume/dried biomass. (Julianti *et al.*, 2019).

Preparation of *Spirulina platensis* chocolate candies (prebiotics)-

For preparation of *Spirulina platensis* chocolate candies 250gm of Desiccated coconut, 50g of sugar, 1gm *Spirulina* powder (Sankara pandian *et al.*, 2022), 150gm dark chocolate compound, and 50g of butter were taken, mixed thoroughly, cooked and shaped into small balls which were then kept overnight in the freezer.

Recipe	Characteristics	Primary ingredient	Fortifying ingredient
Candy	Control	Desiccated coconut, Vegetable oil, sugar, Dark chocolate	<i>Spirulina</i> 1gm
	Fortified	Desiccated coconut, Butter, sugar, Dark chocolate	

Result and Discussion:

Microscopic identification-

Under the microscope at 10X and 40X *Spirulina splatensis* culture was observed for taxonomic identification. It was observed that *Spirulina* under the microscope was cylindrical, with spiral coils in it. After 30 days of cultivation the green color of *Spirulina platensis* was converted into a light faded green color due to nutrient starvation, which is related to nitrogen and phosphorous (Saxena R.*et al.*, 2022).

Cultivation of *Spirulina*-

The *Spirulina platensis* species were successfully grown in a crude medium. The medium composing OF 0.5 gm/l of NPK-15-15-15 was used for growing *Spirulina*. This crude medium was found to be cost-effective In comparison with medium, in terms of quantity of chemical ingredients whereas, the NPK complex fertilizer supplied the three major elements required for *Spirulina platensis* growth, and sodium bicarbonate was used as a carbon source in crude medium. For ideal salinity sodium chloride and MgSO₄ as a macronutrient were supplied and then the growth curve of *Spirulina platensis* was obtained by measuring optical density (O.D) at 670 nm. The graph obtained by measuring optical density against time shows an increasing growth rate of *Spirulina platensis*.

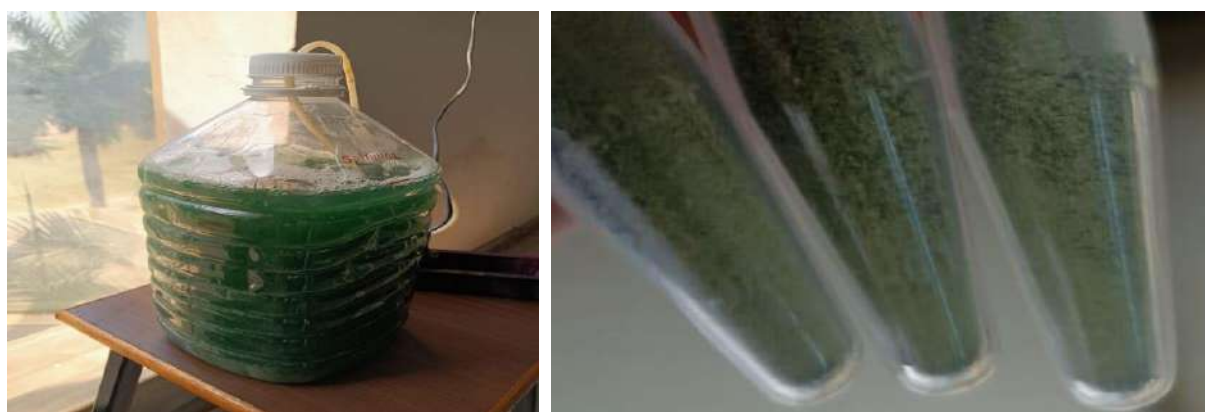
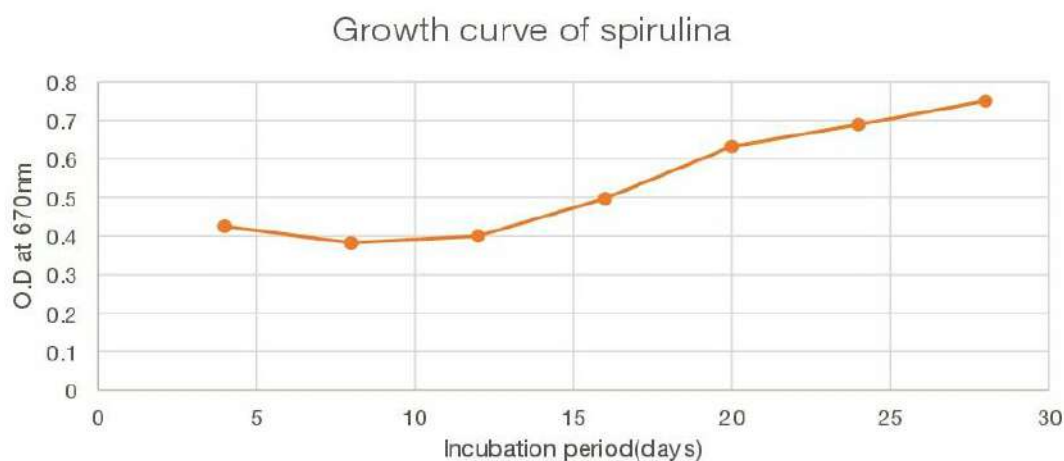


Fig.a. Cultivation of *Spirulina platensis* Fig.b. Harvested *Spirulina platensis*



Phytonutrient analysis of *Spirulina platensis*-

Estimation of protein content and Nitrogen content-

The analysis of protein content from *Spirulina platensis* was found 54.25% and nitrogen content of 8.68% cultivated in crude medium. In *Spirulina* 60% protein content and 12% nitrogen content was reported which was cultivated in medium. Considering the cost saving possibilities, present study revealed that, crude medium is better source for *Spirulina platensis* cultivation as well as for the protein content.

Estimation of total carbohydrates-

Carbohydrates were composed of carbon, hydrogen, and oxygen, made up of sugars, starches, cellulose and lignin. Carbohydrate is an essential component for metabolism and metabolic processes. (wijffels *et al.*, 2010) stated that algal carbohydrates can provide human health benefits in the form of dietary fibers, anticoagulants, and antioxidants. In the present study carbohydrate content of *Spirulina platensis* found was 18% by the phenol-sulphuric acid method. In *Spirulina platensis* total carbohydrates estimated were 15.3%

Extraction and Estimation of pigments (chlorophyll-a, chlorophyll-b, Total carotenoids and phycocyanin)-

In the present study, chlorophyll-a pigment in *Spirulina* species was found 0.51µg/ml, and chlorophyll-b was estimated as 0.49 µg/ml. Total Carotenoids in *Spirulina platensis* was found 0.2 µg/ml and phycocyanin was found 0.46 mg/ml. The concentration of pigments, such as Chlorophyll-a 2.27µg/l, Chlorophyll-b 1.51µg/ml, carotenoids 0.17µg/ml and phycocyanin 0.05mg/ml was reported.

Total Lipid Extraction Method-

The total lipid content in *Spirulina platensis* was found 24.99%.

Determination of Calcium-

Spirulina platensis is potent source of calcium. Calcium content in *Spirulina platensis* is, 800 mg/1g.

Nutritional analysis of control candy and fortified product-

Nutrients	Control candy	Fortified candy
Protein %	48.18	54.25
Total Fat %	24.83	24.99
Carbohydrate %	14	15.30

Conclusion:

Spirulina platensis was successfully grown in crude medium under natural and laboratory conditions. Crude medium can be considered as cost effective medium for *Spirulina* cultivation. After phytonutrient analysis it was noted that protein content from *Spirulina* species was found 54.25%, nitrogen content of 8.68% and carbohydrate content was 18%.*Spirulina plantens* is potential source of calcium .Consumption of spirulina can meet daily requirement for calcium. Furthermore,*Spirulina* chocolate candies can be consumed as a protein supplement which may help in fulfilling the protein requirements among vulnerable population.

References:

- 1) Coles, J.F., Jones, R.C., Effect of temperature on photosynthesis-light response and growth of four phytoplankton species isolated from a tidal freshwater river.(2000)
- 2) Delrue F., Alaux E., Moudjaoui L., Gagnard C., Fleury G., Perhou A., Richaud P., Petitjean M. and Sassi J. F. Optimization of *Arthrospira platensis* (*Spirulina*) fermentation Growth: From Laboratory Scale to Pilot scale.(2017)
- 3) Eppley, RW, Talbows, P.G., Dubinsky, Z. Wyman. K.. Temperature and phytoplankton growth in the sea. Fish, Bull. 70, 1063-1085, <http://fishbull.noaa.gov/70-4/eppley.pdf>. 1995. Growth-irradi plankton Laminated Oceanogr. 30.(1972)
- 4) Gabriel Martins da Rosa, Luisa Maraes, Michele da Rosa Andrade Zimmermann de Souza, Jorge Alberto Vieira Costa *Spirulina* cultivation with a CO₂ absorbent: Influence on growth parameters & macromolecule production (2015)
- 5) Gami Bhavat, Naik Abhishek, Patel Beena Cultivation of *Spirulina* species in different liquid media (2011)
- 6) Goldman, J.C.. Carpenter, E.J., 1974. A kinetic approach to the effect of temperature on algal growth. Limnology Oceanogr. 19, 756-766.(1974)
- 7) Gouveia, L. and Oliveira, A.C.J. Microalgae as a raw material for biofuels production. Journal of Industrial Microbiology and Biotechnology, 36:269-274.(2009)
- 8) Henrikson, R. Microalga *Spirulina*, superalimento del futuro. Ronore Enterprises, 2^a ed. Ediciones Urano, Barcelona, España., pp. 222.(1994)
- 9) J.M.B.M.G. Bandara, K. K. I. U. Arunakumara Development of low-cost Growing media for *Spirulina* using Alternative Carbon sources (2022)
- 10) Joshi V.P., Chauhan P.M., Joshi k. B., Joshi N.H. Growth parameter Optimization & Biochemical Appraisals of *Spirulina platensis* (2018)
- 11) Jung F., Jung. C. G. H., Krüger - Genge Kupper Jan-Heiner Factors influencing the growth of *Spirulina platensis* in closed photobioreactors under CO₂ - O₂ conversion (2019)
- 12) Kumaresan G. K. Sivakumar, Rajan L. Fradlin Slingh Effect of Abiotic factors on the growth of *Spirulina platensis* strains (2020)
- 13) Markou G., Georgakakis D. Cultivation of filamentous cyanobacteria (blue-green algae) in agro-industrial wastes. & wastewaters (2011)
- 14) Mohamad Salah shurain, Fares Almomani, Simon Judd, Rahul R. Bhosale, Anand kumar Potencial for green algae. *spirilina* to capture carbon dioxide from gas stream (2016)
- 15) Montagnes, D.J.S., Franklin, M., 2001. Effect of temperature on diatom volume, growth rate, and carbon and nitrogen content: reconsidering some paradigms.
- 16) Murugan T., and Manikandavelu D. Indian Hydrobiology.10 (2): 331-333.(2007)
- 17) Murugan T₁, Rajesh R. Cultivation of two species *Spirulina* (*Spirulina platensis* & *Spindling pantells* var lonar) on sea water medium and extraction of C-phycoyanin (2014)
- 18) Pandey J. P., Pathak N., Tiwari A. Standardization of pH and light intensity for the biomass production of *Spirulina platensis* (2010)
- 19) Platt, T.. Jassby, A.D. The relationship between photosynthesis and light for natural assemblages of coastal marine phytoplankton. J. Phycol. 12, 421-430.(1976)
- 20) Ruma Arova soni, k. Sudhakar, R., Rana Comparative study on the growth performance of *Spirulina platensis* on modifying culture media (2019)

- 21) Salunke, K.J., Magar, S.A., Joshi, R.R., Wadikar, M.S., . Comparative study on the growth of *Spirulina platensis* on different culture media Biosci. Discov.(2016)
- 22) Shabana kouser AU, Arabi Mohammed Saleh, 2012, International Journal of Pharmacy & Pharmaceutical Sciences ISSN-0975-1491, vola, Issue3,(2012)
- 23) Sharani, G., Saranraj. P. and Kanchana, D., *Spirulina* cultivation: A review, International Journal of Pharmaceutical and Biological Archive, 3:1327-1341.(2012)
- 24) Sudhakar, K., Premalatha, M., 2015. Characterization of microalgal biomass through FTIR/TGA/CHN analysis: application to *Scenedesmus* sp. (2015)
- 25) Tolga G., Ksan Zekeruyaoulu and A.K. Ulknur.. Turkey Journal of Biology. 31: 47-52. (2007).
- 26) Vieira Costa, J.A.; Colla, L.M.; Duarte Filho, P.F. Improving *Spirulina Platensis* biomass yield using a fed-batch process. *Bioresour Technol.*92, 237-241. [CrossRef].(2004)
- 27) Yoder, J.A. Effect of temperature on light-limited growth and chemical composition of *Skeletonema costatum* (Bacillariophyceae). *J. Phycol* 15. 352 – 372.(1979)

A Geographical Study of *Khidrapur Religious Tourist Center* in Shirol Tahsil

**Dr. Govardhan S. Ubale¹ Dr. Shubhangi S. Kale² Dr. Sunil G. Bhosle³
Dr. Siddharth S. Ghoderao⁴**

¹Associate Professor, ^{2,3,4}Assistant Professor,
Department of Geography,
Vivekanand College, Kolhapur (Autonomous) Maharashtra.

ABSTRACT:

In India, religious tourism has been important both historically and currently. A major draw for tourists is the diversity of the physical, social, cultural, historical, and religious elements. There is a great deal of potential for religious tourism in India, particularly in Maharashtra, due to the country's diverse religious heritage, rich cultural heritage, historical sites, and advantageous geographic location. Kopeswar Temple is at Khidrapur, Kolhapur district, Maharashtra. It is a Hindu temple dedicated to Shiva. This temple is in Maharashtra It is also accessible from Sangli as well. It was built in the 12th century by Shilahara king Gandaraditya between 1109 and 1178. There are certain issues that tourists found. The current study has reviewed the actual scenario, conditions, issues with facilities and services, and solutions to these issues from a geographical standpoint.

Keywords: Tourism Industry, Religious tourism, Socio-Culture Historic aspects.

INTRODUCTION:

The most significant and quickly expanding business nowadays is tourism. The economy of several nations and governments is entirely dependent on tourism. The district of Kolhapur boasts a wealth of religious historical background and socio-cultural establishments. Additionally, it is bordered by other sacred sites, including Khidrapur, Mahalaxmi, Jotiba, Kattayani, and Nrisinhwadi. Maharashtra's Khidrapur Religious Center is the most significant location for the Jain religion. In Maharashtra and throughout India, it is a well-liked holy location. For religious reasons, people travel to this location from various Indian states. Excellent connections to Maharashtra's roads and trains are available at Khidrapur station. In the Shirol taluka of Khidrapur village in the Kolhapur district of Maharashtra, there is an old stone temple dedicated to Mahadev called Kopeswar Temple. The Krishna River banks where the temple is located. Generally, the construction of this Kopeswar temple may have started during the Chalukya rule around the seventh century. Further, the work was completed during the Shilahara rule in the 11th-12th century. The Yadavas of Devagiri are also recorded to have contributed to its construction. Its architectural style is similar to that of Belur, Halebid in the south. Outside the temple is a Mandapam supported on 48 pillars. This mandapam does not have a full roof. A

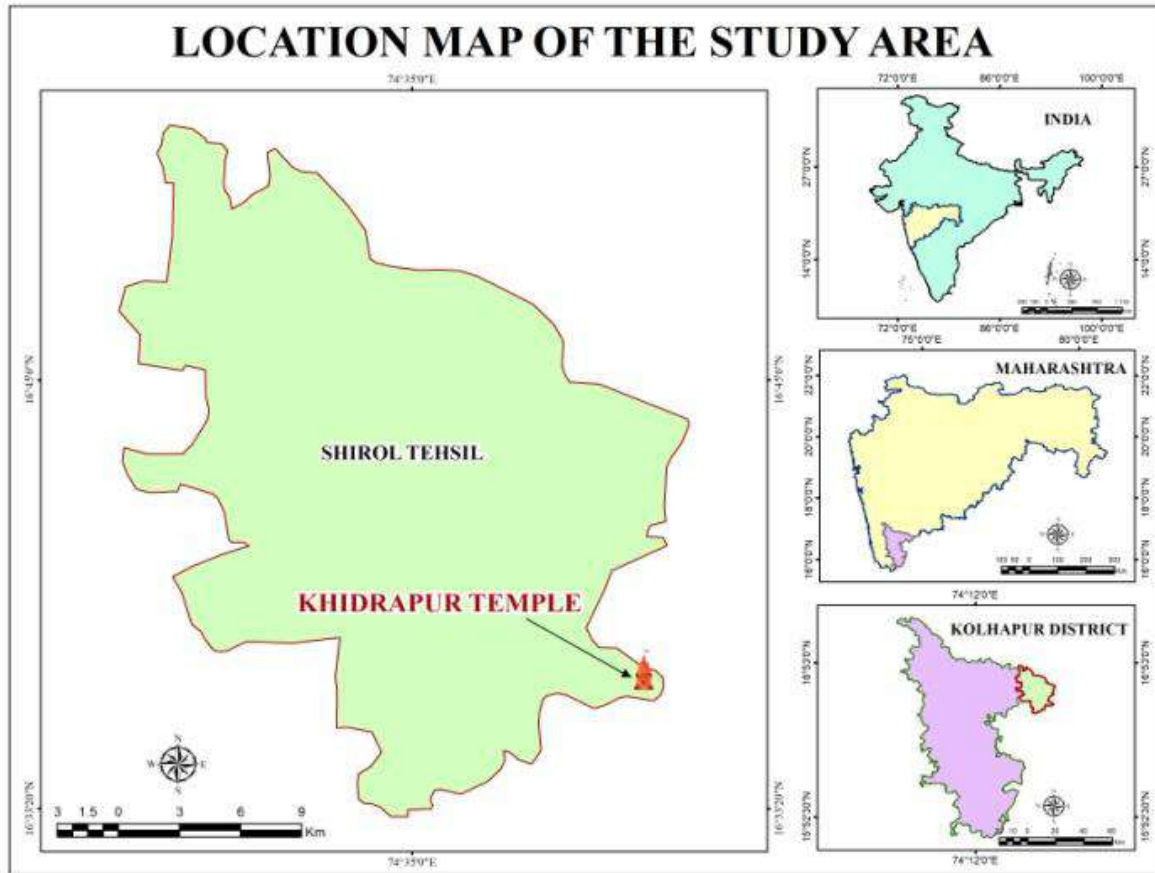
circular space is intentionally left blank. This mandapam was used for Yagya. Therefore, it is the place where the smoke of home-havana goes out.

STUDY AREA:

The Khidrapur Religious Center is situated in the stunning western Maharashtra countryside, close to Shirol Tal. Around 7 kilometers separates Khidrapur from Jaysingpur, 45 miles from Kolhapur, and approximately 15 km separates it from Ichalkaranji. It is 16°42' North and 74°41' East in lat-long coordinates. This center covers 5547 mt² area. 24 °C is the average monthly temperature. There is 100 cm of precipitation annually. Kopeshwar Temple is an ancient stone temple of Mahadev in Khidrapur village of Shirol taluka in Kolhapur district of Maharashtra. The temple is situated on the bank of river Krishna.

The Talvinyas of the Kopeshwar temple consist of an open mandapa, a covered mandapa, a space and a sanctum sanctorum, slightly separated from the main mandapa. On the cupola of the sanctum sanctorum is a row of smaller shikharas replicating the main shikhara. The original roof of the space and pavilion is non-existent. An open mandapa, somewhat detached from the mandapa, known as Swargamandapa, never had a roof. The Kopeshwar temple is facing east and at the front is the Purmandapam of Triratha Talvinyas instead of Mukhamandapam. On the interior of these pillars Kartikeya and Ashtadikpala are shown with vehicles. Behind these twelve columns are nine columns of comparatively less width. There are twenty square pillars around the twelve pillars in the middle of the auditorium. Beyond these rows of columns are the walls of the auditorium. On both sides of this hall there are gawkshes for light. From the mandapa to the space there are gatekeeper idols on either side of the entrance. The gate of the sanctum sanctorum is of Panchashak type. There are two Shivalingas in the sanctum sanctorum.

The stone carved elephants on those nets are very beautiful. At the base of the door there are five gatekeepers on either side. The main auditorium is also very beautiful. Further to the sanctum sanctorum, a beautiful rangoli-like nakshi is carved at the base of the entrance. The sanctum is a bit dark. But after training the eyes, one realizes that there are beautiful idols inside as well. In all these idols, their size and proportions stand out.



OBJECTIVE:

1. To study the Geographical and Religious conditions.
2. To study the available facilities and services in the study area.
3. To highlight the problems faced by tourist.

METHODOLOGY:

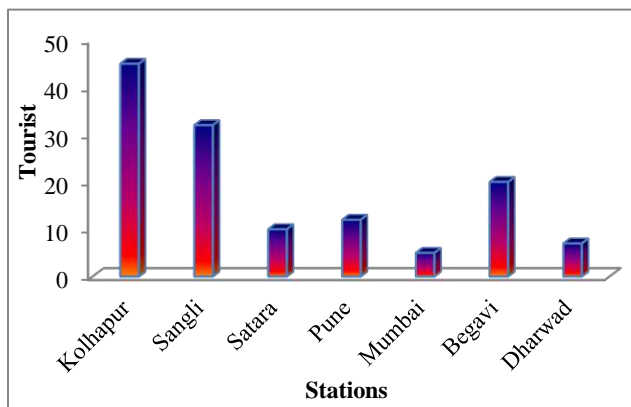
Both primary and secondary data served as the foundation for this research study. The primary data was gathered by means of questionnaires, interviews, and on-site observations. To obtain secondary information, the secondary data gathered from the Kolhapur Gazetteer, Journals, Books, and Internet are also referred to. The gathered data was subjected to basic statistical analysis and was appropriately represented using cartographic techniques.

DISCUSSION:

Regarding religion and tourism, the Khidrapur sacred place is importance. Tourists are drawn to the area because of the excellent conditions. The current study shed information on the actual state and potential of religious tourism in the area under investigation. Below is a detailed study of the same.

Table No .1: Tourist Visited at Bahubali from Different Part of India

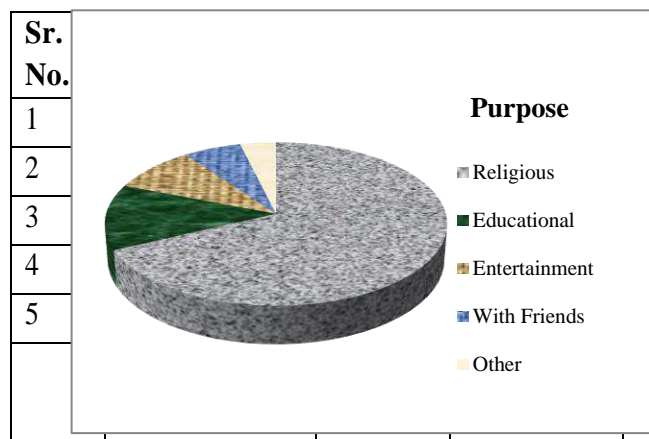
Sr.No.	State	District	Tourist	Percentage
1	Maharashtra	Kolhapur	45	34.35
2	Maharashtra	Sangli	32	24.42
3	Maharashtra	Satara	10	7.63
4	Maharashtra	Pune	12	9.16
5	Maharashtra	Mumbai	05	3.81
6	Karnataka	Begavi	20	3.22
7	Karnataka	Dharwad	07	15.26
Total			131	100



Source- Field Work

According to the above table, the Kolhapur district is home to a higher percentage of religious tourists, which is 34.35 % of tourists, came from there. Sangli, the second district, accounted for 24.42 % of all visitors to the Khidrapur temple. With 18.48 % of visitors coming from Karnataka, it's a well-known Hindus Lord Shiva's pilgrimage site in Kolhapur. From Mumbai and Pune district there are coming tourist i.e. 13 % during festivals, a large number of visitors travel to Khidrapur Center from all across India and the districts of Maharashtra.

Table No.2: Purpose Wise Classification of Tourists



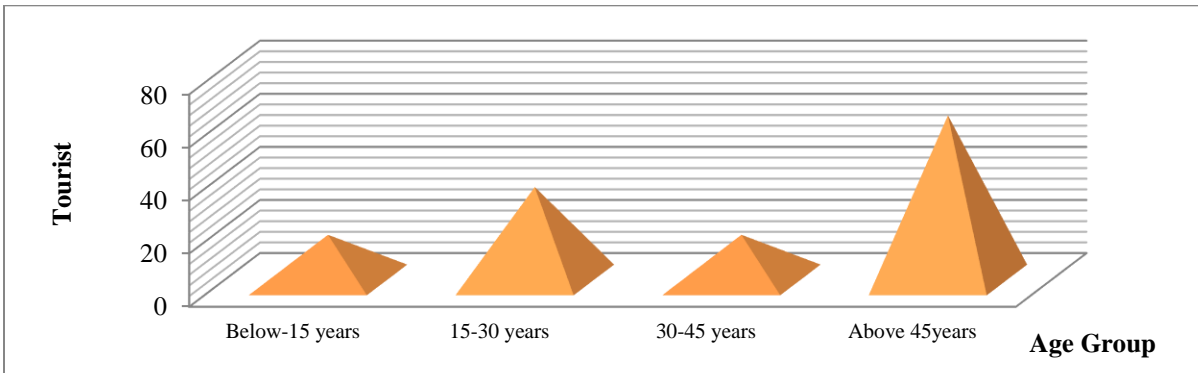
Source: - Field Work

The table no. 2 indicates why tourists come to Khidrapur. It has been noted that 67.93 % of visitors to Khidrapur do so for religious reasons. 12.97 % people arrive for educational purpose from schools and other educational institutions. Approximately 9.16% of tourists arrive for entertainment purposes, with the rest visitors having other intentions.

We've noticed that more people come to Khidrapur exclusively for religious reasons.

Table No.3: Age-Group Wise Classification of Tourists

Sr. No.	Age-Group	Male	Female	Total	Percentage
1	Below-15 years	08	09	17	12.97
2	15-30 years	15	20	35	26.71
3	30-45 years	09	08	17	12.97
4	Above 45years	17	45	62	47.32
Total		49	82	131	100

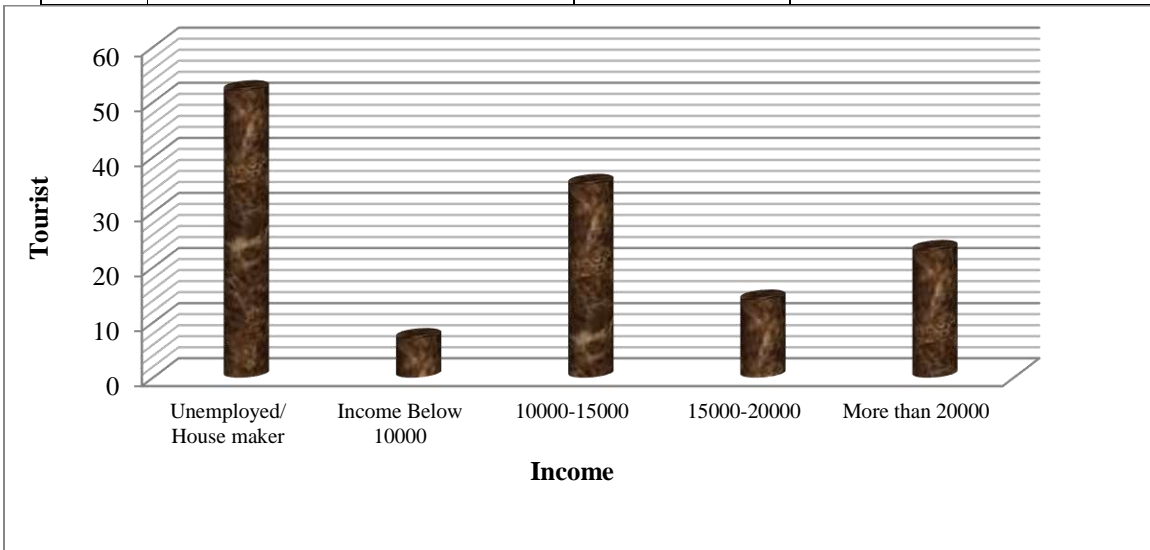


Source- Field Work

The age range of the tourists who visited Khidrapur is displayed in the accompanying table no.3. It has indicated that, 12.97 % tourist age is below 15 years. We have observed that, 26.71 % visitors are 15 to 30 years ages. It has been noted that 12.97 % of visitors to Khidrapur are between the ages of 30 and 45. Approximately 47.32 % of visitors are between the ages of 15 and 30 and older than 45. The data indicates that the majority of visitors to Khidrapur are above the age of forty five.

Table No.4: Income Wise Classification of Tourists

Sr. No.	Monthly Income group	Tourist	Percentage
1	Unemployed/ House maker	52	39.69
2	Income Below 10000	07	5.34
3	10000-15000	35	26.71
4	15000-20000	14	10.68
5	More than 20000	23	17.55
Total		131	100



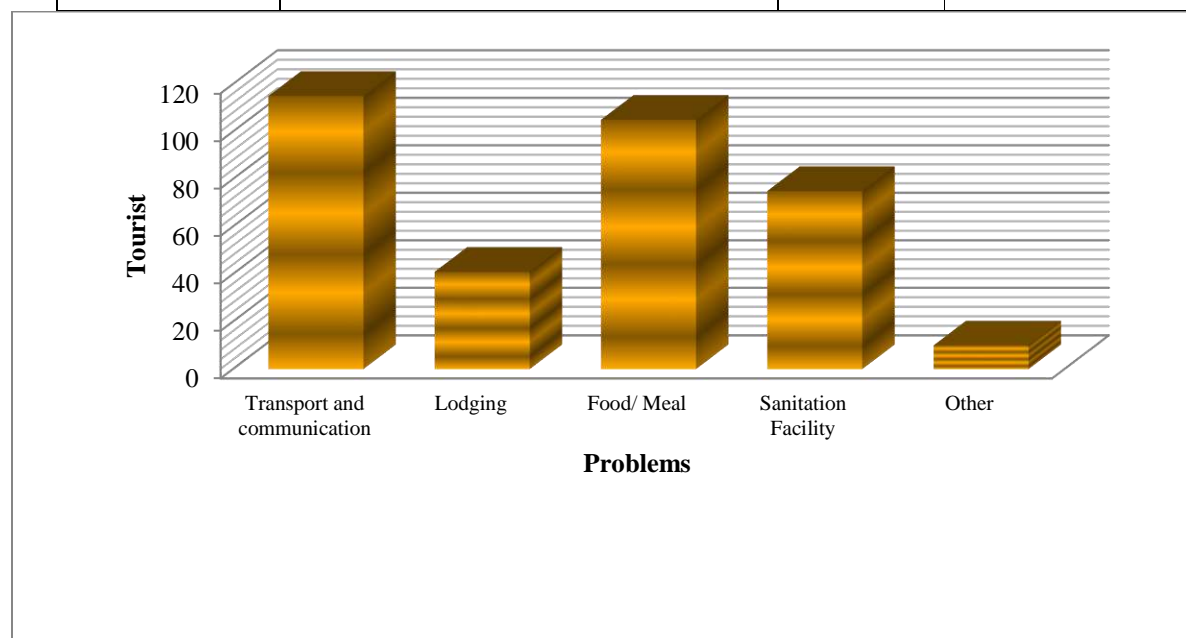
Source- Field Work

This investigation has shown that there is a favorable correlation between the condition of the economy and tourism. Since tourism is impossible without money, money is a crucial

component in the development of tourist destinations. According to Table No. 4, 39.69 % visitors are unemployed or house makers. It has noted that, 5.34 % of visitors come from families with incomes under 10000 rupees. More than 25% of visitors are from the higher income bracket, defined as those with monthly incomes between 10000 to 15000 rupees. Approximately 10.68 % of visitors came from the income bracket of 15,000–20,000 rupees. It has indicated that 17.55 % visitors came from income of more than 20000 rupees.

Table No 5: Problems of Tourists in Khidrapur

Sr. No.	Problems	Tourist	Percentage
1	Transport and communication	115	87.78
2	Lodging	41	31.29
3	Food/ Meal	105	80.15
4	Sanitation Facility	75	57.25
4	Other	10	7.63



Source- Field Work

Although the Khidrapur Trust and other private organizations offer a great deal of services to travelers, there are several issues. Many visitors to this center deal with a variety of issues. The two biggest issues are those transportation and communication. Approximately 87.78% of tourists have experienced transportation-related issues due to a scarcity of automobiles and bad road conditions, making driving extremely difficult. About 31.29% of visitors have trouble finding a place to stay. There are hotels available, but it is a relatively small facility, and there

are no other private housing options nearby. Approximately 80.15% of tourists have experienced dietary difficulties. It has noted that, 57.25% tourist indicated sanitation problems. The amenities that are offered do not meet the needs of visitors to Khidrapur Center.

CONCLUSION:

One of the Jain holy temples in the Kolhapur district is called Khidrapur. Due to its Hindu religious background, and agricultural plain area, it has the potential to become one of Maharashtra's most popular tourist destinations in India. It has been noted that the majority of visitors come from Maharashtra, as well as other parts of India. The majority of visitors to Khidrapur did so for religious reasons. The majority of visitors to Khidrapur are in the working age range. Transportation, lodging, roads, health, sanitation, security, and other issues are present. While certain facilities are offered, tourists are not satisfied with them. If these issues are resolved, this location has the potential to grow significantly and earn international recognition in India.

REFERENCES:

Gazetter of Kolhapur District.

Gharpure Vitthal (2001): Geography of Tourism, Pimpalpure and Co. Publication, Nagpur.

Pravin R. Talekar Dr. M. B. Potdar (2011): Religious Tourism in Kolhapur District: A Geographical Analysis, *Lokavishkar Vol-1, No. II Interdisciplinary Research Institute, Kolhapur*

Patil M. A., Gophane B.N. (2012): Tourism, and Women Empowerment: A Study of Solapur District, *M.B.P., Sanshodhan Patrika, Vol-XXXIX(1)*, Jan -July 2012 PP46 -49.

R. M. Kendre (2012): A Geographical Study of Shri Manudevi Religious and Natural Tourist Centre in Jalgaon District. Maharashtra, *Bhugolshatra Parishad, Pune's 29th National Conference – Sovineer*.ISBN:978 -93-81354-40-7, PP 02-06.

Jagdale. U. G. and Dushing A. G. (2012): A Geographical Study of Tourist Centers in Junnar Tahsil –With special reference to Ozar. Maharashtra, *Bhugolshatra Parishad, Pune's 29th National Conference – Sovineer*.,ISBN:978 -93-81354-40-7, PP07-10.

Majalekar. K. H., Mane S.S. and Ubale G. S. (2013): A Geographical Study of Religious Tourist Centers in Hatkanagle Tahsil., *International Journal of Advance and Applied Research (IJAAR)*, Sovineer.ISSN:2347-7075, Vol- 1,

S.J.Steenbruggen. (2016). Tourism Geography: Emerging Trends and Initiatives to Support Tourism in Morocco. *Journal of Tourism & Hospitality*, 5(3).

Bao, J. (2002). Tourism geography as the subject of doctoral dissertations in China, 1989-2000. *Tourism Geographies*, 4(2), 148-152

Shaw, G. and Williams, A.M. (2002). Critical Issues in Tourism: A Geographical Perspectives, *2nd ed.*, 371 pp. Blackwell: Oxford.

Williams, S., & Lew, A. A. (2014). Tourism geography: Critical understandings of place, space and experience. Rout ledge

कदमवाडी परिसरातील कचऱ्याची विल्हेवाट लावण्याच्या पद्धतींचा अभ्यास.

योगिता एस. पाटील, डॉ. उर्मिला खोत

सहाय्यक प्राध्यापक

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

yogitacom05@gmail.com

गोषवारा :-

माणसाच्या दैनंदिन जीवनात निरनिराळ्या प्रकारचा कचरा निर्माण होतो शहरामधील कचरा हा गुंतागुंतीचा व गंभीर प्रश्न बनत चालला आहे कचरा रस्त्यावर फेकल्यामुळे शहर आणि गांव यांचं सौंदर्य तर नष्ट होतेच पण त्यामुळे आरोग्यविषयक प्रश्न सुद्धा निर्माण होतात.

शहरात निर्माण होणाऱ्या कचऱ्याचा अभ्यास करणे व कचऱ्याचे व्यवस्थापन व विल्हेवाट कशाप्रकारे करता येईल याचा अभ्यास करणे आवश्यक आहे.यासाठी लोकांची निवड करून त्यांना कचरा विल्हेवाट लावण्याच्या योग्य पद्धती महानगरपालिके कडून सांगितल्या जातात. त्या पद्धती किती लोक अमलात आणतात व कचऱ्याची विल्हेवाट कशी लावतात हे अनुसूची पद्धत वापरून बघितले असता बरेच लोक जागृत झाले आहेत हे दिसून आले आणि काही लोकांमध्ये जागृती करणे गरजेचे आहे. त्यांना कचऱ्याचा पुनर्वापर करण्याविषयीचे ज्ञान दिले पाहिजे. ओल्या आणि सुक्या कचऱ्याचे घराच्या घरीच योग्य व्यवस्थापन झाले तर कचऱ्याचे ढीगच्या ढीग साठणार नाहीत. पर्यावरणाचा होणारा न्हास हा जागतिक स्तरावरील बहुचर्चित असा एक महत्वाचा विषय आहे.नाश झालेल्या पर्यावरणामध्ये कधीही येणाऱ्या पिढीचे निरोगी भविष्य साध्य होऊ शकत नाही. पर्यावरणाच्या न्हासाला प्रदूषण हे एक महत्वाचे कारण आहे. म्हणूनच १००% लोकांमध्ये कचऱ्याची योग्य विल्हेवाट लावण्याविषयीची जागृती झाली पाहिजे म्हणजे रस्त्याच्या बाजूला कचरा फेकला जाणार नाही व रोगराईचा प्रादुर्भाव होणार नाही आणि आपला भारत देश १०० % “स्वच्छ भारत” होईल.

मुख्य शब्द : पर्यावरण, कचरा ,विल्हेवाट,रोगराई, घंटागाडी

प्रस्तावना :-

माणसाच्या दैनंदिन जीवनात निरनिराळ्या प्रकारचा कचरा निर्माण होतो शहरामधील कचरा हा गुंतागुंतीचा व गंभीर प्रश्न बनत चालला आहे कचरा रस्त्यावर फेकल्यामुळे शहर आणि गांव यांचं सौंदर्य तर नष्ट होतेच पण त्यामुळे आरोग्यविषयक प्रश्न निर्माण होतात. वाढते औद्योगिकरण, रोजगाराची उपलब्धता व शहरी जीवनाचे आकर्षण यामुळे शहराची लोकसंख्या भरमसाठ वाढू लागली आहे. त्यामुळे वाढत्या लोकसंख्येबरोबर अनेक प्रश्न निर्माण होऊ लागले. शहरात निर्माण होणारा कचरा दोन प्रकारचा असतो. १) द्रवरूप कचरा २) घनरूप कचरा

घनरूप कचरा वाहून नेण्याचे नियोजन प्रत्येक शहरात आहे. तसेच शहरी भागात जल प्रदूषण व साथीचे रोग इत्यादी समस्या कचऱ्यामुळे निर्माण होतात. जगभरातल्या अनेक शहरात गोळा केलेला कचरा जमा करण्यासाठी जागेची कमतरता भासत आहे.

अशा प्रकारे कचरा एकत्र करून तो जाळणे या पद्धतीचा अवलंब केला जात नाही. कारण या पद्धतीत मानवी आरोग्यास घातक आहेत. कचऱ्याचे व्यवस्थापन करण्यासाठी एकात्मिक पद्धतीचा विकास करण्याची गरज भासत आहे. त्यामध्ये गोळा करण्याची पद्धत त्यावर प्रक्रिया करून त्यातील पुनर्वापरास योग्य घटक वेगळे करणे उर्वरित कचऱ्याचा नाश करण्यासाठी कचऱ्याचे व्यवस्थापन करणे या साऱ्या प्रक्रियांचा मेळ घालण्याची गरज आहे. कचऱ्याची विल्हेवाट लावण्याच्या अनेक पद्धती आहेत. त्यातील काही महत्वाच्या पद्धती पुढीलप्रमाणे आहेत जसे की कंपोस्ट खत तयार करणे, गांडूळ पालन करणे, उर्जानिर्मिती करणे, गोबर गॅस तयार करणे, टाकाऊ वस्तूंचा पुनर्वापर करणे.

ओल्या आणि सुक्या कचऱ्याचे घरच्या घरीच योग्य व्यवस्थापन झाले तर कचऱ्याचे ढीगच्या ढीग साठणार नाहीत. ओल्या कचऱ्यामध्ये पाला पाचोळा, भाजीपाल्याची देठे, फळाफुलांचा कचरा, खरकटे अन्न ह्याचा समावेश होतो. तर कोरड्या कचऱ्यामध्ये कागद, प्लास्टिक, धातू, कापड, रबर, काच ह्यांचा समावेश होतो. आपल्याला शून्य कचरा हे ध्येय ठरवले पाहिजे. शून्य कचरा म्हणजेच कचऱ्याची विल्हेवाट लावण्याच्या संपूर्ण विचार. वस्तू वाया घालण्याचे प्रमाण कमी करणे, सवयी बदलणे, हाताला वळण लावणे, सार्वजनिक स्वच्छतेची मुल्ये जपणे यासाठी आपण स्वःताशी काही गोष्टी ठरविल्या पाहिजेत. म्हणजेच प्लास्टिक पिशव्यांचा वापर टाळला पाहिजे, वस्तू लगेच फेकून न देता त्या पुन्हा वापरल्या पाहिजेत, वापरा आणि फेका ऐवजी वापरा आणि पुन्हा वापरा अशी सवय लावून घेतली पाहिजे, प्लास्टिक डब्बे, बाटल्या पुन्हा वापरता येतात, पाठमोरे कागद वापरता येतात अशा अनेक सवयी लावून घेता येतात.

पर्यावरणाचा होणारा ऱ्हास हा जागतिक स्तरावरील बहुचर्चित असा एक महत्वाचा विषय आहे. पर्यावरण आणि विकास यावर १९९२ साली रिओ दि जानेरो येथे झालेल्या वसुंधरा परिषदेमध्ये असे मान्य केले होते की, नाश झालेल्या पर्यावरणामध्ये कधीही येणाऱ्या पिढीचे निरोगी भविष्य साध्य होऊ शकत नाही. पर्यावरणाच्या ऱ्हासाला प्रदूषण हे एक महत्वाचे कारण आहे.

उद्देश –

- १) कचऱ्याची विल्हेवाट कशी लावावी ह्याबद्दल किती लोक जागृत आहेत हे अभ्यासणे व जागृत नसलेल्यांमध्ये ह्याविषयीची जागृती निर्माण करणे.
- २) कचऱ्याची विल्हेवाट योग्य रीतीने न लावण्याने उद्भवणाऱ्या समस्यांची जाणीव करून देणे.
- ३) ठराविक वस्तू फेकून न देता त्याचा पुनर्वापर करता येतो ही माहिती त्यांच्यापर्यंत पोहचवावी.
- ४) कचऱ्याची योग्य विल्हेवाट लावणे किती गरजेचे आहे याचे गांभीर्य लोकांना यावे व कचऱ्यामुळे होणारे प्रदूषण काही प्रमाणत तरी कमी व्हावे.

मर्यादा –

- १) पूर्ण कोल्हापूर शहरातील अभ्यास करणे शक्य नसल्याने कोल्हापूर शहरातील कदमवाडी या भागाची अभ्यास करण्यासाठी निवड केली.
- २) कदमवाडीतील पूर्ण कुटुंबांचा अभ्यास करणे शक्य नसल्याने तेथील ४० कुटुंबांचा अभ्यास करणे मर्यादित होते.

संशोधन कार्यपद्धती :-

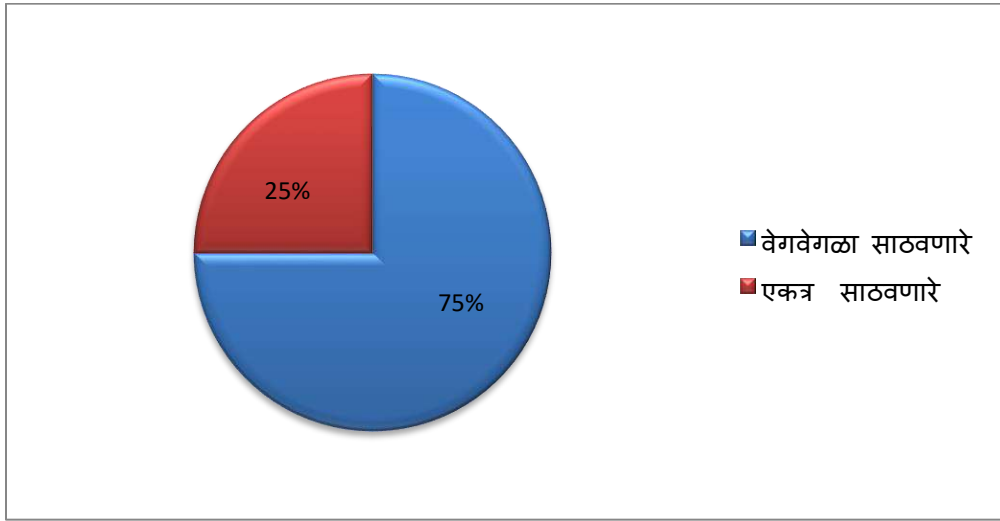
अ) माहितीचे संकलन -

कदमवाडी परिसरातील कचऱ्याची विल्हेवाट कशा प्रकारे लावली जाते ह्या विषयी अभ्यास करण्याकरिता कदमवाडी परिसरातील ४० कुटुंबांना प्रत्यक्ष भेटून स्वतः तयार केलेल्या अनुसूचीद्वारे माहिती घेताना प्रत्येक कुटुंबातील लोक कचऱ्याची विल्हेवाट कशा प्रकारे लावतात, ओला व सुका कचरा वेगळा करतात का, रोज घंटागाडी येते का, कचरा उघड्यावर फेकून दिला तर त्यामुळे रोगांचा प्रादुर्भाव कसा होतो, काही वस्तू (कचरा) लगेच न फेकता त्याचा पुनर्वापर करतात का, यासर्व विषयी त्या लोकांना असलेल्या ज्ञानाची माहिती संकलित केली.

माहितीचे विश्लेषण -

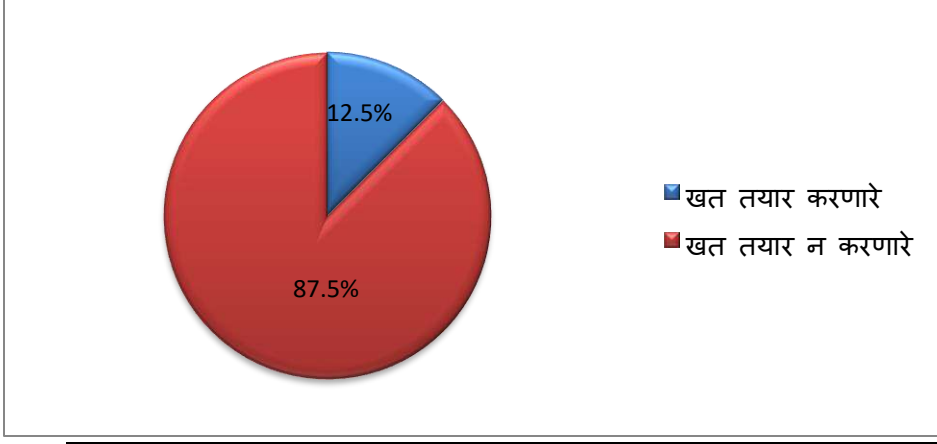
अनुसूचीद्वारे संकलित केलेल्या माहितीचे खालील उद्देशानुसार विभागणी करून त्याचे विश्लेषण करण्यात आले.

- ओला व सुका कचरा वेगवेगळा साठविणाऱ्या कुटुंबांचा अभ्यास -



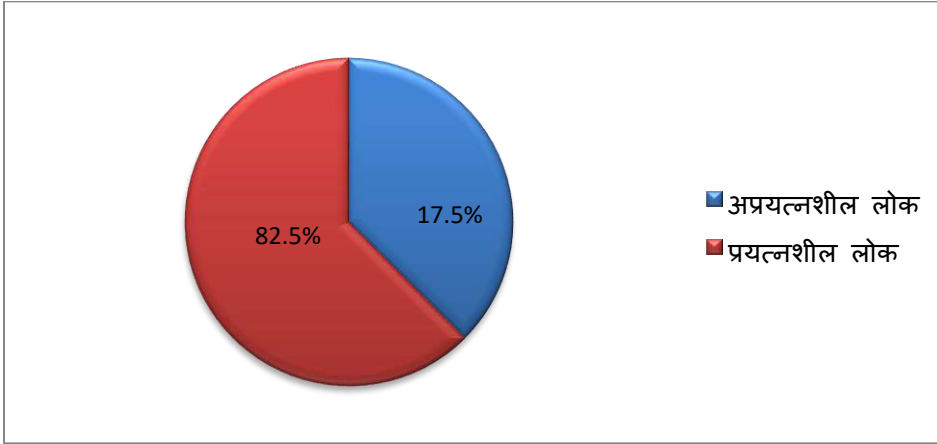
वरील आकृतीमध्ये दर्शविल्या प्रमाणे ७५ % कुटुंब ओला व सुका कचरा वेगवेगळा साठवतात. आणि २५ % कुटुंब हा कचरा एकत्रच साठवतात.

- ओला कचरा वेगळा करून त्या पासून खत तयार करण्याविषयीचा अभ्यास -



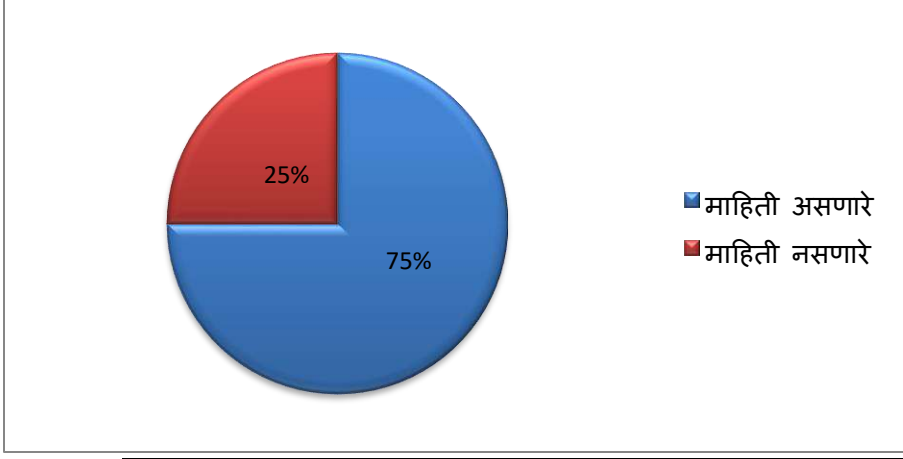
वरील आकृतीमध्ये दर्शविल्या प्रमाणे १२.५ % कुटुंबांना फक्त ओला कचरा वेगळा करून त्या पासून खत तयार करतात व बाकीचे ८७.५ % लोक या विषयी माहिती असून देखील त्याचा खत म्हणून वापर करत नाहीत.

- कचऱ्याची योग्य विल्हेवाट लावण्यासाठी प्रयत्नशील कुटुंबांचा अभ्यास –



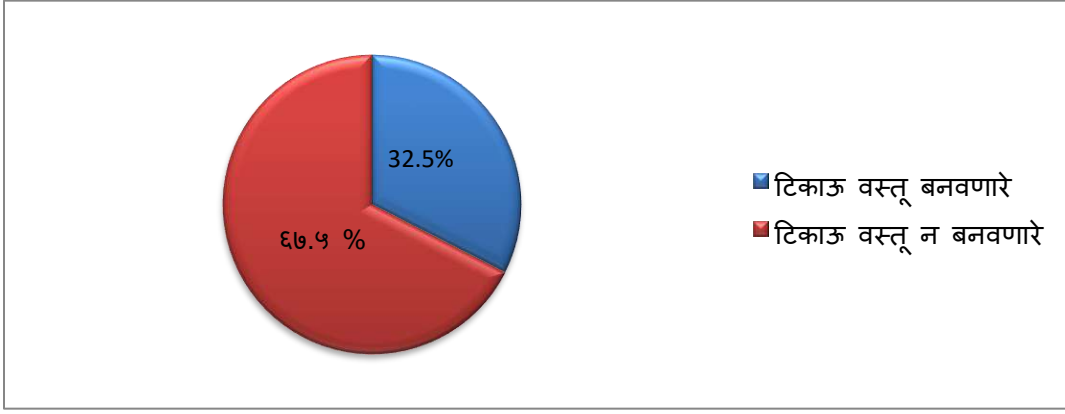
वरील आकृतीमध्ये दर्शविल्या प्रमाणे ८२.५ % कुटुंबांना कचऱ्याची योग्य विल्हेवाट लावण्यासाठी प्रयत्नशील आहेत. पण १७.५ % ह्याबाबत जास्त विचार करत नाहीत.

- कचऱ्यामुळे कोणते रोग उद्भवतात हे माहित असणाऱ्या कुटुंबांचा अभ्यास –



वरील आकृतीमध्ये दर्शविल्या प्रमाणे ७५ % कुटुंबांना कचऱ्यामुळे कोणते रोग उद्भवतात हे माहित आहे पण अजूनही २५ % लोक या माहितीपासून वंचित आहेत.

- काही कचऱ्यामधून टाकावू पासून टिकावू वस्तू तयार होतात याची माहिती आहे किंवा नाही याविषयीचा अभ्यास –



वरील आकृतीमध्ये दर्शविल्या प्रमाणे ३२.५ % कुटुंबांना टाकावू पासून टिकावू वस्तू बनवता येतात हे माहित आहे. व ते अशा वस्तू तयार करून त्याचा उपयोग ही करतात हे लक्षात आले. उदा. प्लास्टिकच्या कॅन चा उपयोग झाडे लावण्यासाठी किंवा शोपीस तयार करण्यासाठी होतो. पण त्याचबरोबर ६७.५ % लोकांना अजून याबाबतची माहिती असून सुद्धा वेळे अभावी याचा वापर करू शकत नाहीत परिणामी त्या टाकून दिल्या जातात.

काही भागात घंटागाडी पोहचते तर काही भागात पोहचत नाही परिणामी कचरा रस्त्याच्या बाजूला फेकला जातो. उघड्यावर टाकलेला कचरा घातक आहे असे वाटते याचा अभ्यास केला असता असे दिसून आले कि १०० % कुटुंबांना उघड्यावर

टाकलेला कचरा घातक आहे हे माहित आहे पण तरीही बऱ्याच ठिकाणी अजूनही कचरा असाच उघड्यावर टाकला जातो. परिणामी तेथील परिसर अस्वच्छ दिसून आला.

निष्कर्ष –

कोल्हापूर शहरातील कदमवाडी परिसरातील कुटुंबांचा कचरा विल्हेवाट लावण्याच्या विषयीचा अभ्यास केला असता असे दिसून आले की, बऱ्याच कुटुंबामध्ये ओला व सुका कचरा वेगळा साठवत नाहीत त्यामुळे ओल्या कचऱ्याचा खत म्हणून वापर करता येत नाही. व तो सर्व एकत्र केलेला कचरा कुंडीत फेकला जातो. काही कुटुंबापर्यंत घंटागाडी पोहचू शकते ते लोक कचरा घंटा गाडीत देतात पण काही कुटुंबापर्यंत घंटा गाडी येत नसल्यामुळे कचरा उघड्यावर फेकून देतात त्या कचऱ्यावर डास व माशांचा प्रादुर्भाव होऊन रोग राईला आमंत्रण दिले जाते. उघड्यावर टाकलेला कचरा घातक आहे हे या परिसरातील लोकांना माहित आहे पण तरीही तो काही प्रमाणात उघड्यावर फेकला जातो.

ओला कचरा वेगळा करून त्या पासून १२.५ % कुटुंब खत तयार करतात तर

८७.५ % कुटुंब वेळेअभावी कचरा फेकून देतात.

कचऱ्यामुळे कोणते रोग होतात हे ७५ % कुटुंबांना माहित आहे आणि २५% कुटुंबांनी उघड्यावर पडलेल्या कचऱ्यामुळे रोग होऊ शकतात याचा विचारच केला नाही.

याच बरोबर ३२.५ % कुटुंबातील लोक टाकावू कचऱ्यापासून टिकावू वस्तू बनवतात. पण अजून ६५.५ % कुटुंबातील लोक वेळे अभावी तो कचरा म्हणूनच फेकून देतात. ८२.५ % कुटुंबातील लोक कचऱ्याची योग्य प्रकारे विल्हेवाट लावण्यासाठी प्रयत्न करतात तर १७.५ % कुटुंब त्यासाठी अजून प्रयत्नशील नाहीत.

यावरून असे दिसून आले की, १०० % कुटुंब कचऱ्याची योग्य प्रकारे विल्हेवाट लावण्यासाठी प्रयत्नशील नाहीत. अजूनही काही ठिकाणी रस्त्याच्या बाजूला कचरा पडलेला दिसून येतो. त्यामुळे रोग-राईला आमंत्रण मिळते म्हणूनच १०० % कुटुंबांनी कचऱ्याची योग्य प्रकारे विल्हेवाट लावण्यासाठी प्रयत्न केले पाहिजेत त्यांच्यामध्ये त्या विषयीची जागृती केली पाहिजे. ज्यावेळी सर्व लोक याचा विचार करतील त्याचवेळी आपला भारत देश “स्वच्छ भारत” होईल.

संदर्भ :

१) प्रा. डॉ. विठ्ठल धारपुरे “पर्यावरण शास्त्र” मनोहर पिंपळापुणे ,पिंपळापुणे & कंपनी. पब्लिशर्स, नागपूर .

२) डॉ. तु. म. वराट “पर्यावरणशास्त्र एक अभ्यास” रेणुका प्रकाशन साईकृपा औरंगपुरा, औरंगाबाद.

Isolation And Characterization of antimicrobial peptides (AMPs) from isolated microorganisms

Shweta A Pise*¹, Dr.N.H.Nadaf²,A.R.Jituri²,P.K.Guhagarkar²

Department of Microbiology, Vivekanand College, Kolhapur

Department of Microbiology, Shivaji University, Kolhapur

ABSTRACT :

The rapid increase in drug resistant infections has presented a serious challenge to antimicrobial therapies. Use of antimicrobial peptides can be a great step to face this challenge as antimicrobial peptides leads bacteria to develop low or no resistance. These proteins have broad activity directly kill bacteria, yeast, fungi, viruses and even cancerous cells. Most AMPs shows bactericidal activity by interacting with cell membrane leading to lysis of cell. In this project, we have aimed to isolate & characterize AMPs from microorganism isolated from different soils. Total 10 isolates were obtained. Out of 10, one organism was potent. This one organism was examined for it's ability to produce AMP. The antimicrobial activity of AMP against Gram positive & Gram negative target organisms were studied & results were concluded.

Keywords

Antimicrobial peptides, antimicrobial therapy, drug resistant infections , bactericidal activity ,host defense peptides

INTRODUCTION

The rapid increase in drug resistant infections is emerging a serious challenge to antimicrobial treatments. The failure of most powerful antibiotics to kill "superbugs" clearly indicates need to introduce other new control agents. (1) Antimicrobial peptides (AMPs) have shown great promise because use of AMPs leads bacteria to develop low or no resistance.

AMPs also known as host defense peptides are conserved molecules found in organisms ranging from prokaryotes to humans(7). AMPs are critical components of host innate immune system that serve as endogenous antibiotics(10). These proteins have broad activity directly kill bacteria, yeast, fungi, viruses and even cancerous cells.(1)(9)(12)

The mechanisms of action of AMPs are diverse and in some cases specific. Most AMPs appear to exert their bactericidal activity by interacting with negatively charged bacterial membrane through electrostatic interactions and then forming pores into the cytoplasmic membranes which leads to bacterial cell lysis (3)(5). AMPs permeabilize microbial cytoplasmic membrane with increasing severity with time. AMPs can dissipate electrochemical gradient across microbial plasma membranes within a few seconds of addition. Thus, AMPs are able to rapidly pass through thick peptidoglycan layer of Gram positive and the lipopolysaccharide layer

of Gram negative bacteria. AMPs interact with cytoplasmic membrane first and then accumulate intracellularly where they block critical cellular processes such as inhibition of protein/nucleic acid synthesis and disruption of enzymatic/protein activity. In addition to direct killing of microbes, AMPs also activate immune cells(11) resulting in enhanced microbial killing and control of inflammation. Most AMPs have shown to interact with innate immune system, there is evidence that they are also involved in modulation of adaptive immune system. Exact mechanisms are not well understood, however, some have shown that AMPs may act as vaccine adjuvants.

In this project, we have aimed to isolate and characterize AMPs from micro-organisms isolated from soil. The total number of isolates obtained from soils of various places were 10 out of which one organism was potent and thus, it is examined for its ability to produce AMP. Then, antimicrobial activity of isolated AMP against Gram positive and Gram negative target organisms were studied and results were concluded as per observations.

MATERIAL AND METHODS :-

1] Isolation of AMP producing micro-organisms from soil:

a) Enrichment of AMP producing organisms

For isolation of organism, 2 gm of soil sample was enriched in Czapek Dox medium containing 0.3% NaNO₃, 0.1% K₂HPO₄, 0.05% KCl, 0.05% MgSO₄, AND 0.001% FeSO₄ (4).60 hours incubation of this medium was done at shaking condition.

b) Screening of AMP producing organisms :

The enriched sample was serially diluted up to 10 dilutions. The dilutions as well as stock sample were spread on Czapek Dox agar containing 0.05% yeast extract and incubated for 72 hours.

c) Isolation of AMP producing organisms :

Well isolated dominant colonies were streaked on nutrient agar slants, incubated and refrigerated for further use.

2] Screening of isolated organisms for production of AMPs:

Screening was done by using one Gram positive (*Bacillus subtilis* NCIM 2635) and one Gram negative (*E. coli* NCIM 2832) as test organisms. Seeded nutrient agar(4) containing test organisms were cross streaked with organisms isolated from primary screening followed by incubation for 48 hours.(4)

3] Antimicrobial activity of AMP:

For the isolated organism, antimicrobial activity was performed by time scaling using Mueller Hinton broth. The activity was carried out for 12 hours at the interval of 1 hour. The test organisms used for antimicrobial activity were *Bacillus subtilis* NCIM 2635 and *E. coli* NCIM 2832. The sample withdrawn at each one hour time interval was centrifuged at 8000 rpm for 10

mins and supernatant was poured into wells of seeded agar plate(4), allowed to incubate at room temperature for 24 hours and observed for zone of inhibition.(4)

4] Purification of AMP:

On the basis of results obtained from time scaling experiment, the isolated organism was inoculated in 3 separate flasks and incubated for 7 hours, 10 hours and 72 hours respectively and further proceed for ammonium sulfate precipitation (4)(6) as follows. Briefly, 75 ml of sample from each respective inoculated flask was taken and centrifuged at 8000 rpm for 10 mins. Supernatant was further distributed into 25 ml. Each aliquot was then saturated using 55%, 65% and 75% concentrations of ammonium sulfate and kept for overnight in refrigerator. On next day, these aliquots were centrifuged at 8000 rpm for 10 mins and pellet was dissolved in citrate phosphate buffer of pH 7 (25 mM). Then, dialysis was performed.(4)

The dissolved pellet was placed in dialysis bag and then kept in citrate phosphate buffer pH 7 (25 mM) for dialysis. After dialysis, these samples were monitored for antimicrobial activity and tested again using *Bacillus subtilis* NCIM2635 and *E. coli* NCIM 2832 as test organisms on Mueller Hinton agar medium.

5) Effect of pH on antimicrobial activity:

a) The antimicrobial activity was tested using different pH buffers-

i) Citrate-phosphate buffer of pH 4 (25 mM)-acidic buffer

ii) Glycine NaOH buffer of pH 8.6 (25 mM)-basic buffer

1 ml of each respective buffer + 1 ml of sample obtained after completion of dialysis was mixed together and incubated in refrigerator for 2 hours. After 2 hours, the antimicrobial activity was tested using Mueller Hinton agar and *Bacillus subtilis* NCIM 2635 and *E. coli* NCIM 2832 as test organisms.(4)

b) As per results, Mueller Hinton broth having acidic pH (4) was prepared and a loopful of isolated organism was inoculated into it and incubated overnight at shaking condition.

c) The same process was repeated using neutral pH Mueller Hinton broth.

RESULTS AND DISCUSSION

1] Isolation of AMP producing micro-organisms from soil:

Growth was observed on the nutrient agar plate and two dominant well isolated colonies from each plate were marked and streaked on nutrient agar slant for further use (10 organisms).(Fig.1)



Fig. 1 - Isolated Organisms

2] Screening of isolated organisms for production of AMPs:

The cross streaked seeded agar plates were observed for zone of inhibition around the cross. Such zones were shown by seven organisms, out of which one was dominant as compared to others, and hence, was selected for testing antimicrobial activity further. The organism may be producing AMP which acts on test organism *E.coli*, so zone of inhibition was observed around the cross. (Fig.2)

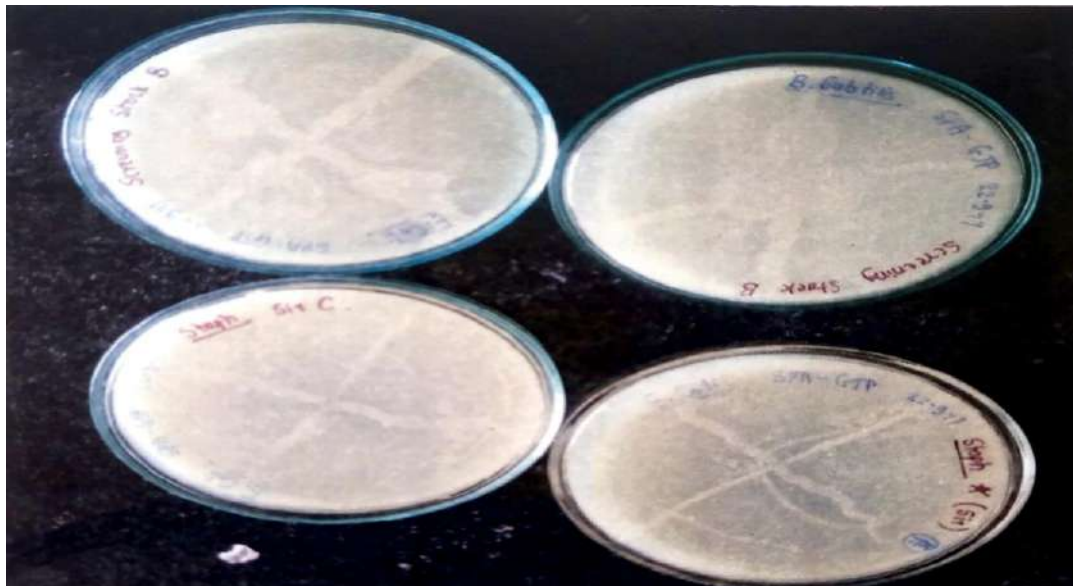


Fig.2 - Screening of organisms for production of AMP

3] Antimicrobial activity of AMP:

After performing time scaling, results were observed in form of prominent zones on the 7th hour, 10th hour and 72 hour plates against test organism *E.coli*. It can be concluded that the organism shows maximum antimicrobial activity at 7th, 10th and 72th hour.(Table No. 1)

Sr. No.	Activity Checked after time interval	Zone of inhibition in mm
1	7	15
2	12	-
3	72	-

Table 1 : Antimicrobial activity of AMP

4] Purification of AMP:

a) Ammonium sulfate precipitation:

After precipitation overnight, the precipitate was observed and this precipitate showed the antimicrobial activity. Hence, it can be concluded that the precipitate may contain proteins (AMP).

b) Dialysis

After dialysis, concentrated protein was obtained. On testing antimicrobial activity of this concentrated protein, results were obtained only on 7th hour seeded Mueller Hinton agar plates(6) against *E.coli* at ammonium sulfate concentrations of 55%, 65% as well as 75%.

5] Effect of pH on antimicrobial activity:

a) Out of the two buffers employing different pH conditions, results were obtained on the Mueller Hinton plates containing sample+ citrate-phosphate (acidic condition) against test organism *E. coli*. So, it can be concluded that the isolated microorganism may produce cationic nature AMP or antimicrobial proteins.

b) When Mueller Hinton broth having acidic pH was inoculated with test organisms no antimicrobial activity was not observed against any organism.

c) But when the same process was repeated with Mueller Hinton broth having neutral pH prominent antimicrobial activity was observed.

This indicated that the isolated protein/AMP shows optimum activity at neutral pH but not at acidic pH. (Fig.3)

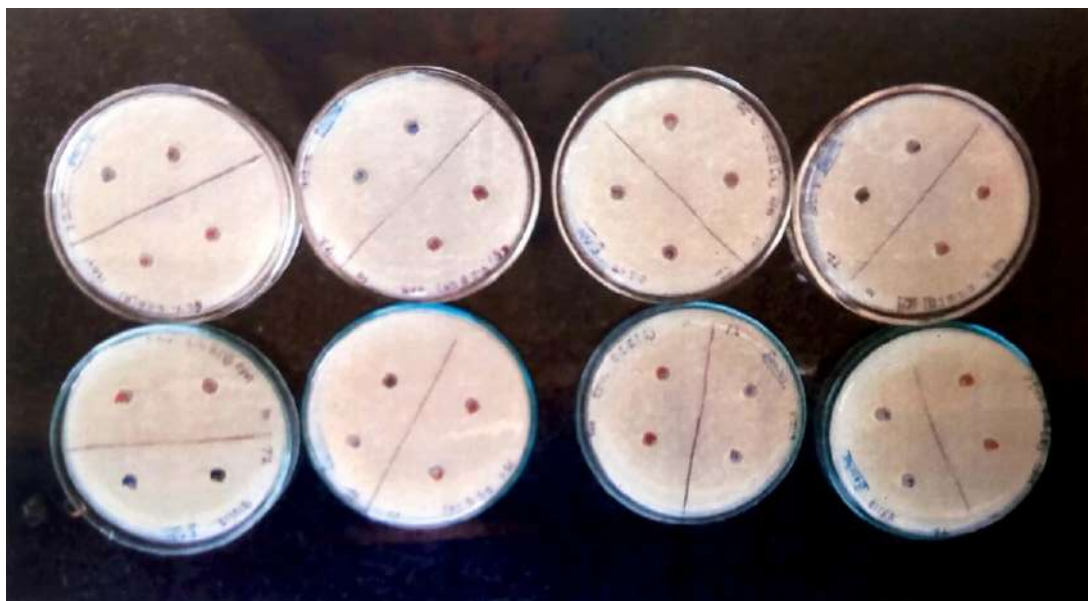


Fig. 3 : Agar plate containing Sample along with different pH buffers

CONCLUSION:

From this study it is concluded that:

- Soil ecological samples contain various microbial species having potential of producing antimicrobial peptides.
- The isolated organism produces antimicrobial peptide (AMP).
- The AMP shows optimum activity at neutral pH, and is also active at acidic pH but the results are fluctuating.

REFERENCES:

1. Bahar AA, Ren D. Antimicrobial Peptides. *Pharmaceuticals*. 2013; 6(12):1543-1575. <https://doi.org/10.3390/ph6121543>
2. Richard M. Epand, Hans J. Vogel, Diversity of antimicrobial peptides and their mechanisms of action, *Biochimica et Biophysica Acta (BBA) - Biomembranes*, Volume 1462, Issues 1–2, 1999, Pages 11-28, ISSN 0005-2736, [https://doi.org/10.1016/S0005-2736\(99\)00198-4](https://doi.org/10.1016/S0005-2736(99)00198-4).
3. Zhang, QY., Yan, ZB., Meng, YM. *et al.* Antimicrobial peptides: mechanism of action, activity and clinical potential. *Military Med Res* **8**, 48 (2021). <https://doi.org/10.1186/s40779-021-00343-2>
4. Muhammad, N., Akbar, A., Shah, A., Abbas, G., Hussain, M., & Khan, T. A. (2015). Isolation optimization and characterization of antimicrobial peptide producing bacteria from soil. *J. Anim. Plant. Sci*, 25, 1107-1113

5. Richard M. Epand, Hans J. Vogel, Diversity of antimicrobial peptides and their mechanisms of action, *Biochimica et Biophysica Acta (BBA) - Biomembranes*, Volume 1462, Issues 1–2, 1999, Pages 11-28, ISSN 0005-2736, [https://doi.org/10.1016/S0005-2736\(99\)00198-4](https://doi.org/10.1016/S0005-2736(99)00198-4)
6. Regmi, S., Choi, Y. S., Choi, Y. H., Kim, Y. K., Cho, S. S., Yoo, J. C., & Suh, J. W. (2017). Antimicrobial peptide from *Bacillus subtilis* CSB138: characterization, killing kinetics, and synergistic potency. *Int. Microbiol*, 20, 43-5
7. Kumar P, Kizhakkedathu JN, Straus SK. Antimicrobial Peptides: Diversity, Mechanism of Action and Strategies to Improve the Activity and Biocompatibility In Vivo. *Biomolecules*. 2018; 8(1):4. <https://doi.org/10.3390/biom8010004>
8. Suda, S., Field, D., Barron, N. (2017). Antimicrobial Peptide Production and Purification. In: Walls, D., Loughran, S. (eds) *Protein Chromatography. Methods in Molecular Biology*, vol 1485. Humana Press, New York, NY. https://doi.org/10.1007/978-1-4939-6412-3_22
9. Giuliani, A., Pirri, G. & Nicoletto, S. (2007). Antimicrobial peptides: an overview of a promising class of therapeutics. *Open Life Sciences*, 2(1), 1-33. <https://doi.org/10.2478/s11535-007-0010-5>
10. Shai, Y., Makovitzki, A., & Avrahami, D. (2006). Host defense peptides and lipopeptides: modes of action and potential candidates for the treatment of bacterial and fungal infections. *Current Protein and Peptide Science*, 7(6), 479-486.
11. Oppenheim, J. J., Biragyn, A., Kwak, L. W., & Yang, D. (2003). Roles of antimicrobial peptides such as defensins in innate and adaptive immunity. *Annals of the rheumatic diseases*, 62 Suppl 2(Suppl 2), ii17–ii21. https://doi.org/10.1136/ard.62.suppl_2.ii17
12. Deslouches, B., & Di, Y. P. (2017). Antimicrobial peptides with selective antitumor mechanisms: prospect for anticancer applications. *Oncotarget*, 8(28), 46635–46651. <https://doi.org/10.18632/oncotarget.16743>

Study of Polysachharide production from Haloalkaliphilic Achaea

Suraj D. Gabale· Dr. S. S. Bajekal· Dr. J. U. Patil

Assistant Professor,

Department of Microbiology,

Vivekanand College, Kolhapur (Autonomous) 416003

ABSTRACT

Microbial exopolysachharides (EPS) are produced by several bacteria and fungi under adverse conditions of environment. Over the years, scientists have also discovered multifarious uses for them in food, pharmaceutical, petroleum and other industries. The EPS from lactic acid bacteria (LAB) today constitute the most widely used EPS in the food industry as they are already accepted as GRAS. However several other microorganisms are also being looked at today and archaea are among the front runners as many members of the halophiles and thermophiles are known to produce copious amount of EPS.

In this paper, we report the production and characterization of an EPS from extremely haloalkaliphilic Arcaeon *Natrialba wudunaensis* SSBJUP-5. Isolated from the famous alkaline Lonar lake, this strain began producing the EPS in a glucose containing medium from the 9th day to reach a maximum yield of 2.4mg/ml on the 15th day. This yield was higher than the one it gave in a non glucose containing medium.

Hydrolysis and chromatographic analysis revealed the polysachharide to consist mainly of glucose and fructose. Rheological studies of the EPS solutions were also carried out and the viscosity found to be unaffected by extremes of pH, temperature and salt concentrations indicated its suitability for several industrial and other applications.

Keywords: Exopolysachharides, Archea, *Natrialba*, Viscosity

INTRODUCTION

Bacterial growth is often accompanied by the production of exopolysaccharides (EPS), which have important ecological and physiological functions. Increasing interest is being generated in the study of these molecules because of their wide applications in food, pharmaceuticals, petroleum and other industries.

Polysaccharides derived from plants and seaweed has been in use for thousands of years. Gum Arabic was a component of embalming fluids used by the ancient Egyptians and red seaweed were cooked by the Chinese during the time of Confucius to produce a gel which was then flavored and sweetened.

Large scale utilization of plant gums and seaweed gums, such as algin and development of economical processes for the seaweed gum began in the 1920's. Since that time other natural sources have been developed such as guar and locust bean. Also, chemical modifications of starch and cellulose have been successful in producing water soluble gums (J. Mata, 2006).

In the continuing search for novel, natural, water soluble polysaccharides, particular attention has been directed in recent years to the production of extracellular polysaccharides of microorganisms.

CHEMICAL NATURE OF POLYSACCHARIDE

In terms of chemical composition, polysaccharides may be divided into two principal groups as-

1. Homopolysaccharides
2. Heteropolysaccharides

1. Homopolysaccharides

Large numbers of microorganisms produce extracellular polysaccharides which are polysaccharides containing only one type of sugar residue. Among the best studied of these polysaccharides are glucans which are formed, often in copious amounts, in culture of species of *Leuconostoc* and *Pediococcus*. These glucans, which are branched molecules with predominantly α -1,6 and some α -1,3 and α -1,4 linkages, have been commercially used as blood plasma extenders.

2. Heteropolysaccharides

Most of the microbial polysaccharides contain more than one type of sugar residues are called as heteropolysaccharides. Representatives from all of the major groups of microorganisms produce extracellular heteropolysaccharides. The bacterium *Pseudomonas aeruginosa* for example, secretes an acidic polysaccharides that contains D-glucose, D-mannose, L-rhamnose and D-glucuronic acid residues. Yeasts of genus *Cryptococcus* characteristically form capsules and that produced by *Cryptococcus laurentii* contains D-mannose, L-xylose and D-glucuronic acid residues. Algal mucilage also frequently contains glucose and xylose as the main constituent sugars.

The bulk of all carbohydrates in nature exist in the form of polysaccharides. Microorganisms produce polysaccharides of three distinct types: extracellular, structural and intracellular storage forms.

The extracellular polysaccharides can be further classified into:

- (a) Capsules, those are integral with the cell wall, as well as structurally demonstrable microcapsules.

(b) Loose slime components that accumulate in large quantities outside the cell wall then diffusing into the culture medium.

During growth, these extracellular polysaccharides contribute a gummy texture to bacterial colonies on a solid medium or cause increased viscosity in a liquid medium.

The capsular component can be separated from the amorphous loose slime by centrifugation. The slime formers may produce slime in large quantities and in some cases the viscosity becomes so great that a liquid culture remains in place when the culture flask is inverted. The slime polysaccharides can be recovered in large quantities in the culture fluids.

Microbial Polysaccharide

Extracellular polysaccharides (EPS) produced by genera such as *Klebsiella* and *Streptococcus* have been well characterized for a number of species. In addition to this, many *Pseudomonas* species such as *Pseudomonas atlantica* form polymers (Heisch, 1990). Some other bacterial strains that have also been reported to produce slime is *Acetobacter xylinum*, a Gram negative bacterium characterized by its capability to synthesize many complex exopolysaccharides with the principal one being named acetan. Propionibacteria are also reported to synthesize polysaccharide during lactose fermentation. This polysaccharide mainly contains metabolites such as glucose and galactose. Microbial polysaccharides with important mechanical properties have a significant impact in commercial applications (Nicolaus, 1999). For example, xanthan gum is an anionic polysaccharide produced by the bacterium *Xanthomonas campestris*. Because of its high viscosity the *Pseudomonas* polysaccharide has rheological properties over a wide range of temperature and pH. It is commonly used as thickening agent in food products, for motility control in several tertiary oil recoveries, in petroleum drilling fluids and in the pharmaceuticals and cosmetics industries, *Aureobasidium pullulans* is cultivated on an industrial scale for the production of useful polysaccharide.

Importance Of Bacterial Exopolysaccharides

Xanthomonas campestris is a bacterium originally isolated from plant. It produces viscid or gummy colonies on agar medium (Breed and Alonzo, 1957)

Xanthan gum is one of the most extensively investigated polysaccharides of high molecular weight and natural polysaccharides containing D-glucose, D-mannose, D-glucuronic acid and acetic acid. Xanthan gum has many industrial applications such as in textile printing and dyeing, ceramic glazes, slurry explosives. Other applications are in foods such as pastry fillings, sauces and gravies, dairy products and it has agricultural application also.

It has major applications as Blood plasma extender (Gronwall, 1957), oil well drilling (Owen, 1950) and Iron-Dextran complex.

In the food industry, many polysaccharides are used as thickeners or viscosifiers, stabilizing or emulsifying agents, and as gelling and water binding agents or texturizers

(Sutherland, 1986). The majority of these additives are of plant origin, for instance starch, locust bean gum, guar gum and alginate. Xanthan gum is the only approved microbial polysaccharide produced by *Xanthomonas campestris*, a phytopathogenic, non-GRAS (Generally recognised as safe) bacterium. In addition, most of the plant carbohydrates used are chemically modified to remove their rheological properties (Roller and Dea, 1992) their use is the European Union.

Exopolysaccharides from lactic acid bacteria can be subdivided into three groups; (i) dextrans mainly composed of α -1,6-linked and 1,3-linked glucose residues, namely dextrans (*Leuconostoc mesenteroides* subsp. *Mesenteroides* and *Leuconostoc mesenteroides* subsp. *dextranicum*) and mutans (*Streptococcus mutans* and *Streptococcus subrinus*); (ii) fructans mainly composed of α -2,6-linked fructose molecules, such as levan (*Streptococcus salivarius*); (iii) heteropolysaccharides produced by mesophilic (*Lactobacillus lactis* subsp. *lactis* and *Lactobacillus lactis* subsp. *cremoris* and thermophilic (*Lactobacillus delbrueckii* subsp. *bulgaricus*, *Lactobacillus helveticus* and *Streptococcus thermophilus* lactic acid bacteria (Cerning, 1990). The latter group of exopolysaccharides has not yet been studied in much detail (Cerning, 1995). However, they play an important role in the theology, texture and mouth feel of fermented milk drinks (Cerning, 1990). For instance, the creamy, smooth texture is one aspect of the quality of yoghurt that seems to be determined by the ability of yoghurt bacteria to produce exopolysaccharides. In addition some exopolysaccharides may contribute to human health, either as a non-digestible, food fraction (Gibson and Roberfroid, 1995), or because of their antitumor activity (Oda et al 1983).

Commercially Produced Polysaccharide

The first microbial polysaccharide to be commercialized was dextran. Microbial polysaccharide that has reached and maintained large scale commercial production is xanthan gum, the polysaccharide produced by the bacterium ***Xanthomonas campestris***. Suttan and Kiluam (1970) determined that the chemical components of xanthan gum remained the same even when produced by industrial type fermentation.

Polysaccharide from Halophiles:

In the last few years, there has been an increased interest on extremophilic microorganisms as extracellular polysaccharide (EPS) producers. Extreme environments are proving to be a valuable source of microorganisms that secrete interesting new molecules, including exopolysaccharides. Halophilic bacteria are such extremophiles and the properties of their extracellular polysaccharides seem to offer numerous applications in various fields of industry (Margesin and Schinner, 2001).

MATERIAL AND METHODS

1) Studies on extracellular polysaccharide production

The the laboratory strain of *Natrialbawudunaoensis* was cultivated and maintained in specific haloalkaliphilie media at 40°C. The cultivation was continued for 12 to 16 days.

The EPS was then purified by solvent extaction method. The broth was centrifuged at 10000 rpm for 20 min. Supernatant was taken and to that two volumes of ice cold ethanol were added drop by drop, with stirring. The alcoholic solution;kept at freezing temperature overnight, was centrifuged for 30 min at 15000 rpm. The pellet was then taken in ethanol in an evaporating dish and dried at 40°C to constant weight (Moral A.D., 2003).

II] Characterization of EPS

A) The polysaccharide produced by the isolate was characterized by the general test of carbohydrates including the Molisch, Benedict and chromatographic analysis described by Jayaraman (J. Jayaraman) was performed.

B) Acid hydrolysis of EPS

The EPS was subjected to acid hydrolysis by addition of 2N HCL and boiling for 2 hours. Samples of the hydrolyzed exopolysaccharide solutions were subjected to thin layer chromatographic analysis.

C) Rheological Studies

The viscosity of the purified polysaccharide was determined by Bohlin CSR 10 rheometer using distilled water as standard.

The flow behaviour was determined in aqueous EPS solutions. The influence of temperature was determined at 25, 35, 45 and 55°C in 0.5% w/v solution. The effect of raising the temperature of solution from 25°C to 70°C and 90°C and then allowing it to cool down to 25°C was determined. The effect of pH was tested by dissolving the EPS in distilled water (pH-7.0) and then acidifying with 1N HCL or alkalinizing with 1N NaOH to produce a range from 3 to 12. To test the effect of variable salt concentration on viscosity, the EPS was suspended in (1%w/v) increasing 2 fold concentrations of NaCl (up to 30%) (Moral, 2003)

D) Chromatographic analysis:

40% silica gel was prepared, and slurry was the dragged manually on clean glass plates applying uniform pressure. The plates were activated in hot air oven ay 105°C for half an hour. The sample was applied to silica gel G plates and developed with Ethyl acetate-Isopropanol-water-pyridine (26:14:7:2 v/v). For detection of sugars, plates were sprayed with aniline diphenyl amine. All the sugars are visualized by further heating in hot air oven for few minutes (Jayaraman, 2000).

III) Cultural and Morphological characterization of the Isolate:-

(a) Cultural characters

The cultural characterization of the isolate was done using standard methods as described by Bergey's Manual of Systematic Bacteriology.

(b) Morphological Characters

1) Gram nature

i) Fresh suspension of the culture was prepared to study Gram nature by Hucker and Conn (1923) modified Gram staining method.

ii) KOH Method:

Non-staining KOH method was performed by placing a drop of 3% aqueous KOH on a slide. Using a sterile loop a visible amount of bacterial growth from an agar, culture was transferred to the KOH drop. The cells and KOH were mixed thoroughly on the slide with the wire loop that was then lifted slowly and observed for the stringiness that indicates a Gram negative culture whereas the absence of stringiness denotes Gram positive nature.

2) Motility

Motility was done by hanging drop technique.

IV) Characterisation of the isolate

The isolate was studied for its different biochemical characteristics which includes tests like

(A) Carbohydrate Fermentation Test

Utilization of carbohydrates was studied for testing the ability of organism to utilize carbohydrates as carbon and energy source. Test was carried out using haloalkaliphilic medium excluding trisodium citrate and 1% solution of carbohydrate like glucose, lactose, fructose, sucrose, mannitol, arabinose with Andrades indicator were used. A loopful suspension was inoculated in sugar broth tubes containing respective sugars. The tubes were incubated at 40°C for 12 days. The colour change of medium from yellow to pink will indicate the positive test for carbohydrate fermentation.

(B) Various enzyme production studies

The enzymatic properties of the isolates were studied by using standard procedures.

a) Catalase test:

A loopful of growth of was dipped in 10% w/v hydrogen peroxide and observed for evolution of gas bubbles as a positive catalase test.

b) Oxidase test:

A filter paper strip soaked with freshly prepared 1% solution of oxidase reagent (Tetra methyl p phenylene diamine dihydrochloride) was rubbed with growth of isolate taken by means of glass rod and observed for the appearance of deep blue color on the strip to indicate positive reaction (Atlas, 1993)

c) Amylase activity:

Loopful suspension of isolate was spot inoculated on sterile specific haloalkaliphilic agar medium with 2% starch. The plate was incubated at 40°C for 12 to 16 days.

Then growth was exposed to iodine vapours to detect zones of starch hydrolysis within the blue black background around the colony indicating amylase activity (Harrigan, 1976)

d) Gelatinase activity:

Loopful suspension of isolate was spot inoculated on plate containing specific haloalkaliphilic agar medium containing 1% gelatin and incubated at 40°C for 12 to 16 days.

After incubation the plates were flooded with Frazier's reagent (Harrigan, 1976). and observed for zone of hydrolysis around the colonies against an opaque background.

RESULTS AND DISCUSSION**Purification of halophilic bacteria:**

Purification of the laboratory culture was done on haloalkaliphilic medium supplemented with glucose. Its colonial and morphological characters are presented in Table 1. The strain was Gram negative, non-motile and its colonies were all mucoid. All the colonies were circular and showed a pinkish orange colour with copious slime production.

The isolate was cultivated in specific sterile haloalkaliphilic medium supplemented with glucose. The isolate is seen to be high EPS producing. These results are depicted in Table 1.



Characterization of EPS:

The Molisch test confirmed that the slime produced by the isolate was indeed a polysaccharide. Anthrone and Benedict tests were found to be negative.

The EPS sample was hydrolyzed by standard method and subjected to chromatographic. Results of this analysis when compared with standard relative factor to suspect clearly that the EPS produced by isolate in simple halophilic medium and MY medium was containing Fructose.

Table 1: Analysis of polysachharide by gravimetric method

Medium Used	EPS (gm)
SH Medium	5.0
MY Medium	4.8

The EPS produced in two different haloalkaliphilic medium is shown in table no.1 on the dry weight basis.

Table: 2 Characterization of EPS

Result of general tests for carbohydrates

MOLISH TEST	ANTHRONE TEST	STARCH TEST	BENEDICTS TEST
+	-	+	-

Key: (+)= Positive

(-)= negative

General tests of carbohydrate for EPS sample was studied and results are shown in table no.2, where starch and Molish's test showed positive results.

Table 3: Results of chromatographic analysis

SUGAR	STANAD Rf VALUE
Ribose	0.66
Xylose	0.28
Galactose	0.12
Fructose	0.36
Mannose	0.24
Glucose	0.58
Arabinose	0.68
SH medium	0.38
MY medium	0.41

The obtained Rf value of hydrolyzed EPS sample of the isolate in two different haloalkaliphilic medium when compared with standard Rf values of the sugars, suspected to show sugars as shown in table no. 4A and 4B.

Table 4: Rheological studies**A) Effect of pH on viscosity of EPS:**

pH	Viscosity		
	TEST	CONTROL	FINAL
3	0.125	0.035	0.090
4	0.135	0.050	0.085
5	0.146	0.059	0.087
6	0.157	0.067	0.090
7	0.181	0.091	0.090
8	0.186	0.100	0.086
9	0.440	0.378	0.062
10	0.521	0.451	0.070
11	0.101	0.025	0.076
12	0.113	0.033	0.800

The effect of pH on viscosity of EPS sample showed variable results which are depicted in 4A.

B) Effect of salt concentration on viscosity of EPS:

Salt Concentration	Viscosity (X10 ⁻³)		
	Test	Control	Final
2	0.25	0.17	0.08

4	0.43	0.34	0.09
6	0.62	0.52	0.10
8	0.79	0.73	0.06
10	0.98	0.93	0.05
12	1.19	1.14	0.05
14	1.44	1.37	0.07
16	1.69	1.48	0.21
18	2.04	1.90	0.14
20	2.31	2.06	0.25
22	2.58	2.62	0.04
24	3.49	2.97	0.52
26	3.81	3.36	0.45

The viscosity of exopolysachharide was found to be increased with increase in salt concentration.

C] Effect of temperature on viscosity of EPS:

Temperature (°C)	Viscosity (X10 ⁻³)
40	0.34
50	0.29
60	0.26
70	0.26

The temperature affects the viscosity considerably. The results of which are depicted in the table 4C, with increase in temperature viscosity decreases.

Table 5: Biochemical analysis of the isolate *Natrialba wudonaoensis* SSBJUP-5

A] Results of carbohydrate utilization

Sugar	Results
Glucose	+
Galactose	+
Lactose	+
Sucrose	-
Maltose	+

Key: (+)= positive

(-) = negative

B] Results of enzymatic characteristics:

Enzymatic reactions	Results
Catalase	+
Oxidase	+
Gelatinase	+
Amylase	-
Caseinas	+

Key: (+)= positive

(-) = negative

CONCLUSION:

The isolate used for polysachharide production shown considerable yield in specific haloalkaliphilic medium than MY medium. N dry weight it was found to be potent producer of polysachharide. Chromatographic studies lead to suspect that sugar might be fructose and glucose.

The growthof isolate was stimulated by glucose, ribose, xylose, galactose, arabinose and maltose. Sucrose and mannitol was found to be negative. Catalase and oxidase tests were found to be positive and starch test was negative.

REFERENCES

1. Antón, J., Meseguer, I., & Rodriguez-Valera, F. (1988). Production of an extracellular polysaccharide by *Haloferax mediterranei*. *Applied and Environmental Microbiology*, 54(10), 2381-2386.
2. Atlas, R. M. (2004). *Handbook of microbiological media*. CRC press. <https://doi.org/10.1201/9781420039726>
3. Annarita Poli, Paola Di Donato, Gennaro Roberto Abbamondi, Barbara Nicolaus, "Synthesis, Production, and Biotechnological Applications of Exopolysaccharides and Polyhydroxyalkanoates by Archaea", *Archaea*, vol. 2011, Article ID 693253, 13 pages, 2011. <https://doi.org/10.1155/2011/693253>
4. Nelly Blumenkrantz, Gustav Asboe-Hansen, New method for quantitative determination of uronic acids, *Analytical Biochemistry*, Volume 54, Issue 2, 1973, Pages 484-489, ISSN 0003-2697, [https://doi.org/10.1016/0003-2697\(73\)90377-1](https://doi.org/10.1016/0003-2697(73)90377-1).
5. Cerning, J. (1995). Production of exopolysaccharides by lactic acid bacteria and dairy propionibacteria. *Le lait*, 75(4-5), 463-472.

6. Buck, J. D. (1982). Nonstaining (KOH) method for determination of Gram reactions of marine bacteria. *Applied and Environmental Microbiology*, 44(4), 992-993. <https://doi.org/10.1128/aem.44.4.992-993.1982>
7. Baltz, R. H., Demain, A. L., & Davies, J. E. (Eds.). (2010). *Manual of industrial microbiology and biotechnology*. American Society for Microbiology Press.
8. *Anal. Chem.* 1956, 28, 3, 350–356, Publication Date: March 1, 1956
<https://doi.org/10.1021/ac60111a017>
9. Jones, B., Grant, W., Duckworth, A. *et al.* Microbial diversity of soda lakes. *Extremophiles* 2, 191–200 (1998). <https://doi.org/10.1007/s007920050060>
10. Patowary, K., & Goswami, M. (2017). Biochemical changes in the selected tissues of *Channa punctatus* exposed to Arsenic and its possible revival with turmeric. *The Clarion-International Multidisciplinary Journal*, 6(2), 8-17.
<http://dx.doi.org/10.5958/2277-937X.2017.00022.3>
11. Margesin, R., & Schinner, F. (2001). Potential of halotolerant and halophilic microorganisms for biotechnology. *Extremophiles*, 5(2), 73-83.
12. Juan Antonio Mata, Victoria Béjar, Inmaculada Llamas, Soledad Arias, Philippe Bressollier, Richard Tallon, María C. Urdaci, Emilia Quesada, Exopolysaccharides produced by the recently described halophilic bacteria *Halomonas ventosae* and *Halomonas anticariensis*, *Research in Microbiology*, Volume 157, Issue 9, 2006, Pages 827-835, ISSN 0923-2508,
<https://doi.org/10.1016/j.resmic.2006.06.004>.
13. Quesada, E., del Moral, A. & Béjar, V. Comparative methods for isolation of *Volcaniella eurihalina* exopolysaccharide. *Biotechnol Tech* 8, 701–706 (1994).
<https://doi.org/10.1007/BF00151472>
14. Sutherland, I. W. (1996). Extracellular polysaccharides. *Biotechnology: products of primary metabolism*, 613-657.
<https://doi.org/10.1002/9783527620883.ch16>
15. Sudo, H., Burgess, J.G., Takemasa, H. *et al.* Sulfated exopolysaccharide production by the halophilic cyanobacterium *Aphanocapsa halophytia*. *Current Microbiology* 30, 219–222 (1995).
<https://doi.org/10.1007/BF00293636>
16. Oren, A. (2010). Industrial and environmental applications of halophilic microorganisms. *Environmental technology*, 31(8-9), 825-834.

बहुगुणी आयुर्वेदिक मसाला पान - एक अभ्यास

प्रा. सई पाटील, डॉ. उर्मिला खोत

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

गोषवारा -

विड्याच्या पानाला महत्त्व आहे. मंगल प्रसंगी पानाचा उपयोग केला जातो. पूजा-अर्चा, विवाह प्रसंग किंवा करमणुकीच्या कार्यक्रम प्रसंगी प्रथम पानसुपारी वाटली जाते. पानाला चुना लावून त्यात सुपारी, कात, बडीशेप, खोबरे, विलायची, लवंग टाकले की पानाचा विडा तयार होतो. विड्याला तांबूल असेही म्हणतात. आम्ही तयार केलेला बहुगुणी आयुर्वेदिक मसाला पान मध्ये अनेक आयुर्वेदिक घटक पदार्थांचा वापर केला आहे. सध्या बाजारात मिळणाऱ्या गोड पानांमधून आपणास आवश्यक औषधी गुणधर्म मिळण्याची शक्यता कमी आहे गोड पानांमध्ये टाकण्यात येणारे रंगीत पदार्थ व कृत्रिम सुवासिक पदार्थ कितपत आरोग्यकारक असतील याबद्दल शंका आहे. आम्ही तयार केलेल्या बहुगुणी आयुर्वेदिक मसाला पान यामुळे मुखशुद्धी होते, रक्त शुद्धी होते, ते कफनाशक आहे, पाचक आहे. चुना व कात हे कॅल्शियमचे उत्तम स्रोत असल्याने यांचा उपयोग हाडासाठी हृदयासाठी व स्त्रियांमधील काही आजारांवर होऊ शकतो असे हे बहुगुणी आयुर्वेदिक मसाला पान नियमितपणे सेवन केल्यास आपल्या आरोग्यास त्याचा नक्कीच फायदा होऊ शकतो.

मुख्य शब्द - नागवेली पाने, आयुर्वेदिक घटक पदार्थ, आरोग्यास उपयुक्त.

प्रस्तावना -

विड्याच्या पानाचे भारताच्या इतिहासाशी आणि परंपरेची खूप जुनी नाते आहे पानाचा वापर हा फक्त विडा म्हणून नाही तर अनेक गंभीर आजार दूर करण्यासाठी केला जातो. आजही भारताच्या प्रत्येक गल्लीत चौका किंवा मध्य भागांमध्ये पानपट्टी हमखास दिसते यावरून हेच कळते की विड्याचे पान हे फक्त भारतातल्या नबाब किंवा राजाचंच नाही तर सामान्य जनतेचेही आवडते आहे. पान तांबोली किंवा नागवेल नामक वेलीचे पान असते. याच पानाला इंग्रजी मध्ये बीटल लीफ, हिंदी मध्ये पानचं पान, तेलुगु मध्ये तमालपाकु तर मराठीत याला तांबूल असे म्हणतात.

विड्यात नागवेलीची पाने, चुना, सुपारी, कात, वेलची, लवंग, जायफळ, कापूर, कस्तुरी, कंकोळ, केशर, चांदीचा किंवा सोन्याचा वर्क इत्यादी गोष्टी वापरल्या जात असत त्या तेरा पदार्थांच्या एकत्रिकणामुळे विड्याला 'त्रियोदश गुणी' असे म्हणतात.

त्यातील काही पदार्थ कामेच्छा वाढवतात त्यामुळे ब्रह्मचारी, संन्यासी, विधवा, स्त्री व्रतस्थ यांनी तांबूल ग्रहण करणे निषिद्ध मानले जात असे. काही काळानंतर विड्यामध्ये तंबाखू शिरल्यावर मात्र एक विचित्र संस्कृतिक भेसळ निर्माण झाली. ही गोष्ट नक्की कधी घडली याबद्दल स्पष्टता नाही. तंबाखू आणि आधुनिक नशाबाज पान मसाले यांनी मूळ त्रयोदशगुणी विड्याला बदनाम केले आहे.

संबंधित साहित्याचा आढावा –

पान विडा हा भारतीय खाद्य संस्कृतीच्या मुख्य भाग आहे. कारण जेवण झाल्यानंतर तोंडाची चव कायम ठेवण्यासाठी राजा महाराजा काळापासून अगदी आत्तापर्यंत पानाचा वापर केला जातो. भरपेट ठेवणार नंतर ती आज पान खाणं मस्ट समजले जाते आपल्या भारतीय परंपरेत तर देवालाही पानाचा विडा करून वाहिला जातो आणि नंतर तो प्रसाद म्हणून खाल्ला जातो. प्रत्येक पूजेत किंवा सणावाराला विड्याच्या पानाचा वापर हा शुभ मानला जातो त्यामुळे विड्याच्या पानाचे शुभ प्रतीक आणि चमत्कारी आयुर्वेदिक गुण असे दुहेरी फायदे आहेत.

(महाराष्ट्र ४४- ऑनलाइन, विशेष प्रतिनिधी - संजीव कुमार गायकवाड)

भारताची पानविडा संस्कृती फार जुनी आहे. ते व्यसन न मानता खानदानी शौक म्हणून मानला जाई. धार्मिक विधी मध्ये देखील पानसुपारीला मान पहिला असे. विडा उचलल्यानंतर शौर्याचे मोजमाप होई. मित्रमंडळींची बैठक पान सुपारीच्या भोवती फिरे. लावणीची बैठक, नृत्यांगनेची अदाकारी, संगीताची मैफल, कवालीचा मुकाबला, शायरांचा मुशायरा, गायनांची जुगलबंदी या गोष्टी विड्याशिवाय रंगणे अशक्य! तांबूल संस्कृतीत वापरल्या जाणाऱ्या पान डब्यामध्ये विड्यात घालण्याच्या सर्व वस्तू वेगवेगळ्या आणि नीट ठेवता येतील अशी अंतर्गत रचना असायची. हे डबे आकर्षक आकारामध्ये, नक्षीदार कलात्मक पणे घडवलेले असत डब्यात ठेवलेली पाने सडू नयेत म्हणून काही डबे जाळीदार असायचे.

(तांबूल संस्कृती: पानविडा आणि सौंदर्य, मकरंद करंदीकर)



आकृती क्र. १: नागवेलीची पाने

कार्यपद्धती –

पानाचा स्वाद सर्वांना घेता यावा यासाठी सर्वोत्कृष्ट आणि अत्यंत दर्जेदार बहुगुणी आयुर्वेदिक पान मसाला तयार पुढील पद्धतीने केला.

साहित्य –

नागवेलीची पाने, बडीशेप, धना डाळ, काळे तीळ, पांढरे तीळ, जवस,ओवा, खडीसाखर, वेलदोडा, लवंग, गुंज पाला, ज्येष्ठमध पावडर, पुदिना अर्क, चुना, कात, गुलकंद, लिंबू व हळद इ.

कृती –

नागवेलीची पाने स्वच्छ धुऊन पुसून बारीक कापून घ्यावीत व एक दिवस उन्हामध्ये सुकवून घ्यावेत. बडीशेप, धना डाळ, काळे तीळ, पांढरे तीळ, ओवा, वेलदोडा, लवंग, गुंजपाला बारीक आचेवर भाजून घ्यावेत.भाजलेली बडीशेप, धना डाळ, काळे तीळ, पांढरे तीळ, जवस, ओवा इत्यादीला लिंबूस व हळद लावून घ्यावे व नंतर पुन्हा थोडे भाजून घ्यावे. वरील सर्व साहित्य एकत्र करून मिक्सरला बारीक करून घ्यावे. खडीसाखर बारीक करून तिचा पाक करून घ्यावा त्यामध्ये चुना कात पुदिना अर्क गुलकंद व नागवेलीची सुकवलेली पाने, ज्येष्ठमध पावडर घालून चांगले एकत्र करून घ्यावे नंतर त्यामध्ये वरील बारीक केलेला मसाला घालून चांगले मिक्स करून घ्यावे व घरात सावलीमध्ये एक दिवस सुकवून घ्यावा. असा बहुगुणी आयुर्वेदिक पान मसाला तीन महिने चांगला राहू शकतो.



आकृती क्र. २: बहुगुणी आयुर्वेदिक मसाला पान

बहुगुणी आयुर्वेदिक मसाला पान यामध्ये पुढील घटक पदार्थांचा समावेश करण्यात आला -

- नागवेलीची पाने - या पानांची चव ही तिखट किंवा गोड स्वरूपाची असते. यामध्ये कॅल्शियम, प्रोटीन, खनिजे, कर्बोदके, तंतू/फायबर, जीवनसत्व क मुबलक प्रमाणात आढळते. या पानांमध्ये उत्तम औषधी गुणधर्म असतात. जी रुची वाढवणारी, कांतीदायक, कफनाशक, सारक, शक्तीवर्धक, वायुनाशक, पोट साफ ठेवणारी, पाचक, पित्तनाशक, शरीर वृद्धी करणारी असतात.
- बडीशेप - यालाच इंग्रजीमध्ये Fennel seeds असे म्हणतात. यामध्ये अनेक औषधी गुणधर्म आहेत. जे आरोग्य व सौंदर्यासाठी फायदेशीर ठरतात. बडीशेप मध्ये जीवनसत्व क चे प्रमाण भरपूर असते. तसेच यामध्ये कॅल्शियम, सोडियम, फॉस्फरस, लोह आणि पोटॅशियम सारखी आवश्यक खनिजे ही आढळतात.
- धना डाळ - धना डाळ ही जिवाणूविरोधी, सूक्ष्मजीवविरोधक आणि दाहक विरोधी आहे. धणाडाळीचे सेवन केल्याने अनेक औषधी फायदे होऊ शकतात. यामध्ये प्रथिने कमी स्निग्धे, जीवनसत्व क आढळते.
- ओवा - ओवा हा घटक आपल्या आरोग्यासाठी फारच फायदेशीर मानला जातो. यालाच कॅरम सीड म्हणून ही ओळखले जाते. हा भारतीय जेवणातील एक लोकप्रिय मसाला आहे. ओव्याच्या वापर हजारो वर्षांपासून अनेक पोट्यांच्या आजारावर घरगुती उपाय म्हणून केला जातो. ओव्यामुळे पचनक्रिया सुधारते तसेच कफ, पोट, छातीचे दुखणे, कृमी इत्यादींसाठी फायदेशीर आहे. यासोबतच उचकी, ढेकर या आजारांसाठीही फायदेशीर आहे. ओव्यामध्ये कर्बोदके, प्रथिने, कॅल्शियम, फॉस्फरस, लोह, सोडियम ही पोषक घटक ही आढळतात.
- जवस - यालाच आळशी असेही म्हणतात. यामध्ये ओमेगा ३, ओमेगा ६ या फॅटी ॲसिड पोषक घटकांमुळे जवस हे आरोग्यास अतिशय फायदेशीर ठरते. यातील फायबर किंवा तंतू हे पचनक्रियेसाठी फायदेशीर ठरते.

निष्कर्ष -

सध्या पानविडा तयार करताना अनेक घटक वापरले जातात जसे सॅकरीन पासून बनवलेल्या वेगवेगळ्या स्वादांच्या चटण्या आणि मसाले यांचा वापर पानविड्याची स्वाद वाढवण्यासाठी केला जातो. याचा परिणाम शरीर स्वास्थ्यावर होतो. याशिवाय पाण्यामध्ये तंबाखू घालून खाण्याची देखील प्रथा आहे. त्याचे घातक परिणाम सर्वांनाच माहित आहेत. सध्या जे पान खाल्ले जाते त्यामध्ये फक्त पानच शास्त्रोक्त आहे त्यातील बाकीचे घटक हे शास्त्राला धरून नाहीत. त्याचप्रमाणे पानपट्टीवर जाऊन पान खाणे, कुठेही थुंकणे या गोष्टी करोनामुळे योग्य ठरत नाहीत. तसेच पानपट्टी वर जाऊन पानखाने ही फक्त पुरुषांचीच मक्तेदारी आहे त्यामुळे

स्त्रियांना लहान मुलांना पानाचा स्वाद घेता येत नाही आणि म्हणूनच पानाचा स्वाद सर्वांना घेता यावा यासाठी सर्वोत्कृष्ट आणि अत्यंत दर्जेदार तंबाखू विरहित बहुगुणी आयुर्वेदिक पानाचा स्वाद खऱ्या पान रसिकांना घेता येईल. बहुगुणी आयुर्वेदिक मसाला पान खाल्ल्यानंतर तोंड ही रंगणार किंवा कोठेही थुंकावे लागणार नाही. पूर्ण चर्वण करून खाता येते व त्याचे फायदे शरीर स्वास्थ्य व मुखदुर्गंधी घालवण्यासाठी अत्यंत उपयुक्त ठरते.

विविध आयुर्वेदिक घटकापासून बनवलेल्या बहुगुणी आयुर्वेदिक मसाला पान मध्ये नागवेली पान (मुखदुर्गंधीसाठी गुणकारी) ,कात ब (कफनाशक व रक्त शुद्धीसाठी) चुना (कॅल्शियम), बडीशेप (मुखशुद्धी),ज्येष्ठमध पावडर (कफ व खोकल्यासाठी), गुंजपाला (कफनाशक ,रक्तविषनाशक), लवंग (पाचक) वेलदोडा (गरमी रोगांवर उपयुक्त), पुदिना अर्क (कफनाशक), गुलकंद (सुगंधी) इत्यादी पदार्थांचे बहुगुणी फायदे आहेत असे हे बहुगुणी आयुर्वेदिक मसाला पान नियमितपणे सेवन केल्यास आपल्या आरोग्यास त्याचा नक्कीच फायदा होऊ शकतो.

संदर्भ ग्रंथ :

- माधव चौधरी, 'आहार हेच औषध' गाला पब्लिशर्स, अहमदाबाद
- के. वि. पानसे, 'आहारशास्त्र आणि कला' कॉन्टिनेटल प्रकाशन, पुणे
- Gode P. K. , 'Studies in Indian Cultural History , Vol 1 , Hoshiarpur

संभाषण कौशल्य : स्वरूप व प्रकार

डॉ. स्वप्निल बुचडे, डॉ. डी. के. घाटगे,
विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

● प्रस्तावना :

व्यक्तिच्या जीवनात संभाषणाला महत्त्व आहे. व्यवसायाची विविध क्षेत्रे विस्तारल्याने संभाषण कौशल्याची गरज वाढू लागली. फोनवर बोलण्यासाठी, कार्यालयातल्या सहकाऱ्यांशी चर्चा करण्यासाठी, वरिष्ठांशी विचार-विनिमय करण्यासाठी, ग्राहकांशी व्यवहार करण्यासाठी संभाषण कला आत्मसात करता आली पाहिजे. संभाषणातील पहिली अट प्रसन्न चेहऱ्याने सामोरे जाणे ही होय. समोरच्याचे बोलणे नीट समजून घेणे त्यानंतर आपले विचार, भावना, मते पटतील अशा पध्दतीने समजावून सांगणे याला संभाषण कलेत महत्त्व असते. समोरच्या व्यक्तीला आपल्याशी बोलण्यात किती रस आहे तसेच त्या व्यक्तिच्या आवडीच्या विषयाकडे आपल्या बोलण्याचा ओघ वळविणे यात संभाषणाचे कौशल्य असते. संभाषणकौशल्य ही मानवी जीवनातील महत्त्वाची कला आहे. या स्पर्धात्मक जगामध्ये परिश्रम जेवढे आवश्यक, तेवढेच तुमचे चांगले बोलण्याचे कौशल्यही आवश्यक ठरते. एखाद्याकडे आकर्षक व्यक्तिमत्व नसेल तर त्याची उणीव रसाळ वाणीने, मुद्देसूद व आकर्षक संभाषण शैलीने भरून काढता येईल. जीवनाच्या कोणत्याही क्षेत्रात यशस्वी व्हायचे असेल तर चांगल्या संभाषणकौशल्याची आवश्यकता असते. व्यक्तिच्या हुशारीबरोबरच संभाषणकौशल्य साधण्याची कला आवश्यक आहे.

● उद्देश :

१. प्रस्तुत संशोधनातून संभाषण कौशल्याचे स्वरूप समजून घेता येईल.
२. संभाषण कौशल्याच्या प्रकारांचा अभ्यास करता येईल.

● संभाषण :

संभाषणासाठी किमान दोन व्यक्ती किंवा त्याच्यापेक्षाही जास्त असू शकतात. संभाषण हे दुतर्फा असते. सगळ्यांनी आपापसात-विचारांची, माहितीची, कल्पनांची देवघेव करायची असते. एका व्यक्तीकडून अनेक व्यक्तीकडे देवघेव चालते. त्यामुळे विचारांचे आदानप्रदान होते. हे संभाषण सरळमार्गी चालते. आपल्याला जे सांगायचे ते उदाहरणे देऊन कसे योग्य आहे हे पटवून सांगणे होय. संभाषण नोकरी, व्यवसाय, कार्यालयीन कामकाज, उत्पादित वस्तू किंवा आपल्या योजना नवीन उपक्रम याची माहिती देणे अशा अनेक वेळा घडत असते. संभाषणाने माणसे जोडता येतात. एकत्र बांधता येतात. काही तरी चांगले विधायक घडवावे, हा त्यामागील हेतू असतो. संभाषण (सं+भाषण) या शब्दातील 'सं' चा अर्थच मुळी एकत्र येऊन/ एकत्र येण्यासाठी (Together With) असा आहे. म्हणून संवादासाठी आपली मानसिकता संस्कारित केली पाहिजे. कारण तिचा परिणाम मुखातून बाहेर पडणाऱ्या शब्दावर होत असतो. (नसिराबादकर, ल. रा. : २००८ : २५) यानुसार संभाषण हा शब्द (सं+भाषण)

या दोन शब्दावरून तयार झाला आहे. संभाषणाचा हेतूच मूळात एकत्र येणे असा आहे. संभाषणासाठी मानसिकता विकसीत केली पाहिजे. तरच चांगल्या पध्दतीने संभाषण होऊ शकते. यात वादविवाद, आग्रही मते नसतात.

● **संभाषणाचे स्वरूप :**

विचार, मत, भावना व्यक्त करण्यासाठी संवाद साधण्याची गरज असते. भाषण एका व्यक्तीचे असते तर संभाषण हा शब्द मात्र दोन किंवा अधिक व्यक्तींमधील बोलण्यासाठी वापरला जातो. शब्दांची देवघेव संभाषणातून होते. आपण संवाद साधल्याने शारीरिक दृष्टीने दुसऱ्या व्यक्तीपासून कितीही लांब असलो तरी मनाने जवळ पोहोचतो. संभाषणकौशल्य अवगत असेल तर आपले हेतू साध्य होतात. संभाषण ही कला बोलणे व ऐकणे या दोन कौशल्यावर आधारलेली असते. त्यानुसार आपल्या भाषेवर प्रभुत्व हवे. महत्त्वाची गोष्ट म्हणजे मुद्देसूद बोला. बोलण्यामध्ये पाल्हाळीक वाक्ये नकोत. मुद्द्याचे पुरेसे स्पष्टीकरण हवे त्यासाठी आवश्यक उदाहरण द्यावे. दुसरे महत्त्वाचे संभाषणात नकारात्मक बोलणे नको. कार्यालयात वरिष्ठांशी बोलताना सकारात्मकतेने बोला. एखाद्या कामाची जबाबदारी तुमच्याकडे असेल तर न टाळता आनंदाने स्वीकारून काम चांगले कसे करता येईल सांगा. या सकारात्मक भूमिकेने संभाषण चांगले होऊन तुमच्या व्यक्तिमत्त्वाचाही प्रभाव पाडण्यास मदत होईल.

संभाषणात बोलण्याबरोबर महत्त्वाची क्रिया ऐकणे देखील आहे. समोरची व्यक्ती बोलत असेल तर शांतपणे ऐकून घ्या, मध्येच बोलू नका. दुसऱ्याचे लक्षपूर्वक ऐकले तर आपल्याला प्रतिक्रिया देता येईल. दुसऱ्याचे विचार, भावना, मते शांतपणे व एकाग्रतेने समजून घेणे यांना भाषेच्या व्यवहारात फार महत्त्व असते. त्या श्रवणानुसार आपले उत्तर, विचार, मते, भावना प्रभावीपणे मांडता येतात. योग्य व समर्पक प्रतिसाद देता येतो. (नसिराबादकर, ल. रा. : २००८ : २४) दुसऱ्यालाही काही म्हणायचे असते. सांगायचे असते हे समजावून घेतल्याने नेमकी प्रतिक्रिया देता येते. म्हणून संभाषणकालेत चांगले श्रवणकौशल्य आत्मसात करणे गरजेचे असते.

संभाषणामध्ये आपले विचार स्पष्टपणे मांडावेत. उच्चारात स्पष्टता हवी. कधी अस्पष्ट, तर कधी चुकीचे उच्चार संभाषणात अडचण निर्माण करू शकतात. समोरच्या व्यक्तिला नीट ऐकू जाईल व बरोबर समजेल असे बोलणे असावे. संभाषण हे विचारांची देवाण घेवाण असते तशी ती भावनांचीही देवाण-घेवाण असते. कळत-नकळत आपल्या नजरेतून ती प्रकट होत असते. संभाषणातून आपण एकमेकांच्या भावनांमध्येही सहभागी होत असतो. हे लक्षात घेऊन संवादाला भावदर्शनाची जोड द्यावी. (नसिराबादकर, ल. रा. : २००८ : २६) समोरच्या व्यक्तीशी संभाषण करताना सौजन्य, नम्रता, जिव्हाळा इत्यादी गोष्टी असाव्यात. संभाषणातील विषयानुसार, चर्चेनुसार आवाजातील चढ -उतार, चेहऱ्यावर एकमेकांविषयीची आपुलकी, डोळ्यात एकमेकांना समजून घेण्याची ओढ असेल तर संभाषण औपचारिक न राहता आंतरिक बनते.

संभाषण कौशल्य असण्यासाठी काही वैशिष्ट्ये आत्मसात करावी लागतात किंवा चांगल्या संभाषण कौशल्यासाठी या वैशिष्ट्यांची माहिती असायला हवी. ही वैशिष्ट्ये श्रुती वडगबाळकर यांनी पुढीलप्रमाणे सांगितली.

१. माहिती पूर्ण जाणून घेणे - म्हणजे आपल्याला पूर्ण माहिती असेल तरच आपण समोरच्या लोकांच्या शंकांचे निरसन करू शकतो.

२. ऐकण्याची पूर्व तयारी - आपली सहनशीलता, संयम सुटू न देता पूर्ण ऐकण्याची तयारी करायला हवी. अर्धवट ऐकल्याने गैरसमज वाढतात. संभाषणाला वेगळे वळण लागण्याची शक्यता असते.
३. विविध मतांचा स्विकार करणे व त्यांचा आदर करणे गरजेचे असते. हा संभाषण कौशल्याचा महत्त्वाचा गुण आहे.
४. प्रतिक्रिया देणे - संभाषणात समोरच्या व्यक्तिका बोलण्याला प्रतिक्रिया देणे आवश्यक असते. मान हालवणे, स्मित हास्य करणे, चेहऱ्यावर भाव दाखवणे किंवा एखादा उद्गार काढणे अशा स्वरूपाच्या प्रतिक्रिया देणे आवश्यक आहे. त्यामुळे संभाषण अधिक प्रभावी होते.
५. मन मोठे करणे - संकुचित मने दुसऱ्याशी संभाषण करताना आपल्या मताचा दुराग्रह करतात. म्हणून संभाषणात मन मोठे असावे लागते. विशाल मनात इतरांचे विचार सामावून घेता येतात.
६. विविधता ज्ञात असणे - विविधता माहीत असणे प्रगल्भ मनाच लक्षण असते. संभाषण करताना समोरची व्यक्ती ज्या भागातील, प्रांतातील आहे त्या भागाचे वैशिष्ट्य माहीत असेल तर संभाषण चांगले होते.
७. मूल्यमापन-संभाषण कौशल्याचे हे वैशिष्ट्य आहे की पूर्ण माहिती नसताना मूल्यमापन न करणे.
८. भावनात्मकता- स्वतःच्या भावना, नेमक्या शब्दात व्यक्त करता आल्या पाहिजेत. तसेच दुसऱ्याच्या भावना समजून घेता आल्या पाहिजेत. समोरच्या व्यक्तिका भावना न दुखावता संभाषण करता आले पाहिजे.
९. आशावादी असणे - संभाषण कौशल्यात ही सर्वात महत्त्वाची गोष्ट आहे. नकारात्मकता, निराशा जर आपल्या संभाषणात असेल तर ते कोणालाच एकावेसे वाटणार नाही. माणसाने नेहमी आशावादी असावे. इत्यादी संभाषणकौशल्याची वैशिष्ट्ये सांगितली आहेत.

● संभाषणाचे प्रकार

संभाषणकौशल्य जोपासण्यासाठी संभाषणाचे प्रकार कोणते आहेत. हे माहित असणे गरजेचे आहे. संभाषणाचे एकूण पुढीलप्रमाणे चार प्रकार सांगता येतील.

१. प्रत्यक्ष संभाषण :

दोन व्यक्तीनी समोरासमोर येऊन केलेले संभाषण म्हणजे प्रत्यक्ष संभाषण होय. यामध्ये शिक्षक आणि विद्यार्थी, डॉक्टर-रूग्ण, वकिल आणि अशील, विक्रेता आणि ग्राहक या स्वरूपाची अनेक उदाहरणे प्रत्यक्ष संभाषणात येतात.

२. अप्रत्यक्ष संभाषण :

जेव्हा दोन व्यक्ती समोरासमोर संभाषण करीत नाहीत. दूर कुठूनतरी त्यांचं संभाषण चालू असत. यामध्ये फोन, रेडिओ, दूरचित्रवाणी, पत्र, ई-मेल, सीडी, कॅसेट यासारख्या माध्यमातून एकमेकांशी संवाद साधता येतो.

३. औपचारिक संभाषण :

औपचारिक संभाषणाविषयी डॉ. शांताराम चौधरी म्हणतात दोन अपरिचित व्यक्ती जेव्हा पहिल्याच वेळेस एकमेकांना भेटतात व संभाषण करतात त्याला औपचारिक संभाषण म्हणतात. (चौधरी, (डॉ.) शांताराम : २०१३ : ११५) यामध्ये व्यवसाय, व्यवहार कार्यालयीन काम याप्रसंगी समोरच्या व्यक्तीशी आपणाला औपचारिकपणे संभाषण करावे लागते. व्यवसायात एखाद्या व्यक्तीशी नव्याने ओळख होते. त्या व्यक्तीशी औपचारिक संभाषण केले जाते. तसेच चर्चासत्र, सभा, सेमिनार, कार्यशाळा या

प्रसंगी वक्ते परस्परांशी आपापसात संभाषण करतात, ते औपचारिक स्वरूपाचे असते. टपालखाते, बँका, विमा, मार्केटिंग, कार्यालये या ठिकाणी औपचारिक संभाषण बघावयास मिळते.

४. अनौपचारिक संभाषण :

संभाषणात कुठलीही मर्यादा नसते. अगदी सहज मनमोकळेपणाने बोलणे असते. संभाषणाची भाषा जेव्हा घरेलू असते तेव्हा त्याला अनौपचारिक संभाषण म्हणतात. (चौधरी,(डॉ.) शांताराम : २०१३ : ११५) आई-मुलगी, प्रियकर-प्रियसी, मित्र-मैत्रिण, पती-पत्नी या नात्यामध्ये वेगवेगळ्या विषयावर मनमोकळ्या गप्पा होत असतात. मनातील विचार, कल्पना, भावना मुक्तपणे व्यक्त होतात. या संभाषणात एकमेकांचे ऐकून घेतले जाते. आपल्यावरील अन्याय, अपेक्षा, इच्छापूर्ती बोलून दाखविल्या जातात याला अनौपचारिक संभाषण म्हणतात. यामधील संभाषणाला कुठलीही औपचारिकता नसते. संभाषणाची सुरुवात कशी करावी हा नेहमीच सर्वांना पडणारा प्रश्न आहे. औपचारिकपणे संभाषण केल्याने संभाषण रंगत नाही. प्रथम संभाषण करताना उत्साही, आनंदी, अत्यंत टापटीत स्वच्छ व प्रसन्न असायला हवे. चेहऱ्यावर स्मित हास्य असावे. यामुळे संभाषणात कंटाळवाणेपणा येत नाही.

● निष्कर्ष :

१. संभाषण हा शब्द मात्र दोन किंवा अधिक व्यक्तिमधील बोलण्यासाठी वापरला जातो.
२. संभाषणकौशल्य ही मानवी जीवनातील महत्त्वाची कला आहे.
३. संभाषण ही कला बोलणे व ऐकणे या दोन कौशल्यावर आधारलेली असते.
४. संभाषणात बोलण्याबरोबर महत्त्वाची क्रिया ऐकणे देखील आहे.

● संदर्भग्रंथ :

१. नसिराबादकर, ल.रा. (2008) व्यावहारिक मराठी, आठवी आवृत्ती, फडके प्रकाशन, कोल्हापूर.
२. वडगबाळकर, (डॉ.) श्रुती (2011) वक्तृत्व आणि संभाषण कौशल्य, प्रथमावृत्ती, अक्षर प्रकाशन, कोल्हापूर.
३. चौधरी, (डॉ.) शांताराम (2013) संवाद, संभाषण, आणि भाषिक कौशल्ये, व्यावहारिक उपयोजित मराठी व प्रसारमाध्यमांची कार्यशैली, सांगळे, (संपा.) प्रथम आवृत्ती, डायमंड पब्लिकेशन्स, पुणे.

साहित्य, समाज आणि संस्कृतीचा अनुबंध

डॉ. स्वप्निल बुचडे, डॉ. एकनाथ आळवेकर

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

● प्रस्तावना :

साहित्य हे मानवी भावभावनांच्या अभिव्यक्तीचे महत्त्वाचे माध्यम आहे. ज्यावेळी लेखक साहित्याची निर्मिती करत असतो त्यावेळी त्याला समाजाला आणि समाजातून निर्माण होणाऱ्या संस्कृतीला वजा करता येत नाही. समाज हा केवळ माणसांचा समूह नसतो तर त्यामध्ये समाज आणि संस्कृतीच्या माध्यमातून आलेल्या रूढीपरंपरा व मूल्यांच्या बंधनांनी व्यक्ती सामाजिक जीवन जगत असतात. समाजाच्या जीवन जगण्याच्या रीतीतून संस्कृती आकाराला येत असते. साहित्य ही भाषिक निर्मिती प्रक्रिया आहे. लेखकाच्या समाज व संस्कृतीशी नेमका कशा प्रकारचा संबंध असतो याचाही विचार साहित्याविचाराच्या अनुषंगाने केला जातो.

साहित्य ही लेखकाच्या अनुभवांची अभिव्यक्ती असते. त्याचे अनुभव समाजसापेक्ष असतात. समाजात राहणाऱ्या व्यक्तीचे समाजसापेक्ष अस्तित्व संभवत नाही. लेखकांच्या संपूर्ण आयुष्याची जडणघडण समाजातच होत असते. समाजातल्या रूढ नैतिक, धार्मिक, सामाजिक, सांस्कृतिक मूल्यव्यवस्थेशी असलेल्या ताणतणावातून त्याच्या लेखनाच्या प्रेरणा जन्म घेत असतात. निसर्गाप्रमाणेच कुटुंबव्यवस्था, विवाहसंस्था, धर्म आणि राज्यसंस्थेशी लेखकाचा जो संबंध येतो, त्यातून लेखकांची जीवनाकडे पाहण्याची दृष्टी तयार होत असते. त्याच्या दृष्टीतून तो जीवनाचे आकलन करू पाहतो. लेखक आपल्या भाषिक निर्मितीतून समकालीन सामाजिक, सांस्कृतिक बंधनांच्या पलीकडे जाऊन जीवनाविषयी चिंतन मांडण्याचा प्रयत्न करत असतो.

● उद्देश :

१. प्रस्तुत संशोधनातून साहित्य, समाज आणि संस्कृती म्हणजे काय पाहता येईल.
२. साहित्य व समाज यांच्यातील परस्परसंबंध स्पष्ट करता येतील.
३. साहित्य व संस्कृती यांच्यातील परस्परसंबंध स्पष्ट करता येतील.
४. साहित्य, समाज आणि संस्कृती यांच्यातील अनुबंध स्पष्ट करता येईल.

● संशोधन पद्धती :

प्रस्तुत संशोधन विषयासाठी समाजशास्त्रीय संशोधन पद्धतीचा अवलंब केला जाईल.

● साहित्य, समाज आणि संस्कृतीचा अनुबंध :

साहित्य, समाज आणि संस्कृती यांच्यात गुंतागुंतीचे संबंध असतात. साहित्य हे संस्कृतीचे अंग आहे. असे असले तरीही साहित्य स्वतःच संस्कृतीचे रूप धारण करते. साहित्य हे समाजाचा आरसा असते अशी भूमिका मांडली जाते. म्हणून कोणत्याही साहित्यिकाने निर्माण केलेल्या साहित्याची नाळ शेवटी आपल्याला समाजाशी जोडावीच लागते. यासंदर्भात आपला विचार मांडताना गंगाधर गाडगीळ यांनी आपल्या 'खडक आणि पाणी' या ग्रंथात मांडलेली भूमिका अशी, जीवनाचे सत्य स्वरूप दाखविणे आणि जीवनविषयक उच्च आदर्श वाचकांपुढे मांडणे ह्या दोन्ही गोष्टी साहित्यिक करत असतो. साहित्यिक हा जीवनाविषयी प्रत्यक्षपणे अगर अप्रत्यक्षपणे काही विधाने करीत असतो. जीवनाचा काही अर्थ लावीत असतो. जीवनातील

आदर्श कोणते ते सूचित करित असतो. एखादा तत्त्वज्ञ जीवनाची ज्या पद्धतीने संगती लावीत असतो. त्याचप्रमाणे साहित्यिकदेखील लावीत असतो आणि त्याने जीवनाची लावलेली संगती हे किती सत्य आहे, त्याने माणसापुढे मांडलेले आदर्श नैतिकदृष्ट्या किती उच्च आहेत त्यावरून त्याच्या साहित्याची प्रत अगर योग्यता ठरते. (गंगाधर गाडगीळ : २००३ : ११९)

गंगाधर गाडगीळ यांनी मांडलेल्या मतानुसार जीवनाविषयी आदर्श मांडण्याचे काम साहित्यिक करत असतो.

साहित्य आणि समाज यांच्याबद्दल बोलताना रा. ग. जाधव म्हणतात की, “समाज आणि साहित्य यांच्यातील बंध अनुबंध समाजातील सातत्य व बदल या द्वंद्वाने प्रभावित होत असतात. स्वातंत्रोत्तर काळातील आपल्या दीर्घकालीन परतंत्र समाजाचे स्वतंत्र व स्वयंशासित राजकीय समाजात रुपांतर झाले किंवा अशा प्रकारच्या रुपांतराची प्रक्रिया सुरु झाली. या बदलाची नेमकी साधे व साधने स्पष्ट करण्याचे कार्य स्वतंत्र भारताच्या संहितेने केले. या संहितेत आपल्या समाजातील सातत्याचे स्वरूप आणि परिवर्तनाच्या दिशा गर्भित आहेत. धार्मिक - सांस्कृतिक सहिष्णूता, कायद्याचे राज्य, व्यक्तिस्वातंत्र्य, समूहजीवनाचे स्वातंत्र्य यासारख्या तत्वांनी समाजातील सातत्याचा पुरस्कार करण्यात आला. सामाजिक न्याय, समता, स्त्री- पुरुष समानता, अनुसूचित जाती जमातींच्या संदर्भातील खास तरतुदी, अस्पृश्यता निवारण यासारख्या तत्वांनी समाजातील परिवर्तनाच्या प्रक्रियांना पुरस्कृत करण्यात आले. संविधानातील मूलभूत हक्क व मार्गदर्शक तत्त्वे या तरतुदी म्हणजे अनुक्रमे सामाजिक सातत्य व बदल यांच्याच निदर्शक ठरणाऱ्या प्रणाली आहेत असेही म्हणता येईल. एका दृष्टीने पाहता भारतीय संविधान संहिता ही स्वतंत्र भारतीय समाजाचे जसे राज्यशास्त्र आहे, तसे ते आपल्या समाजाचे नवे समाजशास्त्रही आहे.” रा. ग. जाधव यांनी भारतीय संविधानातील मार्गदर्शक तत्वांना आणि मूलभूत हक्कांना एकूणच समाज धर्मनिरपेक्ष आणि समानतेच्या तत्त्वावर एकत्र ठेवणारी एक महत्वपूर्ण प्रणाली मानले आहे. जी नवीन समाजशास्त्र आकारते. ज्यातून स्वातंत्र्य, समता, बंधुत्व, आणि न्याय या तत्वांचा पुरस्कार केला आहे. स्वातंत्रोत्तर कालखंडात या महत्वपूर्ण तत्वांचा अंगीकार करून नवीन प्रकारच्या विश्वबंधुत्वाचा विचार साहित्याच्या माध्यमातून आकाराला आला. साहित्य आणि समाज यांच्यातील सातत्य टिकविण्याचे काम संविधानाने केले, अशीच भूमिका रा. ग. जाधव यांनी मांडली.

साहित्य ही लेखकाची भाषिक कृती म्हणजेच भाषिक निर्मिती आहे. भाषा ही एक सामाजिक संस्था आहे. लेखकाच्या भाषिक अभिव्यक्तीकडे पाहण्याचे अनेक दृष्टीकोन आहेत. विविध धर्म, पंथ, तत्त्वज्ञान, विचारसरणी यांच्या प्रभावातून साहित्य आणि समाज यांच्यातील परस्परसंबंधाकडे पाहण्याचे वेगवेगळे दृष्टीकोन दिसून येतात. व्यक्ती जशी समाजाचा घटक असते, तसा लेखकही त्या समाजाचाच घटक असलेला पहावयास मिळतो. लेखकाच्या जीवनविषयक कल्पना त्याच्या भोवतालच्या सामाजिक पर्यावरणातून उद्भवलेल्या असतात. त्याचे भावविश्व त्या समाजाच्या संस्कृतीवर पोसलेले असते. सभोवतालचा समाज व सांस्कृतिक परंपरा यांचे आकलन लेखक आपल्या मूल्यदृष्टीतून करित असतो. समाजमान्य मूल्यांचा न्हास लेखकाला अस्वस्थ करित असतो. तसेच त्याला प्रचलित सामाजिक मूल्यांचा जाचही होतो. तो त्या मूल्यव्यवस्थेच्या विरोधात बंड करतो. हे त्याचे बंड भाषिक असले तरी, त्याची कृती सामाजिक असते.

साहित्य आणि समाज यांचा संबंध मांडत असताना साहित्यकृती ही स्वतंत्रपणे कलाकृती म्हणून प्रथम अस्तित्वात असते, हे लक्षात ठेवले पाहिजे. भालचंद्र नेमाडे याबद्दल बोलताना म्हणतात, “साहित्यात समाजाचे प्रतिबिंब उमटलेले असते, ह्या उक्तीचा अर्थ सामाजिक घटना, चळवळी, व्यवहार इत्यादी बाबी सरळ आहेत तशा, आशयात परावर्तीत होतात असा घेता कामा नये. इथे आरशाचे अनेक प्रकार कल्पावे लागतात आणि सामाजिक घटनांचे परावर्तन कधी सरळ, कधी तिरकस, कधी दुरान्वये एखाद्या एखाद्या कुटासारखे होत असते. जे हळुवार पद्धतीने सोडवावे लागते. कवितेत वाच्यार्थ, लक्षार्थ, व्यंग्यार्थ गृहीत

धरलेले असतात, तसे सामाजिक आशय उकळण्याचे अनेक स्तर किंवा पर्याय असतात.” भालचंद्र नेमाडे यांनी मांडल्याप्रमाणे समाजात घडणाऱ्या घटनांचा आशय व्यक्त करत असताना लेखक त्या सामाजिक संदर्भाचे विश्लेषण आपल्या पद्धतीने करून ललित स्वरूपात त्याची अभिव्यक्त करत असतो. म्हणून साहित्य समाजाचा आरसा आहे असे म्हणत असताना समाज व्यवहार जसाच्या तसा परावर्तीत होईल असे नाही.

फ्रेंच तत्वज्ञ हिपोलित तेन यांनी त्यांच्या ‘हिस्टरी ऑफ इंग्लिश लिटरेचर’ या ग्रंथाच्या प्रस्तावनेत साहित्य आणि समाज यांतील संबंध स्पष्ट करण्यासाठी एक पद्धत मांडली आहे. याबद्दल दिगंबर पाध्ये यांनी आपल्या ‘साहित्य समाज आणि संस्कृती’ या ग्रंथात त्याचे विश्लेषण केले. ते म्हणतात की, “साहित्य हे वंश, युगप्रवृत्ती आणि परिस्थिती या तीन घटकांच्या परिणामातून निर्माण होत असते. तेने सुचवलेले हे तीन घटक तसे स्वतंत्र आहेत. म्हणून एखाद्या समाजाच्या साहित्याचा विचार करताना कधी वंश या कल्पनेवर भर देऊन, तर कधी युगप्रवृत्ती व परिस्थिती या घटकावर भर देऊन विचार करणे शक्य असते. इंग्रजी साहित्याचा अभ्यास करताना तेने वंश या कल्पनेवर अधिक भर दिला आहे. वंश या कल्पनेचे तेन प्रणीत स्पष्टीकरण पाहिले तर त्यामध्ये एखाद्या मानवसमूहाला जन्मजात व वारसा म्हणून प्राप्त झालेली वैशिष्ट्ये, स्वभावधर्म, शरीररचना इ. समावेश होतो. ही माणसे वेगवेगळ्या परिस्थितीत जगत असली तरी त्यांच्यावर मूलभूत साच्याच्या काही खुणा राहत असतात असे तेनेचे मत आहे. म्हणजे सर्वसाधारणपणे ज्याला आपण ‘राष्ट्रीय स्वभाव’ म्हणतो तेच तेनेला अभिप्रेत आहे.”

‘संस्कृती’ हा शब्द भारतीय परिप्रेक्षावर व्यापक अर्थाने वापरला जाणारा शब्द आहे. भारतीय संस्कृती किंवा पाश्चात्य संस्कृती असे म्हणत असताना लोकांचे आचारविचार, रीतीरिवाज, रूढीपरंपरा आणि जीवनशैली ह्या गोष्टी समाविष्ट होत असतात. समाजाची मूल्यव्यवस्था त्या समाजाच्या संस्कृतीत सामावलेली असते. लोकांनी आपल्या जगण्यासाठी निर्माण केलेल्या अनेक भौतिक गोष्टी यांचा समावेश जसा संस्कृती या शब्दात होतो, तसाच त्या समाजाच्या सर्व अभौतिक विश्वातील धारणा, संकल्पना व प्रतीक-प्रतिमा यांचाही समावेश होतो. व्यवहारात वापरला जाणारा संस्कृती हा शब्द समाजशास्त्र व अन्य ज्ञानशाखांमध्ये निश्चित अर्थाने वापरला जातो. इरावती कर्वे यांनी, ‘संस्कारपूर्ण आणि संस्कारमय जीवन जगण्याची देशकालविशिष्ट रीत म्हणजे संस्कृती’ अशी व्याख्या केली आहे. यावरून असे म्हणता येईल की, ‘संस्कृती म्हणजे समाजाची समग्र जीवनरीत, व्यक्तीने आपल्या समूहाकडून घेतलेला सामाजिक वारसा, विचार, भावना, श्रद्धा, बाह्य पर्यावरण आणि इतर लोक यांच्याशी जुळवून घेण्यासाठी वापरात येणाऱ्या तंत्रांचा समुच्चय, सामाजिक संघटना, धर्म, आर्थिक व्यवहार या सर्वांचा संस्कृतीत समावेश होतो’.

साहित्य आणि संस्कृतीचा संबंध घट्ट आहे. संस्कृती ही व्यापक संकल्पना असून एखाद्या भाषिक समाजाचे साहित्य हे त्या समाजाच्या संस्कृतीचा एक भाग असते. संस्कृतीच्या अव्यक्त, अदृश्य आणि संकल्पनात्मक अंगाने वहन भाषेच्याद्वारे होत असते. म्हणून संस्कृतीचे अस्तित्व भाषेतच सामावलेले असते. साहित्य ही भाषिक कृती असल्याने साहित्याचे महत्त्व संस्कृतीच्या संदर्भात दुहेरी आहे. साहित्यातून एखाद्या समाजाच्या सांस्कृतिक मूल्यव्यवस्थेचे आदानप्रदान होत असते. त्यामुळे असे म्हणता येईल की, एका बाजूला संस्कृती ही साहित्याच्या निर्मितीचे कारण ठरत असते, तर दुसऱ्या बाजूने साहित्य ही एक सांस्कृतिक शक्ती ठरून संस्कृतीच्या जडणघडणीत सहभागी होत असते.

- निष्कर्ष :

१. साहित्य आणि संस्कृतीचा संबंध घट्ट आहे.

२. संस्कृती ही व्यापक संकल्पना असून एखाद्या भाषिक समाजाचे साहित्य हे त्या समाजाच्या संस्कृतीचा एक भाग असते.
 ३. साहित्यातून एखाद्या समाजाच्या सांस्कृतिक मूल्यव्यवस्थेचे आदानप्रदान होत असते.
 ४. समाजाशिवाय माणसांची कल्पना करता येत नाही तसेच समाज आणि संस्कृतीशिवाय साहित्याचीही चर्चा करता येत नाही.
 ५. साहित्याचा जसा समाजाशी संबंध असतो तसाच तो संस्कृतीशीही असतो.
- **संदर्भग्रंथ :**
१. रा. ग. जाधव, साहित्य व सामाजिक संदर्भ, कॉन्टिनेंटल प्रकाशन, पुणे
 २. दिगंबर पाध्ये, साहित्य, समाज आणि संस्कृती, लोकवाङ्मयगृह, मुंबई
 ३. भालचंद्र नेमाडे, सोळा भाषणे, लोकवाङ्मयगृह, मुंबई
 ४. गंगाधर गाडगीळ, खडक आणि पाणी, पॉप्यूलर प्रकाशन, मुंबई

साहित्य आणि समाज

प्रा. डॉ. प्रदीप पाटील, डॉ. एकनाथ आळवेकर

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

घोषवारा

साहित्यनिर्मितीमधील आणि साहित्यव्यवहारामधील समाज हा अत्यंत महत्त्वाचा आणि अचल असा घटक असतो. त्या त्या काळातील समाज जसा असतो, त्याप्रमाणे त्या काळातील साहित्य आणि साहित्यव्यवहार हा त्यानुरूप आकार धारण करीत असतो. समाजाचा आणि सामाजिकतेचा विचार केल्याशिवाय साहित्यनिर्मितीचा आणि साहित्यव्यवहाराचा अर्थ कळतच नाही. साहित्यकृतीतून आविष्कृत झालेला अनुभव हा कुठल्यातरी समाजातीलच असतो. समाजाशिवाय अनुभव नावाचा घटक अशक्यच असतो. लेखकाची जडणघडण ही समाजातच झालेली असते. त्याची मूल्यदृष्टीही त्याच समाजात आणि त्या समाजाच्या परिप्रेक्षात विकसित झालेली असते.

सांकल्पिक संज्ञा

नवनिर्मिती, साहित्यव्यवहार, अनुबंध, अंतःस्वर, सामाजिक संवेदना, सांस्कृतिक पोषण, भग्नता, रूक्षता, अनोन्य, परिशिलन.

प्रास्ताविक

समाज जीवनाचे, समाज मनाचे प्रतिबिंब साहित्यात उमटलेले असते. किंबहुना साहित्य हा त्यांचा आरसा असतो. अर्थात त्यातून समाजाचा चेहरा दिसणे स्वाभाविक आहे. साहित्य प्रत्यक्ष, अप्रत्यक्षपणे समाजावर काही संस्कार करीत असते. कधी ते ऐकीव स्वरूपाचे, मौखिक स्वरूपाचे असेल. अगदी माणसाच्या बालवयापासून हे घडत असते. मग हे साहित्य धार्मिक, सामाजिक, राजकीय, वैचारिक स्वरूपाचे असू शकते. म्हणजेच साहित्य आणि समाज हे एक अद्वैत असेच आहे. साहित्यामुळे समाज घडतो. पण हे साहित्य समाजाचेच देणे असते, हेही नाकारता येत नाही.

कोणत्याही समाजाचा अनुबंध हा शेवटी समाजाशी असतो. कारण साहित्याचा मुलाधार शेवटी मानवी जीवन आणि त्याचा समाज हाच असतो. समाजजीवनाला वगळून साहित्याची निर्मिती करणे म्हणजे हवेत मनोरे बांधण्यासारखे आहे. कोणतीही चांगली, दर्जेदार साहित्यकृती अशी नुसत्या कल्पनेवर निर्माण करता येत नाही. तर साहित्यकृतीचा गाभा किंवा केंद्र हा माणूस व त्याचे जगणे हाच असतो. साहित्य हे अनेक चौकटी मोडणारे प्रभावी हत्यार आहे. म्हणून साहित्यातून समाजाचा अंतःस्वर उमटला पाहिजे. समाजाचे वैचारिक, मानसिक, सांस्कृतिक पोषण करण्याचे कार्य साहित्यातून होत असते. समाजाचे सर्वांगीण पोषण करणे, सामाजिक संवेदना टिकविण्याचे कार्य साहित्य करीत नसेल तर त्याचे मूल्य शुन्यवत मानले पाहिजे. जीवनातील भग्नता, रूक्षता, भयावहता कमी करून आनंदाचा झरा निर्माण करणे हे जसे साहित्याचे प्रयोजन आहे, तसेच मानवतेच्या उद्धारासाठी सामाजिक चेतना निर्माण करणे हेही कार्य साहित्याने करणे आवश्यक असते.

उद्देश :

१. साहित्याचे समाजातले स्थान व व्याप्ती समजून घेणे.
२. साहित्याचे समाजातले कार्याची नोंद घेणे.
३. साहित्याचा समाजावर होणारा परिणाम शोधणे.
४. साहित्याच्या संदर्भात उद्भवणारे नैतिकतेचे प्रश्न, लेखकाची जबाबदारी, आविष्कार स्वातंत्र्य नियमित करण्याची समाजाची यंत्रणा समजून घेणे.

संशोधन पद्धती :

सदर संशोधनासाठी समाजशास्त्रीय संशोधन पद्धतीचा अवलंब करण्यात येईल.

साहित्य आणि समाज : परस्परसंबंध

साहित्य आणि संस्कृती यांचा अनोन्य संबंध असून साहित्य हा एक मानवी मन, बुद्धीचा व पर्यायाने समाजाचा, संस्कृतीचा आविष्कार आहे, असे दु. का. संत म्हणतात. साहित्याचे मूल्य समाजातील एक सर्जनशील कृती आणि एक स्वतंत्र कलानिर्मिती असे दुहेरी असते. एक सर्जनशील कृती म्हणून साहित्याचा विचार करताना केवळ वाङ्मयीन संदर्भात विचार करून चालत नाही, तर ती कलाकृती ज्या समाजात घडली त्याचा विचारही अपरिहार्य ठरतो. साहित्य हे समाजजीवनाचे अंग असून समाजजीवनाच्या विविध अंगांचे दर्शन साहित्यातून होत असते. साहित्य हे समाजातून निर्माण होते. ते जीवनावर भाष्य करते. जीवनाला समृद्धी आणते. म्हणून समाजजीवनाच्या अभ्यासासाठी साहित्य आणि साहित्याच्या अभ्यासाच्या संदर्भात समाजजीवन महत्त्वाचे ठरते.

साहित्य आणि समाज यांच्यातील परस्परसंबंधाचे स्पष्टीकरण करताना तेन म्हणतो की, “कोणतीही साहित्यकृती घेतली तरी ती केवळ कल्पनांचा खेळ किंवा उद्दिपीत मेंदूतून निघालेली एक क्षणिक लहर असत नाही. ती लिहिणारा साहित्यिक ज्या समाजात वावरतो, त्या समाजाचा, त्याच्या देशाचा, त्या देशाच्या इतिहास, भूगोल, संस्कृतीचा, तो लेखक ज्या काळात जगला, त्या काळातील गुणधर्मांचा एकसमयावच्छेदकरून त्याच्या कृतीवर परिणाम होत असतो. आणि या सर्व घटकांचे परिशिलन केल्यानंतरच त्या कलाकृतीचे सम्यक् दर्शन होऊ शकते.” म्हणजेच साहित्यकृतीच्या मागे जो लेखक आहे, त्याचा शोध त्या कलाकृतीवरून घेता येतो. साहित्यकृती ही एक दृश्य वस्तू आहे. तिच्या मागील अदृश्य लेखकमनाचा मागोवा त्या कृतीवरून आपण घेऊ शकतो. साहित्यकृतीच्या मांडणीवरून, व्यवस्थापनावरून त्या त्या समाजाच्या मनाचा आपल्याला बोध होत असतो.

साहित्य आणि समाज यांच्यातील परस्पर संबंधाचा अभ्यास करताना भालचंद्र नेमाडे यांनी प्रामुख्याने पुढील बाबींचा उल्लेख केला आहे.

१. साहित्याचे समाजातले स्थान व व्याप्ती.
२. साहित्याचे समाजातले कार्य.
३. साहित्याचा समाजावर होणारा परिणाम.
४. साहित्याच्या संदर्भात उद्भवणारे नैतिकतेचे प्रश्न, लेखकाची जबाबदारी, आविष्कार स्वातंत्र्य नियमित करण्याची

समाजाची यंत्रणा.

५. वाचकांची अभिरूची.

६. साहित्य हे सामाजिकतेचा दस्ताऐवज म्हणून कसे अभ्यासावे, याचा शास्त्रीय पध्दती, सर्वेक्षण, समूहमानस साहित्यकृतीद्वारे मांडण्याच्या पध्दती व तंत्र.

म्हणजेच समाजाचा साहित्याकडे पाहण्याचा दृष्टिकोण, लेखकाला दिलेल्या स्वातंत्र्याच्या मर्यादा, त्याला दिलेला प्रतिसाद, मान्यता, लेखकाची परात्मता, आश्रयव्यवस्था, बौद्धिक मालमत्तेच्या संकल्पना आणि कायदे ह्या विषयांचे संदर्भ साहित्य आणि समाज यांच्यातील परस्पर संबंध उलगडण्यासाठी आवश्यक असतात.

साहित्य हा समाजसापेक्ष व्यक्तिमत्त्वाचा आविष्कार असतो. साहित्यात लेखकाच्या आत्मनिष्ठेस, जीवनदृष्टीस व भावनात्मक प्रतिक्रियांना महत्त्व असल्याने प्रत्येक साहित्यकृती अनन्यसाधारण बनत असते. लेखकाची आत्मनिष्ठा जितकी निरामय, उत्कट व अविचल तितके त्याचे साहित्य जिवंत व परिणामकारक होते. साहित्याची निर्मिती व्यक्ती करित असते पण त्याचे वाचन, विश्लेषण, मूल्यमापन समाज करित असतो.

साहित्य आणि समाज यांच्यातील परस्पर संबंधाचा अनुबंध स्पष्ट करताना डॉ. विलास पाटील म्हणतात, “साहित्याच्या निर्मितीमागील व्यक्तिमन सामाजिक घटकाशी अभिमुख असते. परंतु साहित्यातील सामाजिकता व्यक्तिमनाची असते व ती अपरिहार्य असते. साहित्याचे परिणामक्षेत्र समाज असतो.” या अर्थाने निर्माण झालेले साहित्य हे एकाचवेळी ते व्यक्तिनिष्ठ व समाजनिष्ठ असते.

यावरून साहित्य आणि समाज यांच्यातील परस्पर संबंधाचे स्वरूप लक्षात येते. लेखक हा समाजाचा घटक असतो. परिणामी त्याचे साहित्यही सामाजिक पर्यावरणाचे क्रिया, प्रतिक्रियात्मक फलित असते. साहित्य हे वैयक्तिक असून ते सामाजिक बनते, असे मला वाटते.

साहित्य आणि सामाजिक परिस्थिती

साहित्य हे सामाजिक परिस्थितीचे अपत्य मानले जाते. साहित्यनिर्मितीची पाळेमुळे समाजात रूजलेली असतात. तसेच साहित्यिकाची जडणघडण होण्यास तत्कालीन सामाजिक परिस्थिती, विचारप्रणाली, त्या विशिष्ट भाषेतील वाङ्मयीन व शैलीविषयक परंपरा इत्यादी घटक कारणीभूत असतात. साहित्य आणि सामाजिक परिस्थिती यांच्यातील संबंधाचे विवेचन करताना अंजली सोमण म्हणतात, "साहित्यकृती ही प्रतिभेची निर्मिती असते आणि स्वतःची वैशिष्ट्ये पूर्णतः ती जपत असते, हे खरे आहे. पण त्याचवेळी ज्या काळात व ज्या परिस्थितीत ती निर्माण होते, त्या परिस्थितीचा प्रभाव व मर्यादा पूर्णपणे ओलांडू शकत नाही, हे मान्यच करावे लागते." प्रतिभावंत साहित्यिक कुठे आणि केव्हा निर्माण होतात हे सांगता येत नसले व प्रतिभेच्या व्यापारात काही गूढता असली तरी एकदा कलाकृती निर्माण झाली की, तिच्यावर त्या काळाचा व परिस्थितीचा स्पष्ट, अस्पष्ट असा ठसा उमटलेलाच असतो.

कोणत्याही काळातील कलाकृती घेतल्यास तिच्यामध्ये निर्मात्याची प्रकृती, त्या काळात त्या निर्मितीक्षेत्रात पूर्वसूरीचे सिध्द झालेले कर्तृत्व, निर्मितीपरंपरा, तत्कालीन शैलीविशेष, निर्मात्याच्या मनात विशिष्ट निर्मितीच्या अनुषंगाने चाललेली व्यक्तिगत व कालसापेक्ष आंदोलने, उद्भवलेले कल्पनातरंग, नवनिर्मितीविषयीच्या त्याच्या उत्साहाची प्रत इत्यादीचा अंतर्भाव झालेला दिसतो.

साहित्य हे आर्थिक, सामाजिक, राजकीय, सांस्कृतिक स्थित्यंतरापासून दूर राहू शकत नाही. या क्षेत्रातील बदलाचा परिणाम साहित्याचा आशय, अभिव्यक्ती व आकृतीबंधावर होत असतो. विशिष्ट सामाजिक परिस्थितीत काहीवेळा नवे आकृतीबंध रूढ होत असतात.

मराठी साहित्याच्या इतिहासाचे विहंगावलोकन केल्यास संत काळातील धार्मिक आंदोलन, एकनाथकालीन भाषिक संघर्ष, रामदासकालीन राजकीय चळवळ, १९ व्या शतकातील सामाजिक सुधारणावादाचे आंदोलन, २० व्या शतकातील राजकीय आंदोलन, महात्मा गांधींनी प्रेरित केलेली ग्रामोद्धाराची चळवळ, साम्यवादाच्या प्रभावाने निर्माण झालेली कामगार चळवळ, संयुक्त महाराष्ट्राचे आंदोलन, १९६० नंतर उदयास आलेल्या दलित, ग्रामीण, आदिवासी, सांस्कृतिक चळवळी या आंदोलनांचा मराठी साहित्याची भाषा, साहित्याचा आशय आणि अभिव्यक्तिवर परिणाम झालेला दिसतो. एकूणच साहित्याच्या निर्मितीमध्ये त्या त्या काळाचा आणि तेथील सामाजिक परिस्थितीचा संदर्भ येत असल्याचे दिसते.

साहित्य आणि सामाजिक परिस्थिती यावर भाष्य करताना सयाजीराव गायकवाड यांनी साहित्यावर समकालीन परिस्थितीचा प्रभाव असतो, हे उदाहरणाने दर्शविले आहे. तर वि. दा. सावरकरांनी साहित्य हे जीवनाचे एक उपांग असून समाजजीवनाचे चित्रण साहित्यातून यायला हवे, असे म्हटले आहे.

अशाप्रकारे साहित्यावर समकालीन सामाजिक परिस्थितीचा ठसा उमटत असतो. समकालीन परिस्थितीच्या संसर्गाने, संपर्काने साहित्याचे विषय, आशय, शब्दसमूह, अभिव्यक्ती यावर परिणाम होत असतो. समकालीन सामाजिक परिस्थितीतून लेखकाच्या जाणुवा विकसित होत असतात. साहित्याचा व सामाजिक परिस्थितीचा संबंध हा दृढ असतो. या संबंधाचे अस्तित्व स्वीकारावेच लागते.

साहित्य ही एक सामाजिक संस्था आहे. ती समाजाने निर्माण केलेल्या भाषेला आपले माध्यम म्हणून वापरत असते. साहित्यात आलेली प्रतिमा, प्रतिके, छंद ही वाङ्मयीन तंत्रे सामाजिकच असतात. ते समाजातच निर्माण होणारे संकेत आणि मानदंडच आहेत. साहित्य हे समाजाचे पर्यायाने समाजजीवनाचे प्रतिनिधित्वच करत असते. तसेच साहित्य हे एक सामाजिक कार्य आहे. साहित्य ही समाजाची एक अभिव्यक्ती असते. साहित्य कोणत्याही एका काळाचे, सामाजिक परिस्थितीचे अचूक दर्शन घडवित असते. सामाजिक वास्तवाचा कोणतातरी पैलू उलगडून दाखविण्याचे काम साहित्य करित असते.

साहित्य आणि समाज यांच्यातील अनुबंध उलगडण्यासाठी विशिष्ट काळातच विशिष्ट साहित्यप्रकार का निर्माण झाला? लेखकाच्या भावविश्वाची व्याप्ती मर्यादित राहण्याची कारणे कोणती? सामाजिकता लेखकाचे मनोविश्व नियंत्रित करते का? नियंत्रणाचे स्वरूप काय होते? लेखकाची भाषा आणि समाज यांचा काय आणि कोणता संबंध आहे? एखादा साहित्यप्रकारच एखाद्या लेखकाला का जवळचा वाटतो? यासारखे प्रश्न उपस्थित होणे गरजेचे आहे. या प्रश्नांच्या माध्यमातून साहित्याकडे आणि साहित्य व्यवहाराकडे पाहिले असता साहित्य आणि समाज यांच्यातील अनुबंध स्पष्ट होईल. असे असले तरी गेल्या हजार वर्षांच्या साहित्याचा सामाजिक दृष्टीने अभ्यास करणाऱ्यांची संख्या फारशी असलेली दिसत नाही.

निष्कर्ष

१. समाजजीवनाचे, समाजमनाचे प्रतिबिंब साहित्यात उमटलेले असते.
२. साहित्यात आलेली प्रतिमा, प्रतिके, छंद ही वाङ्मयीन तंत्रे सामाजिकच असतात.
३. साहित्य हे समाजाचे पर्यायाने समाजजीवनाचे प्रतिनिधित्वच करत असते.
४. साहित्यावर समकालीन सामाजिक परिस्थितीचा ठसा उमटत असतो.
५. समकालीन परिस्थितीच्या संसर्गाने, संपर्काने साहित्याचे विषय, आशय, शब्दसमूह, अभिव्यक्ती यावर परिणाम होत असतो.

संदर्भ ग्रंथसूची

१. दु. का. संत - 'साहित्य आणि संस्कृती, रत्नागिरी, १९५०.
२. भालचंद्र नेमाडे - 'साहित्याचे समाजशास्त्र, प्रतिमा प्रकाशन, २००७.
३. डॉ. विलास पाटील - 'वाङ्मयधारा, झुंझार प्रकाशन, २००५.
४. हरिश्चंद्र थोरात - 'साहित्याचे सामाजिक संदर्भ, शब्दालय प्रकाशन, २००४.
५. नागनाथ कोत्तापले - 'साहित्य आणि समाज, प्रतिमा प्रकाशन, २००७.

Investment pattern of investors in Mutual Funds: A Case Study of Aditya Birla Sun Life

Dr. Umesh D. Dabade, Mr. Sunny Kale

Assistant Professor, Department of Commerce,
Vivekanand College, Kolhapur (Autonomous)

Email- umeshd001@gmail.com

Abstract -

This research paper investigates the investment pattern of investor regarding to mutual fund with special reference to mutual fund investor of Aditya Birla Sun Life. The mutual fund play very important role in financial security and wealth creation for investor. It is necessary to study on the financial planning strategy in mutual funds by investors. The main objective of this research paper is to study the financial planning and investment elements of mutual funds. This research paper include saving habit, investment options, types of mutual funds reason for investment in mutual funds. This research paper finally concludes that the middle class respondents can prefer mutual fund investment option for children education provision and construction of house. It is also conclude that the high rate of return and interest rate are important reason for invest the amount in mutual funds.

Keywords- Mutual funds, Aditya Birla Sun Life, financial planning, investment pattern

1. Introduction –

The mutual funds stand out as versatile investment vehicles that offer individuals a structures approach to portfolio diversification and wealth creation in the dynamic financial market. Over a past one decade mutual fund have become most important and popular option of short term and long term investment. The economies of scale, liquidity, return potential, low cost, tax benefit, simplicity, transparency, diversification, flexibility and professional management are the advantages of mutual fund. The fees and expenses of mutual funds are disadvantages of mutual funds.

Mutual fund is open ended investment funds which are pools money from many investors to purchase securities. The investors of mutual fund may be institutional or retail. The schemes of mutual funds are managed by experienced and qualified professionals who work towards funds defined objectives. They have more than 8000 schemes are mutual funds available for investors. Investment in equity, debts and commodities are best way of mutual funds. It is necessary to all mutual funds registered with Securities Exchange Board of India (SEBI). The mutual funds investors can register with Association of Mutual Funds in India (IMFI).

2. Statement of the Problem:

The investors have a lot of suspicion about the operation of mutual fund investments. There are many problems faced by the investors at the time investment in mutual funds. The investment elements and saving planning of investor are also covered in this study. After the

considering overall situation of mutual funds and investors researcher has come across the following investigative questions-

1. What is the financial planning of mutual fund investors?
 2. What are the investment elements in mutual funds?
 3. What are the barriers faced by the mutual fund investors while investing in mutual
- Present research paper tries to give proper way out for the above investigated questions.

3. Objectives of the study

1. To study the financial planning of mutual fund investors.
2. To study the investment elements in mutual fund.
3. To study the problems faced by the mutual fund investors while investing in mutual

4. Scope of the study

1. **Topical Scope:** The Topical Scope of Study is “Investment pattern of investors in Mutual Funds: A Case Study of Aditya Birla Sun Life”
2. **Geographical Scope:** the present study covers the Aditya Birla Sun Life mutual fund investors in Kolhapur city.

5. Limitations of the study

1. This study not covered other investment options apart from mutual funds.
2. This study not covered investors of mutual funds other than Aditya Birla Sun Life in Kolhapur city.

6. Research Methodology

A) Sources of Data Collection: The present study includes both primary and secondary source for data collection.

1. **Primary Data:** The primary data is first-hand information collected through detailed questioners from mutual fund investors of Aditya Birla Sun Life in Kolhapur city.
2. **Secondary Data:** The secondary data will be collected by researcher through reference books, websites, newspaper, research papers, articles etc.

B) Sample Design: Researcher has used the convenient random sampling method for sample selection and selected 50 investors of mutual funds in Aditya Birla Sun Life in Kolhapur city.

7. Data analysis and Interpretation

7.1. Demographic profile of Investors

It is necessary to know the demographic profile of the mutual fund investor. Demographic profile includes age, gender, marital status, education and income of investors. The parameters of the demographic profile of investors directly indirectly effect on investment pattern of mutual fund investors.

Table 1.1.

Demographic profile of Investors

Sr. No.	Parameter	Frequency	Percentage
Age			
1	1 to 25 Years	08	16%
2	26 to 50 Years	28	56%
3	50 to 75 Years	10	20%

4	Above 76 Years	04	08%
	Total	50	100%
Gender			
1	Male	26	52%
2	Female	24	48%
	Total	50	100%
Marital Status			
1	Married	36	72%
2	Unmarried	14	28%
	Total	50	100%
Education			
1	SSC	6	12%
2	HSC	7	14%
3	Graduation	19	38%
4	Post-Graduation	13	26%
5	Professional Education	5	10%
	Total	50	100%
Annual Income			
1	Below Rs. 1,00,000	16	32%
2	Rs.1,00,000 to Rs. 5,00,000	20	40%
3	Rs.5,00,000 to Rs. 10,00,000	9	18%
4	Above Rs. 10,00,000	5	10%
	Total	50	100%

Table 1.1 shows that the demographic profile of investor. It is shows that the majority 56% mutual fund investor's age group between 26 to 50 years. The male respondents are 52% and female respondents are 48%. It is also shows that 72% investors are married and 28% investors are in married. It is found that 38% investors completed their graduation, 26 % investors completed post-graduation and 10% investors completed professional education. It is also observed that the 40% investor monthly annual income is Rs.1,00,000 to Rs. 5,00,000 and 32% investors monthly income is Below Rs. 1,00,000.

It is observed that middle age people prefer the investment in mutual funds and they are married. It is also conclude that the educated people are invested in mutual funds.

7.2. Saving habit of Investors

Table 1.2

Saving habit of Investors

Sr. No.	Saving habit of Investors	Frequency	Percentages
1	Save as per planned schedule	15	30%
2	Save something every month	23	46%
3	Save whatever is left after meeting expenses	3	06%
4	Do not save regularly	9	18%
	Total	50	100%

Above table shows the saving habit of investors. It is found that 46% respondents are save the same amount every month and 30% respondents save as per planned schedule. It is also reveals that the majority respondents save money every month as per planned schedule.

7.3. Investment options

Table 1.3

Investment Options

Sr. No.	Investment options	Frequency	Percentages
1	Fixed deposit	22	20
2	Mutual fund	50	45
3	Direct Equity	11	10
4	Post office saving scheme	17	15
5	Bonds	8	7
6	Other	4	4
	Total	112	100

Table 1.3 shows that the investment options choose by the investor. It is multiple options question so frequency total is 112 and all respondent are chose more than one investment option. It is observed that all 50 respondents choose mutual fund option for invest the monthly saved amount. The 22 respondents prefer fixed deposit option for investment. The researcher used convenient sapling method for data collection so all 50 respondents prefer mutual fund option for investment.

7.4. Frequency of Investment in Mutual fund

Table 1.4

Frequency of Investment in Mutual fund

Sr. No.	Frequency of Investment in Mutual fund	Frequency	Percentages
1	Monthly	23	46%
2	Quarterly	11	22%
3	Six monthly	10	20%
4	Annually	06	12%
	Total	50	100%

The above table shows that frequency of fund investment in mutual funds. It is observed that 46% respondents monthly invest the funds in mutual funds and 22% respondents are investing quarterly funds in mutual funds. It is reveals that the investors are investing the money in mutual funds as per saved amount.

7.5. Amount invested in Mutual Fund (Yearly)

Table 1.5

Amount invested in Mutual Fund (Yearly)

Sr. No.	Amount invested in Mutual Fund	Frequency	Percentages
1	Below Rs. 1,00,000	23	46%
2	Rs. 1,00,000 to Rs. 2,00,000	16	32%
3	Rs. 2,00,000 to Rs. 3,00,000	07	14%
4	Above Rs. 3,00,000	04	08%
	Total	50	100%

Table 1.5 shows that the yearly amount invested by investor in mutual funds. It is observed that the 46% respondents are investment below Rs. 1,00,000 in mutual funds and 32% respondents invest the Rs. 1,00,000 to Rs. 2,00,000 in mutual funds. It is reveals that the majority respondents are from middle class family so they invest the funds less than Rs.2,00,000 in mutual funds.

7.6. Type of Mutual Fund

Table 1.6

Types of Mutual funds

Sr. No.	Types of Mutual funds	Frequency	Percentages
1	Equity fund	27	54%
2	Debt fund	14	28%
3	Hybrid fund	09	18%
	Total	50	100%

The above table shows that the types of mutual funds preferred by investors. It is shows that the 54% respondents are preferred equity funds option for investment and 28% respondent prefer debt funds option for investment in mutual funds. The hybrid fund option chooses by 18% respondents. It is reveals that the equity fund is a favorable option to invest in mutual funds.

7.7. Primary goal for investment in mutual fund

Table 1.7

Primary goal for investment in mutual fund

Sr. No.	Primary goal for investment in mutual fund	Frequency	Percentages
1	Provision for children education	21	42%
2	Construction of house	12	24%
3	Provision for old age	07	14%
4	Provision for family members/dependent	10	20%
	Total	50	100

Above table 1.7 shows that primary goal for investment in mutual funds. It is found that the 42% respondents invest the funds in mutual funds for provision for children education. It is also shows that 24% investors invest the funds in mutual funds for house construction. It is reveals that the basic purpose or goal of investment in mutual fund is provision of children education and house construction.

7.8. Reason for choose the investment in mutual fund

It is necessary to find out the reason for choose the mutual funds option for investment. There are various reasons for mutual fund investment options such as tax saving, saving, liquidity, high rate of returns, safety, interest rate, systematic withdrawal plan and transparency.

Table 1.8

Reason for choose the investment in mutual fund

Sr. No.	Reason	Frequency	Percentages
1	Tax Saving	06	05%
2	Regular saving	11	09%

3	Liquidity	07	06%
4	High rate of return	29	24%
5	Safety	10	08%
6	Interest rate	28	24%
7	Systematic withdrawal plan	23	19%
8	Transparency	05	04%
	Total	119	100

Above table shows the reasons for choose the mutual fund option for investment. It is shows that majority 29 investors choose mutual fund option due to high rate of returns through investment in mutual funds. It is also found that 28 investors choose mutual fund investment option due to interest rate. It is observed that the systematic withdrawal plan provided by mutual funds so 23 investors prefer investment in mutual fund. The regular saving and safety reasons for choose the investment in mutual funds by 11 and 10 investors respectively.

7.9. Problems faced by investor

Table 1.9

Problems faced by investor

Sr. No.	Particular	Frequency	Percentages
1	Yes	18	36%
2	No	32	64%
	Total	50	100

It is necessary to identify the problems faced by investors at the time investment in mutual funds. Above table shows that 36% investors have faced problems at the time invest the amount in mutual funds and 64% respondents have no problems in investment in mutual funds.

Table 1.10

Problems faced by investor

Sr. No.	Problems	5	4	3	2	1	Total
1	Inefficiency in mutual fund management	10	16	24	8	0	58
		17.240%	27.59%	41.38%	13.79%	0%	100%
2	Poor services	20	32	18	0	0	70
		28.570%	45.71%	25.71%	0%	0%	100%
3	Lack of Transparency	0	24	27	2	2	55
		0%	43.64%	49.09%	3.64%	3.64%	100%
4	Heavy commission of agent	0	20	15	6	5	46
		0%	43.48%	32.61%	13.04%	10.87%	100%
5	Limited Product:	0	24	27	6	0	57
		0%	42.11%	47.37%	10.53%	0%	100%
6	Malpractices in trading:	15	32	9	8	0	64
		23.44%	50.00%	14.06%	12.50%	0%	100%
7	Lack of satisfactory performance	25	12	24	6	1	68
		36.76%	17.65%	35.29%	8.82%	1.47%	100%

8	Shortage of investment professional skills	30	32	6	2	1	71
		42.25%	45.07%	8.45%	2.82%	1.41%	100%

(5= strongly agree, 4= Agree, 3= Neutral, 2 Disagree, 1= strongly disagree)

Table 1.10 shows the problems faced by investor at the time investment in mutual fund. It is shows that shortage of investment professional skills, poor services lack of satisfactory performance this problems faced by investors.

Findings -

This research paper found that the majority middle age respondents invest the money in mutual fund. It is also reveals that the educated people give preference to investment in mutual fund. It is reveals that the investors are save some money from each month for investment purpose. The majority investor monthly invests less than Rs. 2,00,000 in mutual funds. It is observed that the equity fund is popular types of mutual fund. It is reveals that the basic purpose or goal of investment in mutual fund is provision of children education and house construction. Due to high rate of returns and interest investors are give preference to mutual funds.

Conclusion-

This research paper concludes that the middle class investors prefer mutual fund investment option for children education provision and construction of house. The regular saving, high rate of returns, safety, interest rate and systematic withdrawal plan this are important reason for choose the investment in mutual funds. It is finally conclude that majority investors have no any problems regarding investment in mutual funds.

References –

1. Nalina K.B., Anusha P. Kottur (2014.) “A Study on Mutual Fund Performance Evaluation”, VSRD International Journal of Business and Management Research, Vol. IV, Issue III March.
2. TRIPATHI, S., & JAPEE, D. G. P. (2020). Performance Evaluation Of Selected Equity Mutual Funds In India.
3. Bobade, P., Nakhate, V., Malkar, V., & Bhayani, M. An empirical study on awareness & acceptability of mutual fund in Pune City.
4. Tripathi, S. (2020). An Empirical Study Of Mutual Fund Awareness Among The People Of Ahmedabad.
5. Rao, K. C. N. A Study on Mutual Funds in India with respect to Perception of Indian Investor towards Investment in Mutual fund Market.
6. Sharma, K. B. (2020). Performance Analysis of Mutual Fund: A Comparative Study Of The Selected Debt Mutual Fund Scheme In India.
7. Saxena, K., & Sheikh, R. (2019). Impact of Demographic Variables on Mutual Fund Investment Behaviour: An Empirical Study. Journal of the Gujarat Research Society, 21(16), 957-969.

A Comprehensive Analysis of Urbanization's Geographic Patterns and Environmental Impacts

Dr. D. V. Patil, Dr. G. S. Ubale

Department of Geography

Vivekanand College Kolhapur (Autonomous)

Abstract:

The practice of concentrating people in urban areas, or urbanization, is a worldwide phenomena with profound effects on a region's physical and human landscape. The objective of this study is to investigate the spatial trends and ecological effects of urbanization, elucidating the intricacies and difficulties linked to swift urban expansion.

Given the world's unparalleled concentration of people in urban regions, it is critical for sustainable development to comprehend the spatial distribution, causes, and effects of urbanization. Through a global lens, the article examines various geographic trends, taking into account elements like urban sprawl, land use, and population density. Through an analysis of the factors that contribute to urbanization, such as globalization, migration, and industrialization, the study reveals the complex dynamics at play in this revolutionary movement. Grimmond, S. U. E. (2007) In addition, the effects of urbanization on the environment—such as pollution, habitat loss, and the urban heat island effect—are examined. utilizing case studies from various geographical areas. Ultimately, the research adds to a sophisticated understanding of the complex interactions between urbanization, geography, and the environment by projecting future patterns and ramifications. The information provided here is intended to help urban planners and politicians create resilient, sustainable cities in the face of the world's fastest-growing urbanization.

Introduction:

Urbanization is a complex phenomenon that is defined by the growing density of people living in urban areas, which propels city development and expansion. This study aims to explore the geographic spread of urbanization, the factors that propel it, and the environmental effects it has on the surrounding environments. One of the defining features of the modern world is urbanization, the continuous and transformational process of population concentration in metropolitan regions. & Qi, J. G. (2009)

Cities are growing at a never-before-seen rate throughout the world as more people move from rural to urban areas, significantly altering both the physical and human geography of those areas. In order to understand the complex dynamics involved in urbanization, this research conducts a thorough examination of the geographic patterns and environmental repercussions of urbanization.

A tapestry of patterns that differ between areas and continents can be seen in the spatial distribution of urbanization. Widespread megacities in Asia and revived post-industrial

landscapes in Europe are only two examples of how urbanization has manifested itself geographically. It is influenced by a variety of historical, cultural, and economic factors. Comprehending these trends is not only essential for geography academics but also for decision-makers in government, urban planners, and environmental organizations trying to solve the problems brought on by fast urbanization.

The forces driving urbanization are similarly complex. Urbanization is primarily driven by industrialization, migration from rural to urban regions, and globalization. These factors have an impact on surrounding regions' environments, Su, S., Xiao, R., Jiang, Z., & Zhang, Y. (2012) change ecosystems, and redefine land usage in addition to the demographic upheavals. Thus, in order to promote sustainable urban growth, a careful analysis of the geographic patterns and environmental effects of urbanization is necessary.

The insights gained from this analysis will not only improve our academic understanding but will also inspire practical tactics for policymakers and urban planners as we stand at the crossroads of a rapidly urbanizing globe. We work to uncover the complexities underlying this worldwide phenomenon by looking at the geographic patterns and environmental effects of urbanization. This helps people understand the complicated interaction that exists between human settlements and the environments they inhabit.

Geographic Patterns of Urbanization:

It is essential to examine the geographic patterns connected to urbanization in order to comprehend its dynamics. This section will explore the global geographical distribution of urban regions, looking at things like urban sprawl, land use, and population density. We'll look at case studies from various areas to show the variety of urbanization trends. Wu, J., Jenerette, G. D., Buyantuyev, A., & Redman, C. L. (2011)

Urbanization is a worldwide phenomenon that takes many different geographic forms, all of which work together to carefully modify the planet's landscapes. This section explores the spatial distribution of urbanization, highlighting the complex and dynamic processes by which urban areas develop and change in various geographical locations.

Global Distribution of Urban Centers:

The world's urban population concentrations are not all the same. Cities with more than ten million people are known as megacities, and they are found mostly in Asia and Africa. Smaller urban clusters and peri-urban areas contribute significantly to the general trends of urbanization at the same time.

Population Density and Urban Sprawl:

Urban areas are arranged spatially in ways that go beyond simple population density. Understanding the expansion of cities in both vertical and horizontal directions is possible by looking at population density and the phenomenon of urban sprawl. Zhao, Y., Wang, S., Ge, Y., Liu, Q., & Liu, X. (2017) High-density urban centers and expansive suburbs side by side create a special set of transportation, land use, and infrastructure development difficulties. The repercussions of these patterns on the broader urban fabric will be explained in this section.

Regional Disparities in Urban Development:

Regional discrepancies become more evident as an area becomes urbanized. Different rates of urban growth in developed and emerging regions result in differences in infrastructure, economic growth, and living standards. Analyzing these geographical differences is essential to comprehending the wider effects of urbanization on social and economic processes.

Historical and Cultural Influences:

Historical and cultural influences are deeply entwined into the spatial patterns of urbanization. Certain cities have grown naturally over ages, mirroring the advancement of societies in the past. Globalization and industry have caused rapid urbanization in other places. This section will reveal the distinct paths that cities around the world have taken by looking at the historical and cultural background.

Impact of Natural Features on Urban Layout:

An area's physical geography has a major influence on the patterns of urbanization. Rivers, coasts, and fertile plains are examples of natural features that are frequently the sites of city formation. Gaining knowledge about how these natural elements affect the spatial distribution of urbanization can help us better understand how human settlement interacts with the environment. Liu, P., Wu, C., Chen, M., Ye, X., Peng, Y., & Li, S. (2020)

The goal of this investigation into the geographic patterns of urbanization is to decipher the complexity present in the world's urban environment. We seek to obtain a thorough grasp of how human civilizations alter their physical environments through the process of urbanization by closely examining the regional differences in urban development. This part advances the main objective of our research, which is to perform a thorough investigation of the geographic patterns and environmental effects of urbanization, through case studies and analyses.

Drivers of Urbanization:

A multitude of variables, such as social, political, and economic forces, propel urbanization. This section will examine how the urban landscape has been shaped by globalization, industrialization, and migration from rural to urban areas. It is crucial to comprehend these forces in order to create plans and strategies that effectively manage and prepare for sustainable urban expansion.

Environmental Impacts:

The growth of metropolitan areas has a significant impact on biodiversity, air and water quality, and ecosystems. The environmental problems brought on by urbanization will be discussed in this part, including pollution, habitat loss, and the urban heat island effect.

Habitat Loss and Biodiversity:

Urban growth frequently results in the fragmentation and degradation of habitat, which is detrimental to biodiversity. This section highlights case studies and illustrates the geographic variations in the reduction of biodiversity. It focuses on specific cases of habitat loss caused by urbanization.

Mitigation Strategies and Sustainable Urban Development:

This section examines ways for mitigating the effects of urbanization on the environment and sustainable urban development practices. In order to determine best practices, case studies of cities that have successfully implemented green programs and environmentally conscious urban planning are analyzed..

Conclusion:

In summary, the thorough examination of the spatial trends and environmental effects of urbanization highlights the complex dynamics that define the contemporary urban environment. Urbanization is a global phenomena that is influenced by political, social, and economic forces. It shows itself in different ways across different countries, reflecting the distinctive characteristics of each urban environment. Rapid urbanization has significant negative effects on the environment, endangering ecosystems, the quality of the air and water, and biodiversity in general. Fragkias, M. (2010).

Different levels of density, land use, and sprawl characterize the spatial distribution of urbanization, making a nuanced understanding necessary to meet the unique difficulties that each metropolitan area faces. Urbanization is fueled by a number of factors, including as globalization, migration, and industrialization, all of which have a significant impact on the way cities are planned and how policies are implemented.

The need of implementing sustainable development techniques is underscored by the negative environmental effects of urbanization, including pollution, habitat loss, and the urban heat island effect. The implementation of mitigation techniques, which encompass a range from green infrastructure to intelligent urban design, is crucial in tackling the adverse effects of urban expansion.

For the purpose of formulating policies that work, it is critical to anticipate and comprehend future patterns in urbanization. The urban landscape will transform in ways never seen before due to the integration of technology, the rise of smart cities, and the necessity of adapting to climate change. Moghadasi, M. (2019)

Essentially, this thorough examination adds to the larger conversation about the connection between geography and urbanization. Stakeholders may cooperate to create cities that prioritize ecological sustainability, human well-being, and inclusive prosperity in addition to accommodating the rising urban population by understanding the complex interactions between spatial patterns, driving forces, and environmental repercussions. Urbanization can become a good force that balances human growth with the fragile balance of the natural world by using such comprehensive ways. Wang, H., He, Q., Liu, X., Zhuang, Y., & Hong, S. (2012).

References.

- Dadashpoor, H., Azizi, P., & Moghadasi, M. (2019). Land use change, urbanization, and change in landscape pattern in a metropolitan area. *Science of the Total Environment*, 655, 707-719.
- Deng, J. S., Wang, K., Hong, Y., & Qi, J. G. (2009). Spatio-temporal dynamics and evolution of land use change and landscape pattern in response to rapid urbanization. *Landscape and urban planning*, 92(3-4), 187-198.
- Grimmond, S. U. E. (2007). Urbanization and global environmental change: local effects of urban warming. *The Geographical Journal*, 173(1), 83-88.
- Liu, P., Wu, C., Chen, M., Ye, X., Peng, Y., & Li, S. (2020). A spatiotemporal analysis of the effects of urbanization's socio-economic factors on landscape patterns considering operational scales. *Sustainability*, 12(6), 2543.
- Seto, K. C., Sánchez-Rodríguez, R., & Fragkias, M. (2010). The new geography of contemporary urbanization and the environment. *Annual review of environment and resources*, 35, 167-194.
- Su, S., Xiao, R., Jiang, Z., & Zhang, Y. (2012). Characterizing landscape pattern and ecosystem service value changes for urbanization impacts at an eco-regional scale. *Applied Geography*, 34, 295-305.
- Wang, H., He, Q., Liu, X., Zhuang, Y., & Hong, S. (2012). Global urbanization research from 1991 to 2009: A systematic research review. *Landscape and urban planning*, 104(3-4), 299-309.
- Wu, J., Jenerette, G. D., Buyantuyev, A., & Redman, C. L. (2011). Quantifying spatiotemporal patterns of urbanization: The case of the two fastest growing metropolitan regions in the United States. *Ecological Complexity*, 8(1), 1-8.
- Zhao, Y., Wang, S., Ge, Y., Liu, Q., & Liu, X. (2017). The spatial differentiation of the coupling relationship between urbanization and the eco-environment in countries globally: A comprehensive assessment. *Ecological modelling*, 360, 313-327.

Effect of Self-focusing and Diffraction Length on Propagation of Gaussian Laser Beam in Non-Degenerate Germanium having Space Charge Neutrality.

T.U. Urunkar^{1*}, A. V. Shinde¹, N. A. Narewadikar¹, M.V.Takale²

¹ Department of Physics, Vivekanand College (Autonomous), Kolhapur, India

² Department of Physics, Shivaji University, Kolhapur, India

(* Corresponding Author Email: truption16@gmail.com)

Abstract. It is widely known that self-focusing length R_n and diffraction length R_d play crucial role in propagation dynamics of Gaussian laser beam in non-degenerate germanium having space charge neutrality under ponderomotive nonlinearity. The key interest of present investigation is to study the effect of interval of $R = R_d / R_n$ to sustain the competition between the phenomena of diffraction and self-focusing during beam propagation. To explain it further the plot between function $F(R)$ against R is studied in depth. The behaviour of the beam width parameter f with the dimensionless propagation distance under various intervals of R is examined by numerical estimates. It is found that the self-focusing length and rate of defocusing changes with R .

Keywords: Gaussian, self-focusing, defocusing, self-trapping, germanium.

INTRODUCTION

There are wide range of applications for interactions of high intensity laser beam with plasma such as laser particle acceleration[1], inertial confinement fusion [2]. For these applications laser must have to propagate through plasma medium without any divergence (Self-focusing or defocusing). In present paper authors have adopted the theoretical approach given by Akhmanov et al. and developed by Sodha *et al.* [3] called WKB and Paraxial approximation. This paper confers the propagation of Gaussian laser beam in non-degenerate germanium having space charge neutrality. In present medium the nonlinearity is induced because of the non-uniform heating and consequent redistribution of carriers in the presence of an electromagnetic beam.

THEORETICAL FRAMEWORK

Consider a field distribution of Gaussian laser beam of the following form propagating along z axis

$$A_0^2 = \frac{E_0^2}{f^2} \exp\left(\frac{-r^2}{r_0^2 f^2}\right)$$

where E_0 is an initial amplitude of Gaussian laser beam with initial beam-width r_0 and f is the dimensionless beam width parameter. The effective dielectric constant of nonlinear medium is

$$\varepsilon = \varepsilon_0 + \Phi(A_0^2) \quad \text{-----(1)}$$

where, ε_0 and $\Phi(EE^*)$ are the linear and nonlinear terms of the dielectric constant.

For non-degenerate germanium the nonlinear term of the dielectric constant is given by [4]

$$\Phi(A_0^2) = \frac{\omega_p^2}{\omega^2} \alpha_c \left(1 + \frac{m_e}{m_h}\right) A_0^2 \quad \text{-----(2)}$$

Following approach given by Akhmanov et al. and developed by Sodha et al. [3], we have obtained the dimensionless beam-width parameter f

$$\frac{\partial^2 f}{\partial \xi^2} = \frac{4}{f^3} \left(1 - \frac{R_d^2}{R_n^2}\right) \quad \text{-----(3)}$$

$$\xi = z / R_d, R_d = kr_0^2, R_n = (2\varepsilon_0 r_0^2 / \varepsilon_2 E^2)^{1/2}$$

Where, R_d and R_n are diffraction and self-focusing lengths respectively.

RESULTS AND DISCUSSION

Equation (4) is second order nonlinear differential equation which gives evolution of a laser beam during propagation to non-degenerate germanium. The first term on right-hand side of this equation gives to the diffraction divergence of the beam while second term gives the convergence resulting from the ponderomotive nonlinearity. Under initial condition ($f = 1, \xi = 0$) the right hand side of equation (4) becomes,

$$F(R) = 4(1 - R^2), \text{ Where, } R = R_d / R_n$$

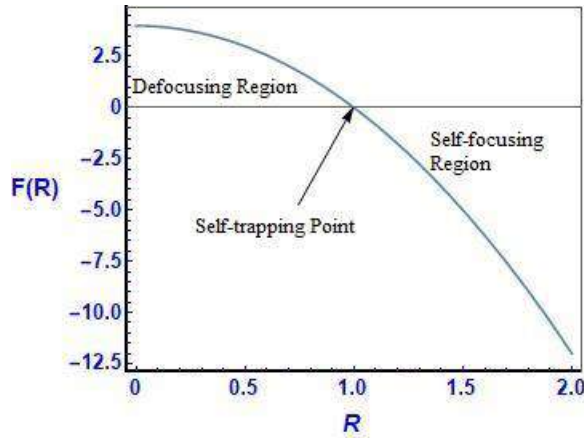


Fig. 1: Variation of F(R) as a function of R

To explore the effect of R right at the beginning one has to pay little attention to plot shown in Fig.1. The plot can be conveniently studied for three distinct conditions.

Self-trapping:

$$F(R) = 0 \text{ for } R = 1 \text{ i.e. } R_d = R_n$$

Self-focusing:

$$F(R) < 0 \text{ for } R > 1 \text{ i.e. } R_d > R_n$$

Defocusing:

$$F(R) > 0 \text{ for } R < 1 \text{ i.e. } R_d < R_n$$

The simple analytical approach leads to following limits for R is depicted in Fig.1. The limits of R investigated in above conditions can support the graph of beam width parameter f versus normalized propagation distance ξ as shown in Fig.2. From Fig.2 the steady state defocusing of beam is observed for $R < 1$ the beam undergoes defocusing.

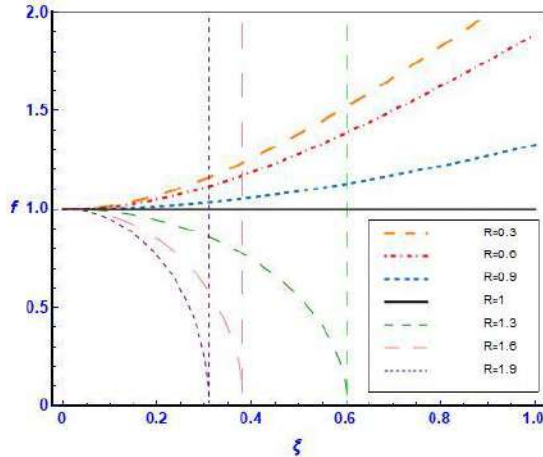


Fig. 2: beam width parameter f versus normalized propagation distance

Again as R increases from 0 to 1 rate of defocusing decreases. The beam propagates without convergence or divergence (self-trapped mode) at exact value $R=1$. It is also evident from Fig.2 that self-focusing is observed for $R > 1$ and as R increases from 1 self-focusing length decreases. Such self-focusing character of Gaussian beam in beam in non-degenerate germanium having space charge neutrality has been already reported in earlier studies [4].

CONCLUSION

It is observed that our investigation shows that pre-conditioning of self-focusing and diffraction length at the beginning of propagation can determine propagation dynamics effectively.

REFERENCES

1. V. Malka, *Phys. Plasmas* **19**, 055501 (2012)
2. S. Atzeni, *Eur.Phys.Lett.* **109**, 45001 (2015).
3. M. S. Sodha, A. K. Ghatak and V. K. Tripathi, *Prog. Opt.* **13**, 169-265 (1976).
4. S. Patil, M. Takale, V. Fulari, M. Dongare, *J. Mod. Opt.* **55**, 3527–3533 (2008).

१९९० नंतरच्या ग्रामीण कादंबरीतील बदलते वास्तव

प्रा. डॉ. एकनाथ आळवेकर, डॉ. प्रदीप पाटील

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

● प्रस्तावना :

मराठी साहित्यातील ग्रामीण साहित्य प्रवाह १९६० नंतरच्या कालखंडातील महत्त्वाचा साहित्य प्रवाह आहे .या साहित्य प्रवाहात कथा,कादंबरी या वाङ्मय प्रकारात बरेचसे साहित्य लिहिले गेले. ग्रामीण जीवनातील विविध घटक,तिथला निसर्ग, शेती, बोलीभाषा, तिथले सामाजिक सांस्कृतिक जीवन यांचे प्रतिबिंब या साहित्यामधून उमटू लागले.थोडक्यात, ग्रामीण संवेदनशीलतेचे चित्रण या साहित्य प्रवाहातून आले आहेत .

● उद्दिष्ट्ये :

१. १९९० नंतरच्या ग्रामीण कादंबरीची ओळख करून देणे.
२. १९९० नंतरच्या ग्रामीण कादंबरीतील चित्रित झालेले वास्तव जाणून घेणे.
३. खेड्यातील बदलता समाज, बदलती संस्कृती समजावून घेणे.
४. ग्रामीण साहित्यातून येणाऱ्या नव्या प्रश्नांची, समस्यांची ओळख करून घेणे.

● संशोधन पद्धती :

प्रस्तुत संशोधनासाठी समाजशास्त्रीय संशोधन पद्धतीचा अवलंब केला आहे.

● ग्रामीण मराठी कादंबरीची वाटचाल :

पिराजी पाटील (१९०३) ही रा. वि. टिकेकर उर्फ धनुर्धारी यांची पहिली ग्रामीण मराठी कादंबरी. विसाव्या शतकाच्या पूर्वार्धात र. वा. दिघे, बा. सी. मर्ढेकर, श्री. ना. पेंडसे, गो. नी. दांडेकर यांचे कादंबरी लेखन महत्त्वपूर्ण मानावे लागते. बा. सी. मर्ढेकर वगळता बाकीच्या कादंबरीकारानी मराठीच्या मुख्य कादंबरी प्रवाहाच्या अनुकरणाचाच किता गिरविला. सौंदर्यवादाचा प्रभाव या कालखंडातील कादंबरी लेखनावर आढळतो. पुढे स्वातंत्र्योत्तर कालखंडात या दृष्टिकोनात हळूहळू बदल होत गेला. व्यंकटेश माडगूळकर, ग.ल.ठोकळ यांचे कादंबरी लेखन महत्त्वाचे ठरले.पुढील कालखंडात १९६०ते १९८० व १९८० नंतरची कादंबरी असे दोन टप्पे पडतात.पहिल्या टप्प्यात उद्धव शेळके, आनंद यादव, रा.रं. बोराडे इत्यादी लेखकांचा समावेश होतो. १९८० नंतरच्या टप्प्यात रंगनाथ पठारे, राजन गवस, विश्वास पाटील, सदानंद देशमुख, मोहन पाटील, कृष्णात खोत, द. तु. पाटील इत्यादींचा समावेश होतो. आत्मभान या आलेल्या लेखकानी आजचे वर्तमान वास्तव आपल्या लेखनातून टिपले आहे.

● बदलत्या ग्रामीण वास्तवाचे स्वरूप:

आजचे ग्रामीण साहित्य हे नव्या संवेदनशील सर्जनशील मनाचा आविष्कार आहे.आज ग्रामीण भागात परिवर्तन घडले आहे. त्याचबरोबर नवे प्रश्न, नव्या समस्याही निर्माण झाल्या आहेत. आजच्या ग्रामीण लेखकांना हे प्रश्न भेडसावतात व त्यातून नवे प्रश्न मांडणाऱ्या कलाकृती निर्माण होताना दिसतात. आजच्या ग्रामीण साहित्यिकांच्या लेखनाबद्दल वासुदेव मुलाटे म्हणतात,

‘नित्याच्या सरळमार्गी जीवन जगू इच्छिणाऱ्या माणसांच्या मनाचा कोंडमारा, येणारे गुदमरलेपण, जाणवणारी दाहकता, परिस्थितीच्या वणव्यात होरपळून निघणारे माणसांचे आक्रोश, आतले आवाज ,स्फुंदणारे अंतर्गत मन, दाटून येणारे हुंदके, उसाचे आणि निश्वास आजच्या ग्रामीण साहित्याच्या लेखणीचे विषय आहेत.

● **ग्रामीण कादंबरीतील अपेक्षित चित्रण:**

बदलत्या ग्रामीण वास्तवामध्ये अनेक गोष्टी येतात. प्रसार माध्यमाचा ग्रामीण जनमानसावर झालेला प्रभाव विशेषतः दूरचित्रवाणीचा प्रभाव, केबल संस्कृतीचे आक्रमण, सभासमारंभाना आलेला पूर ,जाहिरात संस्कृतीचे अतिक्रमण, गावच्या प्रवेशद्वारावरील कमानी, फ्लेक्सबोर्ड इत्यादी तसेच शेतीची होत चाललेली भयानक अवस्था ,वृक्ष संवर्धनाविषयी बेफिकिरी, खोट्या साक्षी देणे, खोटी प्रकरणे तयार करणे , सर्व काही सरकारने करावे ही भूमिका सातत्याने घेण्याची वृत्ती, सहकाराला लागलेली घरघर, शहराकडे स्थलांतर, दूरचित्रवाणी संस्कृतीतील कुसंस्काराचे होणारे अनुकरण, वृद्धांचे होणारी दयनीय अवस्था ,ग्रामपंचायत ते लोकसभा सर्वत्र घोषणाबाजीला आलेले महत्त्व, गावातील संघर्षांचे प्रसंग, व्यसनांचा सुकाळ , मटका, गुटखा, गावठी दारू इत्यादीचा समाजाच्या शारीरिक व मानसिक आरोग्यावर होणारे परिणाम ,मनोरुग्णांची वाढती संख्या, शेतकऱ्यांच्या आत्महत्या, धरणग्रस्तांचे न सुटणारे प्रश्न इत्यादीमुळे ग्रामीण वास्तव कमालीचे तणावपूर्ण ,नाट्यमय दुःखद व विषण्ण झालेले दिसते. याचे वेधक चित्रण ग्रामीण कादंबरीत अपेक्षित आहे.

● **१९९० नंतरच्या कालखंडातील ग्रामीण कादंबरीतील वास्तव चित्रण:**

१९९० नंतरच्या कालखंडातील आनंद यादव(गोतावळा), विश्वास पाटील(पांगिरा), राजन गवस(तणकट), सदानंद देशमुख(तहान, बारोमास), कृष्णात खोत (गावठाण, रौंदाळा), मोहन पाटील (लिगाड व खांदेपालट), द. तु. पाटील (चैत) असे काही ग्रामीण कादंबरीचे टप्पे पाडता येतील. वरील कालखंडात ग्रामीण जीवनाचे चित्रण करताना संदर्भ बदलत केल्याचे जाणवते. ग्रामीण जीवनामध्ये होणारे स्थित्यंतर या कादंबऱ्यातून चित्रित होऊ लागले. ग्रामीण जीवनातील शेती, सामाजिक, सांस्कृतिक जीवन, तिथले आधुनिक प्रश्न, जागतिकीकरणाचा ग्रामीण जनमानसावर झालेल्या परीणाम, निसर्गाकडे पाहण्याचा दृष्टिकोन, बदलत चाललेली भाषा, शहराचा वाढता प्रभाव यातून ग्रामीण वास्तव चित्रण विविध प्रकारे शब्दांकित झाले.

१९९० नंतरच्या कालखंडात ग्रामीण समाजमन ढवळून निघाले आहे. शिक्षण, सण, उत्सव, संस्कृती या सगळ्या गोष्टी बदलत गेल्या. त्याचप्रमाणे बुवाबाजी दिखाऊ धार्मिकता यांना आलेली चलती पाहावयास मिळते. आचार विचारातून स्पष्ट होणा-या विसंगतीचे दर्शन होते. देवळे बांधणे, जत्रा , ऊरुस, सप्ताह, मोठ्यांचे लग्न समारंभ, सत्कार समारंभ, वाढदिवसानिमित्त किंवा एखाद्या महत्त्वाच्या प्रसंगानिमित्त होणाऱ्या नृत्य स्पर्धा इत्यादीतून होणारे बाजरी मूल्यांचे दर्शन घडते. दूरचित्रवाणी, मोटरसायकली मोटारी यांची सुबत्ता आढळते पण शिक्षण, स्त्री स्वातंत्र्य, गरिबांचा उद्धार, ग्रंथालयांची उभारणी याबाबतीतील उदासीनता व त्यातून सांस्कृतिक जीवनाचा होणारा -हास यांचेच दर्शन या कालखंडात होताना आढळते.

या प्रश्नापैकी बरेचसे प्रश्न १९९० नंतरच्या कादंबऱ्यातून आलेले आहेत. रंगनाथ पठारे, राजन गवस, विश्वास पाटील यांचे कादंबरीलेखन पूर्वीच्या कादंबऱ्यापेक्षा वेगळे झाल्याचे दिसते. प्रस्तुत लेखांमध्ये ग्रामीण कादंबरीतील बदलते वास्तव प्रातिनिधीक कादंबऱ्यांच्या आधारे मांडले आहे.

राजन गवस यांच्या 'तणकट' या कादंबरीमध्ये बदललेल्या ग्रामव्यवस्थेचे चित्रण येते. कादंबरीमध्ये बाळासाहेब शेडबाळे भ्रष्टाचार करतो. खेड्यातील जातीव्यवस्था, सध्याच्या दूरचित्रवाणीवरील मालिकातून स्त्री-पुरुषातील अनैतिकतेचे होणारे दर्शन याचे प्रतिबिंब या कादंबरीत असून संसारी स्त्री पुरुषातील विवाहबाह्य संबंधाचे चित्रण यात येते.

खेड्यात सुद्धा मानवतेला लागलेला सुरंग खेड्याचे होणारे विकृतीकरण, खेड्याचे झालेले दृश्य अदृश्य स्वरूपातील शहरीकरण, दलित तरुणांचे वेगवेगळ्या संघटना बांधणे आणि वर्तमानपत्रात प्रसिद्धी मिळवणे. 'संघटित व्हा' चा मूळ हेतू बाजूला पडल्याचेच चित्रण येते.

सदानंद देशमुख यांच्या 'तहान' आणि 'बारोमास' मधून बदलत्या ग्रामजीवनातील अनेक संदर्भ आले आहेत. खेड्याचे बदलते रूप दाखविताना 'तहान' मध्ये सारंगपूरचे जुनं गाव आणि नवगाव असे दोन भाग केले आहेत. नव्या गावात स्टेट बँकेची शाखा, पुढे त्या मार्गावर पेट्रोल पंप, हॉटेल, धाबे, पानपट्ट्या गावात वर्तमानपत्र, टीव्ही, रेडिओ इत्यादी माध्यमातून देश परदेशातल्या बातम्या कळतात. तरुण पिढी नव्या व्यवसायात आहे. वर्तमानपत्राची एजन्सी घेणे, एसटीडी बूथ चालवणे याचे दर्शन घडते. दोन पिढ्यातील संघर्षात झालेली वाढ बबन शेवाळे आणि राघोजी शेवाळे यांच्या संवादातून जाणवते.

'बारोमास' मधून शेती असूनही शेतकरी कुटुंबांना जगण्यासाठी यातायात कशी करावी लागते? याचे चित्रण आधुनिकीकरण आणि जागतिकीकरण या पार्श्वभूमीवर महत्वपूर्ण ठरते. शेतकऱ्यांच्या नव्या पिढीचे चित्रण करताना कादंबरीतील एकनाथ शिक्षण, नोकरी- व्यवसाय या चक्रात अडकलेला आहे. शेतकऱ्यांची नवी पिढी शेती सोडून उच्च शिक्षण घेताना आढळते. पण शेतीपासून ती पिढी दूर जात आहे. शेतीकडे धंदा म्हणून पाहण्यास ही पिढी नकार देत. यातील मधु शेती करण्यापेक्षा मित्रांच्या संगतीने झटपट श्रीमंत होण्याचा मार्ग शोधतो. पारंपरिक व्यवसायाने ग्रामीण संस्कृतीपासून पूर्णपणे फारकत घेतलेली आढळते. नव्या तरुण पिढीला शहरीकरणाचे आकर्षण मधू आणि अलकाच्या रूपाने पाहावयास मिळते. शेतकऱ्यांच्या मुली, सुना शहरात राहण्याचे स्वप्न बघतात.

एकविसाव्या शतकाच्या प्रारंभीच्या वर्षात आपल्या कादंबरी लेखनाला प्रारंभ केलेले कोल्हापूर परिसरातले ग्रामीण कादंबरीकार कृष्णात खोत यांनी 'गावठाण' आणि 'रौंदाळा', 'झड-झिंबड', 'धूळमाती', 'रिंगाण' या कादंब-या लिहिल्या आहेत. 'गावठाण' मध्ये ग्रामीण परिसरातील पारंपरिक वर्णन असले तरी काही प्रसंग मात्र बदलत्या वास्तवाबद्दल सांगतात. आत्तापर्यंत शेतकरी गाई, म्हैशींना गाभण घालवण्यासाठी पाडा, रेडा यांचा वापर करीत पण 'गावठाण' मधील त्या डोंगरातील खेड्यात सुद्धा आता ढोरावरचा डॉक्टर येतो. आणि इंजेक्शन देऊन ढोराला गाभ घालवतो याचे चित्र येते.

कृष्णात खोतांच्या कादंबऱ्यातील बदललेल्या ग्रामीण वास्तवाबद्दल रंगनाथ पठारे म्हणतात, "गावठाण'मध्ये जे नाही ते सारं 'रौंदाळा' मध्ये आहे. 'गावठाण' मधल्या बारक्या गावातले शेतकरी एकमेकांना धरून राहणारे एकमेकांच्या अडीनडीला उभे राहणारे आहेत. शेतकरी सुद्धा एकमेकांच्या सुखदुःखात अंतःकरणापासून सहभागी होताना दिसतो. याउलट 'रौंदाळा'मध्ये गावठाणाचाच रौंदाळा झाल्याचं आपल्याला दिसतं. गावठाणमधलंच पुढचं बदलेल राजकारणग्रस्त गाव आपल्याला या दुसऱ्या कादंबरी दिसतं."

'रौंदाळा'मध्ये मात्र बदललेला कालखंड बऱ्याच प्रसंगातून वाचकांसमोर उभा केला आहे. राजकारणग्रस्त गाव असंच या गावचे वर्णन करता येईल. कारण प्रत्येक जण कोणत्या ना कोणत्या निमित्ताने राजकारणाच्या जंजाळात सापडतो. तिथे घराघरात

राजकारण शिरलेले दिसते. तरुणपिढी अधिक सक्रिय होताना आढळते. ग्रामपंचायत, बँक, सोसायटी निवडणूक यात लोक उत्साहाने भाग घेऊन डाव प्रतिडाव खेळतात. एका पुढाऱ्यांची सोसायटी म्हटल्यावर दुसरा पुढारी लगेच सोसायटी काढतो. गाव तसं लहान पण सोसायटी संस्था मात्र दोन-दोन, तीन- तीन असे चित्र आज ग्रामीण भागात आढळते. या घाणेरड्या स्वार्थी राजकारणामुळे खेळण्यात सुद्धा माणुसकी हरवत चालली की काय? असा प्रश्न निर्माण होतो.

‘धूळमाती’ या कादंबरीमध्ये खेड्यात शब्दाला मान असतो पण काळ बदलला तसा शब्दावरचा विश्वास संपत चालला याबद्दलचा प्रसंग कुळ आणि जमीन मालक यांच्यामधील कादंबरीकाराने रेखाटला आहे. एकमेकाबद्दलच्या उपकाराची जाण न ठेवणे, अविश्वास दाखवणे, हव्याशी वृत्तीमुळे जवळची नाती तोडणे त्यामुळे संवेदनशील माणसाला होणारा त्रास दादाच्या निमित्ताने कादंबरीत चित्रित झाला आहे.

‘चैत’ या कादंबरीमध्ये गावचा चैत साजरा करताना त्यावर जागतिकीकरणाचा प्रभाव पडल्याचे जाणवते. पूर्वी चैताला पायी येणारी माणसं आता मोटरसायकल, कार घेऊन येतात. जत्रेत जाहिरातींचे डिजिटल बोर्ड पाहायला मिळतात. जत्रेच्या निमित्ताने तरुणांच्यातील वाढलेल्या व्यसनाधीनतेचे चित्रण येते. कादंबरीतील जनकच्या म्हणण्याप्रमाणे जुन्या काळात चैत ठिक होता पण आता तो काळ राहिलेला नव्हता.

- **निष्कर्ष :**

आजचा ग्रामीण लेखक बदलत्या वास्तवाचा वेध घेताना अनेक नवनवीन प्रश्न मांडत आहे. खेड आणि शहर यांच्यातील अंतर हळूहळू कमी होताना त्याचा परिणाम सामाजिक, सांस्कृतिक जीवनावर, भाषेवर, राहणीमानावर, मानसिकतेवर कसा होतो ह्याचे भान हे कादंबरीकार आणून देतात.

- **संदर्भ :**

१. मुलाटे वासुदेव : साहित्य, समाज आणि परिवर्तन, पृष्ठ क्र. ४८
२. पठारे रंगनाथ : परिवर्तनाचा वाटसरू, (१६ जुलै ते ३१ जुलै, २००९) पृष्ठ क्र. २१

Antimicrobial activity of aq. and alcoholic extract of *Terminalia catappa* L. drug resistant bacteria isolated from a clinical sample causing Urinary Tract Infection (UTI)

Anjor Jadhav,

Department of Microbiology,

Vivekanand College (Autonomous), Kolhapur

Abstract: Drug Resistance might be a threat in future and for the same reported cases. To find a solution for the same in Urinary tract causing drug resistant bacteria various samples of the plant *Terminalia catappa* were used against these pathogenic drug resistant Urinary Tract Infection (UTI) Causing bacteria.

Keywords: Drug resistance, Urinary Tract Infection (UTI), antimicrobial resistance

Introduction:

Antibiotic resistance is rising to dangerously high levels in all parts of the world and it's accelerated by the misuse and overuse of antibiotics. In developing countries like India, recent hospital and some survey-based data showed increase in number of antimicrobial resistance Infectious diseases have become a major cause of morbidity and mortality worldwide [1]. Where antibiotics can be used for human or animal use without a prescription, which makes emergence and spread of resistance, is made fast and worse. Similarly, in some countries due to lack of the standard treatment guidelines, antibiotics are often over-prescribed by health workers and veterinarians and over-used by the public. In developing countries where sanitation is still poor, unprescribed antibiotics used for the reduce the morbidity and mortality caused by food-borne and other poverty-related infections [2]. Now a days Urinary tract infection remains a common and important bacterial infection among adults especially in females. Urinary tract infection (UTI) is most common infectious disease after respiratory tract infection in hospital practices. Although UTIs occur in all age groups including men and women, clinical studies suggest that the overall prevalence of UTI is higher in women. [3]. Although, *Escherichia coli* have been reported as the commonest isolate causing UTI, few authors have reported changing patterns in the prevalence of uropathogens [4]. *Escherichia coli* are the single most important organism causing urinary infection. Increasing antimicrobial resistance among *E. coli*. strains circulating in community populations are an important issue relevant to antimicrobial strategies for treatment of urinary infection [5]. Various plant chemicals which are useful to control infection and until the advent of antibiotics were

only the remedies available. Plants are rich in a wide variety of secondary metabolites such as tannins, terpenoids, alkaloids & flavonoids which have been found in vitro to have antimicrobial properties. Terminalia species are widely distributed in the southern Asia, Himalayas, Madagascar, Australia, and the tropical and subtropical regions of Africa. Terminalia plants in southern Asia have been intensively studied phytochemically due to their wide usage in Asian (India, Tibetan, and Chinese) traditional medicine systems. Tropical almond, botanically equated as *Terminalia catappa L.* is a large spreading tree so far, 39 *Terminalia* species have been investigated for their phytochemical constituents, which resulted in the identification of terpenes, tannins, flavonoids, lignans and simple phenols, amongst others. Pharmacological studies suggest that they have exhibited activity on liver and kidney protection, antibacterial, anti-inflammatory, anticancer, have displayed a positive effect on immune regulation, cardiovascular disease and diabetes, and acceleration of wound healing [6]. In India the kernel oil extracted from *Terminalia catappa L.* is used medicinally as an alternative source of oil for true almond oil. Colombians employ the oil as a pectoral emulsion. It is also taken to relieve abdominal inflammation [7].

In the present study, attempts were made to evaluate the antimicrobial activity of aqueous extract of different parts of this plant against drug resistant bacterial and fungal species using disc diffusion and agar well diffusion methods. In the present study, various plant parts like fruits, flower, stem, leaf, seed cover have been screened for the antimicrobial activity by using various solvent extraction methods against bacterial and fungal species using various techniques.

1. Materials and Methods

Materials

Equipment and Apparatus

Apparatuses and equipment used in this study were shown in Table3-1.

Table(4-1):The general equipment used in the present work

Equipment	
Autoclave	Oven
Centrifuge	Laminar flow cabinet

Incubator	Deep freezer
Electrical balance	Sterilized cotton swabs
Water bath	Conical flasks
Light microscope	Disposable syringes
Refrigerator	Test tubes
Micro centrifuge	Disposable petri-dishes
Hotplate	Eppendorff cooling centrifuge
Vortex mixer	Distillator

Chemical materials:

All chemicals that used in the present work are illustrated in Table 3-2

Table (4-2): Chemical compounds used in the present work.

Chemical	Manufacturing company	Origin
Ethanol(96%)	HiMedia	(India)
Crystal violet	HiMedia	(India)
Iodin	HiMedia	(India)
Barium chloride	HiMedia	(India)

Hydrochloric acid	HiMedia	(India)
Ethidium bromide	HiMedia	(India)
Glycerol(C ₃ H ₈ O ₃)	HiMedia	(India)
Sodium chloride	HiMedia	(India)
chloroform	HiMedia	(India)
Phenol	HiMedia	(India)
Kovacsreagent	HiMedia	(India)
Agarose	HiMedia	(India)
Gramstain	HiMedia	(India)

Culturemedia

Table(4-3):culture media used in the current study.

Culture media	Manufacturing company	origin
MacConkey agar	HiMedia	(India)
Muller Hinton agar	HiMedia	(India)
Nutrient broth	HiMedia	(India)
Eosin methylene blue agar	HiMedia	(India)

Plant material:

The various parts of plants of *Terminalia catappa* Linn. were collected from Mangalwarpeth, Kolhapur, Maharashtra, India during October 2019.

Methods

Study Area

This study was conducted in Department of Microbiology Aster Aadhar Hospital, Kolhapur District. Geographically, Kolhapur District is located in the south west Maharashtra state, in India .

4.2.2 Study Design

This study was designed for people who suffers from UTI from January - 2020 to March - 2020. Both out and in patients presenting or highly suspicious of having UTI were screened in the study. Patient with a history of antibiotic administration in the

Last two weeks and any female who was in their menstruation period were excluded

from the study. After taking sample from each patient, questionnaires with both open ended questions such as age and closed ended questions with categorical values such as gender were administered. Then midstream urine (MSU) samples were collected from the patients.

Sample Collection

In the study we collected 101 samples from different age group and category by Clean Catch Midstream collection method where patients were asked to clean the periurethral area, (i.e., tip of penises, labial folds and valva) carefully with washing soap and water or mild detergent, then rinsed with warm water to remove detergent. The first portion of voided urine is discarded and the subsequent midstream urine is collected directly into sterile wide mouth container and then it will be used for testing. The urine sample has to be fresh its means that the patient has to take the sample as fast as possible for testing and if any delay of more than 1-2 hours is unavoidable, one of the following methods of storage can be used 'like refrigerate the specimen at 4°C, or using of commercially available urine transport tube containing boric acid, glycerol -sodium formate. After collecting the sample each and every container will be provided with the patient name, gender, and a tag to prevent confusion in the samples.

Sample Processing

After the sample reach the laboratory the sample was monitored by routine urine examination like microscopic examination to make sure that the person has Urinary tractinfection. The mere presence of bacteria in urine does not indicate urinary tract infection the person has to have a count of 10^5 or more organism per millilitre to indicate the disease, there are two methods of microscopic examination one is wet mount which is used to observe pus cells, RBCs, epithelial cells and crystals. Ten or more pus cells per mm³ of undiluted urine is an indication of significant bacteria. The other method is Gram staining of the sample, if the smear shows 1 or 2 bacteria per 2- 3 microscopic field of un-centrifuged urine or 5 bacteria per oil immersion field of centrifuged deposit, it will be considered as significant bacteria. Beside microscopic examination there are other methods like Chemical and Enzymatic methods for indicating Urinary tract infection.

Isolation of pathogenic bacteria from urine sample:

To isolate a single colony the collected sample were streaked directly on MacConky agar and blood agar, and then incubated at 37°C for 24 hours.

3.2.5.1 Identification of Bacteria

Following methods were applied for identification of bacteria.

a) Cultural characteristics

Initially different morphological shape and and colony characters color of *Klebsiella pneumoniae* colonies was appeared on media, large, pink color and very mucoid with lactose -fermenting on MacConkey agar(Figure.1).

Along with *Klebsiella pneumoniae*, *E.coli* and *proteus* species are found on Macconkeys agar showing the pale white and pink coloured colony respectively.

b) Microscopic Examination

The samples were examined microscopically by taking a smear from the growing colonies on the culture media, and it was monitored for the Gram staining to observe the shapes, arrangement and Gram natures of the isolated bacterial cells.

Antibiotic sensitivity test

Antibiotic sensitivity test was performed on the clinical sample from a Urinary Tract

Infection patient to check its resistance against antibiotics like chloramphenicol, erythromycin, fusidic acid, methicillin, novobiocin, penicillin-g, streptomycin & tetracyclin by using Antibiotic Susceptibility Octodisc (HiMedia)G-X-plus is an inert flat circular ring having 8 discs of 6 mm diameter on its projections. These discs are coated with antibiotics that aid antibiotic susceptibility testing of Gram positive organisms. Antibacterial activity was carried out by using Mueller Hinton agar and was autoclaved at 15 lbs. pressure for 20 minutes and cooled to room temperature. The cooled media was poured on to sterile petriplate and allowed for solidification. The plates with media were spread with the respective clinical sample suspension using a spreader. Sterile octodisc was kept on the surface of the agar medium by using sterile forceps. The plates were incubated at 37°C for 24 hours. After incubation period, the diameter of the zone formed around the antibiotic discs were measured and expressed in mm.

(Table 4-4) Octodisc of HiMedia containing antibiotics at different concentrations

Antibiotics	Concentration
Chloramphenicol(C)	25mcg
Erythromycin(E)	5mcg
Fusidic acid(Fc)	10mcg
Methicillin(M)	10mcg
Novobiocin(Nv)	5mcg
Penicillin-G(P)	1unit
Streptomycin(S)	10mcg
Tetracyclin(T)	25mcg

Collection and authentication of plant materials

Selected plant parts such as fruit, flower, stem, leaves, seed and cover of *Terminalia*

catappa Linn. For the proposed study were collected from in and around Kolhapur, Maharashtra, India. Medicinally useful parts of the plants were studied in both fresh and dried conditions as per the standard textual methods.

Preparation of the extract

Powdered samples of fruit, flower, stem, leaf, cover and seed of *T. catappa* L. were used for the preparation of aqueous extracts. Plant powder (50 mg) was taken with 99% ethanol and kept 24 hours (overnight) for extraction. Then, it was filtered using Whatman filter paper. Then, sterile filtration was carried out using sterile syringe & the extract was used for the assessment of antimicrobial activity.

Phytochemical Screening:

Powdered samples of fruit, flower, stem, leaf, cover and seed of *T. catappa* L. were used for the preparation of aqueous extracts. Plant powder (50 mg) was taken with 99% ethanol and kept 24 hours (overnight) for extraction. Then, it was filtered using Whatman filter paper. Then, sterile filtration was carried out using sterile syringe & the extract was used for the analysis of phytochemicals

- **Steroid**

1ml extract was dissolved in 10 ml of chloroform & equal volume of concentrated H₂SO₄ acid was added from the side of test tube. The upper layer turns red and H₂SO₄ layer showed yellow with green fluorescence. This indicates the presence of steroid.

- **Saponin**

5 ml extract was mixed with 20 ml of distilled water then agitated in graduated cylinder for 15 min formation of foam indicates Saponin.

- **Coumarin**

3 ml of 10% NaOH was added to 2 ml of aqueous extract formation of yellow colour indicates coumarins.

- **Emodin:**

2ml of NH₄OH and 3 ml of benzene was added to extract appearance of red colour indicates presence of emodins.

- **Alkaloids**

A quantity (3 ml) of concentrated extract was taken into a test tube and 1 ml HCl

was added the mixture was heated gently for 20 min cooled and filter, the filtrate was used for following test. I) Wagner test: Filtrate was treated with Wagner's reagent; formation of brown reddish precipitate indicates presence of alkaloids. ii. Hager's test: Filtrate was treated with Hager's reagent, presence of alkaloids confirmed by the yellow colored precipitate.

- **Phenol**

Ferric Chloride test: Test extract were treated with 4 drops of Alcoholic FeCl₃ solution. Formation of bluish black colour indicate the presence of Phenol.

Disc preparation:

6mm (diameter) discs were prepared from Whatman filter paper. The discs were sterilised by autoclaving at 121 C. After sterilization the discs were impregnated with different filtrate test samples.

Micro-organisms:

Bacterial species like *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella species*, *Pseudomonas aeruginosa* and fungal species like *Candida albicans* were selected for antimicrobial efficacy studies. The bacterial isolates were first cultured on nutrient agar slants and incubated at 37°C for 24 hours while the fungus *Candida albicans* was cultured on potato dextrose agar/ MGY media for 37°C for 78 hours

Antibacterial activity by agar well diffusion assay

The media was sterilised by autoclaving at 121°C & after sterilisation the media was poured onto sterile petri plates. After pouring the plates were spread with the respective organisms and the plates were kept at 37°C for 24 hours.

Method:

Antibacterial activity was carried out by standard method. Mueller Hinton agar was prepared and autoclaved at 15 lbs. pressure for 29 minutes and cooled to room temperature. The cooled media was poured on to sterile Petri plates and allowed for solidification. The plates with media were spread with the respective bacterial suspensions using a spreader. Wells were bored with the help of a sterile borer in the agar medium. Each well was labelled with the help of a marker and the filtrate was filled in the respective well. (E.g., Fruit, flower, stem, leaf, etc.) Each plate containing 4

samples and Ethanol as a control. The plates were incubated at 37°C for 24 hours. After incubation period, the diameter of the zone formed around the wells were measured and expressed in mm. In the present study antibacterial activity of aqueous extracts of fruit, flower, stem, leaf, seed of *Terminalia catappa* L. was evaluated against microorganisms like gram positive bacteria like *Bacillus cereus*, *Staphylococcus aureus* & Gram negative bacteria like, *Salmonella typhi* & *Pseudomonas aeruginosa*.

2. Results and discussion:

Sample structure:

For study of microorganisms induced illness of UTI amongst 101 patients their urine samples were collected and screened for the isolation. It was observed from table 1. Overall sample there is a 59.09 % of females were suffered from symptoms of UTI and remaining were male.

As urethra and perineum are normally colonized, specimens of urine are frequently contaminated with normal flora from urethra and perineum. There is several methods for preventing contamination of urine sample and these methods are (Suprapubic Aspiration, Catheterization and Clean-Catch Midstream Collection). We used Clean Catch Midstream collection method in the study, it considers one of most convenient and most commonly used method for urine collection,

(Table 5-1). Distribution of patients on the basis of gender, age and medical history.

Gender				Total
Male		Female		24
45		65		
Age				
Below 30		Above 30		24
Male	Female	Male	Female	
10	30*	25	35	

Isolation and identification of the microorganisms on the basis of morphological, biochemical and microscopic examination:

Isolated microbial colonies from urine sample were monitored for the identification using different parameters like morphological including colony characters and Gram staining (Figure 1) and biochemical tests (Table 2) including Vitek-2 identification and sensitivity system (Forbes, 2007). It was observed that isolated microorganism is gram negative microorganism. Figure 5-1: Colony characters; isolated colonies appears pink color and very mucoid with lactose -fermenting on MacConkey and Gram-negative short rods

Antimicrobial Susceptibility testing for isolated microorganism

Antibiotic susceptibility test of the test organism isolated from the clinical samples of Urinary Tract Infection shows resistance against number of antibiotics (Table 2) such as penicillin-g, aminoglycoside such as gentamycin, kanamycin, streptomycin and cephalosporins which states that the organism causing infection is highly drug resistant whereas, zone of inhibition was only observed against tetracycline.

(Table no 5-2) Antibiotic sensitivity test of the clinically isolated sample

Antibiotics	Zone of inhibition (mm)
Chloramphenicol (C)	-
Erythromycin (E)	-
Fusidic acid (Fc)	-
Methicilin (M)	-
Novobiocin (Nv)	-
Penicilin-G (P)	-
Streptomycin (S)	-
Tetracyclin (T)	15mm

Antibiotic mode of action is as follows;

1) Erythromycin($C_{37}H_{67}NO_{13}$):

Erythromycin is a broad spectrum antibiotic. It binds to the 50S ribosomal subunit of bacteria and prevents bacterial protein synthesis by binding to the enzyme peptidyltransferase.

2) Fusidic acid($C_{31}H_{48}O_6$):

Fusidic acid is a steroid antibiotic extracted from *Fusidium coccineum* which is also involved in protein synthesis inhibition.

3) Methicillin($C_{17}H_{20}N_2O_6S$):

Methicillin is a semisynthetic type of antibiotic. It is a narrow spectrum antibiotic which is a derivative of Penicillin antibiotic with bactericidal and β lactamase resistant activity. It prevents cross linking of peptidoglycan and inhibits cell wall synthesis.

4) Penicillin-G($C_{16}H_{18}N_2O_4S$):

It is a broad spectrum antibiotic consisting of β lactam ring which interferes with the cross linkage of peptidoglycan and inhibits cell wall synthesis.

5) Streptomycin($C_{21}H_{31}N_7O_{12}$):

It is a broad spectrum antibiotic, an aminoglycoside antibiotic derived from *Streptomyces griseus*. It irreversibly binds to 16S rRNA and S12 protein of bacterial 30S ribosomal subunit and interferes in the protein synthesis.

6) Tetracycline($C_{22}H_{24}N_2O_8$):

It is a semisynthetic, broad spectrum naphthacene antibiotic isolated from *Streptomyces aureofaciens*. It binds to 30S ribosomal subunit and interferes with the binding of amino acyl tRNA to mRNA ribosome complex and inhibits protein synthesis.

7) Tigecycline ($C_{29}H_{39}N_5O_8$): Tigecycline is used to treat certain serious bacterial infections when other antibiotics may not work. It is related to a class of drugs known as tetracycline antibiotics. It works by stopping the growth of bacteria. This drug binds to the 30s ribosomal subunit of bacteria and blocks entry of amino acyl transfer RNA into the A site of the ribosomes it has 5 times more efficiency than tetracycline.

5. 4 Phytochemical analysis

Preliminary phytochemical investigation of the ethanolic extract of fruits, flower, stem, leaf, seed cover of the plant *Terminalia catappa* Linn. Led to the presence of Saponin, Steroids, Coumarin, Alkaloids & Phenols, whereas Emodins were absent (Table no.2). On the basis of this data researcher can easily isolate particular metabolite from the various parts of plant quantitatively.

(Table5-3)Phytochemicalanalysisofvariousplantpartsof *Terminaliacatappa*

Linn.

SR.	TESTS	RESULT	SAMPLES
1	Steroid: 1ml of extract+10ml Of aq.Chloroform+ Equal amount of concentratedH ₂ SO ₄	Upper layer of the	Fruit +
		Solution turns red and	Flower -
		H ₂ SO ₄ shows yellow	Stem +
		Colour with	Leaf -
		fluorescence	Seed +
		Cover +	
2	Saponin(Foam test): 5ml of extract+20 ml distilled water was agitated in a graduated cylinder for 15 minutes	Foam formation	Fruit +
			Flower -
			Stem -
			Leaf -
			Seed +
		Cover +	
3	Coumarin:	Yellow colour	Fruit +

	<p>3ml 10% NaOH + 2ml of extract</p>		<p>Flower + Stem + Leaf + Seed - Cover + Fruit -</p>
<p>4</p>	<p>Emodins:</p>	<p>Red colour</p>	
	<p>3ml Benzene + 1ml NH₄OH + 1 ml of extract</p>		<p>Flower - Stem - Leaf - Seed - Cover - Fruit +</p>
<p>5</p>	<p>Alkaloids:</p>	<p>Brown precipitate formed</p>	
	<p>3 ml of extract + 1 ml HCl mix and heat for 20 minutes. Then cool & filter the extract.</p> <p>WAGNER'S TEST:-</p> <p>1 ml filtrate + 1 ml Wagner's reagent</p>		<p>Flower + Stem + Leaf - Seed + Cover + Fruit -</p>
<p>6</p>	<p>Phenol:</p>	<p>Bluish black colour</p>	

FERRICCHLORIDE	Flower	-
TEST:- 1 ml of extract treated with 4 drops of alcoholic ferricchloride solution	Stem	+
	Leaf	-
	Seed	-
	Cover	-

5.5 Antimicrobial activity against known bacteria:

(Table 5-4): Antibacterial activity of aqueous extracts of different parts of *T. catappa L*

SR.NO.	Bacteria	Control (Ethanol)	Zone of inhibition (in mm) 50			
			µg	Flower	Fruit	Stem
1	<i>Bacillus cereus</i>	No zone	14	11	16	12
2	<i>Staphylococcus aureus</i>	15	15	16	16	15
3	<i>Salmonella typhi</i>	No zone	17	8	20	11
4	<i>Pseudomonas aeruginosa</i>	No zone	16	11	20	15

Ethanol extract of stem produced maximum inhibition zone of 20 mm for

Salmonellatyphi & *Pseudomonasaeruginosa* among the tested organisms. The ethanolic extract of stem was found to be more potent in controlling the growth of

gram negative bacteria. The fruits extract produced maximum inhibition zone against *Staphylococcus aureus* (16 mm) when compared to stem, fruit extract was found to be effective against gram positive organisms. From the data of the results obtained, it was evident that the extracts of test drugs produced dose dependent bacteriostatic activity. Maximum zone of inhibition was obtained at a concentration of 50 µg/ml concentration of the extract. Among the test drugs, all the parts of the plant shows effectiveness against gram positive as well as gram negative organisms.

Protection against infectious diseases is considered as the primary function of the immune system. A well-functioning immune system resists harmful invasions of pathogens through its innate and adaptive arms of immune responses. In immunocompromised conditions, herbal supplements can be used as adjuvants to enhance the function of the immune system. In this way, herbal drugs which show promising antimicrobial activity can be considered as immune enhancers. Hence in the present study, antimicrobial activity of the selected plant drugs was evaluated against some bacterial and fungal pathogens.

5.6 Antimicrobial activity of extract against isolated pathogenic bacteria.

Antibacterial activity of the plant *Terminalia catappa* Linn. also studied against isolated bacteria from clinical sample of Urinary tract infection. After investigation it was observed that the maximum zone of inhibition was seen at 50µl of ethanolic extract (Table 4) of cover which is 28mm and minimum zone at the same concentration which is 12mm respectively. At 80µl (table 5) concentration of the ethanolic extracts of different parts of *Terminalia catappa* Linn. Maximum zone of inhibition is observed by fruit i.e. 20mm and minimum zone of inhibition by seed i.e. 10 mm. This means at low concentration (50µl) of each ethanolic extract of various parts of *Terminalia catappa* Linn. maximum zones of inhibition was observed and at higher concentration (80µl) of ethanolic extracts of various parts of the plant shows minimum zones.

(Table 5-5) Antibacterial activity of aqueous extracts of different parts of *T. catappa*

L. on bacteria isolated from clinical sample of Urinary Tract Infection by disc diffusion method (50 µl).

SR.NO	Samples	Zone of inhibition in mm(50µl)
--------------	----------------	---------------------------------------

1	Fruit	13
2	Flower	No zone
3	Stem	12
4	Leaf	23
5	Seed	19
6	Cover	28
7	Ethanol	Nozone

(Table5-6)Antibacterialactivityofaqueousextracts of different partsof *T.catappaL.* on bacteria isolated from clinical sample of Urinary Tract Infection by disc diffusion method (80 µl)

SR.NO	Samples	Zone of inhibition in mm(80µl)
1	Fruit	20
2	Flower	Nozone
3	Stem	11
4	Leaf	14

5	Seed	10
6	Cover	No zone
7	Ethanol	No zone

5. Summary and Conclusion:

This project report gives information regarding microorganisms causing urinary tract infections. Further, extraction and analysis of phytochemicals were done from *T. catappa* and then used against these microorganisms to overcome the antibiotic resistance problem.

It was observed that the extract of this plant showed good impact on normal lab isolates as well as pathogens isolated from clinical urine samples of UTI patients. The phytochemical extract showed prominent antimicrobial activity against isolated pathogenic bacteria. The plant contains phenols, alkaloids, emodins, coumarins, saponin, and steroids from its various parts. However, further studies are needed to explore pharmacological properties of *Terminalia catappa* L for its potential in preventing UTI causing pathogenesis. Overall, this study revealed the usefulness of medicinal plant *Terminalia catappa* L to control UTI infections caused by pathogenic microorganisms.

References:

- 1) Kumar, S.G., Adithan, C., Harish, B.N., Sujatha, S., Roy, G. and Malini, A., 2013. Antimicrobial resistance in India: A review. *Journal of natural science, biology, and medicine*, 4(2), p.286.
- 2) Rossolini, G.M., Arena, F., Pecile, P. and Pollini, S., 2014. Update on the antibiotic resistance crisis. *Current opinion in pharmacology*, 18, pp.56-60.
- 3) Dash, M., Padhi, S., Mohanty, I., Panda, P. and Parida, B., 2013. Antimicrobial resistance in pathogens causing urinary tract infections in a rural community of Odisha, India. *Journal of family & community medicine*, 20(1), p.20.
- 4) Omorie, R., Erebor, J.O., Ahonkhai, I., Isibor, J.O. and Ogefere, H.O., 2008. Observed changes in the prevalence of uropathogens in Benin City, Nigeria. *NZJ Med Lab Sci*, 62(2), pp.29-31.
- 5) Gupta, K., Hooton, T.M., Naber, K.G., Wullt, B., Colgan, R., Miller, L.G.,

- Moran, G.J., Nicolle, L.E., Raz, R., Schaeffer, A.J. and Soper, D.E., 2011. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: a 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clinical infectious diseases*, 52(5), pp.e103-e120.
- 6) Zhang, X.R., Kaunda, J.S., Zhu, H.T., Wang, D., Yang, C.R. and Zhang, Y.J., 2019. The genus *Terminalia* (Combretaceae): An ethnopharmacological, phytochemical and pharmacological review. *Natural products and bioprospecting*, 9(6), pp.357-392.
- 7) yMesa, J.T.R., 1945. *Plantas medicinales, aromáticas y venenosas de Cuba*.
Ministerio de Agricultura, Servicio de Publicidad y Divulgación.
- 8) Greenberg, R.M., 2013. New approaches for understanding mechanisms of drug resistance in schistosomes. *Parasitology*, 140(12), p.1534.
- 9) Bansal, D., Malla, N. and Mahajan, R.C., 2006. Drug resistance in amoebiasis. *Indian Journal of Medical Research*, 123(2), p.115.
- 10) Loeffler, J. and Stevens, D.A., 2003. Antifungal drug resistance. *Clinical infectious diseases*, 36(Supplement_1), pp.S31-S41.
- 11) Chethana, G.S., Hari, V.K.R., Mirzaei, F. and Gopinath, S.M., 2013. Review on multidrug resistant bacteria and its implication in medical sciences. *J Biol Sci Opin*, 1, pp.32-37.
- 12) Tanwar, J., Das, S., Fatima, Z. and Hameed, S., 2014. Multidrug resistance: an emerging crisis. *Interdisciplinary perspectives on infectious diseases*, 2014.
- 13) Dalziel, J.M., 1937. The useful plants of west tropical Africa. *The useful plants of West Tropical Africa*.
- 14) Batawila, K., Kokou, K., Koumaglo, K., Gbeassor, M., De Foucault, B., Bouchet, P. and Akpagana, K., 2005. Antifungal activities of five *Combretaceae* used in Togolese traditional medicine. *Fitoterapia*, 76(2), pp.264-268.
- 15) Lin, C.C., Chen, Y.L., Lin, J.M. and Ujii, T., 1997. Evaluation of the antioxidant and hepatoprotective activity of *Terminalia catappa*. *The American journal of Chinese medicine*, 25(02), pp.153-161.
- 16) Mohale, D.S., Dewani, A.P., Chandewar, A.V., Khadse, C.D., Tripathi, A.S. and Agrawal, S.S., 2009. Brief review on medicinal potential of *Terminalia catappa*. *Journal of Herbal Medicine and Toxicology*, 3(1), pp.7-11.
- 17) Gilman, E.F. and Watson, D.G., 1994. *Terminalia catappa*. *Fact Sheet ST-626*.
- 18) Lin, Y.L., Kuo, Y.H., Shiao, M.S., Chen, C.C. and Ou, J.C., 2000. Flavonoid

glycosides from *Terminalia catappa* L. *Journal of the Chinese Chemical Society*, 47(1), pp.253-256.

- 19) Oliveira, J.T.A., Vasconcelos, I.M., Bezerra, L.C.N.M., Silveira, S.B., Monteiro, A.C.O. and Moreira, R.A., 2000. Composition and nutritional properties of seeds from *Pachira aquatica* Aubl, *Sterculia striata* St Hil et Naud and *Terminalia catappa* Linn. *Food Chemistry*, 70(2), pp.185-191.
- 20) Duke, A.J. and JM, B.G., Dr. Duke's Phytochemical and Ethnobotanical Databases.[Online Database] 2015.
- 21) Mohale, D.S., Dewani, A.P., Chandewar, A.V., Khadse, C.D., Tripathi, A.S. and Agrawal, S.S., 2009. Brief review on medicinal potential of *Terminalia catappa*. *Journal of Herbal Medicine and Toxicology*, 3(1), pp.7-11.
- 22) Masuda, T., Yonemori, S., Oyama, Y., Takeda, Y., Tanaka, T., Andoh, T., Shinohara, A. and Nakata, M., 1999. Evaluation of the antioxidant activity of environmental plants: activity of the leaf extracts from seashore plants. *Journal of Agricultural and Food chemistry*, 47(4), pp.1749-1754.

Morioka, T., Suzui, M., Nabandith, V., Inamine, M., Aniya, Y., Nakayama, T., Ichiba, T. and Yoshimi, N., 2005. Modifying effects of *Terminalia catappa* on azoxymethane-induced colon carcinogenesis in male F344 rats. *European Journal of Cancer Prevention*, 14(2), pp.101-105.
- 23) Braga, F.C., Serra, C.P., Júnior, N.S.V., Oliveira, A.B., Côrtes, S.F. and Lombardi, J.A., 2007. Angiotensin-converting enzyme inhibition by Brazilian plants. *Fitoterapia*, 78(5), pp.353-358.
- 24) Chitmanat, C., Tongdonmuan, K., Khanom, P., Pachontis, P. and Nunsong, W., 2003, February. Antiparasitic, antibacterial, and antifungal activities derived from a *Terminalia catappa* solution against some tilapia (*Oreochromis niloticus*) pathogens. In *III WOCMAP Congress on Medicinal and Aromatic Plants-Volume 4: Targeted Screening of Medicinal and Aromatic Plants, Economics 678* (pp. 179-182).
- 25) Kamtchouing, P., Kahpui, S.M., Dzeufiet, P.D.D., Tedong, L., Asongalem, E.A. and Dimo, T., 2006. Anti-diabetic activity of methanol/methylene chloride stem bark extracts of *Terminalia superba* and *Canarium schweinfurthii* on streptozotocin-induced diabetic rats. *Journal of Ethnopharmacology*, 104(3), pp.306-309.
- 26) Ellery, K. and Ellery, W., 1997. *Plants of the Okavango Delta: a field guide*.

Tsaro..

- 27) Kinoshita, S., Inoue, Y., Nakama, S., Ichiba, T. and Aniya, Y., 2007. Antioxidant and hepatoprotective actions of medicinal herb, *Terminalia catappa* L. from Okinawa Island and its stannin corilagin. *Phytomedicine*, 14(11), pp.755-762.
- 28) Shinde, S.L., Junne, S.B., Wadje, S.S. and Baig, M.M.V., 2009. The diversity of antibacterial compounds of *Terminalia* species (*Combretaceae*). *Pakistan Journal of Biological Sciences*, 12(22), p.1483.
- 29) Jagessar, R.C. and Alleyne, R., 2011. Antimicrobial potency of the aqueous extract of leaves of *Terminalia catappa*. *Academic Research International*, 1(3), p.362.

Hierarchical Distribution of Towns in Kolhapur District

Dr Sunil Bhosale, Dr Govardhan Ubale, Dr. Sidharth Ghoderao
Vivekanand College (Autonomous), Kolhapur

Introduction:

Maharashtra is one of the advanced states in the country as far as industries are concerned. Similarly, Kolhapur is also one of the developing districts of the state. According to the Census 2011 district Kolhapur has a total population of 38,76,001, comprising of 19,80,658 males and 18,95,343 females constituting 3.4 per cent of state's population spread over 2.5 per cent of its area. The proportion of urban population to total population for Kolhapur district increased from 29.81 per cent in 2001 to 31.75 per cent in 2011 Census. Nearly 32 per cent population living in urban areas. This indicates a bottom level of urbanization in the district. Because of there were agricultural dominant.

The level of urbanization is a good indicator of level of development and also provides the base for analyzing the quality of life in spatial perspective. In this paper an attempt has been made to examine the levels of urbanization and development as well as to look into hierarchy of towns and its impact of urban centres on their peripheries. The entire study is based on primary and secondary data. Data is mainly derived from the District Census Handbook of Kolhapur and field work. Hierarchy of towns is calculated from rank size Rule method.

Objectives:

1. To look into distribution and growth of urban population in Kolhapur district.
2. To measure the Hierarchical distribution towns in Kolhapur district.
3. To Calculate Primacy index of town in Kolhapur District.

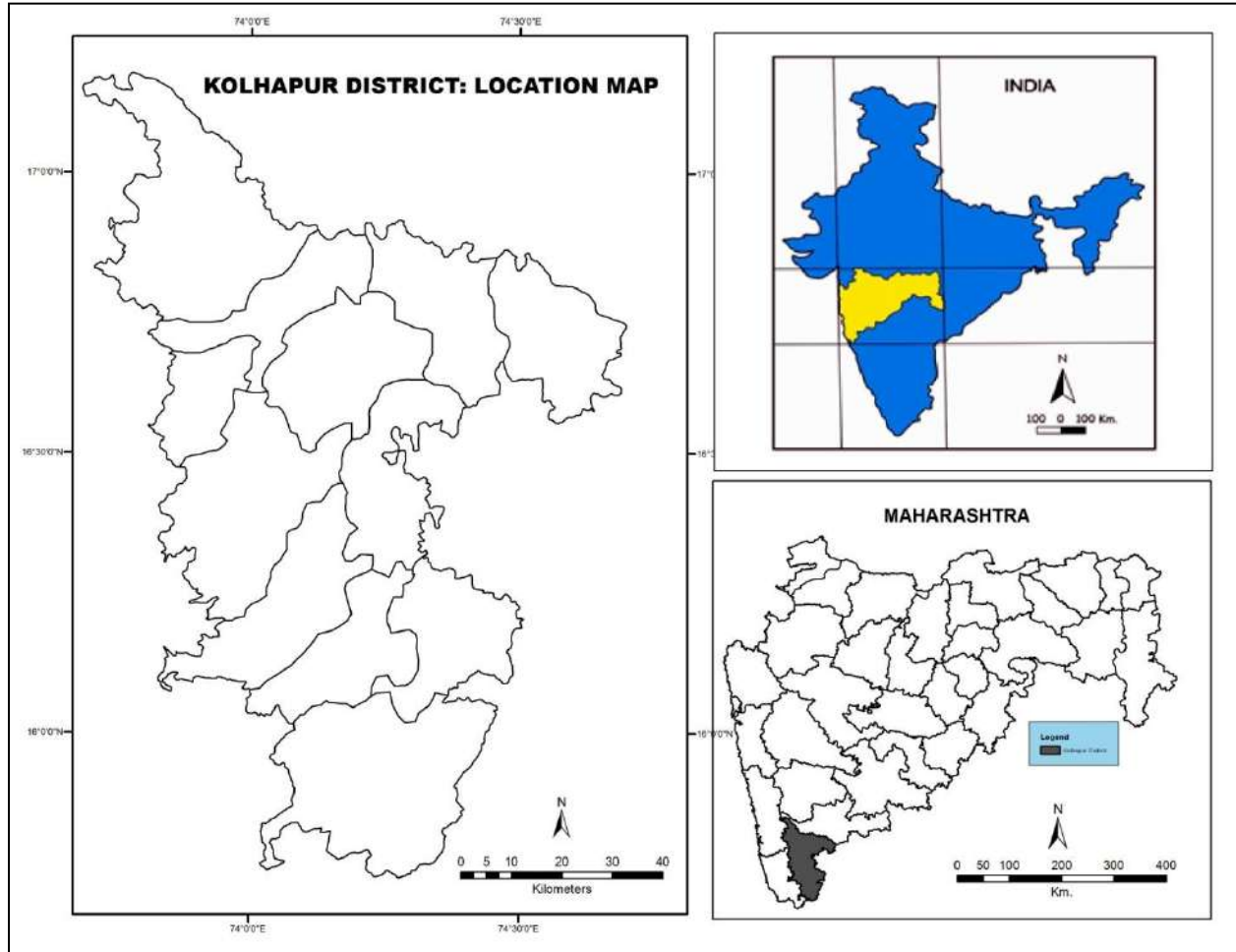
Data Base and Methodology:

The present study is mainly based on the primary and secondary data. Data is mainly derived from the district census handbook of Kolhapur 1991 and 2001. Development indicators data computed from 1991 and 2001 census handbook of Kolhapur district and 2013 data are collected from field work. To measure the Hierarchical distribution of towns by population size class method and to calculate Primacy index. Apart from the statistical techniques, various cartographic techniques have been employed to construct the maps, graphs and diagrams to understand the spatial patterns and processes in distribution and development of towns.

Study Area:

Kolhapur district is situated in the extreme southern part of Maharashtra State. It lies between 15° 43' and 17° 17' north latitudes and 73° 40' and 74° 42' east longitudes. It is surrounded by Sangli district to the north, Karnataka State to the east and south and Ratnagiri

and Sindhudurg districts to the west. The Sahyadri ranges to the west and Varna river to the north form the natural boundaries.



The district has an area of 7,685.00 sq. km.; population of 3,876,001 persons as per Census 2011. While the area of the district accounts for 2.5 percent of the total area of the State. The headquarters of the district is at Kolhapur, a city with a population of 549283 as per provisional population 2011 Census. Kolhapur was the capital of the former Kolhapur State, a premier State of the Deccan and was also the seat of the Residency for Deccan States. It derives its importance from its past political associations and its present position as a great commercial, religious, cultural and educational centre. It is well connected both by road as well as by rail.

Distribution and Growth of Urban Population in Kolhapur District 1991 – 2001.

According to census 2001 the district Kolhapur has a total population of 3523162 comprising of 1807470 males and 1715692 female constituting 3.6 per cent of states population spread over 2.5 per cent of its area. Among the 12 tehsil of the district Karvir tehsil is most populous and Bavda tehsil the least.

Table No: 1

Decadal Change in Population of Tehsil by Residence, 1991-2001

Sr. No	Tehsil	Decadal Variation 1991 - 2001	1991 Urban Population in %	2001 Urban Population in %
1	Shahuwadi	5.1	3.3	3.1
2	Panhala	16.3	1.4	1.4
3	Hatkanangale	39.2	44.3	50.0
4	Shirol	17.8	17.7	17.9
5	Karvir	31.1	56.7	60.5
6	Bavda	0.0	0.0	0.0
7	Radhanagari	0.0	0.0	0.0
8	Kagal	17.3	13.2	13.3
9	Bhudargad	0.0	0.0	0.0
10	Ajra	0.0	0.0	12.2
11	Gadhinglaj	13.3	11.3	11.7
12	Chandgad	0.0	0.0	0.0
Total	Kolhapur Dist.	33.5	26.3	29.8

Source: Kolhapur District censuses Handbook 2001.

In Kolhapur district out of the total population 70.2 per cent are residing in rural areas and remaining 29.8 per cent in urban areas. The proportion of urban to total population for Kolhapur district increased from 26.3 percent in 1991 to 29.8 per cent in 2001 census. Nearly 30 per cent population living in urban areas. This indicates a very low level of urbanization in the district. It is observed that only Shahuwadi tehsil has shown decrease in proportion of urban population (3.3 per cent in 1991 to 3.1 per cent in 2001) 5 tehsil viz., Hatkanangale 44.3% to 50.00%, Shirol 17.7 % to 17.9 %, Karvir 56.7 % to 60.5 %, Kagal 13.2% to 13.3% & Gadhinglaj 11.3% to 11.7% in 1991 to 2001 have shown increase in proportion of urban population. Bavda, Radhanagari, Bhudargad & Chandgad tehsil did not have areas & remaining one tehsil Ajra new census Town created after 1991 census.

In urban areas Hatkanangale tehsil has the highest growth rate (39.2 per cent) because of two census towns newly form after 1991 census. Shahuwadi tehsil has shown the lowest growth rate (5.1 per cent) out of 12 tehsil only Hatkanangale tehsil (39.2 per cent) has registered growth rate above the district average while 6 tehsil Shahuwadi (5.1 per cent) Panhala (16.3 per cent) Shirol (17.8 per cent), Karvir (31.1 per cent), Kagal (17.3 per cent) & Gadhinglaj (13.3 per cent) falls below the district urban average 4 tehsil recorded nil urban areas.

Hierarchy of Town's In Kolhapur District

In India hierarchy of places as recognized in the census of population is popular. In Kolhapur District above the features of primacy are reflected in the uneven development of different segments of the urban hierarch from below table it is observed that the proportion of population in towns of Kolhapur District above 1,00,000 large town categories has increased

from 63.49 % in 1951 to 71.48 % in 2001. On other hand share of population has declined from 27.15 % in 1931 to 2.56 % in 2001. The decrease in the share of population of towns less than 10000 reflects the absence of a vibrant urban system associated with the rapid increase of settlement joining the rank of towns and is a pointer to the lack of economic diversification at the lower level of the urban hierarchy.

Table No: 2

Population Size Class Distribution of Towns in Kolhapur District

Year	Class of Town					
	I (> 100000)	II (50000-99999)	III (20000-49000)	IV (10000-19999)	V (5000-9999)	VI (< 5000)
1931	0.00	61.82	0.00	11.03	20.97	6.18
1941	0.00	62.00	0.00	12.38	20.71	4.91
1951	63.49	0.00	12.72	0.00	22.26	1.53
1961	60.90	16.56	0.00	13.97	6.64	1.92
1971	58.84	19.93	0.00	16.07	3.62	1.53
1981	76.26	0.00	8.73	12.44	1.38	1.19
1991	78.95	0.00	12.46	6.45	1.76	0.38
2001	71.48	0.00	20.50	5.46	2.23	0.33

Source: Kolhapur District Censes Handbook.

Primacy of Kolhapur within Kolhapur District:

In the all states of Northern India show absence of primacy. While the larger states like West Bengal, Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh and newly formed states of Jharkhand, Uttaranchal and Chhatisgarh show tendency for primacy. The efficiency of urban system in any country, state or district is largely dependent upon the distribution of size and spacing of the urban centers. It determines whether the urbanization process is uniform throughout the region or centralized.

In Maharashtra pattern of urbanization has been mainly large city oriented. When considered within Kolhapur district, there is not another centre which has able to go near Kolhapur in terms of population growth or even its economic development. The Index of Primacy for the study area has been calculated. It is found from the respective Census data of each year that in the study area the second largest urban centre, after Kolhapur, has been Ichalkaranji.

$$\text{Index of Primacy} = \frac{\text{Population of the largest city}}{\text{Population of the second-largest city}}$$

Table No: 3

Primacy Index of Kolhapur City upon Kolhapur district.

Year	Index of Primacy
1931	5.61
1941	5.01
1951	4.99
1961	3.68
1971	2.95
1981	2.55
1991	1.89
2001	1.91

Source: District censuses handbook 2001.

The calculation shows that in respective four decades the level of primacy of Kolkata has been decreasing. There are several factors responsible for the growth of primacy: strong centralized Government, economic factors, industrial agglomeration, migration and efficiency of modern transport, of these factors chief two which led to the Kolhapur classic primacy are spread of migration. Kolhapur did not originate primarily as a response to the need of the surrounding rural areas, smaller towns and cities, but it was mainly a product of the administrative and economic needs of the Empire of Rajarshri Chhtrapti Shahu Maharaj in Karveer which was in a sense Kolhapur multifaceted hinterland and domain of influence.

Conclusion:

In Kolhapur district there are 12 tehsil out of this 2 tehsil viz. Karvir (56.7% & 60.5%) and Hatkanangale (44.3% & 50%) tehsil having more than district average (26.3% & 29.8%) of urban population in 1991 and 2011 respectively. It is clearly indicated that in few pocket of district urban population have been concentrated. More than 55% of population concentrated in I class (< 100000 Population) Towns. Kolhapur Municipal Corporation is a primate city within District according to 1931 to 2011.

Reference:

1. Kolhapur District Census Handbook 1991 and 2001.
2. Khullar (2007): “India A Comprehensive Geography”, Kalyani Publication, Ludhiana, p.p. 414 – 419.
3. Singh. R.Y (1994): Geography of Settlements, Rawat Publications, Jaipur.

Identification of Land Use Land Cover and Change Detection Analysis of Case Study Shirol Tehsil in Kolhapur District Using GIS And Remote Sensing Techniques

Dr. Siddharth S. Ghoderao¹ Dr. Govardhan S. Ubale² Dr. Sunil G. Bhosle³

Department of Geography, Vivekanand College, Kolhapur (Autonomous) Maharashtra.

INTRODUCTION

Land use/cover is a key factor in controlling climate change, meteorological conditions and air quality forecast. One of the main obstacles facing environmentalists is the change in land use and cover. It not only affects the watershed's hydrological response and carbon pool, but it also sets off a series of events that worsen every aspect of human life, including increased flooding, increased soil erosion, increased reservoir sedimentation, altered rainfall patterns, decreased rainfall, etc. Modern approaches to managing natural resources and tracking environmental change now heavily emphasize changes in land use and land cover. For the management and planning of natural resources, maps of land use and land cover are essential. These land use/cover codes offer a uniform framework for classifying different types of land units.

SIGNIFICANCE OF RESEARCH

Shirol Tehsil land use land cover and change detection analysis will aid in identifying and comprehending the changes that have occurred in the area over time. This data can be used to make decisions about land use planning and management. The findings of this study will help to inform decisions about land use planning and management, as well as protect our environment. A significant contribution to our understanding of land use change. If the study discovers a significant increase in the amount of urban development in the area, it could be used to argue for the need to invest in infrastructure such as roads, schools, and hospitals. Make future development and conservation plans. A government agency could use the data to identify areas for residential growth and agricultural land reduction.

OBJECTIVE

- To Study the Identification of land use land cover in Shirol Tehsil.
- To Study the change detection analysis of case study Shirol tehsil.

STUDY AREA

Shirol Tehsil is situated in Maharashtra's Kolhapur District. The study area is situated in Maharashtra's southern region. Shirol is located at India country in the Districts place category with the GPS coordinates of 16° 44' 9.6144" N and 74° 36' 14.8248" E. Shirol Tehsil has a total area of 503 km², of which 34.87 km² is urban and 468.52 km² is rural. Shirol Tehsil has a total population of 3, 91,015 people, of which 70,882 live in urban areas and 3, 20,133 reside in rural areas. The population density in Shirol Tehsil is 776.8 people per square km. In

recent years, the Shirol Tehsil has experienced significant urbanization and industrialization, particularly along the National Highway 4 (NH4) that passes through the region. This has led to converting agricultural land and forested areas into urban areas and industrial estates.

METHODOLOGY

Methodology is one of the most important parts of any research work. The present study has integrated data from different sources and used different methods and approaches to analyse the long-term land use land cover changes in the Shirol tehsil. Grid-based classification was applied as a new approach for the image classification purpose. Varieties of software's were employed in the present study following the different requirements of the work. The ERDAS (Earth Resources Data Analysis System) Imagine was used for image processing, masking and classification. Meanwhile, ArcGIS was employed for database development, spatial data analysis, producing thematic maps.

In this study we downloaded two satellite images from the USGS website (<http://glovis.usgs.gov>) covering the 20-year time frame from 2001 to 2021. The ETM + satellite data with 30m spatial resolution with four spectral band was used to create LULC map. First, we download satellite data of Shirol tehsil for 2001 and 2021. Then using ArcGIS layer stack this satellite image and Mosaic was created to cover the whole area then composite into Shirol tehsil. After that using ERDAS software we do supervised classification of those image and prepare Land Use/Land cover map of Shirol tehsil. Elevation data for DEM, collected from internet (USGS site) which was used to create slop, hill shade, aspect, and contour map. Landsat ETM+ satellite data were used to generate land use and land cover map for 2001 and 2021 and Landsat 7 satellite images taken from the USGS website. • SRTM DEM image from USGS. The following Landsat data is used to create a land use/land cover map.

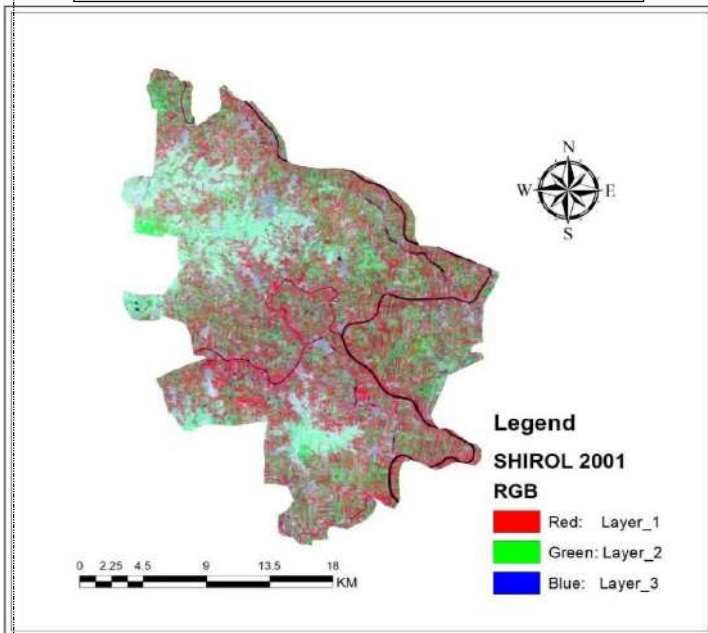
LAND USE LAND COVER

Land use is the actual use of the land by its human inhabitants. Land use is the purpose of human activity on the land. It is usually but not always related to the land cover. Land use may at times be based on property boundaries but the actual use of the land will not necessarily correspond to land ownership. Land use is the way in which, and the purposes for which, human beings employ the land and its resources: for example, farming, mining, or lumbering. Land cover describes the physical state of the land surface: as in cropland, mountains, or forests. The term land cover originally referred to the kind and state of vegetation (such as forest or grass cover), but it has broadened in subsequent usage to include human structures such as buildings or pavement and other aspects of the natural environment, such as soil type, biodiversity, and surface and groundwater.

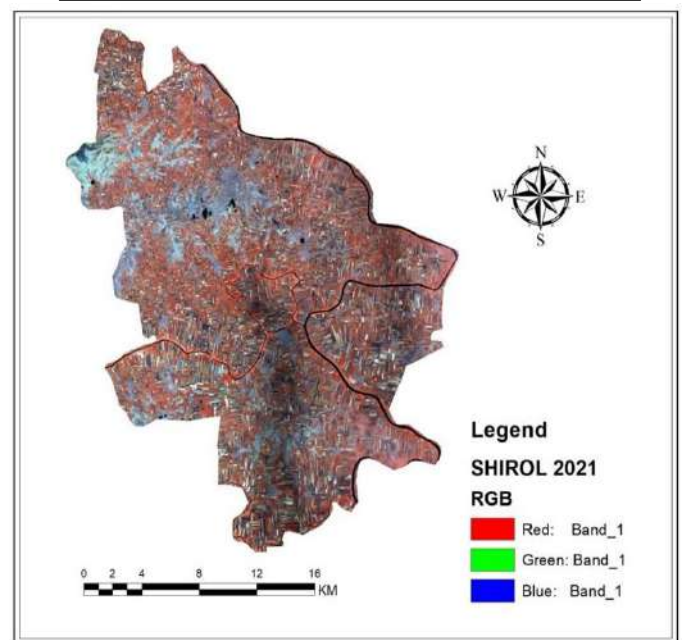
Land cover is the physical material at the surface of the earth. Land covers include grass, asphalt, trees, bare ground, water, etc. There are two primary methods for capturing information on land cover: field survey and thorough analysis of remotely sensed imagery. Land cover is distinct from land use despite the two terms often being used interchangeably. Land use is a description of how people utilize the land and socio-economic activity - urban and agricultural land uses are two of the most commonly recognized high-level classes of use.

At any one point or place, there may be multiple and alternate land uses, the specification of which may have a political dimension.

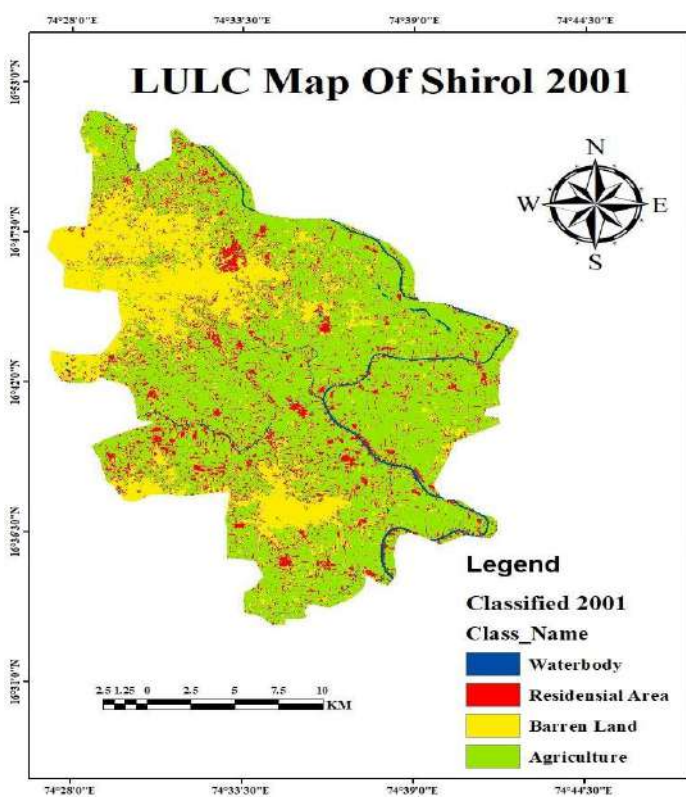
LAND USE LAND COVER 2001



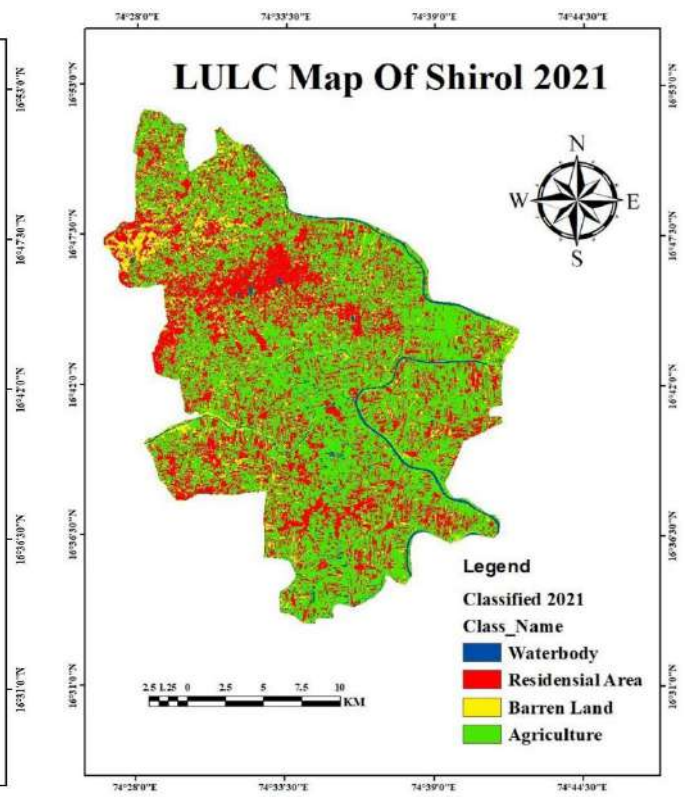
LAND USE LAND COVER 2021



LULC Map Of Shirol 2001



LULC Map Of Shirol 2021



CONCLUSION

The land use and land cover of Shirol tehsil in Kolhapur district were compared in 2001 and 2021. The rise in residential area could be attributed to population growth and urbanization. The map depicts the detection of change in the area of various land classes in a Shirol tehsil from 2001 to 2021. During the 20 years, the tehsil's proportion of total area increased by 12.2%. Residential areas increased by 179.5 percent during this period. The total area of water increased by 221.67 hectares or 26.7%. Agriculture decreased by 3251.7 hectares (9.9%), while barren land decreased by 7593.37 hectares (65.8%). Climate change may be to blame for the increase in water body area. The decrease in agricultural land area could be attributed to a shift to more intensive farming methods or the conversion of agricultural land to other uses, such as residential or commercial development. The reduction in barren land area could be attributed to reforestation or other land reclamation efforts.

The analysis of Shirol Tehsil land use patterns between 2001 and 2021 reveals several significant changes. Water bodies have expanded slightly, indicating potential changes in water resources and hydrological conditions in the region. The agricultural land has shrunk, implying potential changes in agricultural practices, land conversion, or land management strategies. Shirol Tehsil's residential area has grown significantly, indicating rapid urbanization and population growth. Barren land has decreased, indicating the possibility of land development or conversion of previously barren areas to other land use categories. Population growth, economic development, and climate change are all likely causes of changes in land use and land cover. Population growth has increased land demand, resulting in the conversion of agricultural land to residential and commercial use. Economic development has also increased demand for land, as businesses have expanded and new industries have emerged. Climate change has also contributed to changes in land use and land cover by increasing the frequency and intensity of extreme weather events such as floods and droughts. The findings indicate that the land use landscape in Shirol Tehsil has changed over the last two decades. These land use changes could be influenced by urbanization, population growth, and changes in agricultural practices. A more detailed analysis that takes into account other factors such as industrial development, infrastructure projects, and environmental policies, on the other hand, would provide a more comprehensive understanding of the underlying causes.

References:

1. M. B. Nanavati (Foreward): Readings in land utilization, The Indian Society of Agricultural Society of Agricultural Economics, Bombay, 1957. P. 2.
2. Das, M.M. (1958): 'Land use Pattern Assam', Geographical Review of India, Vol. 43, No. 3, pp. 243- 244.
3. Jainendra Kumar (1986): "Land Use Analysis-A Case Study of Nalanda District", Bihar Inter- India Publication, New Delhi.
4. Dr. Hajare R. V., Shinde A. S. and Mane S. P. (2014), "A Geographical Analysis of Problem Associated With Low Nutrition Level in Solapur District Maharashtra, (India)". Journal of Golden Research Thoughts, Volume IV, Sept.

2014, ISSN 2231-5063, DOI Prefix 10.9780/2215063, Journal with Impact Factor 2.2052. Pp-1-6.

5. Das, M.M. (1984): “Agricultural Landuse And Cropping Pattern In Assam”, Geographical Review Of India, Kolkata, Vol.44/4.
6. Socio-Economic Review and Statistical Abstract of Kolhapur District. 2011.

भरडधान्य आरोग्यदायी अन्न

सई स. पाटील, डॉ. उर्मिला एस.खोत

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

गोषवारा -

भरडधान्य काही दशकांपूर्वी आपल्याकडील आहाराचा मुख्य भाग होती. परंतु पॉलिश धान्यामुळे ती रोजच्या आहारातून दिसेनाशी झाली. अस्सल भरण पोषण करणारी ही भरडधान्य तितकीच महत्त्वाची आहेत त्यामुळे अशा भरडधान्यांना महत्त्व मिळावे आणि जागतिक पातळीवर त्यांचा वापर वाढावा म्हणून भारताने पुढाकार घेतला. भरड धान्य म्हणजे लहान बीज असलेल्या तृणवर्गीय पिकांचा एक अत्यंत वैविध्यपूर्ण गट. साधारणता भरड धान्य ही आकाराने बारीक गोलाकार तसेच खाण्यासाठी जशीच्या तशी वापरता येतात या धान्याला विशेष प्रकारची शुद्धता किंवा कोणतीही विशेष प्रक्रिया करावी लागत नाही. भरडधान्य हे श्री अन्न म्हणूनही ओळखले जाते. भरडधान्याबाबतची जागरूकता अभ्यासाकरिता प्रत्यक्ष भेटीद्वारे व अनुसूची द्वारे माहिती घेतली यामध्ये ते घेत असलेल्या भरडधान्या विषयीची माहिती जसे त्यांना भरड धान्य म्हणजे कोणती धान्य आहेत याबद्दल माहिती आहे का? त्यातील पोषक घटकांविषयी माहिती आहे का? याविषयीची माहिती संकलित केली यावरून असे लक्षात आले बहुतांशी लोक ज्वारी या धान्याचा जास्त वापर करतात बाजरी नाचणी वरी यासारख्या भरड धान्यांचा वापर कधीतरीच करतात. तसेच त्यांना त्यातील पोषक घटकांविषयी माहिती जाणून घेण्याची इच्छा आहे.

मुख्य शब्द - भरडधान्य, पोषक घटक, श्रीअन्न

● प्रस्तावना :

बदलत्या जीवनशैलीमुळे तारुण्यातच आता विविध आजारांना सामोरे जावे लागत आहे. या पार्श्वभूमीवर यंदाचे वर्ष २०२३ - २०२४ हे “आंतरराष्ट्रीय भरडधान्य वर्ष” म्हणून घोषित केले आहे. भरड धान्यांना निरोगी धान्य म्हटले जाते. साधारणता भरड धान्य ही आकाराने बारीक गोलाकार तसेच खाण्यासाठी जशीच्या तशी वापरता येतात त्याला विशेष प्रक्रिया करण्याची गरज नसते.

“बारीक दाणेदार रचना असलेल्या तृणधान्यांना भरडधान्य असे म्हणतात“ ज्वारी बाजरी नाचणी वरी राळे गोदरा ही भरडधान्य म्हणून ओळखली जातात. त्यापैकी ज्वारी आणि बाजरी ही साधारणतः आकाराने मोठी असलेली धान्य असून त्यांनात्यापीकी “ग्रेटर मिलेट” तर आकाराने बारीक असलेली नाचणी, वरी, राळा, कोद्रा, प्रोसो ही सर्व “मायनर मिलेट किंवा बारीक धान्य” म्हणून ओळखली जातात.

भारतीय पद्धतीच्या आहारात भरड धान्यांचा वापर केला जातो पण तो रोजचा नसतो आहारात जास्त करून गव्हाचा वापर केला जातो त्यामुळे ग्लुटेन इंटरन्स म्हणजेच गहू न पचणे या विकाराने गंभीर रूप घेतले आहे अशा लोकांसाठी भरडधान्य ही उपयुक्त ठरतात रोजच्या आहारात भरड धान्यांचा वापर केला पाहिजे.

भरडधान्यांमध्ये भरपूर प्रमाणात जीवनसत्वे, खनिजे आणि फायबर असते त्यामुळे त्यांचा आहारात भरपूर वापर केला पाहिजे अलीकडच्या काळात हृदयरोग आणि मधुमेहाचे रुग्ण वाढत आहेत अशा रुग्णांसाठी किंबहुना हे आजार उद्भवू नये

म्हणून ही धान्ये उपयुक्त आहेत फायबरचे प्रमाण अधिक प्रमाणात असल्याने मूळव्याध, बद्धकोष्ठता किंवा पोटाचे विकार उद्भवत नाहीत.

● **भरड धान्यातील पौष्टिक गुणधर्म :**

१. भरडधान्य हे ग्लुटेन फ्री आहे.
२. भरड धान्य ही आम्लता निर्माण न करणारी आहेत.
३. भरड धान्याच्या सेवनाने रक्तातील शर्करा किंवा साखरेच्या प्रमाणात घट होते त्यामुळे मधुमेही व्यक्तींना उपयुक्त.
४. भरड धान्याच्या सेवनाने कोलेस्ट्रॉल कमी होण्यास मदत होते त्यामुळे हृदयविकार आणि रक्तवाहिन्यांशी संबंधित रोग टळतात.
५. भरडधान्यांमध्ये तंतुमय पदार्थ किंवा फायबर भरपूर प्रमाणात आहे त्यामुळे पचनाचा कालावधी वाढतो.
६. ही धान्य आपल्या मोठ्या आतड्यात ओलावा निर्माण करतात यामुळे बद्धकोष्ठता होण्यापासून आपली सुटका होते.

● **संशोधनाचे उद्दिष्ट :**

1. लोकांना भरड धान्यातील पोषक घटकांविषयी माहिती करून देणे.
2. लोकांनी आहारात भरडधान्याचा वापर करावा म्हणून जागृती निर्माण करणे.

● **माहितीचे संकलन आणि विश्लेषण :**

प्राथमिक स्वरूपाची सांख्यिकीय माहिती प्रश्नावली, अनुसूची व क्षेत्रभेट यांच्या माध्यमातून घेतली त्यासाठी ४० कुटुंबाचा सर्वे केला व ते आहारात घेत असलेल्या भरड धान्य विषयी माहिती संकलित केली.

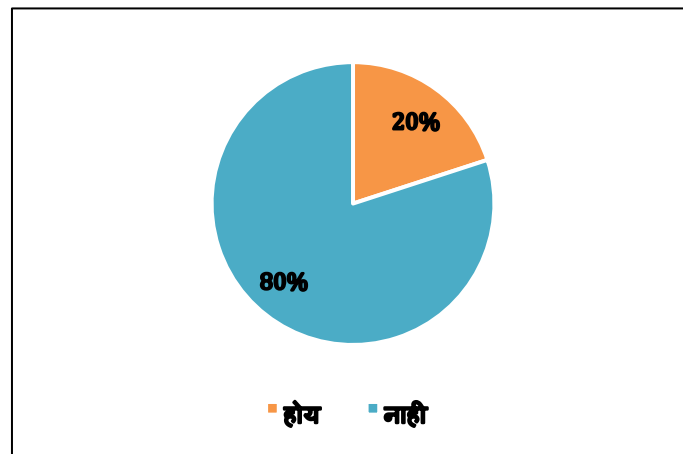
दुय्यमस्वरूपाची सांख्यिकीय माहिती संदर्भ ग्रंथ, इंटरनेट सांकेतिक स्थळे, दैनिक वृत्तपत्रे, मासिके यांच्या माध्यमातून घेतली.

संकलित केलेल्या माहितीचे व्यवस्थित मांडणी करून तक्ते, स्तंभालेख, यांच्या साह्याने विश्लेषण केले.

● **विश्लेषण :**

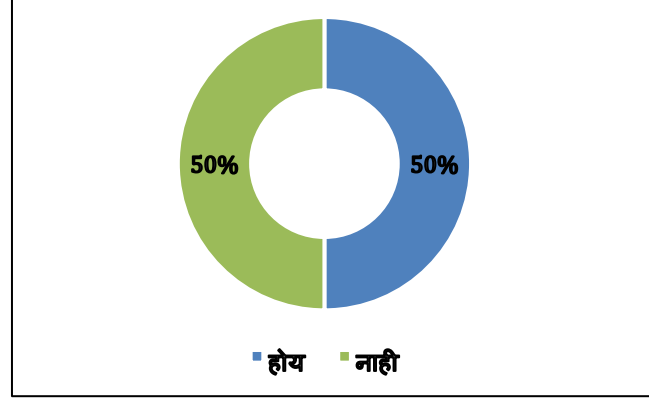
प्रस्तुत अभ्यास विषयांमध्ये संकलित केलेल्या माहितीच्या उद्देशानुसार विभागणी करून त्याचे विश्लेषण करण्यात आले.

२०२३ - २०२४ आंतरराष्ट्रीय भरडधान्य वर्ष



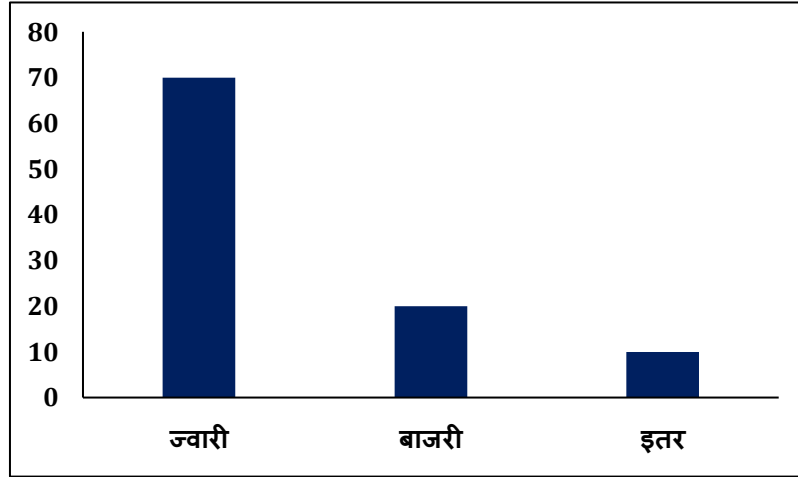
आकृती क्रमांक १ नुसार २०२३ - २०२४ आंतरराष्ट्रीय भरडधान्य वर्ष हे ८० % लोकांना माहित नाही तर २० % लोकांना माहित आहे.

भरड धान्याविषयी माहिती



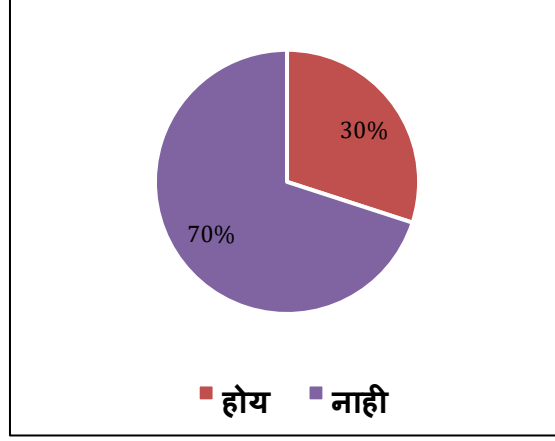
आकृती क्रमांक २ नुसार सर्वेक्षणात असे आढळून आले की भरड धान्या विषयी ५०% लोकांना माहिती आहे तर ५०% लोकांना माहिती नाही.

आहारात भरड धान्यांचा वापर



आकृती क्रमांक ३ नुसार दैनंदिन आहारात भरड धान्यांपैकी ज्वारीचा वापर ७० % लोक करतात, बाजरीचा वापर २०% लोक करतात, इतर भरडधान्य म्हणजे नाचणी वरी इत्यादींचा वापर १०% लोक करतात.

भरडधान्यातील पोषक घटकांविषयीची माहिती



आकृती क्रमांक ४

आकृती क्रमांक ४ नुसार सर्वेक्षणात असे आढळून आले की ७०% लोकांना पोषक घटकांविषयी माहिती नाही तर ३०% लोकांना माहिती आहे.

● निष्कर्ष :

१. ८० टक्के लोकांना २०२३ -२०२४हे वर्ष आंतरराष्ट्रीय भरडधान्य वर्ष आहे हे माहित नाही.
२. ५० टक्के लोकांना भरड धान्य विषयी माहिती नाही.
३. लोकांच्या दैनंदिन आहारात जास्त करून ज्वारी या भरड धान्याचा वापर केला जातो
४. लोकांना भरड धान्यातील पोषक घटकांविषयी शास्त्रशुद्ध माहिती नाही पण ती त्यांना जाणून घेण्याची इच्छा आहे

● संदर्भ ग्रंथ

१. मोळवणे मंजुषा “अन्नाचे विज्ञान पोषणशास्त्र ”आत्मभान प्रकाशन, हिंगोली.
२. वाघमारे शोभा “ पोषण आणि आहार ” विद्या बुक्स पब्लिशर्स, औरंगाबाद.
३. स्नेहल खांडेकर, आहार तज्ञ(सकाळमधील लेख).

Tax Planning Analysis: Overview

Mr. Sunny. S. Kale, Dr. Umesh Dabade

Assistant Professor

Vivekanand College, Kolhapur (Autonomous)

Abstract:

This research paper on tax planning provides an overview of various tax planning strategies and tools that can help individuals and businesses minimize their tax liabilities while maximizing their savings and cash flow. The paper highlights the importance of a balanced approach to tax planning that integrates both short-term tax savings and long-term financial planning considerations. It also discusses potential limitations and trade-offs associated with tax planning, such as the dynamic nature of tax laws and regulations and the risk of excessive focus on tax planning at the expense of other financial management opportunities. The paper concludes by emphasizing the need for regular review and adaptation of tax planning strategies, seeking professional guidance and collaboration, and considering the potential impact of tax strategies on different financial scenarios.

Key words: Tax planning strategies, Tax deductions and credits, Tax planning tools, Tax implications.

Introduction:

Tax planning is a crucial aspect of financial management for individuals and businesses. It involves utilizing various strategies and tools to minimize tax liabilities while ensuring compliance with tax laws and regulations. One of the most famous tax planning tools is the use of tax deductions and credits. Tax deductions and credits are widely used to reduce taxable income and lower overall tax obligations. Tax deductions are expenses that can be subtracted from taxable income, such as mortgage interest, business expenses, and charitable contributions. On the other hand, tax credits are direct reductions of the actual tax liability, such as the child tax credit or energy efficiency credits. Pros: One of the pros of utilizing tax deductions and credits is that they can significantly reduce taxable income, resulting in lower tax obligations. This can lead to higher savings and increased cash flow for individuals and businesses. Effective tax planning is essential for individuals and businesses to maximize their savings and cash flow. By implementing various strategies and utilizing tax deductions and credits, it is possible to minimize tax liabilities while remaining compliant with tax laws and regulations. In addition to deductions and credits, there are numerous other tax planning tools and techniques that can be employed to achieve optimal financial outcomes. In this analysis, we will explore a range of tax planning strategies and their potential impacts on overall financial management. In addition to utilizing tax deductions and credits, there are various other tax planning strategies that individuals and businesses can employ to optimize their financial management.

Objectives:

1.To explore the various tax planning tools and techniques available to individuals and businesses

2. To examine the potential limitations and trade-offs associated with tax planning strategies,

In addition to tax deductions and credits, there are several other tax planning tools and techniques that individuals and businesses can employ to achieve optimal financial outcomes. These include:

Tax planning involves using various strategies and tools to minimize tax liabilities within the legal framework. In India, individuals and businesses have several tools and techniques at their disposal for effective tax planning. Here are some commonly used ones:

For Individuals:

1. **Tax-saving investments:** Utilize instruments like Public Provident Fund (PPF), Equity-linked Savings Schemes (ELSS), National Pension System (NPS), and tax-saving Fixed Deposits to claim deductions under Section 80C.
2. **Health Insurance:** Avail deductions under Section 80D for premiums paid towards health insurance for self, family, or parents.
3. **Home Loan Interest:** Claim deductions under Section 24 for interest payments on a home loan.
4. **Donations:** Deductions under Section 80G for donations to specified charitable organizations.
5. **HRA and LTA:** Employees can avail exemptions on House Rent Allowance (HRA) and Leave Travel Allowance (LTA) by providing relevant bills and proof.
6. **Income Splitting:** If possible, distribute income among family members in lower tax brackets.
7. **Tax-Free Allowances:** Utilize components like LTA, medical allowances, etc., which are tax-free up to a certain limit.

For Businesses:

1. **Tax Deductions:** Claim deductions on various expenses incurred for business purposes, like employee salaries, rent, utilities, depreciation, etc.
2. **Tax Credits:** Utilize Input Tax Credits (ITC) under GST for taxes paid on inputs.
3. **Capital Expenditure:** Depreciation benefits can be availed on assets purchased for business use.
4. **Transfer Pricing:** Businesses dealing with related parties should ensure that transactions are at arm's length to avoid tax implications.
5. **R&D Tax Credits:** Companies involved in research and development activities can claim tax benefits under Section 35(2AB).
6. **Tax Holidays:** Some sectors or regions might enjoy tax holidays or reduced tax rates as per government policies to encourage investments.

Common to Both:

1. **Tax Planning through Trusts:** Establishing trusts for specific purposes can provide tax advantages.
2. **Tax Deferral Strategies:** Postponing income or accelerating deductions in a manner that reduces the current tax burden.
3. **Structuring Investments:** Choosing investment vehicles that offer tax advantages, such as tax-free bonds or long-term capital gains benefits on specific assets.

4. **Compliance:** Ensuring timely filing of returns, adhering to regulations, and keeping accurate records to avoid penalties and interest.

Effective tax planning can provide several benefits for individuals and businesses in terms of savings and cash flow. Here are some of the key benefits:

1. Lower Tax Obligations:

By utilizing various tax planning strategies and tools, individuals and businesses can reduce their tax liabilities, resulting in lower tax obligations. This reduction in tax obligations leads to higher savings and increased cash flow, which can be used for other financial goals such as investments, debt repayment, or emergency funds.

2. Improved Financial Management:

Effective tax planning involves a comprehensive approach to financial management that takes into account both short-term tax savings and long-term financial planning considerations. By integrating tax planning into their overall financial management strategies, individuals and businesses can make informed decisions that align with their unique financial goals and aspirations, leading to improved financial outcomes.

3. Increased Flexibility:

Effective tax planning can provide individuals and businesses with increased flexibility in terms of financial decision-making. By reducing tax obligations and increasing savings, individuals and businesses have more financial resources at their disposal, which can be used to pursue new opportunities or respond to unexpected financial challenges.

4. Compliance with Tax Laws and Regulations:

Effective tax planning involves ensuring compliance with tax laws and regulations, which can help individuals and businesses avoid costly penalties and legal issues.

Overall, effective tax planning can provide significant benefits for individuals and businesses in terms of savings and cash flow, improved financial management, increased flexibility, and compliance with tax laws and regulations. The potential limitations and trade-offs associated with tax planning strategies include:

1. Long-Term Financial Planning vs. Short-Term Tax Savings:

Tax planning strategies may prioritize short-term tax savings over long-term financial planning, potentially restricting liquidity and flexibility in the long run.

2. Complexity and Compliance Burden:

Implementing complex tax planning strategies can introduce a significant compliance burden, leading to increased administrative costs and potential risks of non-compliance.

3. Uncertainty in Tax Policies:

Tax laws and regulations are subject to change, impacting the effectiveness of long-term tax planning strategies and adding unpredictability to their outcomes.

4. Opportunity Cost:

Excessive focus on tax planning may lead to missed opportunities in other areas of financial management, potentially resulting in missed opportunities for long-term wealth creation and protection.

These limitations and trade-offs highlight the need for a balanced approach to tax planning that integrates both short-term tax savings and long-term financial planning considerations. In order to address the limitations and potential drawbacks of tax planning strategies, it is important for

individuals and businesses to develop a balanced approach that integrates both short-term tax savings and long-term financial planning considerations.

Integrated Financial and Tax Planning

Integrated financial and tax planning involves aligning tax strategies with broader financial goals. This approach emphasizes the importance of not only reducing tax liabilities but also ensuring that tax decisions complement overall financial objectives. By taking a holistic view of financial and tax planning, individuals and businesses can avoid the pitfall of prioritizing immediate tax savings at the expense of long-term financial security.

Regular Review and Adaptation

Given the dynamic nature of tax laws and regulations, it is crucial for tax planning strategies to be regularly reviewed and adapted to accommodate changes in the tax environment. Individuals and businesses should stay informed about the latest developments in tax policies and adjust their tax planning strategies accordingly. By remaining proactive in monitoring tax laws, they can mitigate the risk of relying on outdated or ineffective tax strategies.

Professional Guidance and Collaboration

Navigating the complexities of tax planning often necessitates the expertise of tax professionals. Seeking professional guidance can provide individuals and businesses with a comprehensive understanding of the tax implications of various financial decisions. Collaboration with tax advisors, accountants, and financial planners can help ensure that tax planning efforts are aligned with broader financial objectives and are in compliance with current tax laws.

Conclusion:

Tax planning is a crucial aspect of overall financial management for both individuals and businesses. By utilizing the various tools and strategies discussed, such as tax-advantaged accounts, scenario analysis, asset allocation, sustainable tax compliance, and commonly used tax-saving instruments, taxpayers can effectively optimize their tax outcomes while safeguarding their long-term financial interests. It is essential to consider the dynamic nature of tax laws and regulations, as well as the potential impact of tax strategies on different financial scenarios, in order to make well-informed decisions that align with unique financial goals and aspirations. Ultimately, a balanced approach to tax planning that integrates these tools and strategies can contribute to long-term financial resilience and success.

References

1. Taxes and Business Strategy: A Planning Approach By MYRON S. SCHOLLES and MARK A. WOLFSON.. (n.d). <https://www.journals.uchicago.edu/doi/10.1086/NTJ41788986>
2. Benjamin, L J. (1973, January 1). How to Choose a Tax Shelter. *Compensation review*, 5(1), 58-61. <https://doi.org/10.1177/088636877300500109>
3. Editor's Letter. (1999, January 31). *The Journal of Portfolio Management*, 25(2), 1-2. <https://doi.org/10.3905/jpm.1999.390965>
4. Guo, Y., Ouyang, Q., & Peng, M. (2020, December 10). Research on the Role of Tax Planning in Preventing Corporate Tax Risks. *Modern management forum*, 4(4), 156-156. <https://doi.org/10.18686/mmfv4i4.2784>

5. Mgammal, M H., & Ismail, K N I K. (2015, December 10). Corporate Tax Planning Activities: Overview of Concepts, Theories, Restrictions, Motivations and Approaches. Mediterranean journal of social sciences. <https://doi.org/10.5901/mjss.2015.v6n6s4p350>
6. September, 2020 | Forex Traders Review - Making Your Money Work for You - Get Advice. (2020, September 29). <https://forextradersreview.com/2020/09>
7. Tax advantage - Wikipedia. (2004, September 29). https://en.wikipedia.org/wiki/Tax_advantage
8. Tax planning strategies for physicians.. (n.d). <http://americanjournalofsurgery.com/retrieve/pii/S0002961002008954>
9. Tax Reduction and Management Techniques. (2015, August 3). , 399-408. <https://doi.org/10.1002/9781119642497.ch45>
10. Tax-Efficient Investing - The CPA Journal. (2019, May 21). <https://www.cpajournal.com/2019/05/21/tax-efficient-investing/>

कोरोना नंतरच्या शेअर मार्केटमधील आर्थिक गुंतवणूकीबाबतचे विचारमंथन

डॉ. एस. आर.कट्टीमनी,

सहाय्यक प्राध्यापक, इतिहास विभाग प्रमुख ,

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

शिवाजी विद्यापीठ संलग्नित, महाराष्ट्र

भ्रमणध्वनी -९८६००९०६८९

घोषवारा :

COVID-19 म्हणजेच कोरोना ह्या महाभयंकर रोगाने भारतालाच नव्हे तर जगाला आपल्या विळख्यात आणले आहे. कोरोनामुळे सामाजिक, राजकीय, धार्मिक, आर्थिक, सांस्कृतिक, शैक्षणिक व आरोग्यविषयक बदल व समस्या निर्माण झालेल्या आहेत. कोविड 19 च्या पूर्वी नोटबंदी व जीएसटी यामुळे झालेल्या आर्थिक बदलांनी भारतीय अर्थव्यवस्थेच्या वृद्धि दरामध्ये काही काळ अडसर निर्माण झाली होती. यात आणखीनच भर पडली ती म्हणजे कोरोना या महाभयानक अशा साथीच्या आजाराने. अगोदरच सर्वसामान्य भारतीय नागरिकांच्या मनात शेअर मार्केट बदल भीतीचे व संशयाचे वातावरण आहे, कोरोनामुळे यामध्ये आणखीनच वाढ झालेली आपल्याला दिसून येते. प्रस्तुत शोधनिबंधाच्या माध्यमातून गेल्या काही वर्षांच्या कोरोनाच्या पहिल्या, दुसऱ्या व तिसऱ्या लाटेच्या वेळी भारतीय शेअर बाजारातील आर्थिक गुंतवणुकीबाबतच्या माहितीचे विवेचन केले आहे.

कळीचे शब्द: कोविड 19 , नोटबंदी , जीएसटी, अर्थव्यवस्था , शेअर मार्केट आर्थिक गुंतवणुक ...

ऐतिहासिक आर्थिक मंदी :

कोरोनामुळे निर्माण झालेली आर्थिक मंदी पाहता अशी मंदी भारतीय व विदेशी शेअर मार्केटसाठी नवीन नाही. 1929 मध्ये पहिल्या महायुद्धानंतर अमेरिकेमध्ये निर्माण झालेली व नंतर जगभर पसरलेली आर्थिक महामंदी सर्वांना परिचित आहे. दुसऱ्या महायुद्धानेही आर्थिक महामंदीचे सावट निर्माण केले. शीतयुद्ध, जागतिकीकरण, खाजगीकरण, उदारीकरण व तेलाचे राजकारण या व अशा अनेक प्रसंगावेळी आंतरराष्ट्रीय व भारतीय शेअर मार्केटमध्ये अनेकदा चढ-उतार निर्माण झाल्याचे दिसून येते. याचबरोबर 2001 साली झालेल्या अमेरिकेच्या न्यूयॉर्कमधील वलर्ड ट्रेड सेंटर वरील हल्ल्यामुळे अनेकांच्या नोकऱ्या गेल्या व आर्थिक विपन्नावस्था निर्माण झाल्याचे आपणास विदितच आहे. भारतामध्ये 2008 साली निर्माण झालेली आर्थिक मंदी खूप मोठी होती. या आर्थिक महामंदीचा फटका उद्योगजगासहित सर्वसामान्य भारतीयांच्या सामाजिक, राजकीय व दैनंदिन जीवनावर पडल्याचे दिसून आले.

आर्थिक मंदीतील सामान्यांचे नुकसान:

कोरोना वायरस च्या संक्रमणामुळे जागतिक शेअर मार्केट मध्ये मोठ्या प्रमाणावर घसरण झाली. गेल्या दोन वर्षांमध्ये वीस टक्क्याहून अधिक घसरण प्रत्येक देशाच्या मुख्य इंडेक्समध्ये झाल्याचे दिसून येते ज्याला भारतातील निफ्टी व सेंसेक्स हेदेखील अपवाद नाहीत. कोरोना नंतर रशिया व युक्रेन या दोन देशांमधील युद्धामुळे आंतरराष्ट्रीय राजकारण तापले व तिसऱ्या

महायुद्धाच्या भीतीने पुन्हा कोरोना नंतर स्थिरस्थावर झालेले मार्केट मोठ्या अंशाने घसरत गेले. परंतु काही महिन्यांच्या काळापर्यंत व कोरोनाचे संकट संपल्यानंतर आंतरराष्ट्रीय शांतता प्रस्थापित झाली आहे. प्रगती हे मानवाचे लक्षण आहे. प्रगती हा संसार जगाचा नियम आहे. त्यानुसार जरी शेअर मार्केटमध्ये आर्थिक विपन्नावस्थेचे चित्र काही काळ असले तरी ही बिकट अवस्था काही काळापुरतीच असते.

गुंतवणूकदारांनी काय करावे:

गुंतवणूकदारांनी त्यांच्या गुंतवणुकीवर विश्वास ठेवावा. शेअर मार्केट हे अनेकदा अंदाज व भाकितांवर चालते. म्हणजेच ज्या गुंतवणूकदारांचा अंदाज शेअर मार्केटच्या अंदाजाप्रमाणे जुळेल त्याला नफा होईल. काही महिन्यांनी ज्यावेळी बाजार सुरळीत होईल व आर्थिक विपन्नावस्था कमी होत जाईल. त्यावेळी नेमक्या कोणत्या कंपन्यांच्या शेअर्सचे भाव वधारतील या गोष्टीचा अंदाज लावणे अवघड आहे परंतु ही वेळ गुंतवणुकीची आहे. पुढील तीन-चार वर्षांनी या गुंतवणुकीचे खूप चांगले रिटर्न्स म्हणजेच परतावे गुंतवणूकदारांना मिळतील. त्यामुळे गुंतवणूकदारांनी चुकीच्या बातम्यांवर विश्वास न ठेवता स्वतः जवळ असलेल्या शिल्लक रकमेची गुंतवणूक करावी. गुंतवणूकदारांनी सिप (SIP= Systematic Investment Plan) व म्युच्युअल फंड या माध्यमातून योग्यप्रकारे ठराविक अंतराने गुंतवणूक करावी, ज्याचा चांगला परतावा त्यांना पुढील काही काळातच मिळेल. मार्केटचा बॉटम म्हणजेच तळ किंवा खोली कधीच कोणालाही समजली नाही. म्हणजेच मार्केट ची किंमत किती खाली जाऊन पुन्हा तेथून वधारेल हे कुणीही सांगू शकत नाही. यावरील उपाय म्हणजे ठराविक काळाने मार्केटची घसरण होत असताना आपल्याजवळील शिल्लक रक्कम योग्य त्या अभ्यासान्वये व तर्काने मार्केटच्या सध्याच्या परिस्थितीचे अवलोकन करून गुंतवणूक करावी जी नक्कीच लाभदायक असेल.

गुंतवणुकीस कोणती कंपनी चांगली :

काही ब्लूचिप कंपन्या ज्यांच्या शेअर्सचे भाव पत्त्याच्या बंगल्याप्रमाणे घसरताना मार्केटने पाहिले आहेत. मग अशा जागतिक आर्थिक संकटाच्या दरम्यान शेअर बाजार पूर्णपणे कोसळत असताना कोणत्या कंपन्यांच्या शेअर्समध्ये गुंतवणूक करावी व कोणत्या कंपनीचे शेअर चांगले ? ह्याचे उत्तर म्हणजे ज्या कंपनीच्या शेअर्सच्या भावांची घसरण मार्केटच्या घसरणीच्या काळातही तुलनेने कमी होत आहे. ज्या कंपनीचे फंडामेंटल्स चांगले आहेत व मागील 2008 च्या मंदीनंतर ज्या स्टॉक्सनी चांगला परतावा दिला आहे याची आकडेवारी पाहिली तर गुंतवणूक कोणत्या कंपनी च्या शेअर्समध्ये करावे याचा अंदाज येईल.

पेनी स्टॉक्स :

सध्याच्या गुंतवणुकीसाठी पेनी स्टॉक्स हा ही एक चांगला पर्याय आहे. पेनी स्टॉक्स म्हणजे ज्या कंपन्यांच्या शेअर्स ची किंमत दहा रुपये पेक्षाही कमी आहे असे शेअर्स होय. बऱ्याच चांगल्या कंपन्यांच्या शेअर्सचे भाव सध्या कमी झालेले आहेत. काही कंपन्यांच्या शेअर्सच्या किमती एक रुपया पेक्षाही कमी म्हणजे काही पैशांत मिळतात. तेव्हा अशा पेनी स्टॉक्स असणाऱ्या कंपन्यांच्या शेअर्समध्ये पैसे दहा-पंधरा वर्षांसाठी गुंतवले तर त्याचा परतावा खूप चांगला मिळेल. पुढील एका सोप्या उदाहरणाद्वारे आपल्याला ही गोष्ट समजेल. पंधरा वर्षांपूर्वी साखर सहा रुपये किलोने मिळत होती. सध्या ती 36 रुपये इतक्या किमतीने मिळते कारण रुपया या चलनाची किंमत वधारल्याने महागाई वाढल्याचे चित्र दिसते. म्हणूनच आज जरी पेनी म्हणजेच कमी किमतीच्या वाटणाऱ्या शेअर्समध्ये आपण गुंतवणूक केली तरी भविष्यात तिचा परतावा नक्कीच चांगला मिळेल.

Sr.	Company Name	Earlier Price	Recent Price
1	DIGJAM Ltd company	20 oct 2021 20.90/-	345/-
2	Gita Renewable Energy	26 Nov. 2020 6.60	22 Oct 297/-
3	Brightcom Group Limited	1 June 2021 7.10/-	3 Jan 2022 206.20/-
4	Reliance Infra	27 March 2020 9.30/-	14 Dec, 2021 108.35
5	Eicher Motors Company	22 Sept 2006 24.44/-	15 Sept, 2017 3200.80/-

उपरोक्त काही कंपन्याचे पेनी शेअर्स असतानाच्या किमती व नंतर काही कालावधीनंतर त्याचे वधारलेले भाव पाहता आपल्याला पेनी शेअर्स च्या गुंतवणुकीचे महत्व समजून येते .

इंट्राडे करणाऱ्या ट्रेडर साठी काही टिप्स:-

इंट्राडे म्हणजे दररोजच्या दररोज शेअर्स विकत घेऊन त्याच दिवशी काही नफा मिळवून ते विकणे होय. याला शेअर मार्केटमध्ये ट्रेडर्स असे म्हणतात . जे दीर्घकाळासाठी गुंतवणूक करत नाहीत. त्यांच्यासाठी हा काळ फायदा व तोट्याचा म्हणजेच संमिश्र स्वरूपाचा आहे. कारण शेअर मार्केट हा झिरो लमसम खेळ आहे. एकाचा तोटा झाला तरच दुसऱ्याचा फायदा होतो. लहान ट्रेडर्स नी या आर्थिक घसरणीच्या च्या काळात खूप सावधानपूर्वक ट्रेड करावे. बाजारातील एक लहानशी बातमी सुद्धा खूप मोठे आर्थिक नुकसान करू शकते. तेव्हा अशा या मार्केटमधील अनिश्चित वातावरणामध्ये सावधानपूर्वक ट्रेड करावे.

सरकारची भूमिका:

सध्याच्या आर्थिक घसरणीच्या काळात जागतिक आरोग्य संघटना, जागतिक बँक व भारत सरकार जागतिक आर्थिक स्थितीमध्ये सुधारणा करण्यासाठी प्रयत्न करीत आहे. यासाठी लघुउद्योजक, लघुउद्योग, कुटिर उद्योग, हस्त उद्योग, शेतीवर आधारित उद्योग, पशूपालन, आरोग्य सेवा व पायाभूत उद्योगधंद्यांवर भारत सरकार विशेष भर देत आहे. यासाठी केंद्रीय अर्थमंत्र्यांकडून वेगवेगळे आर्थिक पॅकेजेस जाहीर केले जात आहेत. ज्यांचा निश्चितच सकारात्मक बदल व परिणाम नजीकच्या काळात अर्थव्यवस्थेवर दिसून येईल. अर्थव्यवस्थेला उभारी देण्यासाठी, बळकटी आणण्यासाठी रोजगार निर्मितीसाठी व महागाई कमी करण्यासाठी सरकारने या आर्थिक पॅकेजेस जाहीर केलेले आहेत. प्रगती हे मानवाचे लक्षण मानल्यास नजीकच्या काळात पुन्हा एकदा आर्थिक महामंदीतून जग व भारत सावरेल. त्यामुळे शेअर मार्केटसाठी हा काळ घसरणीचा असला तरी गुंतवणूकदारांसाठी ही एक सुवर्णसंधी आहे असे मानावे. जो काळाची पावले ओळखून योग्य त्या कंपन्यांमध्ये गुंतवणूक करेल निश्चितच त्याला भरघोस असा आर्थिक लाभ नजीकच्या काळात होईल.

कोरोना नंतरचे आर्थिक जग:

भारताच्या व जगातील इतर देशांच्या शेअर मार्केटमधील राष्ट्रीय इंडेक्समध्ये झटपट होणारी मोठी घसरण व वाढ यामुळे गुंतवणूकदारांचा कल सोने व चांदी गुंतवणुकीमध्ये वाढलेला दिसून येतो. कोरोना नंतर उत्पादन प्रक्रिया पूर्वीसारखी

सुरळीत झाली आहे. परंतु यानंतर कोणत्या वस्तूंचे उत्पादन करणाऱ्या कंपन्यांना चांगले दिवस येतील, याचे भाकीत करणे अवघड आहे. कारण मध्यंतरीच्या काळात जगाने मोठ्या म्हणजेच बड्या देशांना व बलाढ्य सत्तांना हतबल होताना पाहिले आहे.

तेव्हा सध्याच्या आर्थिक महामंदीच्यानंतर पायाभूत उद्योग, कृषी उद्योग, पशूपालन, आरोग्य सेवा देणाऱ्या कंपन्या, हेल्थ इन्शुरन्स कंपन्या, जीवनावश्यक वस्तूंचे उत्पादन करणाऱ्या कंपन्या व औषधे बनवणाऱ्या कंपन्यांची भरभराट होईल. पर्यटन व इतर सेवा उद्योगांना या आर्थिक पडझडीचा थोडासा त्रास होल परंतु पुन्हा परिस्थिती पूर्वपदावर येईल.

निष्कर्ष :

भारतीय लोकांची मानसिकता प्राचीन काळापासूनच सोने, चांदी, शेतजमीन किंवा घर /प्लॉट अशा भौतिक गोष्टींमध्ये गुंतवणूक करण्याकडे आहे. तसेच शेअर मार्केट मध्ये पैसे गुंतवणे म्हणजे जुगार असल्याची मानसिकता बदलणे देखील गरजेचे आहे. अशातच कोरोना या महाभयंकर रोगाने गुंतवणूकदारांचे पैसे बुडवल्याचा भास निर्माण केला आहे. सध्याच्या रशिया व युक्रेन युद्धामुळेदेखील गुंतवणूकदाराना हवालदिल केले असल्याचे चित्र आपणास पाहायला मिळते.

भारतीय सर्वसामान्य गुंतवणूकदारांना कोरोनाव्हायरसचा प्रसार व आंतरराष्ट्रीय युद्धाची परिस्थिती यामुळे आर्थिक वृद्धी कमी होईल भीती आहे. तसेच सरकारचे धोरण देखील ही घसरण थांबवण्यासाठी पुरेशी ठरत नसल्याचे चित्र आहे. परंतु या गोष्टीच्या प्रत्युत्तरार्थ म्हणून अमेरिकेसह बऱ्याच देशांमधील व भारतातील मध्यवर्ती बँकांनीही व्याजदरांमध्ये कपात केली आहे. यामुळे कर्ज घेणे स्वस्त झाले आहे व अर्थव्यवस्थेला चालना देण्यास साठी सरकारने सर्वसामान्यांना उत्तेजित केले आहे. थोडक्यात, शेअर मार्केटचे विश्लेषक व काही अर्थतज्ज्ञांच्या मते आणखी काही काळ शेअर मार्केट हे अस्थिर राहू शकते.

निष्कर्षाच्या रुपात ईतकेच म्हणणे रास्त ठरेल की कोरोना काळात सेन्सेक्स हा इंडेक्स 23 मार्च 2020 रोजी 3934 अंकांनी खाली कोसळून त्याची किंमत 33 महिन्यांच्या निच्चाकाला म्हणजेच 32778 पर्यंत जाऊन पोहोचली. तसेच निफ्टी 50 या इंडेक्स ची किंमत 1135 अंकांनी कोसळून 7610 इतकी झाली. ज्याने चार वर्षांच्या कमी किंमतीचा नीचांक मोडीत काढला. 7 जानेवारी, 2022 रोजी निफ्टी 17812 तर सेन्सेक्सने 61000 चा टप्पा पार केला. 5 जानेवारी, 2024 रोजी निफ्टी आतापर्यंतचा सर्वात जास्त उच्चांक मोडीत काढत 21710 रुपयावर तर सेन्सेक्स 72112 ट्रेड करत आहे. आंतरराष्ट्रीय घडामोडींमुळे पुन्हा मार्केटने मोठी भरारी घेतली आहे. यावरून आपल्याला हा निष्कर्ष काढता येईल की पूर्वीचे आर्थिक मंदीचे सावट संपल्यानंतर मार्केट पुन्हा नव्याने भरारी घेत व नवे उच्चांक मोडीत गुंतवणूकदारांना भरघोस फायदा करून देत आहे व यापुढेही असेच नवे विक्रम मोडीत मार्केट मधील गुंतवणूकीवर गुंतवणूकदार समाधानी असतील.

थोडक्यात सांगायचे झाल्यास मानवजातीने आज पर्यंत अनेक बिकट प्रसंग अनुभवले आहेत. आंतरराष्ट्रीय राजकारणामुळे व अर्थकरणामुळे अनेकदा शेअर मार्केट ने चढ-उताराचे प्रसंग अनुभवले आहेत. गुंतवणूकदारांचा विचार करता गरज आहे ती आर्थिक सकारात्मक विचारांच्या द्वारे गुंतवणूक करण्याची व फंडामेंटली बळकट शेअर्समध्ये पैसे गुंतवण्याची व योग्य वेळी परतावा घेण्याची.

संदर्भ साधने

1. श्रीधर देशपांडे व विनायक देशपांडे (2004), *भारतीय अर्थव्यवस्था संक्रमण आणि विकास*, हिमालया पब्लिशिंग हाऊस, प्रथम आवृत्ती, मुंबई.
2. डॉ. एन. एल. चव्हाण (2019), *भारतीय अर्थव्यवस्था 1980 पासून*, प्रशांत पब्लिकेशन्स, जळगाव.
3. डॉ. श्रीधर देशपांडे व डॉ. विनायक देशपांडे (2004), *वित्तीय संस्था आणि वित्तीय बाजार*, हिमालया पब्लिशिंग हाऊस, मुंबई.
4. रवींद्र देसाई (2019), *शेअर बाजार जुगार? छे बुद्धिबळाचा डाव!* राजहंस प्रकाशन लिमिटेड, 15 वी आवृत्ती, पुणे
5. M Y Khan (2000), *Indian Financial System*, Tata McGraw -Hill Publishing Company Ltd, New Delhi.
6. V. A. Avadhani (2017), *Securities Analysis and Portfolio Management*, Himalaya Publishing House, Mumbai
7. Aseesh Pandey (2014), *Capital Market and Financial System in India*, New Century Publications, New Delhi
8. S C Manchanda (2019), *Security Analysis and Portfolio Management*, New Age International Limited Publishers, New Delhi.
9. Edmister, R.O.(1986), *Financial Institutions, Markets and Management*, McGraw Hill, New York.
- 10.

जाती संस्थेतील परिवर्तन एक समाजशास्त्रीय अभ्यास

प्रा. एच व्ही चामे

समाजशास्त्र विभाग प्रमुख

विवेकानंद कॉलेज कोल्हापूर, (स्वायत्त)

प्रस्तावना :-

भारतीय समाज हा विविध नटलेल्या समाज आहे. भारतामध्ये अनेक जाती, धर्म, पंथ वेगवेगळ्या समुदायातील लोक एकत्र वास्तविक करत असताना आपल्याला दिसतात. रुढी, प्रथा, परंपरा यांच्या चौकटीमध्ये जीवन जगणारे लोक जगामध्ये आपली एक वेगळी ओळख निर्माण केली आहे. भारतीय समाजाची संस्कृती ही जगात आदर्श मानली जाते. भारत हा पारंपारिकतेला जपणारा विविधतेने नटलेला असा विशाल काय देश आहे ज्या देशांमध्ये परंपरा जपत प्रगती विकास यांच्याकडे वाटचाल होत आहे.

भारतीय समाजाची वाटचाल ही सिद्धू संस्कृती पासून मुस्लिम कालखंड ब्रिटिश कालखंड आणि आजचा या आधुनिक भारत या वेगवेगळ्या कालखंडामध्ये भारतीय समाजाची जडणघडण खूप वेगवेगळ्या पद्धतीने झालेले आपल्याला दिसून येते. भारतीय समाज हा प्राचीन समाज म्हणून ओळखला जातो ज्या समाजाचे संस्कृतीचे एक वेगळा अस्तित्व आहे जे जगातील इतर संस्कृती पेक्षा भारताला वेगळं दाखवतं. भारतीय लोकांवर जाती व्यवस्थेचा खूप मोठा प्रभाव आहे. मदन आणि मुजुमदार यांच्या मते "जात हा एक बंदिस्त वर्ग आहे". जात ही जन्माने मिळते. त्यामुळे ती बदलता येत नाही. म्हणून डॉ. बाबासाहेब आंबेडकर म्हणतात. "जाता जात नाही त्याला जात असे म्हणतात"

जाती व्यवस्थेत सोपान परंपरा होती. त्यात चार वर्ण ब्राह्मण, क्षत्रिय, वैश्य, आणि शूद्र या चार वर्णांत समाजाची विभागणी करण्यात आली होती. प्रत्येक वर्णाला काही अधिकार देण्यात आले. इरावती कर्वे च्या मते जात म्हणजे एक विस्तारित कुटुंब आहे जात या शब्दाचा इंग्रजीत कास्ट असे म्हणतात. हा शब्द पुर्तुगीज भाषेतील कास्टा या शब्दापासून उदयास आला आहे. याचा अर्थ शुद्धता असा आहे. काही अभ्यासक म्हणतात की जात हा शब्द जत या संस्कृत शब्दापासून उदयास आला आहे. याचा अर्थ जन्म घेणे असा आहे म्हणजे जन्मापासून मिळणारा समोर असा याचा अर्थ घेतला जातो

संशोधन पध्दती :-

प्रस्तुत संशोधनासाठी द्वितीय तथ्य संकलनाच्या साधनांचा वापर केला आहे.

संशोधनाचे उद्देश :-

- 1) जाती व्यवस्थेच्या परिवर्तनाची कारणे जाणून घेणे.
- 2) जाती व्यवस्था व व्यक्ती स्वातंत्र्य परस्पर संबंध अभ्यासने.
- 3) जाती व्यवस्था व समाज विकास याचा अभ्यास करणे.

4) जाती व्यवस्था व सामाजिक बंधने याचा अभ्यास करणे.

गृहीतके :-

- 1) जाती मुळे समाज बंदिस्त झाला आहे.
- 2) जाती व्यवस्थामुळे समाज परिवर्तनाला अडथळा निर्माण झाला आहे.
- 3) जाती व्यवस्थामुळे समाजात विषमता निर्माण झाली आहे.
- 4) जाती व्यवस्थेने लोकशाहीला अडथळा निर्माण केला आहे.

जाती व्यवस्थेतील परिवर्तन :-

व्यवसायिक परिवर्तन :-

पूर्वी आपल्या जातीने ठरवून दिलेलाच व्यवसाय करावा असे नियम होते. आपला व्यवसाय सोडून दुसरा व्यवसाय करण्याचे स्वातंत्र्य नव्हते. त्यामुळे लोकांचे जीवन चाकोरी बंद झाले होते. पण आज कोणताही व्यवसायिक परिवर्तन जातीने ठरवून दिलेला व्यवसाय करायला पाहिजे हा जो नियम होता त्यामुळे व्यक्तीला आपल्या आवडीनुसार आपल्यातील कलागुणांना वाव देता येत नव्हते त्यामुळे व्यक्तिमत्त्व विकासाला अडथळा निर्माण झाला होता एखाद्या कनिष्ठ जातीतील मुलगा कर्तुत्वान असला तरी त्याला आपल्याच जातीचा व्यवसाय करावा लागत असे त्यामुळे कनिष्ठ जाती आपला विकास करू शकले नाहीत नंतर अनेक कायदे करण्यात आले त्यामुळे जाती बंधन शिथिल झाले त्यामुळे आपला व्यवसाय करण्याचे स्वातंत्र्य व्यक्तीला मिळाले आज कोणताही व्यक्ती आपल्या इच्छेनुसार एखादा व्यवसाय करू शकतो .आज जातीनुसार व्यवसाय करण्याची बंधन राहिलेले नाही.

विवाहाच्या स्वरूपात बदल

आंतरजातीय विवाह :- भारतीय समाजातील विवाहाला खूप महत्त्व आहे. हिंदू धर्मानुसार विवाह एक पवित्र संस्कार मानला जातो. पूर्वी आपल्याच जातीतीलच जोडीदार निवडला पाहिजे अशा पद्धतीची बंधन होती. जातीबाह्य विवाह केला तर त्यास वेगळी जात मानली जायची त्यांना त्या जातीतील लोकांशी संबंध तोडावे लागत असे जातीतून बहिष्कृत केले जायचे पण आधुनिक काळात पूर्वीसारखी परिस्थिती राहिली नाही. आज प्रेमविवाहाचे प्रमाण वाढले आहे तसेच आपणास हवी ती आवडणारी व्यक्तीशी विवाह करण्याचे प्रमाण वाढले आहेत. आंतरजातीय विवाह कायद्यामुळे विवाह विषयक असणारे जाती बंधन कमी झाली आहेत आणि लोक आपल्या व्यवसायाशी संबंधित असणाऱ्या मुला मुलीशी विवाह करत आहेत. त्यामुळे जातीय बंधनाच्या पलीकडे जाऊन आपल्या विकासाचा विचार करून विवाह होत असताना आज दिसत आहेत.

जाती जातीतील अंतर कमी झाले :-

प्रत्येक जातीचा स्वतंत्र व्यवसाय तसेच जीवन पद्धती त्यामुळे प्रत्येक जात स्वतःला इतरांपेक्षा वेगळी समजत असे. आज जाती व्यवस्था संपूर्ण नष्ट झाली नसली तरी ती कमकुवत झाली आहे. सामाजिक संपर्क वाढत आहे जातीजातीचे अंतर कमी होत आहे. जातीनुसार व्यक्तीला समाजात प्रतिष्ठा मिळत होती ती आज आपल्यातील कौशल्यावर आधारित मानसन्मान प्रतिष्ठा मिळत आहे त्यामुळे जाती जातीतील जे अंतर होतं श्रेष्ठ कनिष्ठ तिची भावना होती त्या कुठेतरी कमी झालेचे दिसून येते.

सामाजिक धार्मिक अपात्रता यात बदल :-

भारतीय समाजात धार्मिक अपात्रता खूप मोठ्या प्रमाणात होती. प्रत्येक जातीला एक विशिष्ट अधिकार देण्यात आलेले होते वरिष्ठ जाती होत्या त्यांना विशेषतः ब्राह्मण या जातीतील लोक पूजा अर्चा मंदिरात प्रवेश करणे वेदाचा अभ्यास करणे या गोष्टी करत पण कनिष्ठ जातीतील लोकांना त्या करू दिला जात नव्हते. त्यांना शूद्र समजले जात असे त्यामुळे ते देव धर्म पूजा पाठ करण्याची परवानगी त्यांना नाकारण्यात आली होती एवढेच नाही तर मंदिर प्रवेश पण त्यांना नाकारण्यात आलेला होता. पण आधुनिक काळामध्ये ही परिस्थिती राहिलेली नाही त्यामध्ये खूप मोठ्या प्रमाणात बदल झालेले आहेत. धर्मनिरपेक्षता यावर कायद्याने भर दिला आहे त्यामुळे धर्म ही वैयक्तिक बाब मानली आहे कोणालाही जातीच्या आधारावर धार्मिक विधी नाकारता येत नाही आणि कनिष्ठ जातीतील लोकांना पूजा पाठ करण्याचे स्वातंत्र्य मिळालेले आहे त्यामुळे जे काही जातीला विशेष अधिकार होते ते कुठेतरी कमी झालेले आहेत किंवा ते नष्ट झालेले आपल्याला दिसून येतात.

अर्जित दर्जाला महत्त्व प्राप्त झाले :-

भारतीय समाजात जातीला खूप महत्त्व होते जाती जन्मावर आधारित असल्यामुळे ज्या जातीत जन्म झाला त्यानुसार त्या व्यक्तीचा समाजामध्ये दर्जा निश्चित केला जात असे व्यक्तीला जात जन्मावरून मिळते .त्यामुळे त्या व्यक्तीचा दर्जा जातीवरून ठरत होता. त्याच्या कर्तृत्वाला कोणतेही महत्त्व नव्हते तो कोणत्या जातीचा आहे याला महत्त्व होते. व्यक्तीला अर्पित दर्जाला महत्त्व होते. समाजात जातीनुसार व्यक्तीला श्रेष्ठ कनिष्ठत्व प्राप्त होत होते पण काळ बदलला समाजात आज मोठ्या प्रमाणात परिवर्तन झाले. त्याचा परिणाम असा झाला की व्यक्तीला महत्त्व प्राप्त झाले आणि जातीचे महत्त्व कमी झाले व व्यक्तीच्या कर्तृत्वाला महत्त्व प्राप्त झाले त्यामुळे स्वतःच्या कर्तृत्वाने प्राप्त केलेला अर्जित दर्जाला आज महत्त्व प्राप्त झालेले दिसून येते वंशपरंपरेनुसार जे जातीनुसार दर्जा मिळायचा त्याचे महत्त्व आजच्या आधुनिक काळामध्ये कमी झाले आहे

विशिष्ट जातीचे वर्चस्व राहिले नाही :-

पूर्वी समाजात जातीच्या आधारावर स्त्रीकरण होते त्यात ब्राह्मण जात ही सर्वश्रेष्ठ मानली जात असत पण काळ परिस्थिती बदलली जातिभेद करणे कायद्याने गुन्हा ठरवण्यात आला आज कोणती जात श्रेष्ठ व कनिष्ठ मानली जात नाही पूर्वीप्रमाणे ब्राह्मणाला पूजापाठ धार्मिक अधिकार राहिलेले नाहीत आज सर्व जाती धर्मांना ती लोकांना समानतेचे तत्व लागू झालेला आहे त्यामुळे कोणतीही जात श्रेष्ठ किंवा कोणतीही जास्त कनिष्ठ न मानता सर्व जाती या समान मानल्या जातात सर्वांना समान अधिकार देण्यात आलेले आहेत.

बलुतेदारीत परिवर्तन :-

जातीय व्यवस्थेमध्ये बलुतेदारीला खूप महत्त्व होते. प्रत्येक जातीमध्ये व्यवसायाचं विभाजन करण्यात आले होते .म्हणून विशिष्ट जातींना आपल्याला ठरवून दिलेला व्यवसाय करावा अशा पद्धतीने समाजाचा नियम होता त्यामुळे प्रत्येक जाती आपल्याला ठरवून दिलेला व्यवसायच करत असेल त्यामुळे व्यक्तिमत्त्व विकासाला अडथळा निर्माण होतो व्यवसाय हेच आपली बंद झाले होते त्यामुळे कोणताही व्यवसाय कोणालाही करता येत नव्हता एखाद्याच्या अंगी एखाद्या व्यवसायाविषयी कौशल्य असतील पात्रता असेल तरी पण ते व्यवसाय करू शकत नव्हते त्यामुळे व्यक्तीच्या विकासाला मारक ठरणारी ही बलुतेदारी व्यवस्था नष्ट होत गेले गावातील बलुतेदारांना काम मिळनासे झाले त्यामुळे ते आपणास आवडेल तो व्यवसाय ते करू लागले.त्यामुळे त्यांच्यात प्रगती झाली.

खानपान निर्बंधातील बदल :-

भारतीय समाजामध्ये जातीविषयक निर्बंध खूप मोठ्या प्रमाणात होते प्रत्येक जातीला एक विशिष्ट प्रकारचे अधिकार देण्यात आले होते काही जाती अस्पृश्य मानल्या गेल्या त्या जातींना कोणतेही अधिकार देण्यात आलेले नव्हते एखाद्या लग्न समारंभामध्ये पण तिला बसायचं नाही बसता येत नव्हतं किंवा एखादी जातीतील मुलांना वरी जातीचे लोक मुलगी देणे किंवा कमी जातीची मुलगी आपल्या मुलाला करणे या गोष्टीला निर्बंध होता त्यामुळे खानपान विषयी जे संबंध होते ते संबंध बंधनात होती त्यामुळे समाजाचे चौकट बनलेली होती त्या चौकटीच्या बाहेर जाऊन कोणालाही जगता येत नव्हतं अशी ही जाती व्यवस्थेची कठोर बंधने अस्तित्वात होती पण आधुनिक काळामध्ये ही बंधने शिथिल झालेली आहेत. आज कनिष्ठ जातीचा व्यक्ती हॉटेलमध्ये किंवा इतर समारंभामध्ये वरील जातीतील व्यक्तीशी व् सोबत खानपान विषयक वैवाहिक संबंध ठेवत असताना दिसत आहे. त्यामुळे पूर्वीचे बंधन किंवा नियमाने आधुनिक काळामध्ये कुठेतरी शिथिल झालेली आहेत

जात पंचायतचे महत्त्व कमी झाले :- समाजामध्ये जातपंचायतीला खूप महत्त्वाचे स्थान जात पंचायतीच्या नियमाला सोडून व्यक्तीला वर्तन करता येत नव्हतं जाती व्यवस्थेने ठरवून दिलेल्या चौकटीमध्येच व्यक्तीला जीवन जगावं लागायचं जातीचे नियम व्यक्ती व्यवस्थित रित्या पाळतो का नाही यासाठी जातपंचायतीची भूमिका खूप महत्त्वाची होती जात पंचायत जातीनुसार व्यक्तीला वर्तन करण्यास भाग पाडत असे जर एखादा व्यक्ती जातीव्यवस्थेचे नियम पायदळी तुडवण्याचा प्रयत्न केला तर जात पंचायतीमार्फत त्याला कठोर शिक्षा दिली जायची त्यामुळे सहसा जातपंचायतीचे नियम तोडून कोणताही व्यक्ती वर्तन करत नसे त्यामुळे जाती व्यवस्था अधिक कठोर बनत गेली. जातीय भेदभाव करणे कायद्याने गुन्हा मानण्यात आले. त्यामुळे जात पंचायत यावर बंधने आली. अनेक ठिकाणी जात पंचायत प्रमुख यांना शिक्षा देण्यात आली कायद्याने जात पंचायत नष्ट करण्यात आली. त्यामुळे जातीय चौकट कमकुवत झाली.

निष्कर्ष :-

भारतीय समाजातील जाती व्यवस्था ही खूप प्रभावी होती. जाती व्यवस्था हि प्रथा, परंपरेला बळ देणारी आहे. जाती व्यवस्था हे पूर्वीसारखी मजबूत राहिली नाही वाढते शिक्षणाचे प्रमाण दरवळण्याच्या साधनात होणारे वाढ त्यामुळे इतर संस्कृतीचा वाढता प्रभाव वेळोवेळी होणारे नवनवीन कायदे यामुळे जातिव्यवस्थेत मोठ्या प्रमाणात बदल झाला आहे. रस्ते वाहतूक यासारख्या सुविधामुळे शहरी समुदायाचा ग्रामीण भागातील लोकांचा वाढता संपर्क त्यामुळे शहरी संस्कृती ग्रामीण भागात वाढू लागली आणि त्याचा परिणाम म्हणून जी जाती व्यवस्थेचा प्रभाव ग्रामीण समुदायांमध्ये होता तो दिवसेंदिवस कमी होत गेला.

बदलत्या काळानुसार वर्णव्यवस्थे पेक्षा वर्ग व्यवस्थेला समाजात महत्त्व प्राप्त झाले आहे. जातीपेक्षा आर्थिक घटक महत्त्वाचा बनत गेला. त्यामुळे जातीय दर्जापेक्षा आर्थिक स्थर उंचावर लोकांचा भर वाढत गेला त्यामुळे जातिव्यवस्थेचे महत्त्व जे आहे ते कमी होत गेले.

जातीय व्यवस्था पूर्ण नष्ट झाली असे म्हणता येणार नाही आजही राजकीय लोक आपली हितसंबंध जोपासण्यासाठी स्वतःच्या स्वार्थासाठी जाती राजकारणाचा वापर करून आज राजकारणात वावरत आहेत.

जातपंचायतीचा समाजामध्ये एक प्रकारचा दरारा होता पण शासनाने वेळोवेळी जात पंचायतीवर बंदी आणणारे जे कायदे केले. त्याचा परिणाम असा झाला की जातपंचायतीचे महत्त्व कमी झालं आणि जातीचे नियम पाळण्यासाठी जो दंडक होता तो नाहीसा झाल्यामुळे सहजरीत्या लोक आपले जातीय नियम तोडत गेली आणि त्याचा परिणाम जातीचा प्रभाव कमी होत गेला. खानपान विषयक निर्बंध पूर्वीसारखी राहिलेले नाही. आज जातीव्यवस्थेचा जो प्रभाव दिसतोय तो प्रभाव पूर्वीसारखा राहिलेला

नाही पूर्वी रोटी बेटी व्यवहाराला खूप महत्त्व होते. पण आज आंतरजातीय विवाह किंवा हॉटेलमध्ये जेवण करणे या गोष्टी सर्रास घडत असताना दिसत आहेत त्यामुळे खानपान विषयी जो निर्बंध होते जे नियम पाळले जायचे ते पाळले जात नाही.

ग्रामीण भागामध्ये जातीच्या आधारावर बलूतेदार व्यवस्था तयार निर्माण करण्यात आली होती . प्रत्येक जातीला एक विशिष्ट व्यवसाय ठरवून देण्यात आलेला होता त्या जातीने तोच व्यवसाय करायचा अशा पद्धतीचे जातीय बंधन होते त्यामुळे कोणताही व्यक्ती आपल्या जातीच्या पलीकडे जाऊन व्यवसाय करू शकत नव्हता त्यामुळे व्यक्तिमत्त्व विकासाला खूप मोठा अडथळा निर्माण झालेला होता पण नवनवीन कायदे केल्यामुळे जातपंचायतीचे महत्त्व कमी झाल्यामुळे ही जे बोलतेदारी व्यवस्था आहे की बदलत्या आधुनिक काळामध्ये टिकू शकले नाही स्वस्त दरामध्ये शेतीविषयक अवजारे सहजरित्या उपलब्ध होऊ लागले किंवा इतर सुविधा उपलब्ध होऊ लागल्या आहे नवीन नवीन तंत्रज्ञांचा वापर मोठ्या प्रमाणात वाढला आणि त्याचा परिणाम असा झाला की जे बलूतेदारी सिस्टम अनेक वर्षांपासून चालू होती ती मोडकळीला आली. जे बलूतेदारी होते त्यांनी आपला पारंपारिक व्यवसायाने एक आधुनिकतेची जोड दिली आणि आजूबाजूच्या मोठ्या गावामध्ये किंवा शहरांमध्ये जाऊन आपले दुकाने आधुनिक पद्धतीने निर्माण केले व पूर्वीचे पारंपारिक पद्धतीने वर्षाकाठी मोबदला दिला जात होता तसा मोबदला न घेता आज रोख मोबदला घेऊन बलूतेदार काम करत असताना दिसतात. उदाहरणात चांभार चपलीचे मोठे दुकान, कटिंग सलून धोबी असेल त्यांनी लॉन्ड्री अशा पद्धतीचे व्यवसाय करू लागले व रोख स्वरूपामध्ये आपल्या कामाचा मोबदला घेऊ लागले. त्यामुळे बलूतेदारी व्यवस्था जरी नष्ट झाली असेल तरी पण जे विशिष्ट जाती विशिष्ट व्यवसाय करायचा त्या जाती आजही आपला आधुनिक पद्धतीने व्यवसाय करत असताना दिसत आहेत.

संदर्भ सूची :-

1) रामनाथ चव्हाण : भटक्या विमुक्त जमातीची जातपंचायत. खंड २/२००४ देशमुख आणि कंपनी प्र लि पुणे.

2) जातिव्यवस्था :- मिथक वास्तविकता चूनोतीया - सच्चिदानंद सिन्हा -राजकमल प्रकाशन -2016

3) Basic Reaserch Methods-Guthrie Gerard-2016

4) भारतीय जातीव्यवस्था –लोकसत्ता – 02 मे 2014

5)<https://mr.wikipedia.org/wiki/%E0%A4%9C%E0%A4%BE%E0%A4%A0%E0%A4%BF%E0%A4%B5%E0%A5%8D%E0%A4%AF%E0%A4%B5%E0%A4%B8%E0%A5%8D%E0%A4%A5%E0%A5%87%E0%A4%9A%E0%A5%87%E0%A4%A8%E0%A4%BF%E0%A4%B0%E0%A5%8D%E0%A4%AE%E0%A5%82%E0%A4%B2%E0%A4%A8>.

5) मराठी विश्वकोस –ईश्वरचंद विद्यासागर

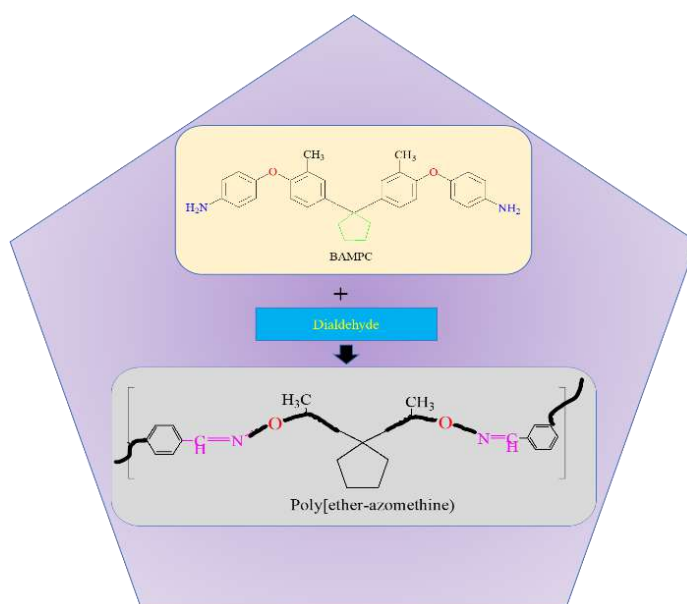
6) जातीव्यवस्था आणि महाराष्ट्रातील जाती जमाती –सुनील सागळे-ग्रंथाली प्रकाशन मुंबई

Exploring New Polymer Structures: Synthesis and Characterization of Methyl Co-poly(ether-azomethine) with Pendant Cardo Cyclopentylidene Moiety

Sanjay S. Ankushrao^{1*}, Anil A. Ghanwat², Suraj D. Jadhav¹

1. Department of Chemistry, Vivekanand College (Autonomous) Kolhapur, Maharashtra India.
2. School of Chemical Sciences, Punyashlok Ahilyadevi Holkar Solapur University, Solapur, Maharashtra, India.

Corresponding Email id: sanjayankushrao@vivekanandcollege.ac.in



Abstract

Through a number of stages, a new diether-diamine monomer i.e. 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC) was synthesized. It has a cardo cyclopentane ring and a pendant methyl group. By using FT-IR, ¹H NMR, and ¹³CNMR spectroscopy, the structure of the novel methyl substituted diether-diamine monomer was confirmed. Taking a proportionate amount of aromatic dialdehydes with a new diamine (BAMPC) undergo polycondensation to create a series of Co-poly(ether-azomethine)s with cardo cyclopentane units. It has been investigated how solubility and thermal stability are affected by the insertion of cardo cyclopentane, a pendant methyl group, in the Co-poly(ether-azomethine)s matrix together with the dialdehydes [terephthalaldehyde and terephthalaldehyde]. poly(ether-azomethine)s exhibit T_g values between 165°C and 178°C and T_d values between 456°C and 486°C indicated good thermal stability. These polyazomethines displayed solubility in several polar aprotic solvents such as DMF, NMP, DMAc, and DMSO at

ambient temperature or upon heating. A poly(ether-azomethine) exhibit T_g values between 165°C and 178°C and T_d values between 456°C and 486°C indicated good thermal stability. These polyazomethines displayed solubility in several polar aprotic solvents such as DMF, NMP, DMAc, and DMSO at ambient temperature or upon heating. SPAM-2,3,4,5 exhibited amorphous nature, with a large peak in the range of 2θ=20° and SPAM-1 polymer exhibited semicrystalline nature, as confirmed by an X-ray diffraction analysis. Co-poly(ether-azomethine)s have inherent viscosities between 0.20 and 0.39 dL/g.

Keywords: Diamine, Co-poly(ether-azomethine), Cyclopentylidene moiety,

1. Introduction

The polymers that have (-CH=N-) linkages in polymer backbone called as Poly-imines or poly(Schiff base)s. Poly(Schiff base)s are classes of materials identified as polyazomethines. These conjugated polymers are mostly gorgeous because they show good mechanical strength [1], good thermal stability [2], photoconductivity [3] and optical properties [4]. Since this wide range of charming properties, polyazomethines have potential applications in many fields e.g. semiconductors, battery anodes or cathodes, advanced technology materials, integrated electro optics for switching, energy storage and conversion devices, displays [5-7], electroluminescence (EL) devices [8], etc. The first polyazomethine was described in 1923 as a result of polycondensation of terephthaldehyde and benzidine [9]. Since then, conjugated aromatic polyazomethines with different moieties on both sides of CH=N group have been described [10-12]. Polyazomethines can be synthesized by solution polycondensation [13], chemical vapour deposition [14-16] and oxidative polymerizations [17].

Yet, polyazomethines are usually infusible polymers and have poor solubility problems, which would minimize their practical applications. Several modified polyazomethines, such as poly(azomethine-ester)s [18], poly(azomethine-ether)s [19], poly(azomethine-carbonate)s [20], poly(amide-azomethine-ester)s [21], poly(acrylate-azomethine)s [22], thermosetting polyazomethines [23] poly(azomethine-sulfone)s [24-27] were produced with the aim to enhance the solubility, to reduce the melting temperature and to promote specific properties such as mesomorphism [28]. Numerous approaches have been reported to enhance the solubility of polyazomethines. The insertion of flexible alkyl and alkoxy groups as the substituents has been evidenced to be effective, though at the expense of their thermal stability [29-31]. The insertion of bulky substituents such as tetraphenylethylene, triphenylamine and diphenyl fluorene has been investigated [32-34]. The copolymerization of electron rich, solubility-enhancing aromatic or heterocyclic units such as carbazole, thiophene and fluorene [35-38] has also been discovered.

Aromatic polyazomethines are usually synthesized by solution polymerization and melt polymerization technique. Polyazomethines with a wide range of applications have had frequent increasing interest due to having a lot of valuable properties such as excellent mechanical strength and high thermal stability as well as

their optoelectronic properties and semi-conductivity [39-41]. Yet, these applications have been limited by their poor solubility in common organic solvents and low molecular weights. Moreover, the relatively rare availability of new dialdehyde monomers also hindered the chemical structure modifications of polyazomethines. Several approaches have been reported to enhance the solubility of polyazomethines. The insertion of flexible alkyl and alkoxy groups as the substituents has been proved to be operative, although at the expense of their thermal stability [42-44]. The integrations of bulky substituents such as tetraphenylethylene, triphenylamine and diphenylfluorene have been investigated [45-47]. The co-polymerization as well as electron rich, solubility-enhancing aromatic or heterocyclic unit such as carbazole, thiophene and fluorene [48-51] has also been discovered.

The chemical alterations of polyazomethines are mainly attained by synthesizing new diamine and then polymerizing them with commercially available dialdehydes TPA and/or IPA. These efforts targeting at either solubility improvement or investigating their thermal stability. Hence here in reported the synthesis of new series of poly(ether-azomethine)s from newly synthesized methyl substituted diamines and from commercial IPA/TPA.

2. Experimental methods

2.1 Materials

All the solvents / chemicals were purified before use by following the standard procedures.

1. 3-mercapto propanoic acid, 10% Pd/C, terephthaldehyde & isophthaldehyde were purchased from Sigma Aldrich and used as received.
2. Potassium carbonate (K_2CO_3) was dried under vacuum at 150°C for 6 h.
3. DMF was vacuum distilled from P_2O_5 and DMAc was purified by vacuum distillation from barium oxide.
4. Cyclopentanone, 4-fluoronitrobenzene were purchased from Spectrochem and O-cresol, hydrazine hydrate purchased from S.D. fine chemicals and used as received.

2.2 Synthesis of new methyl substituted diether-diamine monomer

2.2.1 Synthesis of 1, 1-bis (4-hydroxy 3-methyl phenyl) cyclopentane (BHMPC)

In a 250 mL three necked round bottom flask equipped with HCl gas deep tube, reflux condenser and magnetic stirrer were placed 64.80 g (0.60 mol) of o-cresol and 8.4 g (0.1 mol) of cyclopentanone and 0.2 mL 3-mercaptopropanoic acid. To this reaction mixture dry HCl gas was bubbled at room temperature. The reaction mixture becomes solid in 2 h. The solid reaction mixture was dissolved in ethyl acetate (600 mL) and neutralized by washing with aq. $NaHCO_3$ solution 3 X 200 mL, followed by washing with distilled water 2 X 200 mL. The organic layer was dried over magnesium sulfate, decanted and distilled off to obtain viscous liquid. Then upon

addition of pet ether in viscous liquid, solid product was separated. The solid product was washed with water and dried under vacuum. Finally, the bisphenol was reprecipitated through methanol-water mixture [52].

Yield: 15.10 g (65 %)

M.P.: 140°C

2.2.2 Synthesis of 1, 1-bis[4-(4-nitro phenoxy)-3-methyl phenyl] cyclopentane (BMNPC)

In a 500 mL three neck round bottom flask equipped with calcium chloride guard tube, thermowell, nitrogen gas inlet and magnetic stirrer were placed 11.28 g (0.04 mol) 1, 1-bis (4-hydroxy 3-methyl phenyl) cyclopentane (BHMP) and 12.56 g (0.08 mol) 4-fluoronitrobenzene in 60 mL N, N-dimethyl formamide (DMF), then 11.04 g (0.08 mol) of anhydrous K₂CO₃ was added. The resulting reaction mixture was refluxed for 8 h. Then allowed to cool at room temperature and water was added in reaction mixture to precipitate the product. The product was isolated by filtration, washed with water then washed with ethyl acetate and finally dried under vacuum [53].

Yield: 22.86 g (98%),

M.P.: 270°C.

IR: 3062 cm⁻¹ (Aromatic –CH stretch), 2959, 2870 cm⁻¹ (Aliphatic –CH stretch) 1505, 1346 cm⁻¹ (-NO₂ stretching), 1256, 1178 cm⁻¹ (C-O-C stretching).

¹H NMR (400MHz, DMSO-d₆), δ (ppm): 8.13 (d, 4H), 7.31 (d, 4H), 7.12 (d, 4H), 6.87 (s, 2H), 2.31(s, 6H), 2.08 (m, 4H), 1.60 (m, 4H).

2.2.3 Synthesis of 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC)

In a 250 mL single neck round bottom flask equipped with calcium chloride guard tube and magnetic stirrer were placed 13.10 g (0.025 mol) of the 1, 1-bis [4- (4-nitro 3-methyl phenoxy) phenyl] cyclopentane (BMNPC) and 0.284 g of 10% Pd/C and 13.5 g hydrazine hydrate in 100 mL 75:25 mixture of ethanol and N, N'-dimethyl acetamide. The resulting reaction mixture was kept at refluxed temperature for 10 h. The progress of reaction was monitored by TLC. At the end reaction mixture was filtered while hot to remove the catalyst. The obtained filtrate was poured into 500 mL of water under vigorous stirring to give a light-yellow product. Finally, product was filtered, washed with ethanol and dried. BAMPC recrystallized from DMAc-water system [54].

Yield: 9.86 g (85 %) **M.P.:** 160°C.

IR: 3464, 3377 cm⁻¹ (-NH₂ stretching), 3010, 2957, 2869, 1276, 1165 cm⁻¹

¹H NMR (400MHz, CDCl₃), δ (ppm): 7.28 (s, 2H), 7.11 (d, 2H), 7.02 (d, 2H), 6.78 (s 4H), 3.35 (s, 4H), 6.68 (s, 4H), 2.25(s, 10H), 1.70(m, 4H).

¹³C NMR (100MHz, CDCl₃), δ (ppm): 153.93, 149.80, 143.28, 141.84, 129.79, 127.84, 125.26, 119.77, 116.75, 116.27, 54.64, 38.94, 23.02, 16.55.

2.3 Synthesis of poly (ether-azomethine)s from 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane

In a 100 mL three necked round bottom flask equipped with a reflux condenser, a magnetic stirrer, a calcium chloride guard tube and a nitrogen gas inlet were placed [0.001 mol; 0.464 g of 1, 1-bis[4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC)] in 3 mL N, N-dimethyl acetamide (DMAc) containing 5% lithium chloride (0.150 g). After the mixture became clear, 0.134 g (0.001 mol) terephthaldehyde (TPA) was added in flask and the resulting mixture was stirred overnight. Finally, the polymerization mixture was heated at 140°C for 4 h. The resulting viscous mass was added to a large excess of water. The fibrous polymer was isolated by filtration. The polymer (SPAM-1) was washed several times with hot water to remove any inorganic impurities and was dried under vacuum at 60°C overnight. The yield was 99% and the inherent viscosity of polymer in NMP was 0.39 dL/g. The polyazomethines and co-polyazomethines SPAM-2 to SPAM-5 were synthesized with varying mol proportion of TPA and IPA by similar procedure [55].

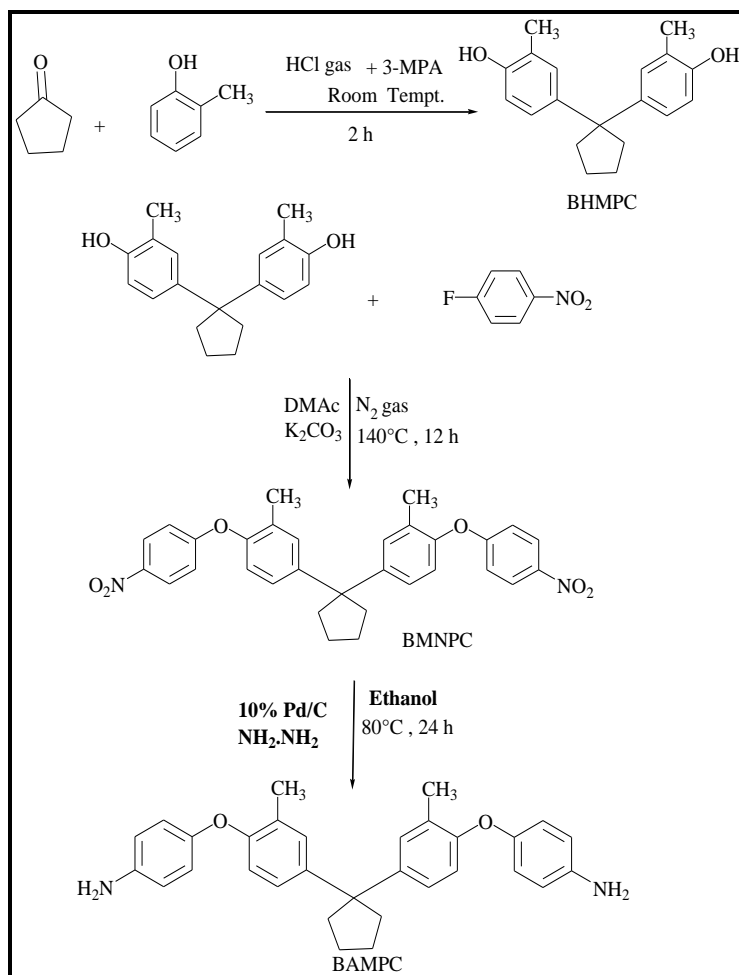
3. Results and Discussion

In order to obtain processable polyazomethines, a new diamine monomer with ether linkage, cardo moiety and pendant methyl group *viz.*, 1, 1-bis[4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane was utilized. To study the effect of ether linkage, cyclopentylidene cardo moiety and methyl substitution on solubility behavior, a series of co-poly(ether-azomethine)s was synthesized by high temperature solution polycondensation of 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane with commercially available aromatic dialdehydes such as terephthaldehyde, isophthaldehyde and a mixture of terephthaldehyde and isophthaldehyde.

Homo and Co-polyazomethines were characterized by inherent viscosity measurements, solubility tests, FTIR spectroscopy, X-ray diffraction, thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC).

3.1 Synthesis of 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane

In the first step, cyclopentanone was reacted with o-cresol by using HCl gas in the presence of 3-mercapto propanoic acid as catalyst to obtain the bisphenol (BHMPC). The bisphenol followed by reacts with 4-chloronitrobenzene in presence of anhydrous K₂CO₃ to yield intermediate dinitro compound *viz.*, 1, 1-bis [4-(4-nitro phenoxy)-3-methyl phenyl] cyclopentane (BMNPC). Pure BMNPC was characterized by FT-IR, ¹H-NMR spectroscopy.



Scheme 3.1 Synthesis of 1, 1-bis[4-(4-amino phenoxy)- 3-methyl phenyl]cyclopentane

FT-IR spectrum of BMNPC (**Fig.1**) exhibited characteristic absorption bands at 1505 cm^{-1} (asymmetric $-\text{NO}_2$ stretching) and 1346 cm^{-1} (symmetric $-\text{NO}_2$ stretching). The band at 3062 and 2959 cm^{-1} were assigned to aromatic $-\text{CH}$ stretch and aliphatic $-\text{CH}$ stretch respectively. The band at 1255 and 1178 exhibits C-O-C stretching which indicates presence of ether linkages in di-nitro compound.

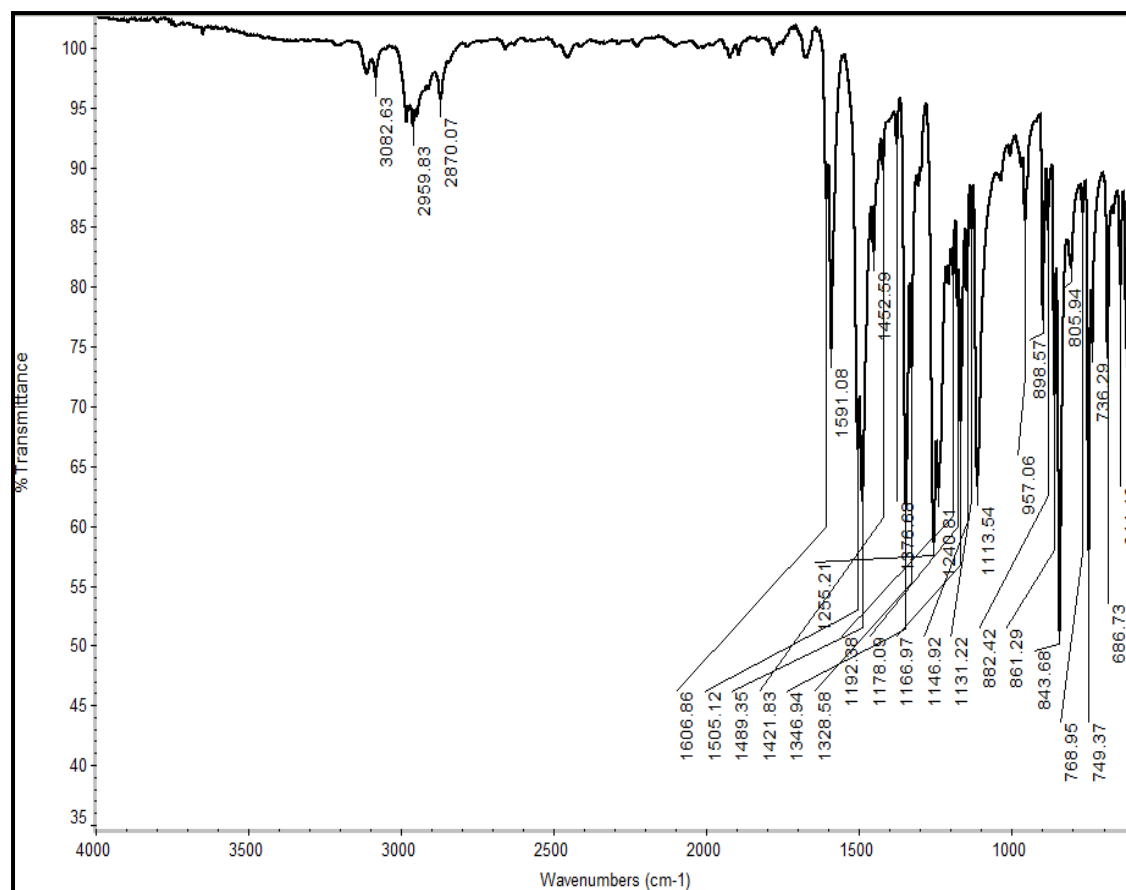


Fig..1 FT-IR spectrum of 1, 1-bis [4- (4-nitro phenoxy)-3-methyl phenyl] cyclopentane

¹H-NMR spectrum of BMNPC is depicted in **Fig. 2**. The aromatic protons ‘h’ and ‘g’ appeared in the range 8.13 δ, ppm and 7.31 δ, ppm as doublet and which is corresponding to aromatic protons of phenyl ring attached to nitro group. The aromatic proton ‘c’, ‘d’ and ‘e’ appeared in the range 7.12 δ, ppm and 6.87 δ, ppm as singlet and doublet respectively which is corresponding to aromatic protons of phenyl ring attached to cyclopentane ring. The proton ‘f’ flanked by two methyl groups displayed a peak at 2.08 δ, ppm as singlet and the aliphatic protons ‘a’ and ‘b’ appeared as two multiplets at 1.60 and 2.31 δ, ppm, respectively.

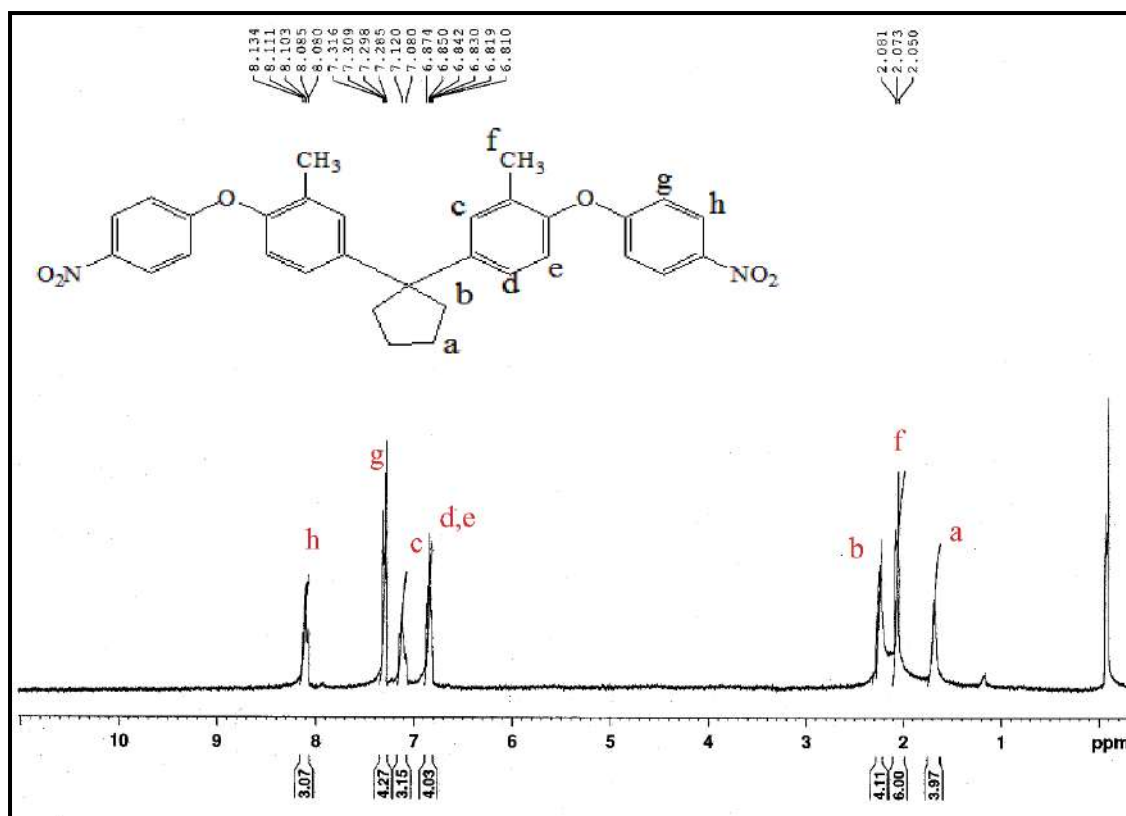


Fig. 2 ^1H NMR spectrum of 1, 1-bis[4-(4-nitro phenoxy)-3-methyl phenyl] cyclopentane

In the next step, BMNPC was reduced to the diamine *viz.*, 1, 1-bis [4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane (BAMPC) by catalytic hydrogenation using hydrazine hydrate and Pd-C (10 wt.%). The crude diamine was purified by recrystallization from DMAc-water and was characterized by FT-IR, ^1H -NMR, ^{13}C NMR and Mass spectroscopy.

FT-IR spectrum of BAMPC (**Fig. 3**) exhibited N-H stretching absorption bands at 3464 (asymmetric N-H stretching) and 3377 cm^{-1} (symmetric N-H stretching) and C-O-C stretching at 1223 cm^{-1} and 1122 cm^{-1} . Band at 3010 cm^{-1} is due to aromatic C-H stretching and band at 2957 and 2869 cm^{-1} is due to aliphatic C-H stretching of cyclopentane moiety.

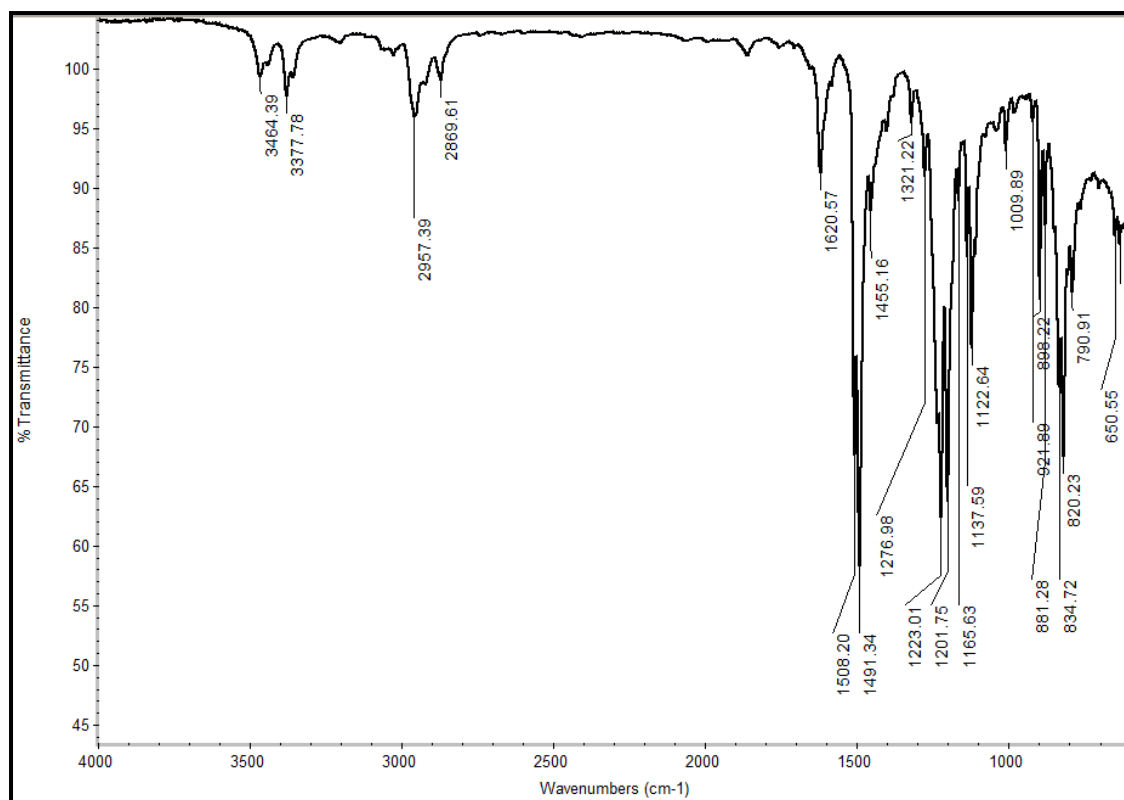


Fig. 3 FT-IR spectrum of 1, 1-bis [4- (4-amino phenoxy)- 3-methyl phenyl] cyclopentane

$^1\text{H-NMR}$ spectrum of 1,1-bis[4-(4-aminophenoxy)-3-methyl phenyl]cyclopentane (BAMPC) is represented in **Fig.4**. The aliphatic protons 'a' and 'b' were observed for methylene group of cyclopentylidene ring at 1.70 and 2.25 δ , ppm. The aliphatic protons 'f' at 2.25 δ , ppm overlapped with proton 'b' and it is corresponding to methyl group attached to aromatic ring. The aromatic protons 'd' and 'e' displayed peaks at 6.78 and 6.68 δ , ppm, appeared as doublet respectively. The aromatic proton 'g' and 'i' appeared as a doublet at 7.02 δ , ppm and 7.28 δ , ppm corresponding to phenyl ring attached to cyclopentylidene ring. The proton 'h' appeared as a singlet at 7.11 δ , ppm. The signal at 3.35 δ , ppm is due to $-\text{NH}_2$ protons.

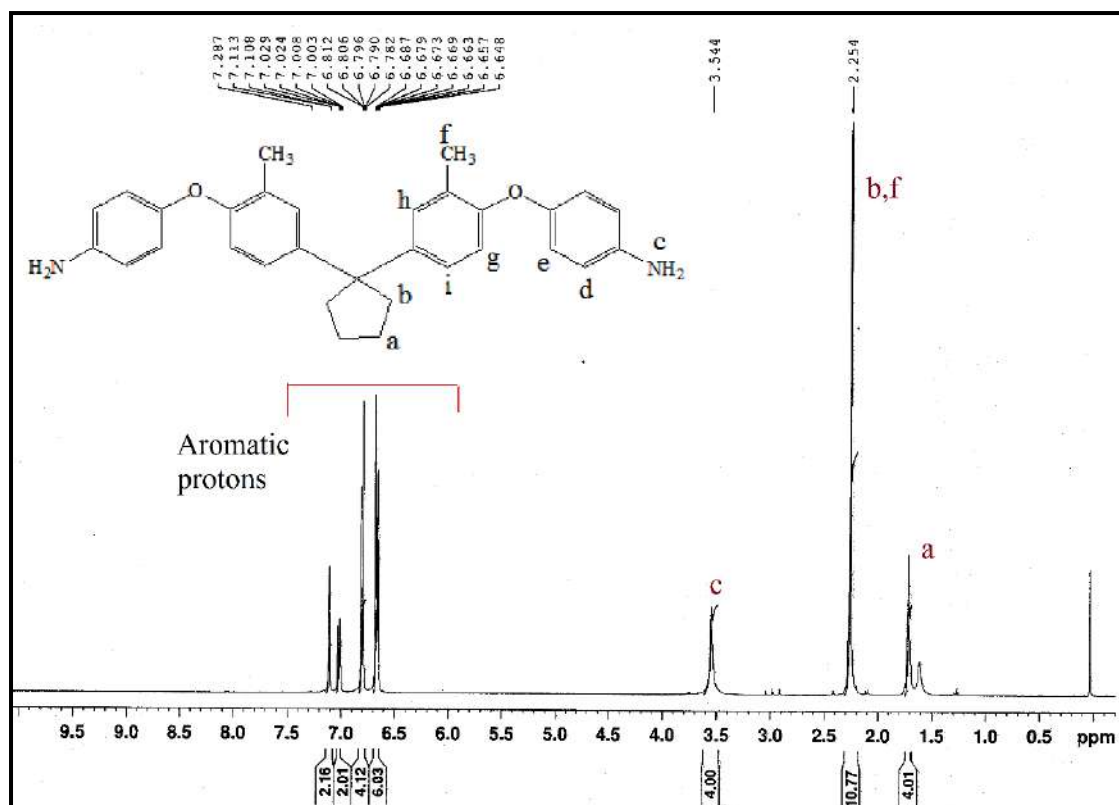


Fig. 4 ^1H NMR spectrum of 1, 1-bis [4- (4-amino phenoxy)- 3-methyl phenyl] cyclopentane

^{13}C -NMR spectrum of 1,1-bis[3-methyl-4-(4-amino phenoxy)phenyl]cyclopentane (BAMPC) along with assignments is presented in **Fig. 5**. ^{13}C NMR spectrum showed fourteen NMR signals to 14 types of different carbon atoms. The NMR signals appeared at 127.84, 125.26, 119.77, 116.75, 116.27 δ ; corresponding to aromatic CH carbons. The tertiary carbons showed signals at 153.93, 149.80, 143.28 (C-NH₂), 141.84, 129.79 δ , and 54.64 δ whereas CH₂ carbon gave NMR signals at 38.94, 23.02 δ confirming aliphatic cyclopentylidene ring. The carbon showed signal 16.55 δ confirming methyl group attached to aromatic ring.

DEPT spectrum (**Fig. 6**) of BAMPC also confirms the structure of amino compound, all the quaternary carbons are absent in the spectrum and the peaks of CH and CH₃ carbons are upper sides at 129.79, 125.26, 119.80, 116.71, 116.27 δ and 16.58 respectively. The peaks of CH₂ appeared at down side at 38.93, 23.0 δ .

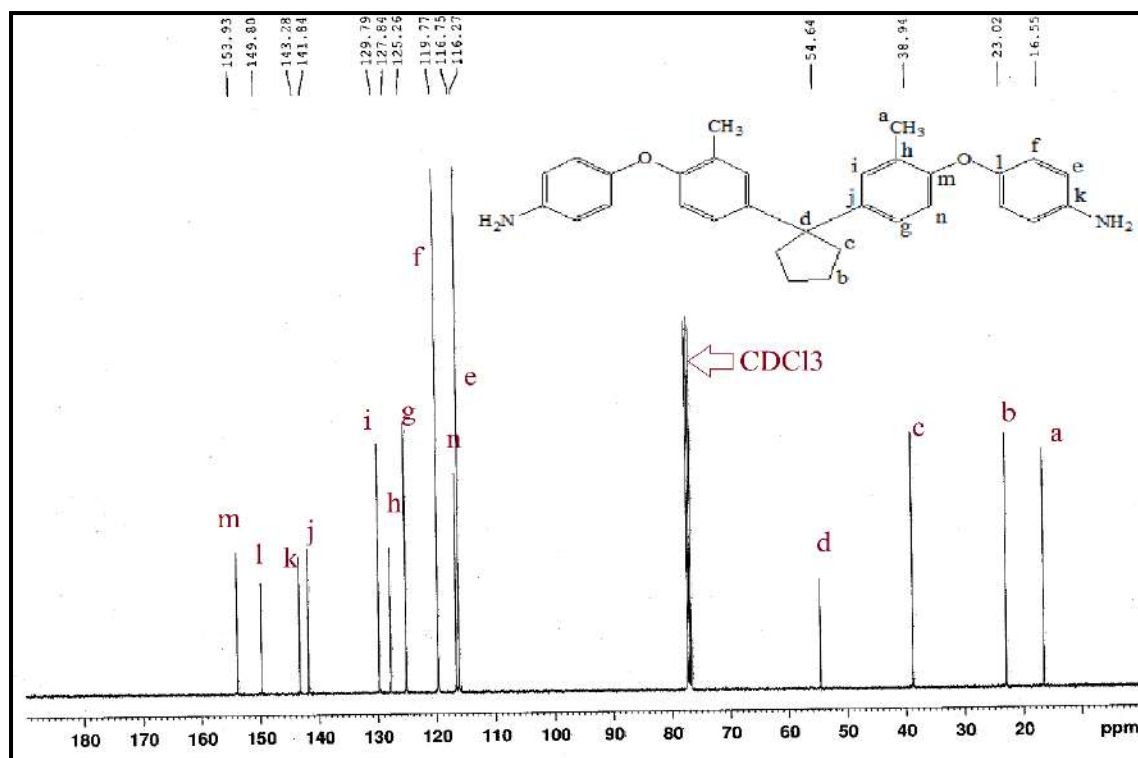


Fig.5 ¹³C NMR spectrum of 1, 1-bis [4- (4-amino phenoxy) - 3-methyl phenyl] cyclopentane

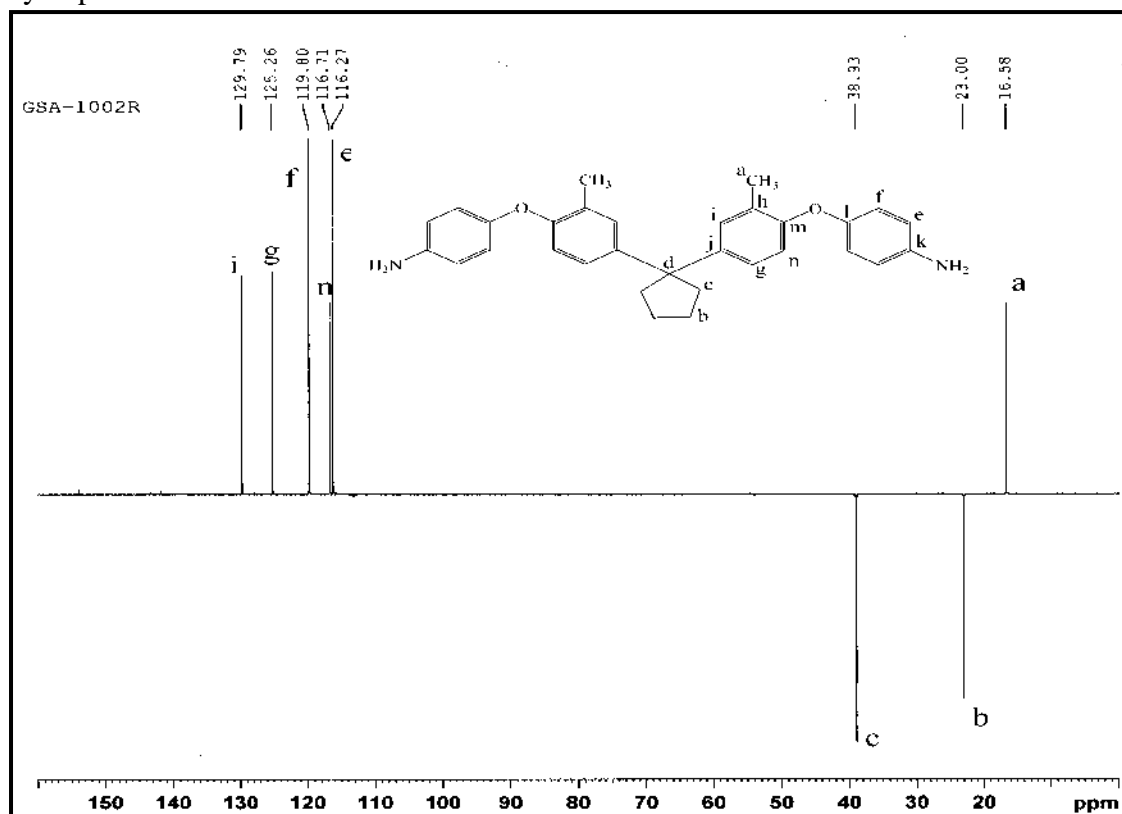


Fig. 6 DEPT-135 spectrum of 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane

The mass spectrum of (**Fig.7**) BAMPC showed molecular ion peak at m/e 465 corresponding to molecular weight of BAMPC.

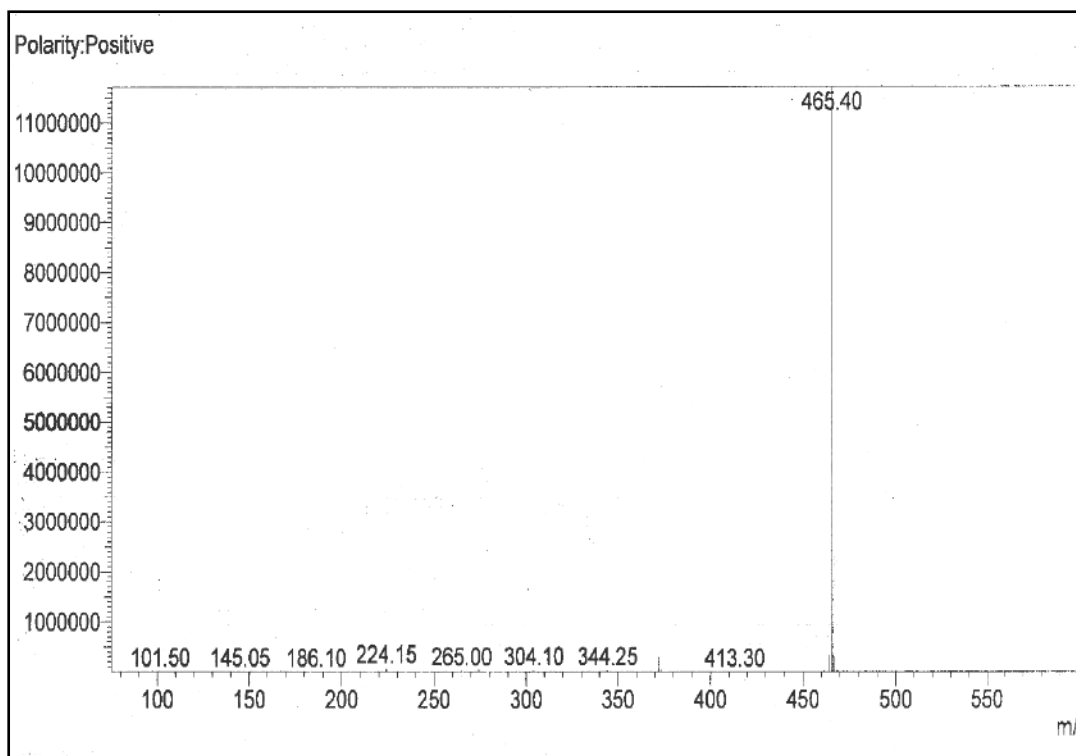
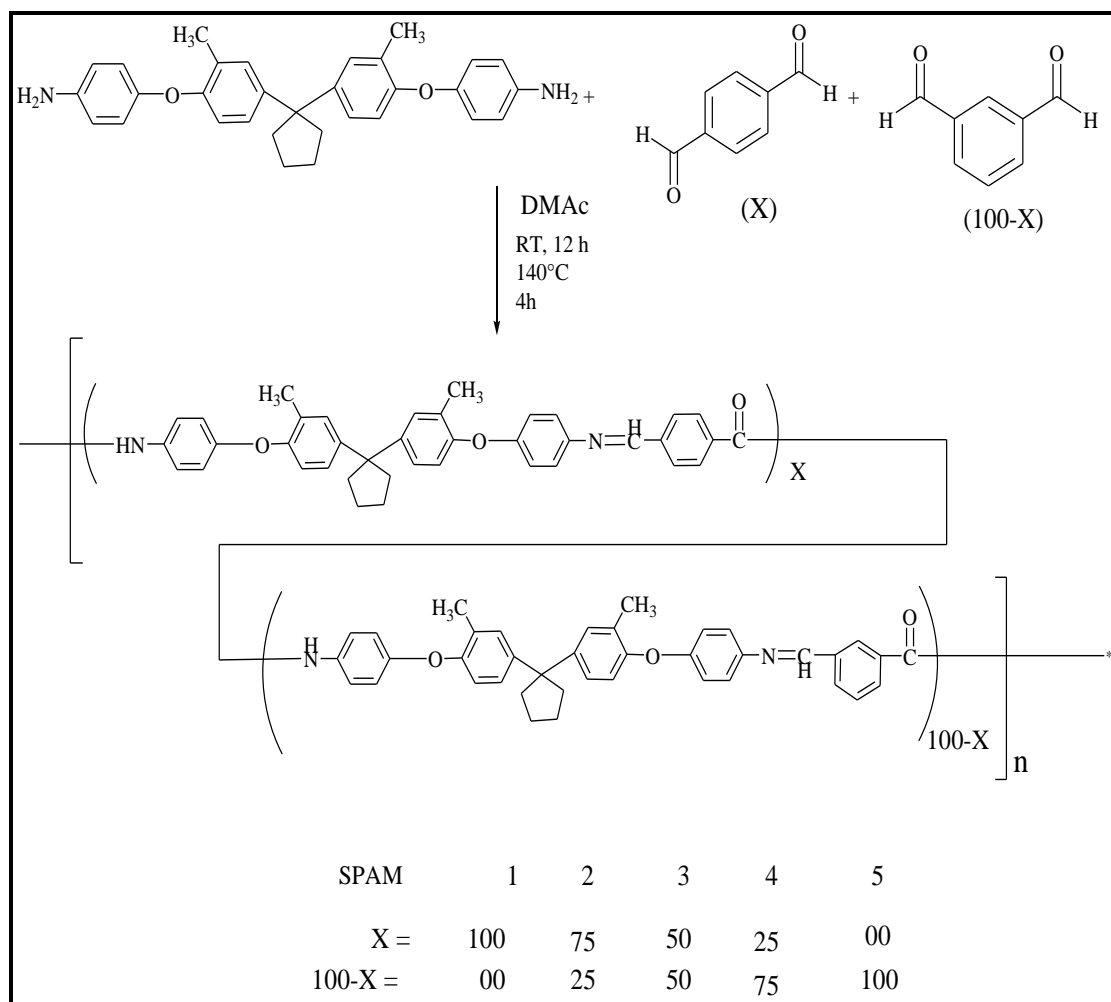


Fig.7 Mass spectrum of 1, 1-bis [4- (4-amino phenoxy)-3-methyl phenyl] cyclopentane

3.2 Synthesis of poly(ether-azomethine)s from 1, 1-bis[4-(4-amino phenoxy)-3-methyl phenyl] cyclopentane

A series of methyl substituted homo and co-poly(ether-azomethine)s were synthesized as outlined in **Scheme 4.2** by elevated temperature solution polymerization of BAMPC with dialdehydes TPA and/or IPA in DMAc containing LiCl. Lithium chloride was used to absorb water formed during the polycondensation. The polymerization proceeded smoothly giving highly viscous solution. The resulting polymers were precipitated by pouring the viscous solutions in water. The inherent viscosities of all these polymers were determined in NMP and ranged from 0.20 to 0.38 dL/g. The data of these poly (ether-azomethine)s are presented in **Table 4.1**.



Scheme 3.2 Synthesis of poly(ether-azomethine)s (SPAM-1 to SPAM-5)

Table 1. Yield and Viscosity of Poly(ether-azomethine)s

Polymer Code	Monomers			Yield %	Inherent Viscosity dL/g ^a
	Diamine BAMPC Mol %	TPA Mol%	IPA Mol%		
SPAM-1	100	100	0	99	0.39
SPAM-2	100	75	25	98	0.28
SPAM-3	100	50	50	97	0.33
SPAM-4	100	25	75	98	0.20
SPAM-5	100	0	100	99	0.24

^aInherent viscosity was measured at a concentration of 0.5 % (W/V) in NMP at 30°C

Structural Characterization

The polymers were characterized by the infrared spectroscopy. The IR spectrum of poly (ether-azomethine) SPAM-1, **Fig. 8** showed the characteristic absorption at 1624 cm^{-1} (CH = N stretching). The sharp bands occurring at 1229 and 1121 cm^{-1} in the spectra of the polymers are due to the asymmetrical and symmetrical vibrations of the(C-O-C) ether linkage. The presence of bands at 2970 and 2865 cm^{-1} can be assigned to assymetric and symmetric aliphatic (C-H stretching) vibrations. The vibration at 827 cm^{-1} indicates para catenation of aromatic rings.

The IR spectrum of poly (ether-azomethine) SPAM-3, **Fig. 9** showed the characteristic absorption at 1623 cm^{-1} (CH = N stretching). The sharp bands occurring at 1229 and 1156 cm^{-1} in the spectra of the polymers are due to the asymmetrical and symmetrical vibrations of the(C-O-C) ether linkage. The presence of bands at 2969 and 2846 cm^{-1} can be assigned to asymmetric and symmetric aliphatic (C-H stretching) vibrations. The vibration at 832 cm^{-1} indicates para catenation of aromatic rings.

The IR spectrum of poly (ether-azomethine) SPAM-5, **Fig. 10** showed the characteristic absorption at 1621 cm^{-1} (CH = N stretching). The sharp bands occurring at 1234 and 1122 cm^{-1} in the spectra of the polymers are due to the asymmetrical and symmetrical vibrations of the(C-O-C) ether linkage. The presence of bands at 2970 and 2872 cm^{-1} can be assigned to assymetric and symmetric aliphatic (C-H stretching) vibrations. The vibration at 835 cm^{-1} indicates para catenation of aromatic rings.

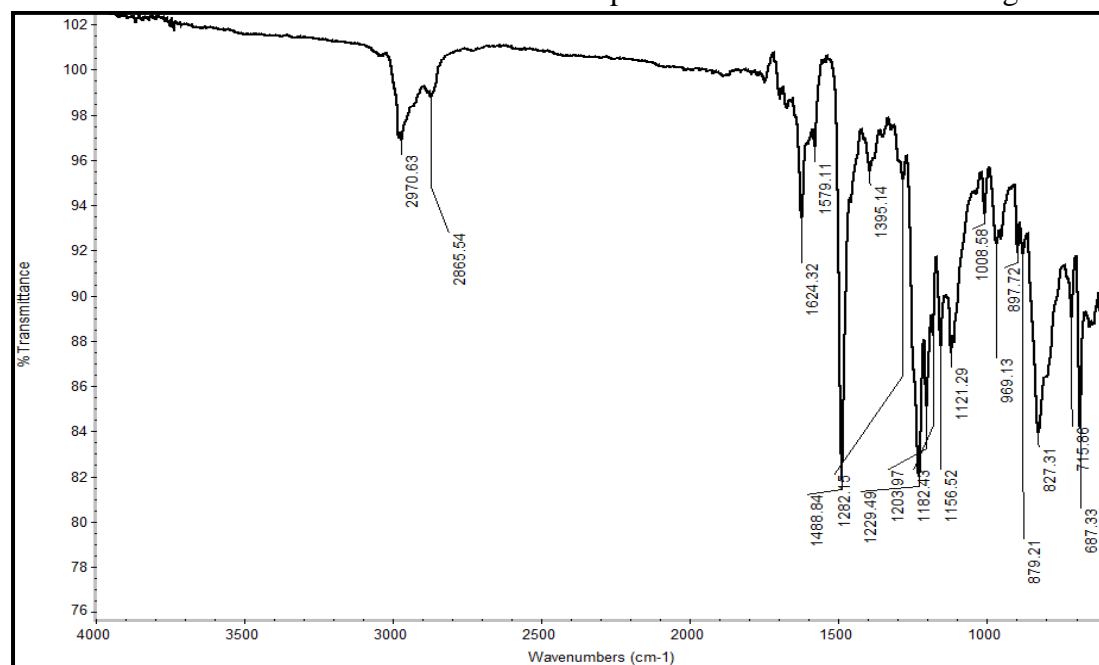


Fig. 8 FT-IR spectrum of SPAM-1

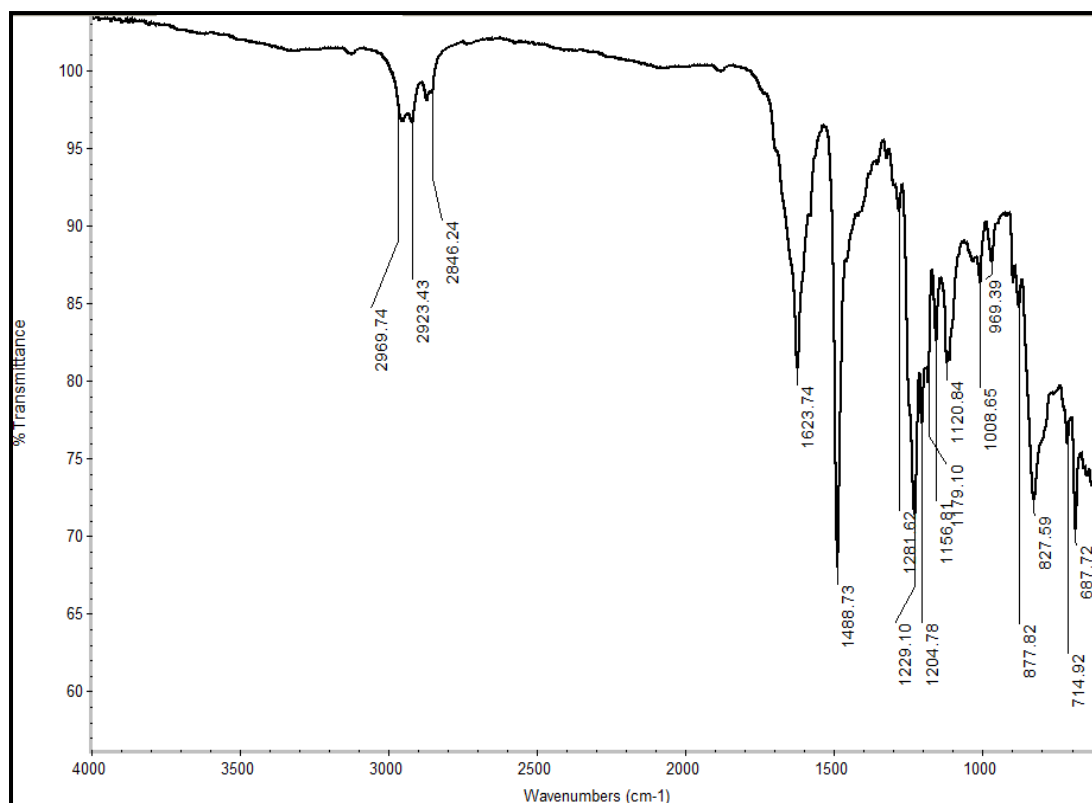


Fig. 9 FT-IR spectrum of SPAM-3

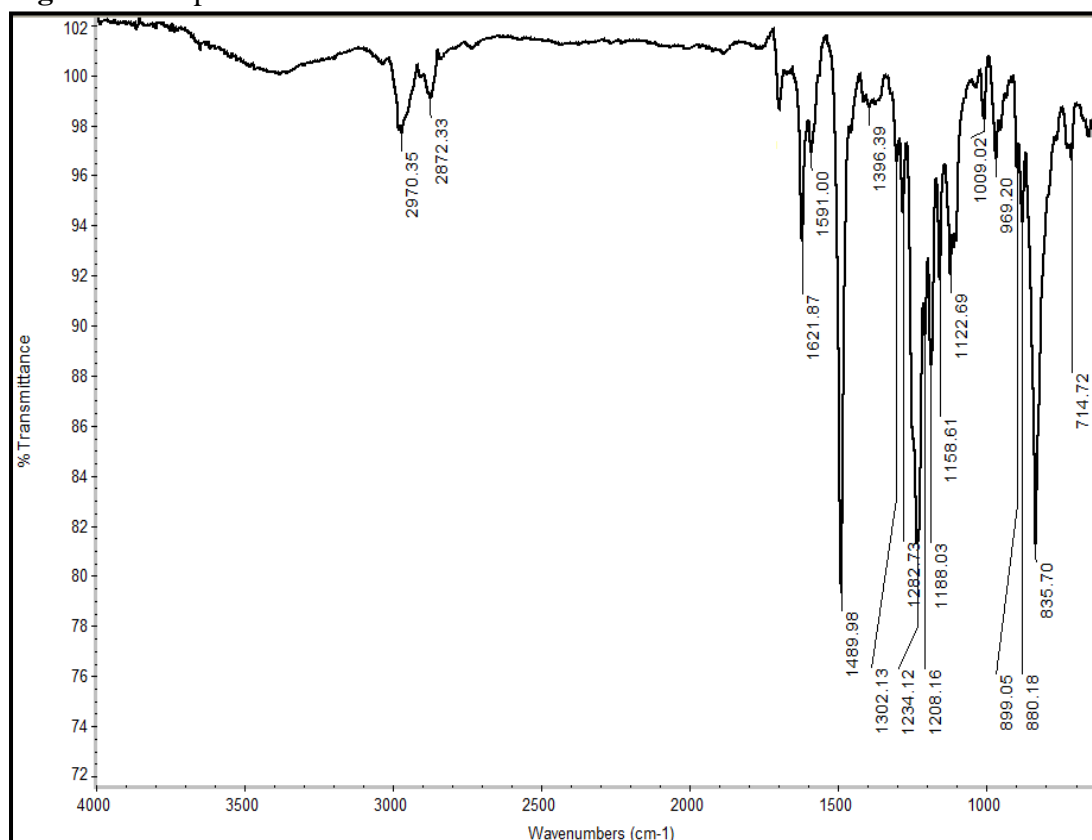


Fig 10 FT-IR spectrum of SPAM-5

Solubility properties

Solubility characteristics of methyl substituted poly(ether-azomethine)s are summarized in **Table 2**. It is observed that the entire poly (ether-azomethine) SPAM-

1 to SPAM-5 exhibited solubility in organic solvent N-methylpyrrolidone (NMP) and also shows partial solubility in solvents such as THF and DCM. All these Polyazomethines (SPAM-1 to SPAM-5) are insoluble in solvents such as DMF, DMAc and DMSO. Polymer SPAM-1 synthesized from terephthaldehyde (TPA) exhibit less solubility due to its stiff structure attributed more close packing of polymer chains. But polyazomethine SPAM-4 shows better solubility in solvents DMF, DMAc, NMP and DMSO, thus good improvement in solubility of these polymer, as expected; can be attributed to the copolymerization of novel diamine with TPA and IPA, introduction of cardo cyclopentylidene moiety, pendant methyl substitution and ether linkages in the polymer backbone.

Table 2. Solubility behavior of Poly(ether-azomethine)s

Polymer Code	Solvents							
	DMF	DMAc	DMSO	NMP	THF	CHCl ₃	DCM	C.H ₂ SO ₄
SPAM-1	-	-	-	+	±	-	+	+
SPAM-2	±	±	-	+	±	-	+	+
SPAM-3	±	±	-	+	±	-	+	+
SPAM-4	+	+	+	+	±	-	±	+
SPAM-5	±	±	±	+	±	-	±	+

+ : Soluble ;

- : Insoluble on heating;

± : Sparingly soluble

Thermal properties

Thermal behaviour of polymers was evaluated by means of thermogravimetry and differential scanning calorimetry. **Table 3.** incorporate the thermal data such as glass transition temperature (T_g), initial decomposition temperature (T_i), 10 % decomposition temperature (T_d) and residual weight at 900°C.

Table 3. Physical properties of Poly(ether-azomethine)s

Polymer Code	Thermal behaviour ^b			
	T_i °C	T_d °C	T_g °C	Residual Wt % at 900°C
SPAM-1	416	486	178	18
SPAM-2	414	474	175	19
SPAM-3	410	456	170	18

SPAM-4	414	484	170	17
SPAM-5	409	470	165	16

^b Temperature at which onset of decomposition was recorded by TG at a heating rate of 10°C/min.

T_g- Glass transition temperature determined at second heating by DSC at a heating rate of 10°C/min

T_d – Temperature of 10% decomposition

T_i – Initial decomposition temperature.

The thermal stability of the methyl substituted poly(ether-azomethine)s outlined in **Fig. 11** was studied at a heating rate of 10°C/min in nitrogen atmosphere by thermogravimetric analysis. T_d values were in the range of 456°C to 486°C. In general, these polymers, like other poly-Schiff bases, exhibited good thermal stability in nitrogen; 10% weight loss only takes place when they are heated beyond 456°C in nitrogen. The initial decomposition temperature (T_i) were in the range of 409°C to 416°C. The residual weight at 900°C were in the range of 16%-19%.

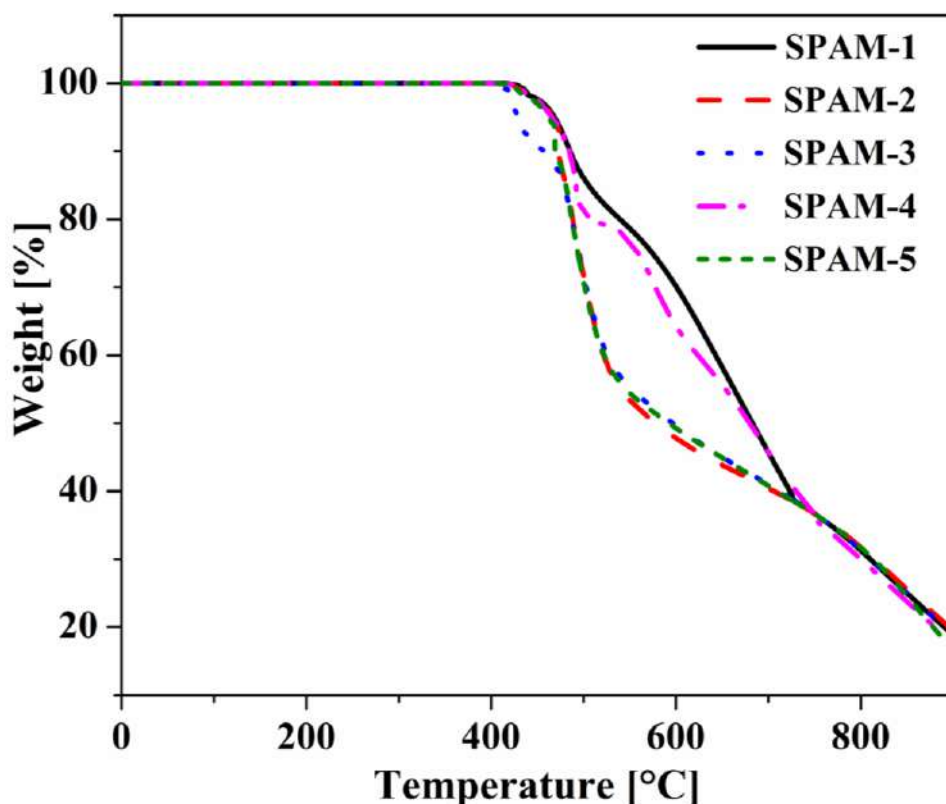


Fig. 11 TGA curve of Poly(ether-azomethine)s SPAM-1 to SPAM-5

The DSC curves (**Fig. 12**) represent the T_g values of methyl substituted poly(ether-azomethine)s. All these polyazomethines exhibits a T_g indicative of an amorphous or glassy morphology. The glassy morphology of these polyazomethines is due to the presence of cardo groups and pendant methyl substitution in the polymer backbone as well as copolymerization, which inhibited the crystalline packing. All the

polymers show T_g in between 165-178°C. The higher T_g of SPAM-5 compared to the T_g of other polymers is due to the usage of terephthaldehyde (TPA) which exhibits rigid structure attributed more close packing of polymer chains.

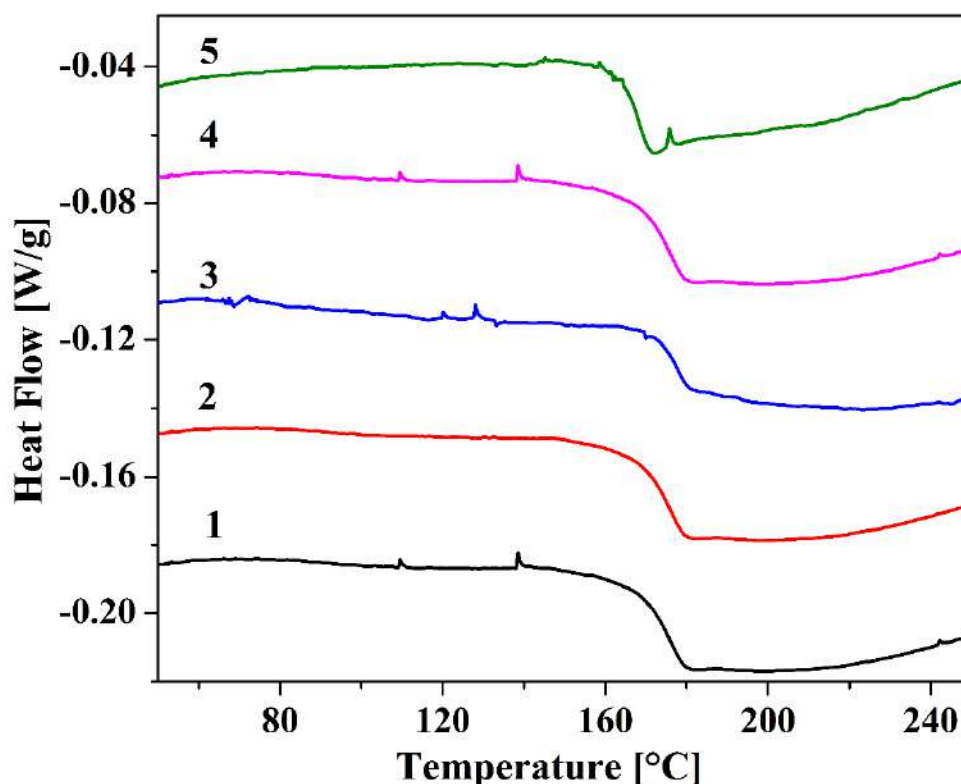


Fig 12. DSC curve of Poly(ether-azomethine)s SPAM-1 to SPAM-5

X-Ray diffractograms of polymers exhibited a broad halo in the wide angle region (at about $2\theta \approx 20^\circ$) indicating that, the polymers were amorphous in nature. The methyl substituted Poly (ether-azomethine)s were also characterized by the wide angle X-ray diffractometer. The X-ray diffraction pattern of all poly (ether-azomethine)s is shown in **Fig 13**. It is observed that, the polymer (SPAM-4) is highly amorphous in nature. This may be attributed to the copolymerization of novel diamine with IPA and TPA, introduction of cardo cyclopentylidene moiety of novel diamine monomer, methyl substitution and ether linkages which may have disrupted the chain regularity and packing leading amorphous nature. On the contrary, SPAM-1 polymer exhibited semicrystalline nature; this may be due to presence of para catenation of TPA leading to the close packing of the chains.

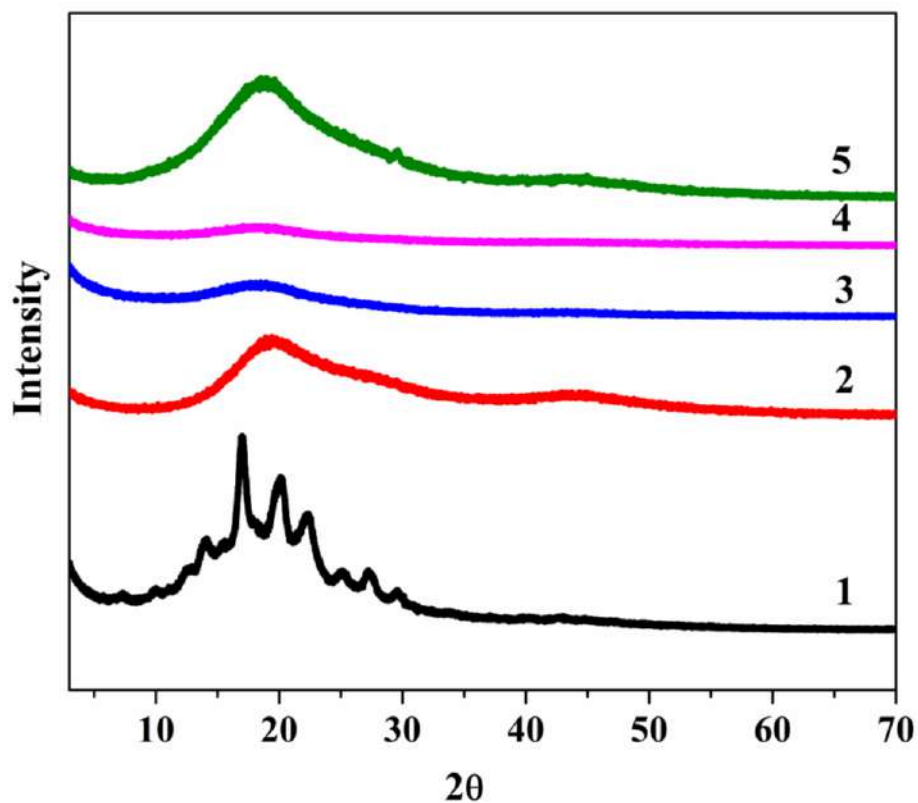


Fig. 13 XRD curve of Poly (ether-azomethine)s SPAM-1 to SPAM-5

4. Conclusions

We have successfully synthesized and characterized poly(ether-azomethine)s with copolymerization, ether linkage, pendant methyl substitution, and a cardo cyclopentylidene moiety. The resulting polymers showed medium to reasonably moderate molecular weights (0.20-0.39 dL/g). SPAM-4 exhibited enhanced solubility in various solvents, attributed to the unique molecular structure. X-ray diffraction patterns revealed the polymers' amorphous nature, except for SPAM-1, which was semicrystalline. The polyazomethines displayed robust thermal stability (Td: 456°C-486°C), and their glass transition temperatures (Tg: 165°C-178°C) suggested broad processing flexibility. This study offers valuable insights into the synthesis, structure, and thermal properties of these novel polymers.

References

1. Catanescu, O.; Grigoras, M.; Colotin, G.; Dobreanu, A.; Hurduc, N.; Simionescu, C.; *Eur. Polym. Journal*, 37, 2213, 2001.
2. Ribera, D.; Mantecon, A.; Serra, A.; *J. Polym. Sci. A, Polym. Chem.*, 40, 4344, 2002.
3. Suh, S. C.; Shim, S. C.; *Synthetic Metals*, 114, 91-95, 2000.
4. Janusz, J.; *Rev. Adv. Mate. Science*, 8, 82-85, 2004.
5. Jarzabek, B.; *Journal of Non-Crystalline Solids*, 352, 1660-1662, 2006.
6. Aly, K. I.; Khalaf, A. A.; *Journal of Applied Polymer Science*, 77, 1218-1229, 2000.

7. Grigoras, M.; Antonoaia, N. C.; *Polymer International*, 54, 12, 1641-1646, 2005.
8. El-Shekeil, A.; Al-Khader, M.; Abeer, O.; Bakr, A.; *Synthetic Metals*, 43, 147-152, 2004.
9. Puertolas, J. A.; Carod, E.; Diaz-Calleja, R.; Cerrada, P.; Orioi, L.; Pinol, M.; Serrano, J. L.; *Macromolecules*, 30, 773, 1997.
10. Niu, H.; Huang, Y.; Bai, X.; Li, X.; Zhang, G.; *Materials Chemistry and Physics*, 86, 33-37, 2004.
11. Hui, Z.; Gandini, A.; *Eur Polym Journal*, 28, 1461, 1992.
12. Dutta, P. K.; Jain, P.; Sen, P.; R.; Trivedi, P.; Sen, K.; Dutta, J.; *European Polymer Journal*, 39, 1007-1011, 2003.
13. Suh, S. C.; Shim, S. C.; *Synthetic Metals*, 114, 91-95, 2000.
14. Weaver, M. S.; Bradley, D. D. C.; *Synth. Metals*, 83, 61-66, 1996.
15. Tatsuura, S.; Sotoyama, W.; *Appl. Phys. Lett.*, 62, 2182, 1993.
16. Ng, S. C.; Chan, H. S. O.; Wong, P. M. L.; Tan, K. L.; Tan, B. T. G.; *Polymer*, 39, 20, 4963-4968, 1998.
17. Chevrot, C.; Henri, T.; *Synthetic Metals*, 118, 157-166, 2001.
18. Shukla, U.; Rao, K.V.; Rakshit, A. K.; *J. Appl. Polym. Sci.*, 88, 153-160, 2003.
19. Aly, K. I.; Ahmed, R. A.; *Liquid Crystals*, 27, 451-458, 2000.
20. Sun, S. -J.; Chang, T. -C.; Li, C. -H.; *Eur. Polym. J.*, 29, 951-955, 1993.
21. Li, C. -H.; Chang, T. -C.; *J. Polym. Sci., Chem.*, 29, 361-367, 1991.
22. Tanaka, H.; Shibahara, Y.; Sato, T.; Ota, T.; *Eur. Polym. J.*, 2, 1525-1530, 1993.
23. Mormann, W.; Brocher, M.; *Polymer*, 40, 193-198, 1998.
24. Cozan, V.; Butuc, E.; Stoleriu, A.; Rusa, M.; Rusu, M.; Ni, Y.; Ding, M.; *J. Macromol. Sci., Pure Appl. Chem.*, A32, 1243-1262, 1995.
25. Cozan, V.; Gaspar, M.; Butuc, E.; Stoleriu, A.; *Eur. Polym. J.*, 37, 1-8, 2001.
26. Cozan, V.; Avram, E.; *Eur. Polym. J.*, 39, 107-114, 2003.
27. Marin, L.; Cozan, V.; Bruma, M.; *Proceedings of 8th International Symposium on Polymers for Advanced Technologies*, 13-16, Budapest, Section A, September 2005.
28. Choi, M. K.; Kim, H. L.; Suh, D. H.; *Jour. of appli. polym. sci.*, 101, 1228-1233, 2006.
29. Yang, J.; *Polymer*, 46, 10478-10483, 2005.
30. Liou, G. -S.; Lin, H. Y.; Hsieh, Y. L.; *J. Appli. Polym. Sci. part-A*, 45, 4921-4932, 2007.
31. Niu, H. -J.; Huang, Y. -D.; *Material Letters*, 58, 2979-2983, 2004.
32. Niu, H. -J.; Kang, H.; Cai, J.; Wang, C.; *Polym. Chem*, 2, 2804-2817, 2011.
33. Liu, C. -L.; Chen, W. -C.; *Macromol. Chem. Phys.*, 206, 2012-2222, 2005.
34. Park, K. H.; Tani, T.; Kakimoto, M.; Imai, Y.; *Macromol Chem Phys.*, 199, 1029-1033, 1998.
35. Wang, C.; Shieh, S.; Legoff, E.; Kanatzidis, M. G.; *Macromolecules*, 29, 3147-56, 1996.

36. Tsai, F. C.; Chang, C. C.; Liu, C. L.; Chen, W. C.; Jenekhe, S. A.; *Macromolecules*, 38,1958-66, 2005.
37. Kim, H. C.; Kim, J. S.; Kim, K. S.; Park, H. K.; Baek, S.; Ree, M.; *J. Polym. Sci. Part A Polym. Chem.*, 42, 825, 34, 2004.
38. Grigoras, M.; Antonoaia, N. C.; *Polym. Int.*, 54, 1641, 6, 2005.
39. Yang, C. J.; Jenekhe, S. A.; *Chem. Mater*, 6,196–203, 1994.
40. Wang, C. G.; Shieh, S.; LeGoff, E.; Kanatzidis, M. G.; *Macromolecules*, 29, 3147-56, 1996.
41. Grigoras, M; Catanescu, C. O.; *J. Macromol Sci: Part C Polym. Rev.*, 44, 31-73, 2004.
42. Park, S. B.; Kim, H.; Zin, W. C.; Jung, J. C.; *Macromolecules*, 26,1627-32,1993.
43. Yang, C. J.; Jenekhe, S. A.; *Macromolecules*, 28,1180-96, 1995.
44. Thomas, O.; Inganas, O.; Andersson, M.R.; *Macromolecules*, 31, 2676-8, 1998.
45. Liou, G. S.; Lin, H. Y.; Hsieh, Y. L.; Yang, Y. L.; *J. Polym. Sci. Part-A Polym. Chem.*, 45, 4921-32, 2007.
46. Matsumoto, T.; Yamada, F; Kurosaki, T.; *Macromolecules*, 30, 3547-52, 1997.
47. Park. K. H.; Tani, T.; Kakimoto, M.; Imai, Y.; *Macromol. Chem. Phys.*, 199, 1029-33, 1998.
48. Wang. C.; Shieh, S.; Legoff, E.; Kanatzidis, M. G.; *Macromolecules*, 29, 3147-56, 1996.
49. Tsai, F. C.; Chang, C. C.; Liu, C. L.; Chen. W. C; Jenekhe, S. A.; *Macromolecules*, 38, 1958-66, 2005.
50. Kim, H. C.; Kim, J. S.; Kim, K. S.; Park, H. K.; Baek, S.; Ree, M.; *J. Polym Sci. Part A Polym Chem*, 42, 825-34, 2004.
51. Grigoras, M.; Antonoaia, N. C.; *Polym. Int.*, 54, 1641-60, 2005.
52. Ankushrao, S. S.; Gugwad, V. M.; Ubale, V. P.; Maldar, N. N.; Ghanwat, A. A.; *Polym. Sci. - Series B*, 60(3), 263–272, 2018.
53. Ankushrao, S. S.; Patil, Y. S.; Ubale, V. P.; Maldar, N. N.; Ghanwat, A. A.; *J. Macromol. Sci., Part A: Pure and Applied Chem*, 54(6), 411–417, 2017.
54. Mahindrakar, J. N., Patil, Y. S., Salunkhe, P. H.; Ankushrao, S. S.; Kadam, V. N., Ubale, V. P.; Ghanwat, A. A.; *Macromol. Sci., Part A: Pure and Appli. Chem.*, 55(9), 658–667, 2018.
55. Ankushrao, S. S.; Ghanwat, A. A.; Patil, Y. S.; Kadam, V. N.; *J. Adv. Sci. Res.*, 12(3), 2021.

Unveiling the Future of Conductive Complexometric Polymers: A Comprehensive Exploration through Coordination Chemistry

Suraj D. Jadhav, Sanjay S. Ankushrao*, Mr. S. S. Kadam

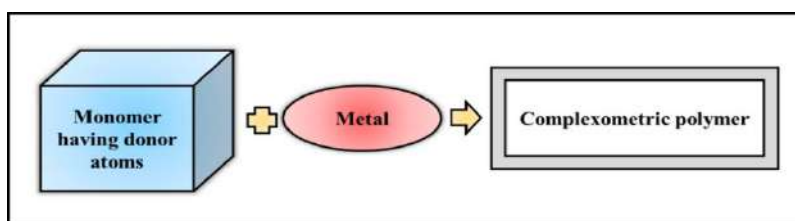
Department of Chemistry

Vivekanand College (Autonomous)

Kolhapur-416 212 (MS) India.

surajdj2197@gmail.com

*sanjayankushrao@vivekanandcollege.ac.in



ABSTRACT

In recent years, there's been a growing interest in advancing polymers, particularly through complexometric polymers via coordination chemistry. This process involves coordinating monomers with donor atoms, forming intricate molecular structures. This concise review highlights the latest developments in complexometric polymers, specifically their synthesis through coordination chemistry. It explores the coordination process between monomers and metals, revealing the mechanisms behind these unique polymers.

A key focus is on the expanding field of conductive applications for complexometric polymers. With the rising demand for materials with enhanced conductivity, the integration of coordination chemistry in polymer synthesis offers a promising avenue. The review features recent cutting-edge research, providing a broad perspective on the evolving landscape of conductive complexometric polymers.

The objective of this knowledge synthesis is to underscore the intricacies of complexometric polymerization and illuminate the extensive potential of these materials in conductivity applications. By consolidating the latest research, this review aims to contribute to the scientific community's understanding and inspire future investigations into the diverse applications of complexometric polymers synthesized through coordination chemistry.

Keywords- Coordination Polymer, Metal, Organic ligand.

I. INTRODUCTION

In today's knowledge-based civilizations, energy consumption is a growing necessity. Energy sources are renewable, sustainable energy sources like wind and solar power [1–2]. The fact that renewable energy sources are inconsistent is by far their greatest

disadvantage. Therefore, there is a great deal of promise for reliable and sustainable energy transportation with effective energy storage from these sources [3–5].

Organic electronics and organic optoelectronics based on conductive polymers have become a new area of study since Heeger et al.'s discovery of conducting polyacetylene in the 1970s [6]. As electrode materials, carbon-based materials, conducting polymers, metal oxides, and their composites can be employed [7]. A semi-metal, carbon, has comparable ionization and electronegativity properties along with strong electrical conductivity. Carbon is good for electrodes because of its remarkable ionic conductivity, which allows it to share and interchange electrons. Various methods must be used to change and regulate the porosity and availability of functional groups on carbon surfaces [8–17].

Conducting polymers are organic polymers with high electrical conductivity, high surface area, porosity, pseudo-capacitive properties, great processability, flexibility, durability, customizable morphology, and reactivity to a wide range of other materials, making them suitable candidates for the creation of electrode materials [18]. Coordination polymers, in particular, are inorganic-organic hybrid materials that combine the best qualities of both inorganic and organic materials. This results in small volume change, quick ion diffusion, high capacity, and high energy density, making CPs a promising option for high-performance batteries [19]. The most typical ways that carboxylic or phosphonic acids, pyridines, or azoles linkers consist of ionic or coordination bonds between metal and oxygen, nitrogen, or any other donor atoms to produce complexometric polymers [20]. Conjugated coordination polymers with long-range planar π -d conjugation are interesting for a variety of applications because they combine the benefits of metal-organic frameworks with conducting polymers [21]. Further, because these coordination polymers are effective, novel materials are required to improve the supercapacitors' pseudo-capacitive characteristics and cycling life in order to maximize their efficiency for conductive applications.

II. LITERATURE REVIEW

The poly(aniline-co-pyrrole)-based conductive coordination polymer was synthesized through complexometric additives as 4'-aminoacetophenone-glyoxime ligand with a Cu/Ni/Co metal precursor [22]. Another coordination polymer was synthesized by using copper metal and the 2,3,7,8-tetraaminophenazine-1,4,6,9-tetraone ligand [23]. Also synthesize the Ni tetrathiafulvalene tetrathiolate coordination polymer, which has a tetrathiafulvalene tetrathiolate ligand and Ni as the central atom [24].

2,7-dioxybenzo[*lmn*] [3,8] Phenanthroline-1,3,6,8(2H,7H)-tetraone] ligand coordinates with potassium metal ions by deprotonating through the Naphthalenediimides core's hydroxamate and carbonyl groups [25]. Further, Alkali-cation reservoir coordination polymers that conduct electricity and have the general formula A₂-TM-PTtSA, where A can contain either Li⁺, Na⁺, or K⁺, TM can be either Fe²⁺, Co²⁺, or Mn²⁺, and benzene-1,2,4,5-tetra-methylsulfonamide ligand [26]. Another, 2,5-dihydroxy-1,4-benzoquinone ligand coordinates with transition metals to form a proton-conductive coordination polymer [27].

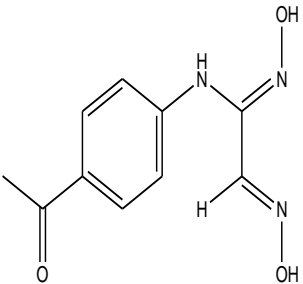
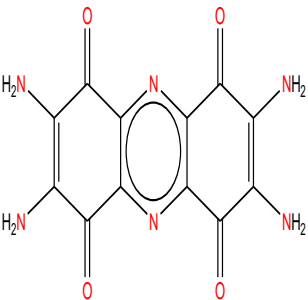
A highly effective crystalline proton-conducting coordination polymer based on a positively charged $[\text{Co}(\text{bpy})_4(\text{H}_2\text{O})_2]^{2+}$ (bpy = 4,4-bipyridine) backbone [28]. A straightforward homogeneous reaction between Cu metal ions and benzenhexaselenol ligand creates nanocrystals of a 2D π -d conjugated copper bis(diselenolene) coordination polymer [29]. The coordination polymer [TAG] $[\text{Fe}^{\text{II}}\text{Fe}^{\text{III}}(\text{ClCNAn})_3]$ was synthesized through mixed-valence Fe II Fe III with ClCNAn²⁻ of chlorocynoanilate dianionic ligand and TAG as tris(amino)-guanidinium [30]. Additionally, H. Liu et al.'s research provides a fundamental understanding of electronic design methodologies that provide better direction for obtaining high conductivities and good mobilities in coordination polymers [31].

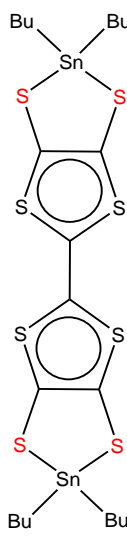
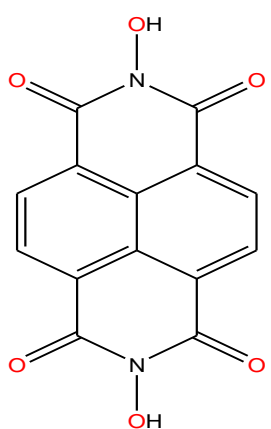
A liquid-liquid interface reaction between BHT/dichloromethane and copper(II) nitrate/H₂O produced a highly crystalline thin film of the copper coordination polymer Cu-BHT (BHT=benzenhexathiol) [32]. A novel electrically conductive one-dimensional Coordination polymers are logically produced at 100°C in DMF applying an electroactive ligand based on anthracene, which coordinates with Cd through its precursor, Cd (NO₃)₂·4H₂O [33]. A new p-type semi-conducting two-dimensional coordination polymer, based on Cu(I) and the bridging 1,3-benzenedithiolate ligand, demonstrates a record Seebeck coefficient among Complexometric polymers, matching the value found for inorganic substances [34].

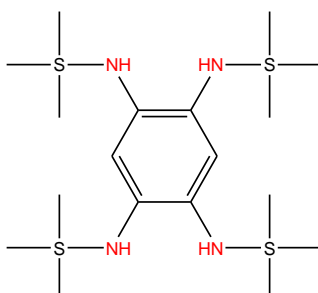
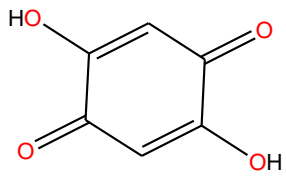
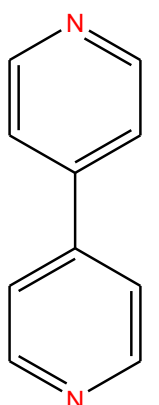
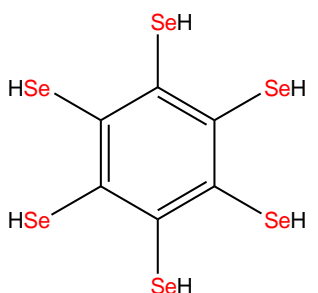
Basically, the corresponding secondary amines, diisobutylamine or diphenylamine, were deprotonated to generate the respective dithiocarbamate lithium salts (Li(S₂CNR₂)). Further, these were reacted with CuCl₂(2H₂O) to give CuII(S₂CNR₂)₂ Complexation with CuBr.S(CH₃)₂ or CuI to given the complexometric polymers [35]. A scalable chemical bath deposition process used to readily establish a 1D π -d conjugated coordination polymer (Ni-BTA) through composed of Ni and organic monomer 1,2,4,5-benzenetetramine (BTA) [36].

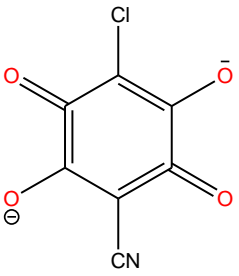
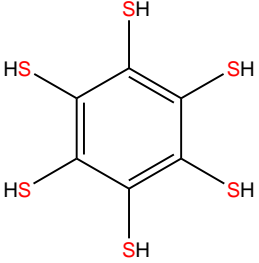
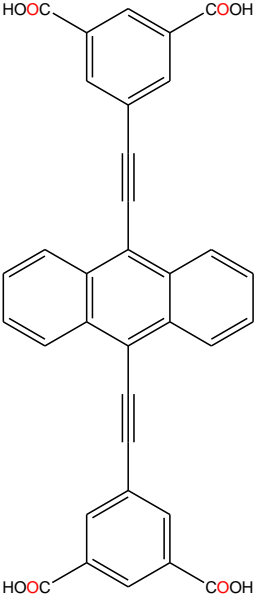
Table 1. Overview of Complexometric polymer.

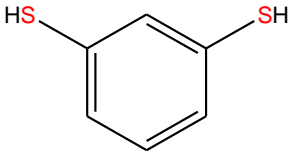
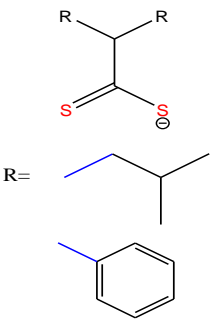
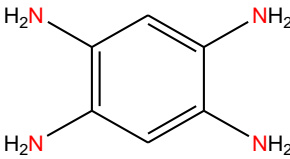
Sr. No.	Monomers	Metals	Complexometric polymer	Properties	Ref.
---------	----------	--------	------------------------	------------	------

1	<p>4'-amino-acetophenone-glyoxime ligand</p> 	Cu/ Ni/ Co	Poly(aniline-co-pyrrole)-based on glyoxime complex	<p>Areal Capacitance:</p> <p>765-1024 mF cm⁻² [per 10 mA cm⁻²]</p>	22
2	<p>2,3,7,8-tetraaminophenazine-1,4,6,9-tetraone [TAPT]</p> 	Cu	Cu-TAPT	<p>Conductivity:</p> <p>400 S m⁻¹ at r.t.</p> <p>And</p> <p>100 S m⁻¹ at 423K</p>	23
3	<p>Tetrathiafulvalene tetrathiolate [TTFtt]</p>	Ni	Ni-TTFtt	<p>Conductivity:</p> <p>1280 S cm⁻¹</p>	24

					
4	<p>2,7-dioxybenzo[lmn] [3,8] Phenanthroline- 1,3,6,8(2H,7H)-tetraone] [O-NDI]</p> 	K	K-ONDI	Conductivity: $10^{-6} \text{ S cm}^{-1}$.	25
5	<p>Benzene-1,2,4,5-tetra- methylsulfonamide PTtSA</p>	<p>A=Li/N a/ K And T.M.= Fe/Co/ Mn</p>	A ₂ -TM-PTtSA	<p>Conductivity: 10^{-7} to $10^{-6} \text{ S cm}^{-1}$ at r. t.</p> <p>High redox potential above 3V</p>	26

					
6	2,5-Dihydroxy-1,4-benzoquinone (H ₂ -DHBQ) 	T.M.= Ni, Mg, Mn, Zn, Co	TM-DHBQ	strong bonding to O ₂ species,	27
7	4,4-bipyridine 	Co	[Co(bpy) ₄ (H ₂ O) ₂] ²⁺	Conductivity: 10 ⁻² S cm ⁻¹	28
8	Benzenehexaselenol [BHS] 	Cu	Cu-BHS	Conductivity: 110 S cm ⁻¹ at 300 K,	29

9	<p>chlorocynoanilate dianionic</p> 	Fe	[TAG][FeIIFeIII(ClCNA _n) ₃]	Conductivity: $2 \times 10^{-3} \text{ S cm}^{-1}$	30
10	<p>Benzene-hexathiol</p> 	Cu	Cu-BHT	Conductivity: $1,580 \text{ S cm}^{-1}$ at r.t.	32
11	<p>5,5'- (anthracene-9,10-diylbis(ethyne-2,1-diyl)) diisophthalic acid</p> 	Cd	[Cd(H ₂ L) ₂].3H ₂ O	Conductivity: $1.04-1.55 \times 10^{-6} \text{ S cm}^{-1}$	33

11	1,3-benzenedithiolate [BDT] 	Cu	$[\text{Cu}_2(1,3\text{-BDT})]_n$	Conductivity: 1.5 mS cm^{-1}	34
12	Dithiocarbamate [DTC] 	Cu	$\text{Cu}[\text{DTC}]$	Conductivity: 1 mS cm^{-1}	35
13	1,2,4,5-benzenetetramine [BTA] 	Ni	Ni-BTA	Electrochromic properties: After 10 000 electrochemical cycles exist excellent durability	36

III. CONCLUSION

The development of polymers benefits tremendously from the inclusion of complexometric polymers. The composition, architecture, and planned applications of complexometric polymers have been shown to be highly variable. Coordination chemistry seems to have achieved enormous progress in polymer science, based on its massive impact over the past few years. Future advances in coordination chemistry with organometallic chemistry will provide powerful and practical chemical instruments for studying precursor materials that may form into complex structures through simple chemical processes.

ACKNOWLEDGMENT

Suraj D. Jadhav and Sanjay S. Ankushrao gratefully acknowledge financial support from the Mahatma Jyotiba Phule Research and Training Institute (MAHAJYOTI).

REFERENCES

- [1] Keskin A. V, Gençten M, Bozar S., Arvas M. B., Gunes S., Y. Sahin, *Thin Solid Films*, 2020, 706, 138093.
- [2] Qazi. A., Hussain F., Rahim N. A. B. D., Hardaker G., Alghazzawi D., Shaban K., Haruna K., 2019, *IEEE Access*, 7, 63837–63851.
- [3] Gencten M., Sahin Y., 2020, *Int. J. Energy Res.*, 44, 7903–7923.
- [4] Chakrabarti B. K., Gençten M., Bree G., Dao A. H., Mandler D. and Low C. T. J., 2022 *Int. J. Energy Res.*, 46, 13205–13250.
- [5] Krishan O., Suhag S., 2019, *Int. J. Energy Res.*, 43, 6171–6210.
- [6] Shirakawa H., Louis E. J., MacDiarmid A. G., Chiang C. K., Heeger A. J., 1977, *J. Chem. Soc., Chem. Commun.*, 578.
- [7] Forouzandeh P., Kumaravel V., Pillai S. C., 2020, *Catalysts*, 10, 969.
- [8] Kumar R., Youssry S. M., Joanni E., Sahoo S., Kawamura G., Matsuda A., 2022 *J. Energy Storage*, 56, 105896.
- [9] Miyake M., Yasuda E., Inagaki M., Kaneko K., Endo M., Oya A., Tanabe Y. B. T.-C. A., 2003 Elsevier Science-Oxford, 435–445.
- [10] Devi N., Sahoo S., Kumar R., Singh R. K., 2021, *Nanoscale*, 13, 11679–11711.
- [11] Guo J., Zhang H., Gu Z., Du M., Lu H., Zhao X., Yang J., Li W., Kang S., Zou W., Wu X., 2022, *Adv. Funct. Mater.*, 2209482.
- [12] Kumar R., Singh R. K., Singh A. K., Vaz A. R., Rout C. S., Moshkalev S. A., 2017, *Appl. Surf. Sci.*, 416, 259–265.
- [13] Joanni E., Kumar R., Fernandes W. P., Savu R., Matsuda A., 2022, *Nanoscale*, 14, 8914–8918.
- [14] Kumar R., A. Perezdel Pino A., Sahoo S., Singh R. K., Tan W. K., Kar K. K., Matsuda A., Joanni E., 2022, *Prog. Energy Combust. Sci.*, 91, 100981.
- [15] Kumar R., Joanni E., Sahoo S., Shim J. J., Tan W. K., Matsuda A., Singh R. K., 2022, *Carbon*, 193, 298–338.
- [16] Kumar R., Sahoo S., Joanni E., Singh R. K., Tan W. K., Moshkalev S. A., Matsuda A., Kar K. K., 2022, *Crit. Rev. Solid State Mater. Sci.*, 47, 570–619.
- [17] Kumar R., Sahoo S., Joanni E., Singh R. K., 2022, *J. Energy Chem.*, 74, 252–282.
- [18] Agobi A. U., Thomas O., Dass M., 2019 *J. Chem. Rev.*, 1, 19–34.
- [19] Wang L., Han Y., Feng X., Zhou J., Qi P., and Wang B., 2016, *Coord. Chem. Rev.* 307, 361–381.
- [20] Xia W., Mahmood A., Zou R., Xu Q., 2015, *Energy Environ. Sci.* 8, 1837–1866.
- [21] Fan K., Zhang C., Chen Y., Wu Y., Wang C., 2021, *Chem*, 7(5), 1224–1243.
- [22] Basili T., Yildirim K. H., Gencten M., Macit M., Sahin Y., 2022, *New J. Chem.*, 47(2), 691–707.
- [23] Fan K., Li J., Xu Y., Fu C., Chen Y., Zhang C., Zhang G., Ma J., Zhai T., Wang C., 2023, *J. Am. Chem. Soc.*, 145(23), 12682–12690.

- [24] Anderson J., Xie J., Ewing S., Boyn J. N., Cheng B., Filatov A., Ma T., Zhao N., Itani R., Cho H., Patel S., Talapin D., 2022, *Nature*, 611, 479–484.
- [25] Yan Y., Zhang N. N., Tauche L. M., Thangavel, K., Pöpl, A., & Krautscheid, H., 2022, *Inorg. Chem. Frontiers*, 9(19), 5016–5023.
- [26] Wang J., Guo, X., Apostol, P., Liu, X., Robeyns, K., Gence, L., Morari, C., Gohy, J. F., & Vlad, A., 2022. *Energy Environ. Sci.*, 15(9), 3923–3932.
- [27] Huang X., Gan L. Y., Wang J., Ali S., He C. C., Xu H., 2021, *J. Phy. Chem. Lett.*, 12(38), 9197–9204.
- [28] Pal S. C., Chand S., Kumar A. G., Mileo P. G. M., Silverwood I., Maurin G., Banerjee S., Elahi S. M., Das M. C., 2020, *J Mater. Chem. A*, 8(16), 7847–7853.
- [29] Cui Y., Yan, J., Chen Z., Zhang J., Zou Y., Sun Y., Xu W., Zhu D., 2019, *Advanced Science*, 6(9), 1-5.
- [30] Sahadevan S. A., Abhervé A., Monni N., Sáenz De Pipaón C., Galán-Mascarós J. R., Waerenborgh J. C., Vieira B. J. C., Auban-Senzier P., Pillet S., Bendeif E. E., Alemany P., Canadell E., Mercuri M. L., Avarvari, N., 2018, *J. Am. Chem. Soc.*, 140(39), 12611–12621.
- [31] Liu H., Wang Y., Qin Z., Liu D., Xu H., Dong H., Hu W., 2021, *J. Phy. Chem. Lett.*, 12 (6), 1612–1630.
- [32] Huang X., Sheng P., Tu Z., Zhang F., Wang J., Geng H., Zou Y., Di C. A., Yi Y., Sun Y., Xu W., Zhu D., 2015, *Nat. Comm.*, 6. 1-8
- [33] Wang S., Liu J., Zhao H., Guo Z., Xing H., Gao Y., 2018, *Inorg. Chem.*, 57(2), 541–544.
- [34] Andrade C., Hawila S., Abdallah A., Rukemampunzi J. L., Mesbah A., Guillou N., Perret F., Wuttke S., Niehau, T., Debord R., Boisron O., Pailhès S., Demessence A., 2023, *Journal of Materials Chemistry C*, 11(42), 14540–14544.
- [35] Michaels H., Golomb M. J., Kim B. J., Edvinsson T., Cucinotta F., Waddell P. G., Probert M. R., Konezny S. J., Boschloo G., Walsh A., Freitag M., 2022, *J. Materials Chem. A*, 10(17), 9582–9591.
- [36] Cai G., Cui P., Shi W., Morris S., Lou S. N., Chen J., Ciou J. H., Paidi V. K., Lee K. S., Li S., Lee P. S., 2020, *Advanced Science*, 7, 1903109 (1-10).

Ocimum gratissimum L.: A Herbal Tea

Desai Mrunalini N., Kagale Lubdha A., Jagtap Dashrath G.

Department of Botany, Vivekanand College, Kolhapur (Empowered Autonomous)

Vijaysingh Yadav College, Peth Vadgaon

mndesai2306@gmail.com

Abstract:

Tea in general and Herbal tea in particular, are gaining increasing consumer attention due to a growing awareness of health benefits derived from their use, but research in product development of flavored herbal tea is limited. The objectives of the study were to conduct formulation mixture of *Ocimum gratissimum* in order to assess their potential for new herbal tea development. Formulation of herbal tea with this herb was done, which imparts colour, aroma, flavor, astringency and overall acceptability to herbal tea and impart many health benefits. Herbal Tea of *Ocimum gratissimum* L. or clove basil with *Camellia sinensis* in proportion of 1:1 is beneficial for increase blood circulation, maintain blood viscosity, reduce acidity, fat burning etc. Further study is necessary to make combinations of specific herbs for different types of ointments.

Key words: Herbal tea, *Ocimum gratissimum*, *Camellia sinensis*, Aroma, Astringency

Introduction:

The Tea is the most consumed beverage in the world, but its origination is attributed to china [1] and becomes as an important commercial food product in the world. After china, the 2nd largest producer of tea is India [2]. These days consumers are cautious of their health so they are demanding for more natural and health benefitting food so tea seems to be a good vehicle in this respect because of its good taste and aroma. Hence tea belongs to a quickly growing market of wellness beverages [3]. Traditionally, tea is classified as green, black and herbal tea [4] and can be differentiated on the basis of their processing stages at the time of manufacturing. *Camellia sinensis* is the plant from which green tea and all kinds of tea are made. Fermentation is not done during herbal tea processing. Herbal tea imparts several health promoting components because of its high range of phenolic compounds. Herbal tea is covered to deliver nearly 4000 bioactive compounds under which one third is polyphenols [5]. Tannins and flavonoids are the important polyphenols present in the Green tea. Catechins, one of the important flavonoid present in the green tea which is also known as vitamin E [6]. Herbal tea imparts several health

benefits like weight loss in obese, to control alzheimer's, parkinson's, blood pressure, diabetes and heart diseases. There are many flavored green teas. Popular flavored green teas are lemon green tea, ginger & mint green tea, lemon honey green tea, jasmine green tea, etc. It is thus

imperative to research the potential of native plant materials in the expansion of new flavored Herbal tea. On the basis of some unpublished reports, however, green tea imparts poor in sensory appeal due to the lack of distinct Flavor properties. Therefore, it may be needed to blend Herbal tea with other herbs as a means of improving its sensory appeal and for good health and wellness. The herbs discussed in the research work are *Ocimum gratissimum* and *Camellia sinensis*.

Ocimum gratissimum L. is commonly known as clove basil or lemon basil and its native range is tropical and sub tropical old world. A polymorphic branched, aromatic shrub nearly 0.5 to 3 m tall belonging to family Lamiaceae, has been identified as a culinary herb with wide applications. *Ocimum gratissimum* is an aromatic, perennial herb, 1-3 m tall; stem erect, round-quadrangular, much branched, glabrous or pubescent, woody at the base, often with epidermis peeling in strips. The plant is mainly distributed in tropical regions and native to South Asia, Africa and various regions of South America Polynesia, Bismarck, Archipelago and the West Indies [5]. The phytochemical study of the plant shows the presence of several bioactive compounds. The aqueous leaf extract assay shows the presence of steroids, tannins, flavonoids, saponins, terpenoids alkaloids, inulins, phenolic compounds, B-carotene, glycosides carotenoids, reducing sugars, phlobatannins, anthraquinones and cardiac glycosides with steroidal ring and deoxy-sugar [3]. *O. gratissimum* is used as a spice and possesses nutritive value and flavouring properties [4]. The plant has a wide application in the traditional system of medicine to cure various ailments. The plant produces essential oil with antibiotic, antioxidant, antimalarial, antifungal, antibacterial, antidiarrheal, antidiabetic, anti-carcinogenic, insecticidal, antimutagenic and antiurolithiatic properties[6].

Materials and Methods:

Kingdom: Plantae

Division: Magnoliophyta

Order: Lamiales

Family: Lamiaceae

Genus: *Ocimum*

Species: *gratissimum*

Binomial name: *Ocimum gratissimum* L.

Local name: Ram tulas

Sample collection and extraction:

The plant specimens were identified and prepared for herbarium. Specimens were authenticated and deposited herbarium in department of botany, Shri V Y college, Peth Vadgaon.

The herbal tea prepared with the help of powder of *Camellia sinensis* and *Ocimum gratissimum*. Powder of *Camellia sinensis* were collected from a local market of

Pethvadgaon. *Ocimum gratissimum* were thoroughly washed under tap water. The clean sample was dried in shade and coarsely powdered by hand crushing and then stored in air- tight, container for further use. Dried Leaves of *Ocimum gratissimum* 50gm and dried leaves of *Camellia sinensis* 50gms (1:1) proportion.

Preparation of Herbal Tea:

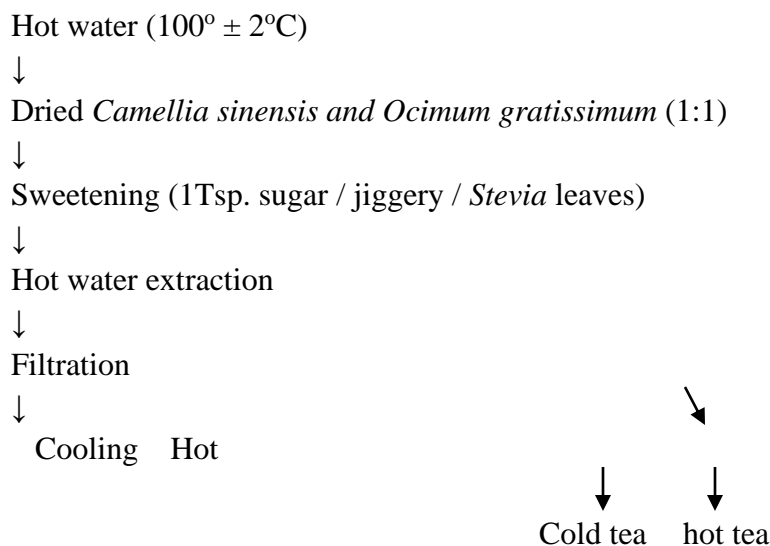


Fig 1: Steps involved in the Process of Herbal Tea preparation

Results:

Herbal tea looks like tea and is brewed in the same way as tea, but it not actually a tea at all. This is because they do not come from the *Camellia Sinensis* bush, the plant from which all teas are made. Herbal teas are actually infusions, and are properly called tisanes. Tisanes are made from mixtures of dried leaves, seeds, grasses, nuts, barks, fruits, flowers, or other botanical elements that give them their taste and provide the benefits of herbal teas. They also taste well and are easy to drink. Your herbal tea may consist of one main herbal ingredient or it may be a blend of herbal ingredients, designed to bring about a specific purpose, such as relaxation, rejuvenation, relief from a specific condition, amongst other things.

Uses of Herbal Tea

- Herbal teas (which are also called 'tisanes') are simple, effective, inexpensive ways to enjoy the taste and benefits of herbs and spices.
- Herbal tea as a refreshing drink.
- Achieving a more calm and relaxed state of mind.

- Supporting heart health.
- Aiding with stomach and digestive problems.
- Providing cleansing properties for the body.
- Promoting energy and wellness.
- Nourishing the nervous system.
- Strengthening the immune system.
- Providing antioxidants to the body.
- Boosting energy levels and invigorating the body.
- Relieving stress.
- Helping to avoid colds.
- Stimulating the internal organs.
- Promoting a good night's sleep.
- Reduce Acidity
- Fat burning
- **Organoleptic Characters**

Camellia sinensis + *Ocimum gratissimum*

Colour: Greenish brown

Odour: Bitter

Taste: Bitter

PH(range): 8-9.

Conclusion:

The above infusion will provide new alternatives to traditional flavored teas which can impart health benefits too. There is lot of uses of this herb which acts like antioxidant, immunomodulator, a mood stabilizer, antiviral and antibacterial. This preparation can be used in dry or liquid form to improve human health. It can be served with or without sugar. Further study is necessary to make combinations and concentrations of specific herbs for treatment of different types of diseases.



References:

1. Emeka I Nweze and Elizabeth E Eze *BMC Complementary and Alternative Medicine* 2009, **9**:37 doi:10.1186/1472-6882-9-37.
2. K.S. Prabhu *et al.*, *The Open Complementary Medicine Journal*, 2009, **1**, 1-15.
3. Parul Namdev, Rajinder K Gupta. *Journal of Pharmacognosy and Phytochemistry* 2015; **4**(2): 282-291.
4. P.Nazni and S.Vimala. *International journal of food and nutritional sciences* 2012; **1**(1):178-182.
5. Sandeep Pandey *IAJPS* 2017, **4** (11), 4234-4242.
6. Suresh G Killedar and Aarti V Pawar. *Journal of Medicinal Plants Studies* 2017; **5**(2): 325-328.

A delicious Recipes of Some Wild Leafy vegetables from Konkan Region

Lubdha Kagale, Mrunalini Desai

Vivekanand College, Kolhapur (Autonomous)

lubdhakagale@gmail.com

Abstract:

Exploration of ethnic traditional food recipes has an immense contribution to the preservation and sustainability of traditional food habits and culture. Wild edible leafy vegetables were currently underutilized (less intake) especially in buffer and transition zones, which can complete the staple foods and partially supplementing the essential macro- and micro-nutrients. Along with this they have the potential to fulfill the dietary needs and ensure balanced nutrition, if consumed in recommended portions and sizes. The main objective of this study was to explore and document traditional food recipes prepared from wild edible leafy vegetables from Konkan region of Maharashtra. The present study was designed to prepare a delicious and nutritious recipe of these wild leafy vegetables to improve the taste of the food. The nutritious recipes like soup, parathas and cutlets were prepared by using these wild leafy vegetables.

Keywords: Wild leafy vegetable, Recipes, Nutritional Importance, Konkan region

Introduction

In India green leafy vegetables are generally consumed in cooked form. These vegetables occupy an important place among vegetables because of their colour, flavor and health benefits. They are inexpensive and important source of nutrients, vitamins, minerals and secondary metabolites (Gupta *et al.*, 2005, Gupta and Prakash, 2009). Coastal people mostly eat rice and fish in their daily diet. However in monsoon various kinds of wild, leafy vegetables grow which are also consumed by these coastal people. Green leafy vegetables are the most widely grown group among the vegetables in many countries. Since ancient times green leafy vegetables have grown for their foliage and are considered as excellent source of essential nutrients. Some commonly consumed green leafy vegetables are spinach, coriander, mint leaves, amaranth, curry

leaves, fenugreek, cabbage, etc. Nutritional composition of these vegetable is reported by Gopalan *et al.* (1996). In developing nations, several wild edible plant are exploited as a source of food because they provide an adequate level of nutrition to the inhabitants (Edmonds and Chweya, 1995) Mostly rural people harvest these wild food resources from different habitats such as home gardens, backyards, fields and also from dykes, common lands, forests, roadsides, slope of hills, water bodies or marsh lands.

Most of the wild vegetables are reported to have a high nutritional potential, medicinal properties and a high yield potential, (Onyango *et al.*, 2000). Much of the rural population in India depends on wild greens to meet their nutritional requirement (Nordeide, 1996). Traditional wild leafy crops are important fresh crops during rainy season.

Material

Collection of wild vegetable samples was made from Ratnagiri and Sindhudurg districts in Konkan, Maharashtra. Frequent visits were made at different places in the two districts during the whole year. Survey of the study region commenced in July 2011 and ended in July 2014. Local places from Ratnagiri and Sindhudurg visited for survey include Chiplun, Kudal, Kankavali and Achra Tahesils.

A survey of Sindhudurg and Ratnagiri districts was carried out to gather information about the wild, leafy vegetables. For this different places like market, bazaars, small shops, in towns and talukas etc. were visited. A questionnaire was prepared and used to record the information from shepherds, cowboys, farmers and housewives. Knowledge of the usage of the vegetables in the past and present for consumption, mode of food preparation and homemade medicinal use of vegetables were known from them. Specimens collected from the field were taken to the local people of village for their correct identification. The field notes and collected information were used for further compilation of the data.

1. *Amorphophallus paeoniifolius*

Common Name- Suran

Family- Araceae

Perennial tuberous herbs. Leaf solitary, 3 partite, leaflets elliptic, lanceolate or oblanceolate. Male flowers numerous in upper part and female flowers few in lower part of spadix, style longer than ovary. Spathes companulate, greenish-pink with brown blotches.

2. *Cassia tora*

Family- Fabaceae

Common Name- Takala

Annual herb. Leaflets obovate-oblong, 3 pairs, flowers in subsessile pairs, in the axils of leaves, crowded upwards. Petals yellow in colour, subequal. Pods subterete, often spreading.

3. *Celosia argentea*

Family- Amaranthaceae

Common Name- Kurdu

Plant erect, herb with 1-2 feet in height. Stem green, ribbed. Leaves green and tinged with red spots. Flowers solitary, terminal, cylindrical spikes. Perianth of 5 separate tepals. Stamens 5, united at base.

Results:

A few simple but tasty recipes of wild leafy vegetables are described in the following pages.

Suran cutlet

Ingredients

Suran leaves- 1 bowl	1tsp-	Cumin seeds
Mashed potatoes- 1 bowl (boiled and peeled)	1tsp-	Sesame seeds
Grated carrot -1/4 bowl		
Ginger, garlic and chilli paste - 2 tbsp		
Corn flour- 3-4 tbsp	Turmeric powder-	1tsp
Salt to taste		

Procedure

Keep suran leaves in boiling water containing kokum, tamarind or lemon juice for 3-5 minutes. Drain off the water and finely chop the leaves, mix in a bowl with mashed potatoes, grated carrot, garlic, ginger and chili paste. Add salt, cumin and sesame seeds and 1tsp oil or some cheese. Make small, flat tikki, roll in sooji and shallow fry in a oil in a pan. Serve with tomato ketchup or coconut chutney.

Suran Vadi

Ingredients

Gram flour- 1 cup
Cumin and coriander seed powder- 1 tsp

Suran leaves- 3-4
Sesame seeds- 1 tsp
Turmeric powder- 1tsp
Asafoetida powder- ½ tsp
Kokum/tamarind juice - 1 tbsp
Red chili powder- 1-2 tbsp
Salt to taste
Sugar/jaggery for taste

Procedure: Mix all ingredients (except suran leaves) to form a thick batter. Wash suran leaves and keep in boiling water for 5 minutes with kokum/ tamarind or lemon juice. Remove thick veins from leaf and apply batter on lower side of the leaf. Place another leaf on it and apply batter on it. Now fold the leaf from one side to make a roll. Place the rolls in a steamer for 10 minutes. After cooling, cut the roll into small pieces and shallow fry in oil to make golden brown crispy vadi. Serve hot with tomato sauce.

Takala and Kurdu paratha

Ingredients

Finely chopped *Celosia* leaves (Kurdu) - 1 bowl
Finely chopped *Cassia* leaves (Takala) - 1 bowl
Wheat flour/mixed grain flour- 1 bowl
Rice flour- 2 tbsp
Ginger and garlic paste- 1 tbsp
Cheese-1cube/Butter- 1tbsp
Green chili paste- 1 tbsp
1tsp- Sesame seeds
Cumin and coriander seed powder- 1 tsp
Asafoetida-1/2tsp
Salt to taste Sugar-1/2tbsp

Procedure

Boil the vegetables for 4-5 minutes and drain off the water cut and mix all the ingredients and knead well with water to form dough. Keep this dough closed for 10- 15 minutes. Divide the dough into small portions or balls. Cover these balls with wheat flour and make a paratha. Roast the paratha on a hot tawa by applying oil from both sides till it turns golden brown. Serve hot with tomato ketchup or pudina chutney.

Kurdu Soup

Ingredients

Celosia leaves (Kurdu) with young shoots- One bowl
Small onion- One
Medium tomato – One

Garlic cloves- Two-four
Pepper powder- One tbsp
Corn flour- One tbsp
Red chili powder- Half tbsp
Salt to taste
Sugar to taste

Procedure

Wash and cut *Celosia* leaves, onion and tomato. Pressure cook all the vegetables and garlic cloves with a small quantity of water. Grind in a mixer and strain through a sieves, mix corn flour and boil on gas flame. Then add salt, black pepper powder and some sugar and again heat for 2-3 minutes. Serve hot.



Celosia argentea (Kurdu)



Kudu and Takala Paratha



Cassia tora (Takala)

Kurdu Soup



Amorphophallus paeoniifolius (Suran)



Suran Cutlets



Suran Vadi

References

1. Gupta, S., Lakshmi, A. J., Manjunath, M. N. and Prakash, J. 2005. Analysis of nutrient and antinutrient content of underutilized green leafy vegetables. *Food Sci. Technol.* **38**(4):339–345.
2. Gupta, S. and Prakash J. 2009. Studies on Indian green leafy vegetables for their antioxidant activity. *Plant Foods Human Nutr.* **64**: 39–45.
3. Gopalan, C.; Sastri, R. B. V.; Balasubramaniam, S. C.; Narasinga Rao, B. S.; Deosthale, Y. G. and Pant, K. C.1996. Nutritive Value Of Indian Foods. Hyderabad, India: National Institute of Nutrition, Indian Council for Medical Research.156p.
4. Edmonds, J. and Chweya, J.1995. Black nightshades, *Solanum nigrum* L. and related species. Promoting the conservation and use of underutilized and neglected crops., Taylor & Francis, London. 234p.
5. Onyango, M. A.; Obiero, H. and Miruka, M. 2000. Indigenous green leafy vegetables in Kenya. A case of a neglected resource. In: Participatory Technology Development for Soil management and legume research network project by Smallholders in Kenya. 245-256p.

भारताचे परराष्ट्र धोरण आणि गुजराल सिद्धांत

अभिषेक प्रविण चौगले¹, अजय प्रभाकर पाटील², समीक्षा फराकटे²

1 संशोधक विद्यार्थी, राज्यशास्त्र विभाग, शिवाजी विद्यापीठ, कोल्हापूर

2 सहाय्यक प्राध्यापक, राज्यशास्त्र विभाग, विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

गोषवारा :

पंडित जवाहरलाल नेहरू यांना भारतीय परराष्ट्र धोरणाचे शिल्पकार समजले जाते. त्यानंतर पंतप्रधानपदी विराजमान झालेल्या प्रत्येक व्यक्तीने आपला ठसा भारताच्या परराष्ट्र धोरणावर उमटवला आहे. इंद्रकुमार गुजराल हे एक वर्षापेक्षा कमी काळ भारताच्या पंतप्रधानपदी होते. तत्पूर्वी दोन वेळा त्यांनी परराष्ट्र मंत्रिपद भूषविले होते. परंतु एवढ्या कमी कालावधीत देखील गुजराल सिद्धांताच्या रूपाने भारताच्या परराष्ट्र धोरणावर त्यांनी अमीट ठसा उमटवला आहे. भारतीय उपखंडात सौहार्दाचे, सहकार्याचे वातावरण जपण्यासाठी, उपखंडातील चीनचा प्रभाव रोखण्यासाठी आणि उपखंडातील शांततापूर्ण सहजीवनासाठी गुजराल सिद्धांत महत्त्वाचा आहे.

पारिभाषिक शब्द: परराष्ट्र धोरण, सार्वभौमत्व, प्रादेशिक अखंडत्व, द्विपक्षीय वाटाघाटी, प्रादेशिक सहकार्य.

प्रस्तावना :

भारताचे त्याच्या शेजारील राष्ट्रांसोबतचे संबंध हा भारताच्या परराष्ट्र धोरणाचा एक महत्त्वाचा भाग आहे. भारतीय उपखंडामध्ये आकाराने आणि लोकसंख्येने भारत हा इतर देशांपेक्षा कितीतरी मोठा देश आहे. त्यामुळे इतर राष्ट्रे आपल्यासोबत संबंध ठेवताना सावध असतात. चीन आणि पाकिस्तान ह्या दोन राष्ट्रांसोबत भारताचे संबंध कायम ताणलेले राहिले आहेत. चीन भारतीय उपखंडामध्ये आपला प्रभाव वाढवण्यासाठी सातत्याने प्रयत्नशील राहिला आहे. या गोष्टींचा विचार करून परराष्ट्र व्यवहार मंत्रीपदी असताना इंद्रकुमार गुजराल यांनी परराष्ट्र धोरणाविषयी काही तत्त्वे मांडली, जी गुजराल सिद्धांत म्हणून ओळखली जातात. गुजराल सिद्धांतामुळे भारतीय परराष्ट्र धोरणाची दिशा बदलली आहे. या सिद्धांतामुळे भूतान, नेपाळ, बांग्लादेश, श्रीलंका, मालदीव यासारख्या शेजारील राष्ट्रांसोबत भारताचे संबंध सुधारण्यास मदत झाली आहे. या सिद्धांतावर टीका झाली. या सिद्धांताची अंमलबजावणी करताना आव्हाने निर्माण झाली, पण या सिद्धांताचे महत्त्व आजही कमी झालेले नाही. या सिद्धांताचा संपूर्ण आढावा घेण्याचा प्रयत्न प्रस्तुत शोधनिबंधातून करण्यात आला आहे.

भारताचा विचार केला तर, शेजाऱ्यांसोबतचे संबंध सुधारणे हे सत्तेवर येणाऱ्या प्रत्येक सरकारच्या परराष्ट्र धोरणाचे ध्येय असते. आदर्श परराष्ट्र धोरण आखताना अनेक अडचणींना सामोरे जावे लागते. उपखंडाचा विचार केला असता भारत आपल्या शेजारी देशांपेक्षा आकाराने आणि लोकसंख्येने खूप मोठा आहे. म्हणूनच या उपखंडाला 'भारतीय उपखंड' असे म्हणतात. त्यामुळे आपल्या लहान शेजाऱ्यांना आपल्या आकाराचा धोका वाटतो. ते त्यांच्या सार्वभौमत्वाचे उल्लंघन होईल

या भीतीने आक्रमकतेने बचावात्मक पवित्रा धारण करतात. संतुलन साधण्यासाठी इतर मोठ्या सत्तांना स्थानिक राजकारणामध्ये आणतात. आपल्या कथित 'मोठ्या बंधू' ची वृत्ती लक्षात घेऊन स्थानिक राजकारण खेळतात. हे देश भारताकडून कोणत्याही परस्पर बंधनाशिवाय उदार वागणुकीची अपेक्षा करतात. त्याशिवाय, भारतासोबतच्या सामायिक प्रादेशिक, वांशिक, भाषिक, धार्मिक आणि सांस्कृतिक दुव्यांमुळे या छोट्या शेजारी देशांना त्यांची ओळख गमावण्याची भीती वाटते.

परराष्ट्र धोरणातील या सर्व गुंतागुंतीची जाण दुसऱ्यांदा भारताचे परराष्ट्र व्यवहार मंत्रीपद भूषविणाऱ्या इंद्रकुमार गुजराल यांना होती. १९८९-१९९० या कालावधीत इंद्रकुमार गुजराल भारताचे परराष्ट्र व्यवहार मंत्री होते. त्यानंतर १ जून १९९६ रोजी त्यांनी दुसऱ्यांदा परराष्ट्र व्यवहार मंत्रालयाचा कारभार स्वीकारला होता. भारताच्या 'शेजारी राष्ट्रांविषयक धोरण'(Neighbourhood Policy) आखण्याचे महत्त्वाचे कार्य त्यांनी केले. हेच धोरण 'गुजराल सिद्धांत' म्हणून ओळखले जाते.

गुजराल सिद्धांत :

- १) भूतान, बांगलादेश, नेपाळ, मालदीव आणि श्रीलंका यांसारख्या शेजारी देशांकडून कोणत्याही परतफेडीची अपेक्षा न करता भारताने सद्भावनेने आणि विश्वासाने जी काही मदत करता येईल, ती करावी.
- २) कोणत्याही दक्षिण आशियाई देशाने आपला भूभाग दुसऱ्या दक्षिण आशियाई राष्ट्रांच्या हिताविरुद्ध वापरण्याची परवानगी देऊ नये.
- ३) देशांनी परस्परांच्या अंतर्गत कारभारामध्ये हस्तक्षेप करू नये.
- ४) सर्व दक्षिण आशियाई देशांनी एकमेकांच्या प्रादेशिक अखंडतेचा आणि सार्वभौमत्वाचा आदर केला पाहिजे.
- ५) त्यांनी आपले सर्व वाद शांततापूर्ण द्विपक्षीय वाटाघाटीद्वारे सोडवले पाहिजेत.

गुजराल सिद्धांताचा सार असा आहे की दक्षिण आशियातील सर्वात मोठा देश असल्याने, भारत उपखंडातील शेजाऱ्यांना एकतर्फी सवलती देऊ शकतो.

गुजराल सिद्धांताचे महत्त्व आणि उपलब्धी

● विवादांचे निराकरण व प्रादेशिक सहकार्य

- १) बांगलादेशसोबतचा पाणी वाटपाचा वाद : गुजराल सिद्धांताची अंमलबजावणी केल्यामुळे १९९६-९७ मध्ये जलदपणे म्हणजे अवघ्या तीन महिन्यात बांगलादेशसोबतचा पाणी वाटपाचा वाद सोडवला गेला. १२ डिसेंबर १९९६ रोजी बांगलादेशसोबत ३० वर्षांचा पाणी वाटपाचा करार झाला. यापूर्वी १९७७ साली झालेला करार १९८८ साली संपला होता. त्यानंतर दोन्ही देशांनी आडमुठेपणा दाखवल्यामुळे पुढील वाटाघाटी होऊ शकल्या नव्हत्या. पा या वेळी वाटाघाटी यशस्वी झाल्या.
- २) नेपाळ जलविद्युत करार : त्याच वेळी, जलविद्युत निर्मितीसाठी महाकाली नदीचा वापर करण्यासाठी नेपाळशी करार करण्यात आला. हा करार पूर्वी वादग्रस्त ठरला होता. पण यावेळी नेपाळमध्ये देखील त्याचे स्वागत झाले.

- ३) चीन सोबतचा सीमा विवाद गोठवणे : नोव्हेंबर 1996 मध्ये भारत आणि चीनने मान्य केलेले विश्वास निर्मितीचे उपाय देखील द्विपक्षीय संबंध सुधारण्यासाठी दोन्ही देशांनी केलेल्या प्रयत्नांचा एक भाग होते. त्यावेळी काही काळासाठी सीमा विवाद गोठवला गेला होता.
- ४) पाकिस्तानशी सामान्य जनतेच्या पातळीवर संपर्क वाढवणे : या सिद्धांतामुळे पाकिस्तानसोबत सामान्य जनतेच्या पातळीवर संपर्क वाढविण्यास मदत झाली आहे; ज्यामुळे संबंधित देश त्यांचे मतभेद सौहार्दपूर्णपणे सोडवू शकतील. 1997 मध्ये भारताने एकतर्फीपणे पाकिस्तानी पर्यटकांना, विशेषतः ज्येष्ठ नागरिक आणि सांस्कृतिक गटांना व्हिसा शुल्क आणि पोलिस अहवाल यासंबंधी अनेक सवलती जाहीर केल्या.
- ५) परस्पराविषयी विश्वास निर्माण करण्यासाठी पाकिस्तानशी चर्चा : जून 1997 मध्ये भारत आणि पाकिस्तान दरम्यान परराष्ट्र सचिव स्तरावरील चर्चा घडून आली. त्यामध्ये दोन्ही देशांनी परस्परांमध्ये विश्वास निर्माण करण्यासाठी, सर्व विवादांचे मैत्रीपूर्ण निराकरण करण्यासाठी आणि वाटाघाटीसाठी आठ क्षेत्रे निश्चित केली. तेव्हा गुजराल सिद्धांताला महत्त्व प्राप्त झाले. पाकिस्तानसोबत संमिश्र संवाद : रेंगाळलेले वाद (उदा. काश्मीर, दहशतवाद) असूनही, 'समस्या सोडवणे आणि मान्य अटींवर सहकार्य करणे' यावर आधारित, पाकिस्तानशी संमिश्र संवादाची सुरुवात.
- ६) श्रीलंका विकास सहकार्य : या सिद्धांताने श्रीलंकेसोबतचे करार सुलभ केले, ज्यामुळे या प्रदेशात विस्तारित विकास सहकार्याला चालना मिळाली.

● **विश्वास निर्मितीचे उपाय :**

- १) प्रादेशिक विश्वास मजबूत करणे : गुजराल यांच्या परराष्ट्र धोरणाच्या दृष्टिकोनामुळे भारतीय उपखंडामध्ये विश्वास आणि सहकार्य लक्षणीयरीत्या वाढले.
- २) भूतानचा जलप्रवाह करार : गंगेच्या पाण्याचा प्रवाह वाढवण्यासाठी कालवा प्रकल्पासाठी भूतानची संमती मिळवण्याचे यशस्वी प्रयत्न. यातून प्रादेशिक सहकार्याचे दर्शन झाले.

● **सातत्य आणि वारसा:**

- १) एकामागोमाग पंतप्रधानांनी केलेले सिद्धांताचे पालन: भिन्न राजकीय विचारसरणी असूनही, सलग पंतप्रधानांनी त्यांच्या परराष्ट्र धोरणाच्या दृष्टिकोनात गुजराल सिद्धांताच्या पैलूंचा समावेश करणे सुरू ठेवले.
- २) चिरस्थायी महत्त्व: भारताच्या प्रादेशिक राजनय आणि शेजारील देशांसोबत सतत सहकार्यात्मक संबंधांचा पाठपुरावा करणे, या दोन गोष्टींमध्ये या सिद्धांताचा वारसा दिसून येतो.

गुजराल सिद्धांताबाबत चिंता आणि आव्हाने :

- चीनचा वाढता प्रभाव : बेल्ट अँड रोड सारख्या उपक्रमांद्वारे उपखंडात चीनच्या प्रभावाचा विस्तार झालेला आहे. गुजराल सिद्धांताद्वारे जो परस्पर संपर्क सुधारण्यावर भर दिला होता, त्याला वाढलेल्या सुरक्षाविषयक चिंतेमुळे आव्हान निर्माण झाले आहे.
- आंतर-प्रादेशिक एकत्रीकरण : दक्षिण आशियातील किमान पातळीवरील प्रादेशिक एकात्मता जिचा जागतिक व्यापारातील वाटा 5% पेक्षा कमी आहे, गुजराल सिद्धांताच्या प्रभावी अंमलबजावणीमध्ये अडथळा आणते.

- चीनच्या तुलनेत असणारी संसाधन विषमता : शेजारच्या प्रदेशात चीनने मोठ्या प्रमाणावर संसाधने तैनात केलेली आहेत. त्याच्याशी बरोबरी करणे भारतासाठी आव्हानात्मक आहे. भारताच्या परराष्ट्र धोरणाचे एक साधन म्हणून विकास सहकार्याच्या परिणामकारकतेवर परिणाम होत आहे.
- आर्थिक मंदीचा परिणाम : भारतातील सध्याच्या आर्थिक मंदीमुळे शेजाऱ्यांसाठी बाजारपेठ आणखी खुली करण्याची इच्छा कमी होते, ज्यामुळे गुजराल सिद्धांताचा आर्थिक स्तंभ कमकुवत होतो.
- सीमेवरील सुरक्षा धोके : भारताच्या सीमा सीमेपलीकडील दहशतवाद, निषिद्ध व्यापार आणि अंमली पदार्थांची तस्करी यासारख्या सुरक्षा धोक्यांसाठी वाहिनी बनतात आणि शांततापूर्ण संबंधांच्या सिद्धांताच्या आकांक्षेला आव्हान देतात.
- अंमलबजावणी आव्हाने आणि लवचिकता : गुजराल सिद्धान्तामधील तत्वांच्या अंमलबजावणीत जी आव्हाने आहेत, त्यापैकी एक म्हणजे शेजारी देश जर मान्य केलेल्या तत्वांपासून विचलित झाले तर त्या सिद्धांताच्या पुनर्मूल्यांकनाची गरज निर्माण होते.
- विकास सहकार्यासाठी संसाधनांची कमतरता : विशेषतः चीनच्या विस्तारित क्षमतेच्या तुलनेत भारताची संसाधने मर्यादित असल्यामुळे गुजराल सिद्धांताचे विकास सहकार्यावरील अवलंबित्व कमकुवत झाले आहे.
- गुजराल यांच्या कार्यपद्धतीवर टीका : सिद्धांत पूर्णपणे अंमलात आणण्यासाठी परराष्ट्र व्यवहाराशी संबंधित नोकरशाहीकडून मनापासून पाठिंबा मिळवण्यात अयशस्वी झाल्याबद्दल गुजराल यांच्या कार्यपद्धतीवर टीका केली जाते.
- पाकिस्तानबाबत मवाळ दृष्टीकोन : पाकिस्तानप्रती गुजराल यांनी अत्यंत सौम्य भूमिका घेतली होती, त्यामुळे भारताला संभाव्य दहशतवादी हल्ल्यांसह भविष्यातील सुरक्षा धोक्यांचा सामना करावा लागला; अशी टीका त्यांच्यावर होते.
- पाकिस्तानसोबत अलगपणाचे धोरण : पाकिस्तानमधील काहीजण हा सिद्धांत म्हणजे इस्लामाबादला एकाकी पाडण्याची भारतीय रणनीती म्हणून समजतात, ज्यामुळे प्रादेशिक सहकार्यात संशय आणि आव्हाने निर्माण होतात.

यापुढील वाटचालीचा मार्ग काय असावा?

- धोरणात्मक पुनर्मूल्यांकन :

विकसित होत असलेल्या भौगोलिक-राजकीय गतिशीलतेला प्रतिसाद म्हणून, भारताने वाढती गुंतागुंत आणि संभाव्य धोके ओळखून आपल्या शेजारील राष्ट्रांसोबातच्या धोरणाचे सखोल पुनर्मूल्यांकन केले पाहिजे.

- शाश्वत प्रतिबद्धतेद्वारे "शेजारी प्रथम" हे धोरण :

सर्व प्रकारच्या राजकीय आणि सामान्य जनतेच्या पातळीवरील शाश्वत प्रतिबद्धता वाढवून 'शेजारी प्रथम' दृष्टिकोनाला प्राधान्य दिले पाहिजे. भारताचे शेजारील राष्ट्रांसोबत सखोल असे सांस्कृतिक संबंध आहेत, त्याचा भारताने लाभ घेतला पाहिजे.

- गुजराल सिद्धांतामधील तत्वांवर सातत्यपूर्ण जोर :

गुजराल सिद्धांतामध्ये नमूद केलेल्या सहकार्य, परस्परसंवाद या प्रमुख तत्वांवर जोर दिला पाहिजे. भारताच्या परराष्ट्र धोरणातील निर्णय घेण्यासाठी आणि शेजारील देशांशी संबंधांना आकार देण्यासाठी या तत्वांशी बांधिलकी राखली पाहिजे.

- आर्थिक आणि प्रादेशिक सहकार्य :

क्षेत्रामध्ये व्यापार, गुंतवणूक आणि पायाभूत सुविधांच्या विकासावर लक्ष केंद्रित करून आर्थिक संबंध अधिक दृढ केले पाहिजेत. SAARC आणि BIMSTEC सारख्या प्रादेशिक उपक्रमांमध्ये सक्रिय सहभागाद्वारे प्रादेशिक सहकार्याला प्रोत्साहन दिले पाहिजे.

- संघर्ष निवारणासाठी मुत्सद्दीपणा :

विवाद शांततेने सोडवण्यासाठी आणि परस्पर समंजसपणा निर्माण करण्यासाठी, सहकार्य आणि स्थिरतेचे वातावरण निर्माण करण्यासाठी नियमित संवाद आणि राजनयिक प्रयत्नांमध्ये व्यस्त राहिले पाहिजे.

- जबाबदार शेजारी धोरण :

इतर देशांच्या अंतर्गत बाबींमध्ये हस्तक्षेप टाळून आणि शेजारी राष्ट्रांच्या सार्वभौमत्वाचा आणि प्रादेशिक अखंडतेचा आदर करून जबाबदार शेजारी म्हणून वागले पाहिजे.

निष्कर्ष :

- १) देशाचे मित्र बदलतील, शत्रू बदलतील, पण देशाचे शेजारी कधी बदलू शकत नाहीत. त्यामुळे देशाच्या परराष्ट्र धोरणाची आखणी करताना गुजराल सिद्धांत हा विचारात घ्यावाच लागतो.
- २) परतफेडीची अपेक्षा न करता भारताने सढळ हाताने भूतान, बांगलादेश, नेपाल, श्रीलंका, मालदीव या शेजारी देशांना मदत केली, तरच भारत खऱ्या अर्थाने 'मोठ्या बंधूची' भूमिका निभावू शकेल.
- ३) काश्मिरसारखे वादाचे मुद्दे बाजूला ठेवून भारताने पाकिस्तानसोबत सामान्य जनतेच्या पातळीवर संवाद वाढवला पाहिजे. शांततापूर्ण मार्गाने वादाच्या मुद्द्यांचे निराकरण केले पाहिजे.
- ४) चीनचा उपखंडातील प्रभाव वाढू द्यायचा नसेल तर गुजराल सिद्धान्ताशिवाय पर्याय नाही.

संदर्भ सूची :

1. देवळाणकर शैलेंद्र, भारतीय परराष्ट्र धोरण : सातत्य आणि स्थित्यंतर, प्रतिमा प्रकाशन, पुणे, २००७
2. Murthy Padmaja, Gujral Doctrine and Beyond, STRATEGIC ANALYSIS, July 1999 (Vol No. XXIII)
3. Gupta Bhabani Sen, Security Dimensions of the Gujral Doctrine, Institute of Peace and Conflict Studies, 1997
4. <https://byjus.com/free-ias-prep/gujral-doctrine>

Potassium Phosphate Catalyzed Synthesis of Erlenmeyer Azlactones

Dipak S. Gaikwad*, Saurabh C. Khilare, Kedar A. Undale

Department of Chemistry, Vivekanand College, Kolhapur (Autonomous), Maharashtra 416003, India

*E-mail: dgchemistry@gmail.com Tel.: +91 231 2658612; fax: +91 231 2658840

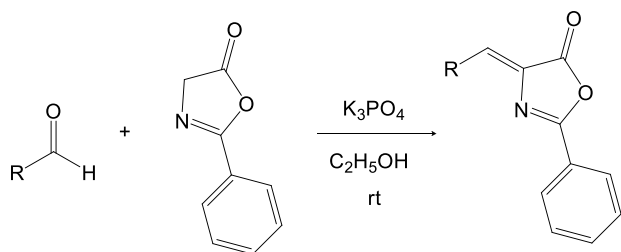
Abstract— A variety of Erlenmeyer Azlactones have been synthesized by reacting aldehyde with 2-phenyl-5(4*H*)-oxazolone using catalytic amount of potassium phosphate in ethanol medium at ambient temperature. Use of potassium phosphate as an inexpensive catalyst makes the protocol more economical. Mild reaction conditions operable at ambient temperature, simple work-up procedure as well as purification of product and high yields (80-98%) are the added advantages of the present method.

Keywords: Erlenmeyer Azlactones, potassium phosphate, ambient temperature.

In 1893, Friedrich Gustav Carl Emil Erlenmeyer¹ discovered the reaction between benzaldehyde with N-acetylglycine in the presence of acetic anhydride and sodium acetate (Erlenmeyer reaction). The reaction proceeds *via* a Perkin condensation following the initial cyclisation of the N-acetylglycine² yielding the so-called Erlenmeyer azlactones. These have been used in a wide variety of reactions as precursors for biologically active peptides³, herbicides, fungicides⁴, as drugs, pesticides and agrochemical intermediates⁵. They have been used in active site titrations of enzymes⁶, as antihypertensives⁷ and in the asymmetric synthesis of amino acids⁸.

A detailed literature survey towards the Erlenmeyer reaction revealed that most of the protocols employed for this reaction operate under high thermal activation⁹⁻¹⁴, microwave activation¹⁵⁻¹⁷ and ultrasonic irradiation.¹⁸⁻¹⁹ There are a few protocols operable at room temperature using N-methylimidazole²⁰, (S)-proline²¹ and (D,L)-proline²². Each of the above method has its own merit with at least one of the limitations of low yields, use of expensive catalyst, long reaction, times, harsh reaction conditions and tedious work-up procedures. The main problem of synthesis of Erlenmeyer Azlactones is presence of strong base would facilitate the self-condensation of the aldehyde. Hence a mild base is to be selected for their synthesis. We envisioned that K₃PO₄ which is a stronger base than alkali carbonates but weaker than corresponding hydroxides might be a useful catalyst for Erlenmeyer reaction.

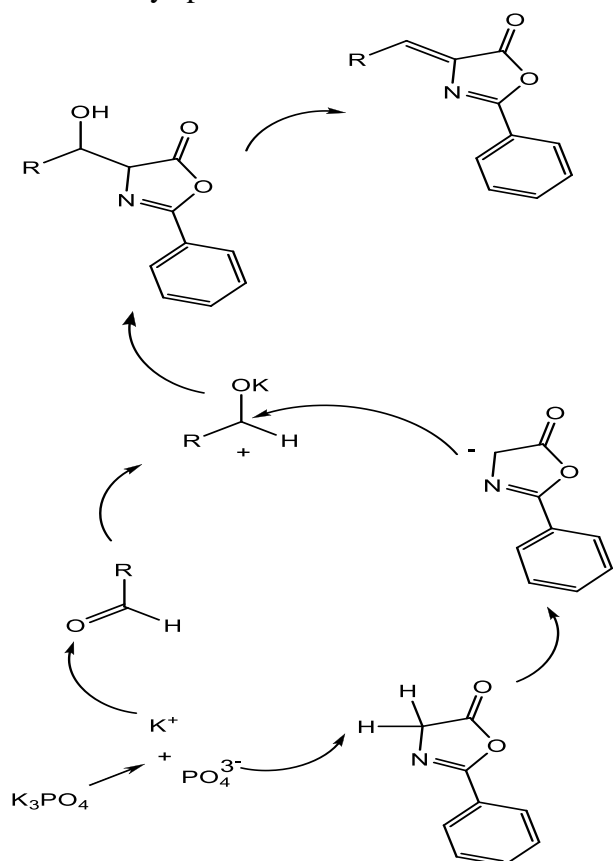
In continuation of our interest in exploring K₃PO₄ for synthesis of organic compounds,²³ we wish to report a simple, practical and efficient method for the synthesis of Erlenmeyer Azlactones from aldehydes and 2-phenyl-5(4*H*)-oxazolone catalyzed by K₃PO₄ at room temperature. (Scheme 1).



Scheme 1: Potassium Phosphate Catalyzed Synthesis of Erlenmeyer Azlactones

Formation of the intermediate azlactone anion (Scheme 2) is the key to the success of the reaction. From our previous experience of K_3PO_4 , we envisioned that K_3PO_4 could be a suitable catalyst for the present transformation, the central K^+ ion is oxophilic makes the carbonyl carbon of aldehyde functionality more electrophilic and the counteranion PO_4^{3-} is sufficiently basic for the formation of anion of 2-phenyl-5(4*H*)-oxazolone. Hence, the reaction took place rapidly and yielded corresponding Erlenmeyer Azlactones in excellent yields. A plausible mechanism is depicted in Scheme 2.

As a case study, to a stirred solution of benzaldehyde (1 mmol), 2-phenyloxazol-5-one (1 mmol) in ethanol (10 mL) potassium phosphate (25 mol %) was added [Scheme 1]. The progress of the reaction was monitored by TLC. Within 15 minutes the reaction was completed, as indicated by the disappearance of the spot due to aldehyde, from TLC. The reaction mixture was poured into ice-water and the precipitate formed was filtered and washed with hexane and recrystallized with hot ethanol and identified by spectral methods.



Scheme 2 : A Plausible Mechanism of Potassium phosphate catalyzed synthesis of Erlenmeyer azlactones

So as to optimize the quantity of catalyst used the reaction was then performed in ethanol medium in varied proportion of catalyst and results are summarized in Table 1. The results reveal that only 20mg (10 mol %) of catalyst is enough to effect synthesis of Erlenmeyer azlactones.

Table 1: Potassium phosphate catalyzed synthesis of Erlenmeyer azlactones at ambient temperature

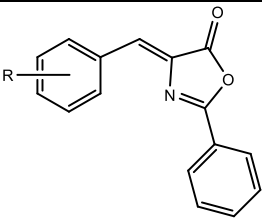
Entry	Catalyst Mol (%)	Time (min)	Yield ^b (%)
1	25	15	85
2	20	15	83
3	15	15	83
4	10	15	82

Reaction conditions: benzaldehyde(1 mmol), 2-phenyloxazol-5-one (1 mmol), ethanol (10 mL), Temp.= rt.

^b Yields refer to pure, isolated products

The reaction was then extended towards the condensation of various aromatic aldehydes with 2-phenyloxazol-5-one and the results are summarized in Table 2. As expected, the reaction proceeds well with aromatic aldehydes bearing electron withdrawing as well as electron donating groups. The heterocyclic aldehydes also given higher yields of azalactones and exhibited the same behavior as that of aromatic aldehydes.

Table 2: Potassium phosphate catalyzed synthesis of Erlenmeyer azlactones at ambient temperature

Entry	Product (3)	Time (min)	Yield (%) ^{a,b}
			
a	R = H	15	82
b	R = 4-OMe	15	65
c	R = 3-Cl	20	88
d	R = 4-CH ₃	10	76
e	R = 4-NO ₂	10	78
f	R = 3-NO ₂	20	88
g	R = 4-isopropyl	15	80
h	R = 4-OH	10	86
i	R = 3,4-OMe	10	80
j	R = 2,5-di-Me	15	84
k	R = 3-OMe, 4-OH, 5-NO ₂	15	83

^a All products showed satisfactory spectroscopic data. (IR, ¹H and ¹³C NMR)

^b Yields refer to pure, isolated products

Experimental

General

All chemicals (Sigma-Aldrich) were used as received. Melting points were determined and are uncorrected. IR spectra were recorded on Perkin-Elmer [FT-IR-783] spectrophotometer. NMR spectra were recorded on Bruker AC-300 (300 MHz for ^1H NMR and 75 MHz for ^{13}C NMR) spectrometer in DMSO- d_6 or CDCl_3 using TMS as an internal standard and δ values are expressed in ppm.

Typical Procedure

To a stirred mixture of aldehyde (1 mmol) in 10 mL ethanol, 2-phenyloxazol-5-one (1 mmol) was added. The reaction mixture was allowed to stir at room temperature for time as mentioned in table-1. The precipitated solid was filtered, washed with water and then with 5mL of hexane. The product obtained was pure by simple recrystallization by ethanol.

Spectral data of selected compound

Entry 3a, Table 2: Mp. 162-165 °C; IR (KBr): 3322, 2930, 1795, 1655, 1165 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ = 7.26 (s, 1H, -CH=), 7.46-7.66 (m, 6H, Ar-H), 8.19-8.23 (m, 4H, Ar-H)

Entry 3c, Table 2: Mp. 160-162 °C; IR (KBr): 3322, 2930, 1799, 1657, 1165 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ = 7.16 (s, 1H, -CH=), 7.40-7.64 (m, 5H, Ar-H), 7.85 (d, 1H, Ar-H), 8.00 (d, 1H, Ar-H), 8.19 (d, 1H, Ar-H), 8.30 (s, 1H, Ar-H); ^{13}C NMR (75 MHz, CDCl_3): δ 125.39, 128.06, 128.58, 129.01, 129.87, 131.12, 131.25, 131.70, 134.02, 134.42, 135.84, 190.25.

Entry 3j, Table 2: Mp. 114-116 °C; IR (KBr): 3321, 2925, 1789, 1651, 1177 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ = 2.43 (s, 3H, Ar- CH_3), 2.48 (s, 3H, Ar- CH_3), 7.15 (s, 1H, -CH=), 7.43-7.53 (m, 5H, Ar-H), 7.77 (d, 1H, Ar-H), 8.17 (d, 1H, Ar-H), 8.61 (s, 1H, Ar-H).

Entry 3k, Table 2: Mp. 165-167 °C; IR (KBr): 3208, 2935, 1791, 1680, 1106 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ 4.02 (s, 3H, Ar-OMe), 7.14 (s, 1H, -CH=), 7.55-7.63 (m, 5H, Ar-H), 8.13 (s, 1H, Ar-H), 8.37 (s, 1H, Ar-H), 9.88 (s, 1H, Ar-OH); ^{13}C NMR (75 MHz, DMSO- d_6): δ 57.20, 112.80, 121.53, 126.94, 127.66, 128.32, 129.79, 129.87, 137.49, 148.67, 150.68, 190.7

Conclusion:

In conclusion, potassium phosphate was found to be an efficient base catalyst to effect Erlenmeyer reaction. A variety of aldehydes undergo Erlenmeyer reaction smoothly in presence of potassium phosphate in short time duration in high yields. Easy isolation of product as well as purification are the added advantages of this method. The interesting feature of this catalyst is that it does not bring about the self condensation of aldehyde.

Acknowledgement:

One of the authors DSG gratefully acknowledges Vivekanand college, Kolhapur (Autonomous) for financial assistance under seed money research grant scheme.

References:

- [1] Erlenmeyer, E. *Annalen*. **1893**, 275, 1.
- [2] Baltazzi, E. *Q. Rev. Chem. Soc.* **1955**, 9, 150.
- [3] a) Etschenberg, E.; Opitz, W.; Raddatz, S. *Brit.* **1980**, 25, 1570140.
b) Reed, J.W.; Kingston, G. I. D. *J. Nat. Prod.* **1986**, 49, 626.

- [4] a) Bakos, J.; Neil, B.; Toros, S.; Eifert, G.; Bihari, F.; Nagy, M.; Saros, L.; Durko, A.; Kuronya, I.; Bohus, P. *Ger. Offen.* **1987**, 11, DE 3641046.
 b) Jeschkeit, H.; Breaemer, B.; Lehmann, H.; Seewald, I.; Kleppel, M. *Ger. (East)* **1989**, 22, DD 266021.
- [5] a) Augustin, M.; Thondorf, I.; Strube, M. *Ger. (East)* **1988**, 14, DD 260063.
 b) Augustin, M.; Strube, M.; Thondorf, I. *Ger. (East)* **1988**, 7, DD 259862.
- [6] Bacse, H. J.; Havsteen, B. *Anal. Biochem.* **1989**, 181, 321.
- [7] Urano, K.; Tornioka, Y.; Okubo, K.; Yarnazaki, K.; Nagamatsu, A. *Jpn. Kokai Tokkyo Koho JP 01 29369 189 29, 3691*, **1989**.
- [8] a) Gillespie, H. B.; Snyder, H. R. *Org. Synth. Coll. Vol.* **1943**, 2, 489; *Org. Synth., Coll. Vol.* **1939**, 19, 67.
- [9] Boruah, A.; Baruah, P.; Sandhu, J. *J. Chem. Res.(S)* **1998**, 614.
- [10] Fred, M.; Pavia, M. *Synthesis* **1988**, 1659.
- [11] Bates, R.; Janda, K. *Synthesis* **1984**, 310.
- [12] Subhashini, N.; Hanumanthu, P. *Ind. J. Chem. Sect. B* **2000**, 39 (3), 198.
- [13] Chel'tsova, G.; Karpeiskaya, E.; Klavunovskii, E. *Bull. Acad. Sci. USSR* **1989**, 38(5.2), 1014.
- [14] Liubeznova, M.; Karpeiskaya, E.; Klavunovskii, E. *Bull. Acad. Sci. USSR* **1990**, 39 (4.1), 731
- [15] Steglich, W.; Gruber, P. *Angew. Chem. Int. Ed.* **1971**, 10 (9), 655.
- [16] Majumdar, K. C.; Ghosh, S. K. *J. Chem. Soc., Perkin Trans. 1* **1994**, 2889.
- [17] Majumdar, K. C.; Biswas, P. *Tetrahedron* **1999**, 55, 1449.
- [18] Raad, I. I.; Hachem, R. Y.; Abi-Said, D.; Rolston, K. V. I.; Whimbey, E.; Buzaid, A. C.; Legha, S. *Cancer* **1998**, 82, 403.
- [19] Anderle, C.; Stieger, M.; Burrell, M.; Reinelt, S.; Maxwell, A.; Page, M.; Heide, L. *Antimicrob. Agents Chemother.* **2008**, 52, 1982.
- [20] Burlison, J. A.; Neckers, L.; Smith, A. B.; Maxwell, A.; Blagg, B. S. *J. Am. Chem. Soc.* **2006**, 128, 15529.
- [21] Y. Aparna, N. J. Prameela Subhashini *J. Chem. Pharm. Res.*, **2010**, 2(3), 473.
- [22] Chuanming, Y.; Baocheng, Z.; Weike, S.; Zhenyuan, X. *Synth. Commun.* **2006**, 36, 3447.
- [23] a) Gaikwad, D. S. Undale, K.A.; Shaikh, T.S.; Pore, D. M. *C. R. Chimie* **2011**, 14, 865.
 b) Undale, K.A.; Shaikh, T.S.; Desai, U. V.; Gaikwad, D. S.; Pore, D.M. *Ind. J.Chem.Sec.B* **2012**, 51, 1039.
 c) Undale, K. A.; Dongare, B. B.; Desai, U. V.; Pore, D. M. *Cat. Lett.* **2009**, 132, 104.

Palladium Nanoparticle-Catalyzed Suzuki-Miyaura Coupling in Multi-Functionalized Ionic Liquid Media

Dipak S. Gaikwad*, Satish S. Kadam, Saurabh C. Khilare, Kedar A. Undale

Department of Chemistry, Vivekanand College, Kolhapur (Autonomous), Maharashtra 416003, India

*E-mail: dgchemistry@gmail.com ; Tel.: +91 231 2658612; fax: +91 231 2658840

Abstract

Herein, we report a novel, multifunctionalized task-specific ionic liquid that induces reactions in water and acts as both a reducing and stabilizing agent for in-situ-generated palladium nanoparticles (Pd-NPs). The palladium nanoparticles were characterized by UV-visible spectroscopy and transmission electron microscopy (TEM), showing a particle size below 10 nm. These nanoparticles exhibited high catalytic activity in the Suzuki cross-coupling of aryl halide with aryl boronic acid without using an external phosphine ligand. The aqueous system containing the ionic liquid along with Pd-NPs was recycled eight times without a significant loss of catalytic activity.

Key words

Ionic liquid, Suzuki-Miyaura coupling reaction, Palladium Nanoparticles, Transmission Electron Microscopy

Introduction

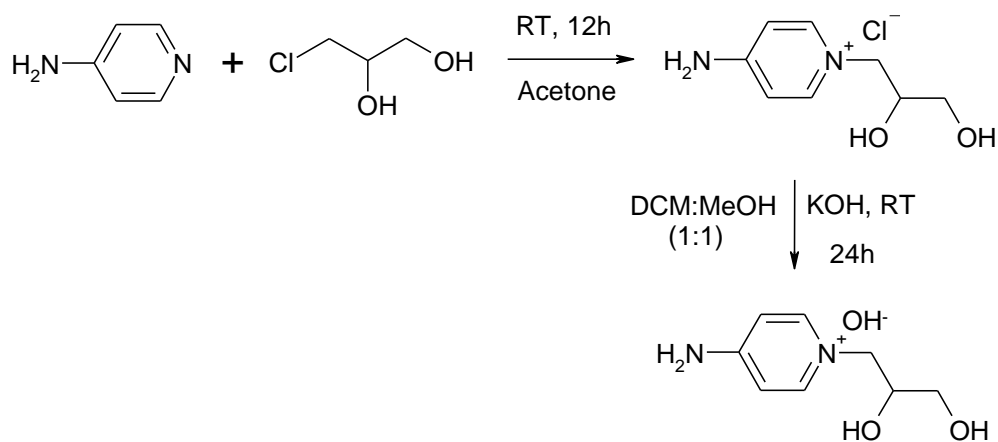
The catalytic activity of metal nanoparticles (NPs) symbolizes a prosperous resource for chemical processes, engaged both in industry and in academics.^{1,2} The synthesis of NPs is of great current interest and it has a potential future. They have applications in diverse fields, including energy conversion and storage, chemical manufacturing, biological applications, and environmental technology.^{3,4} The use of NPs as efficient catalysts in organic reactions has attracted considerable interest in recent times in the context of green chemistry because of their benign character and ease of preparation.⁵ Numerous catalytic systems based on metal nanoparticles immobilized in ionic liquids (ILs) have been developed for hydrogenation, oxidation, alkylation, and C–C coupling reactions under both single-phase and multiphase conditions. In fact, there are some quite recent outstanding reviews on the preparation, characterization, and use (including in catalysis) of soluble metal nanoparticles in ILs.⁶ This is because ILs poses several unique properties, such as negligible vapor pressure, no miscibility with non-polar solvents, and reasonable thermal and chemical stability with excellent electrical

conductivity.⁷ Owing to these unique properties, more attention has been focused on the synthesis of new ionic liquids with functional groups, so-called “task-specific” ionic liquids (TSILs) which will act as reducing as well as stabilizing agent for NPs.

Palladium-catalyzed C-C couplings reactions such as Suzuki, Heck, Sonogashira, Stille and Negishi reactions are the most common couplings which have developed into an important tool in organic synthesis, predominantly for pharmaceutical and agrochemical purposes.⁸ Among them Suzuki coupling⁹ have specially attracted the attention of many researchers, in essence due to the small loading of metal required to afford high turnover frequencies,¹⁰ so that the term “homeopathic palladium” is currently employed. The reaction, however, suffers from a number of drawbacks such as catalyst loss into the product formation, catalyst decomposition and poor reagent solubilities. We take for granted that, these problems might be resolved by the use of newly synthesized ionic liquid. As part of a continuing effort in our laboratory towards the development of new methods in green process,¹¹ herein we disclose a novel protocol for the Suzuki coupling reaction using in situ generated Pd NPs by the use of TSIL as a reducing as well as stabilizing agent. The desired carbon-carbon bond formation proceeded under mild conditions with high efficiency and good functional group tolerance.

Results and discussion

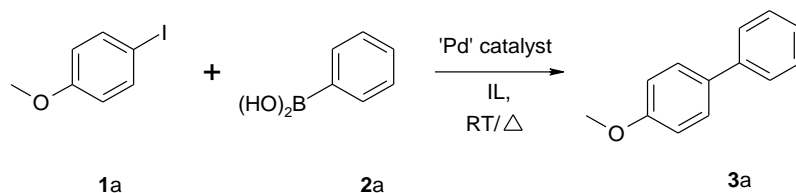
Initially we have synthesized a novel multi functionalized ionic liquid.



Scheme 1: Synthesis of Novel Multi functionalized ionic liquid

Keeping the basic things in mind which are required for synthesis of NPs and further completion of coupling reaction, we focused to synthesis such IL which will fulfill these all requirements (**Scheme 1**). We carried out first quaternisation of 4-amino pyridine and 3-chloro-1,2-diol in acetone at room temperature and increased the basicity of the ionic liquid by incorporating OH⁻ on reaction with potassium hydroxide. The cation of IL contains amino functional group which increases basicity (4-amino pyridine has Pka 9.17) of the ionic liquid and the diol functionality acts as a reducing as well as stabilizing agent for Pd NPs. The formation of IL was confirmed by characterizing its ¹H and ¹³C NMR, and we delighted that spectra confirmed the formation of desired multifunctional IL.

After synthesizing IL, we investigated its use in Suzuki coupling reaction and carried out a model reaction with 4-Iodoanisole **1**, phenylboronic acid **2**, palladium source as a catalyst and synthesized IL i.e. [ADPPY][OH] (20 mol%) in water. When reaction was carried out at room temperature after prolonged reaction time we observed very negligible product, but when the same was carried out at 80°C reaction completed 100%. Results of this preliminary survey are shown in Table 1.



Scheme 2: A Typical Suzuki-Miyaura Coupling reaction

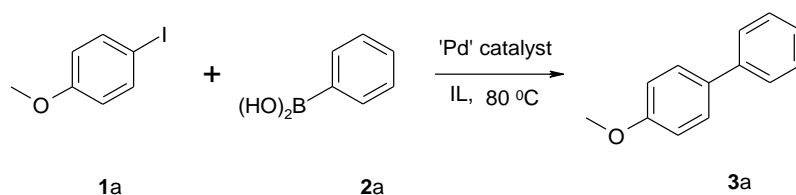
Table 1. Optimization of the reaction conditions

Entry	Catalyst (2 mole %)	Base (mol%)	Temp. (°C)	Yield (%) ^b
1	Pd(PPh ₃) ₄	[ADPPy][OH] (20)	RT	20
2	Pd(PPh ₃) ₄	[ADPPy][OH] (20)	80	60
3	Pd ₂ (dba) ₃	[ADPPy][OH] (20)	80	40
4	Pd/C	[ADPPy][OH] (20)	80	10
5	Pd(OAc) ₂	[ADPPy][OH] (20)	RT	45
6	Pd(OAc)₂	[ADPPy][OH] (20)	80	99
7	Pd(OAc) ₂	[ADPPy][OH] (30)	80	99
8	PdCl ₂	[ADPPy][OH] (30)	80	90

^a Reaction conditions: 4-Iodoanisole (1 mmol), phenylboronic acid (1.1 mmol), Pd catalyst (2 mole %), water (5 mL), ^bIsolated yields.

We also explored the effect of the amount of [ADPPy][OH] and the ratios of substrate i.e boronic acid on the model reaction. The results are listed in Table 2. We found that 20 mol% of [ADPPy][OH] (entry 4 and 5, table 2) is sufficient to promote the coupling reaction. A ratio of 4-Iodoanisole to phenyl boronic acid of 1: 1.1 is sufficient to the almost conversion (entry 4).

Table 2 The effect of the amount of [ADPPy][OH] and the ratio of substrates on the reaction^a

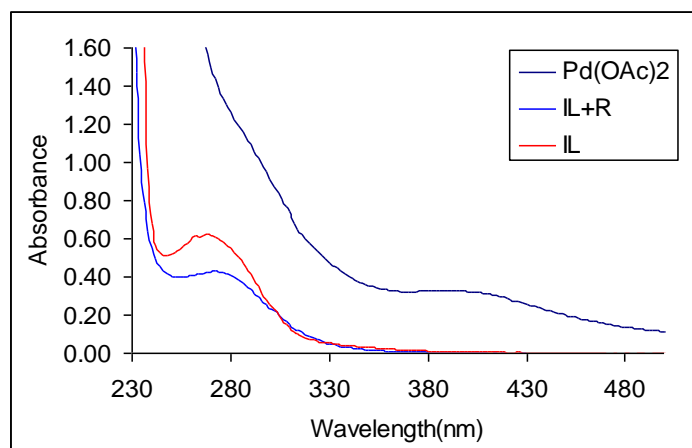


Entry	Ratio substrate : Boronic acid	[ADPPy][OH] (mol%)	Yield (%) ^b
1	1 : 1.0	5	58

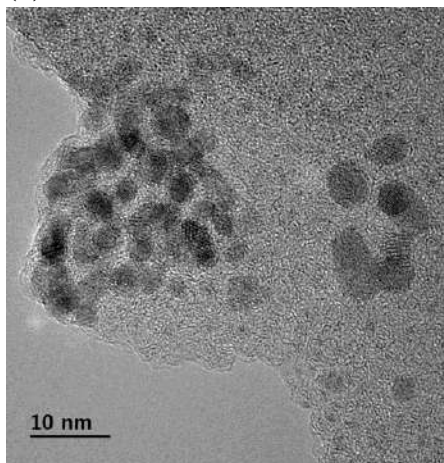
2	1 : 1.0	10	71
3	1 : 1.1	5	79
4	1 : 1.1	20	91
5	1 : 1.5	20	86

Reaction conditions: 4-Iodoanisole, phenylboronic acid, Pd(OAc)₂ (2 mol%), water (5.0 mL), 80 °C; ^b Isolated yields.

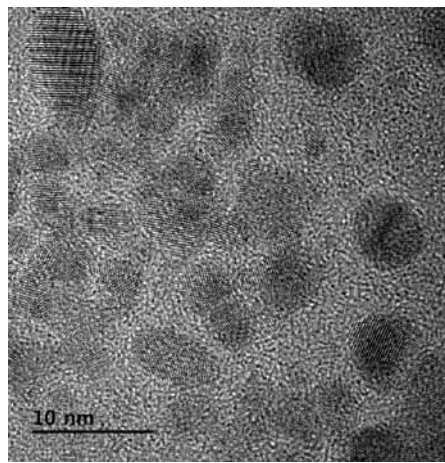
After the completion of reaction, we have extracted the reaction mixture by diethyl ether to separate the synthesized biaryls. Then the aqueous phase have been analysed by recording UV–Vis spectrum in acetone medium and compared the same with that of Pd(OAc)₂ (Fig. 1a). The absorption at 405 nm due to Pd(OAc)₂ disappeared from the reaction mixture due to the formation of palladium nanoparticles. These obtained Pd-Nps is characterized by transmission electron microscopy (TEM) as shown in Fig 1b, 1c.



(a)



(b)

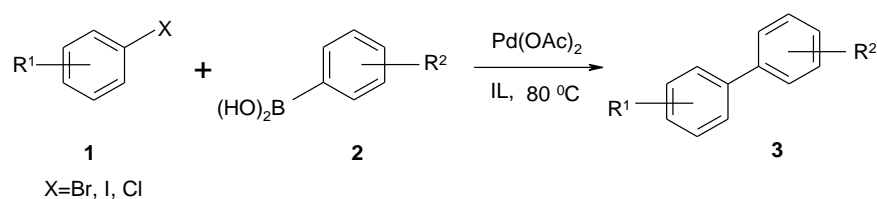


(c)

Fig. 1: (a) UV-Vis Spectra of reaction mixture after completion of reaction (b) & (c) TEM analysis of separated Pd NPs

We chose the optimized reaction conditions as; 1 mmol aryl halides, 1.1 mmol phenylboronic acids, 20 mol% of [ADPPy][OH], 2 mol% Pd(OAc)₂ and 5 mL water at 80 °C. A variety of electron donating and electron withdrawing aryl halides and various substituted phenylboronic acids were then explored as substrates, and the results are listed in Table 3. We found that aryl bromides and iodides reacted with phenylboronic acid efficiently, giving the good to excellent yields.

Table 3. The reactions of aryl halides and phenylboronic acids under the optimized reaction conditions^a



Entry	Aryl Halide	Boronic Acid	Time in min	Yield (%) ^b
a	R ¹ =H, X=I	R ² =H	30	91
b	R ¹ =H, X=Cl	R ² =4-OMe	30	88
c	R ¹ =H, X=Br	R ² =2-Me	30	79
d	R ¹ =4-Me, X=Br	R ² =H	30	89
e	R ¹ =4-Me, X=I	R ² =4-OMe	35	83
f	R ¹ =4-OMe, X=I	R ² =H	35	88
g	R ¹ =4-OMe, X=I	R ² =4-OMe	35	71
h	R ¹ =4-CN, X=Br	R ² =H	45	77
i	R ¹ =4-CN, X=Br	R ² =4-OMe	45	75
j	R ¹ =4-NO ₂ , X=I	R ² =H	50	54
k	R ¹ =4-NO ₂ , X=I	R ² =4-OMe	50	47
l	R ¹ =4-COMe, X=Br	R ² =H	40	76
m	R ¹ =4-OMe, X=Br	R ² =4-OMe	40	69
n	R ¹ =4-OMe, X=Br	R ² =2-Me	45	87
o	1-Naphthyl Iodie	R ² =H	40	55

^a Reaction conditions: aryl halide (1 mmol), boronic acid (1.1 mmol), Pd(OAc)₂ (2 mol%), [ADPPY][OH] (20 mol%), Water (5 mL) at 80 °C. ^b Isolated yield based on the aryl halides.

Green chemistry legislations direct us to minimize the waste and conservation energy. In this standpoint, recycling of catalyst is highly warranted. Hence, we carried out the recyclability study of ionic liquid-PdNps catalytic system for the model reaction. Gratifyingly, it was

observed that the catalytic system can be reused effectively for 8 times without significant loss of activity providing excellent yields of products (**Fig. 2**).

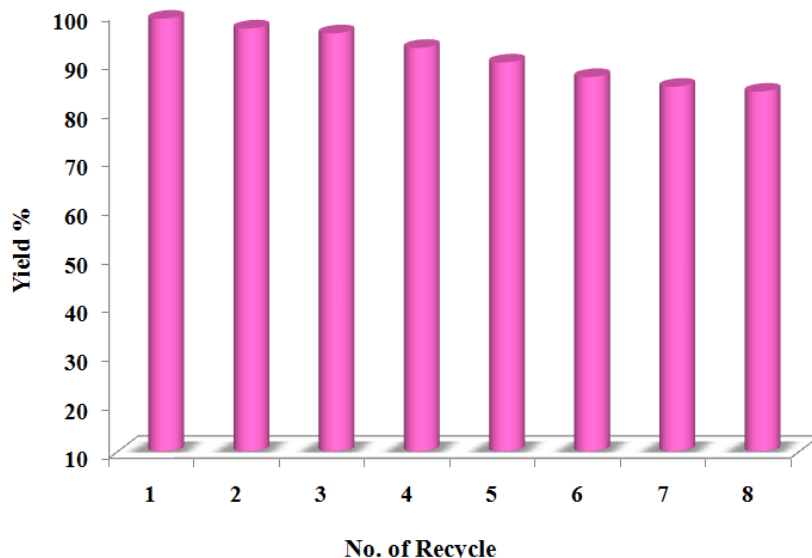


Fig. 2 Reusability of catalytic system (Ionic liquid & Pd NPs)

Experimental Section

Chemicals (Spectrochem, Mumbai) and palladium sources (Spectrochem, Mumbai) were used as received. All reactions were carried out aerobic condition in predried glassware. Infrared spectra were recorded on a Perkin-Elmer FT-IR-783 spectrophotometer. ^1H NMR and ^{13}C NMR spectra were recorded on a Bruker AC spectrometer (300 MHz for ^1H NMR and 75 MHz for ^{13}C NMR), using CDCl_3 as solvent and tetramethylsilane (TMS) as an internal standard. Chemical shifts (δ) are expressed in parts per million (ppm) and coupling constants are expressed in hertz (Hz).

Synthesis of Ionic Liquid:

To a vigorously stirred solution of 4-amino pyridine (10 mmol) in acetone (25 mL), 3-chloro-1,3-propanediol (11 mmol) was slowly added at room temperature and stirred the reaction mixture for 12 h. After the completion of the reaction, acetone was decanted, and the remaining viscous oil was repeatedly washed with diethyl ether to yield a transparent viscous ionic liquid, which was then dried under vacuum. The ionic liquid obtained from the first step, 4-amino-1-(2,3-dihydroxypropyl)-pyridinium chloride [ADPPy][Cl] (10 mmol), was then dissolved in dichloromethane:methanol (1:1) and cooled to 0°C , followed by the addition of potassium hydroxide (11 mmol). It was stirred for 24 h at room temperature. The suspension was filtered to remove the precipitated potassium chloride salt, and the solvent was evaporated under reduced pressure, yielding 4-amino-1-(2,3-dihydroxypropyl)-pyridinium hydroxide [ADPPy][OH].

Typical Procedure for Suzuki-Miyaura Coupling reaction:

In the optimized procedure, [ADPPy][OH] (20 mol%) was added to a mixture of the aryl halide (1 mmol), phenylboronic acid (1.1 mmol), $\text{Pd}(\text{OAc})_2$ (2 mol%) and water (5 mL) in a 25

mL round-bottomed flask. The reaction mixture was stirred at 80 °C until complete conversion of aryl halide had taken place (monitored by TLC). After completion, the reaction mixture was extracted with diethyl ether (5 X 3 mL) and the combined organic extracts were dried over anhydrous sodium sulfate and evaporated under vacuum, leaving the crude product, which was purified by column chromatography. All products have been reported previously, and their identities were confirmed by ¹H NMR and ¹³C NMR spectroscopy.

Conclusions

In conclusion, we have developed an eco-benign method for Suzuki-Miyaura coupling by employing a novel IL-PdNPs catalytic system. The in-situ generation of PdNPs is assisted by a novel multifunctionalized ionic liquid, which also reduces and stabilizes them. The catalytic system can be reused at least eight times without any significant loss in catalytic activity, highlighting one of the green aspects of the method. The novelty of the protocol lies in the exploration of a novel efficient catalytic system for Suzuki coupling, along with additional features such as operational simplicity, reusability of the catalytic system, shorter reaction time, avoidance of conventional volatile organic solvents, no waste formation, 100% atom economy, and an easy work-up procedure. Thus, we believe that our findings portend significant gains toward achieving ideal transformations.

Acknowledgements

One of authors DSG gratefully acknowledges Vivekanand college, Kolhapur (Autonomous) for financial assistance under seed money research grant scheme.

Spectral Data: Spectra Data of Ionic Liquid:

4-amino-1-(2,3-dihydroxy-propyl)-pyridinium hydroxide [ADPPy][OH].

Viscous yellow liquid, ¹H NMR (DMSO-d⁶, 300 MHz, TMS): 3.20 (1H, m), 3.25 (1H, m), 3.72 (1H, s), 3.97 (1H, m), 4.27 (1H, m), 4.81 (1H, s), 5.06 (1H, m), 5.43 (1H, d), 6.85 (2H, d, J=6Hz), 8.09 (2H, d, J=9Hz), 8.31 (2H, s), ¹³C NMR (CDCl₃, 75 MHz, TMS): 60.07, 63.14, 70.86, 109.49, 143.56, 159.54.

Spectral Data of selected compounds:

Entry a, Table 3: White solid, mp 70–72°C; IR (KBr): 3034, 1569, 1481, 1428, 728, 696 cm⁻¹; ¹H NMR (CDCl₃, 300 MHz, TMS): d 7.39–7.44 (2H, m, ArH), 7.49–7.54 (4H, m, ArH), 7.66–7.69 (4H, m, ArH). ¹³C NMR (CDCl₃, 75 MHz, TMS): 127.22, 127.30, 128.80, 141.32

Entry I, Table 3: White solid, mp 120–121°C; IR (KBr): 3073, 2998, 1678, 1602, 1403, 1359, 1283, 1263, 961, 842, 765, 721, 691 cm⁻¹; ¹H NMR (CDCl₃, 300 MHz, TMS): 2.65 (3H, s, CH₃), 7.42–7.48 (3H, m, ArH), 7.62–7.69 (4H, m, ArH), 8.04 (2H, d, J=7.2 Hz, ArH). ¹³C NMR (CDCl₃, 300 MHz, TMS): 26.61, 127.21, 127.26, 128.21, 128.89, 128.93, 135.89, 139.89, 145.78.

References:

- 1 Senanayake, S. D.; Stacchiola, D.; Rodriguez, J. A. *Acc. Chem. Res.* 2013, 46, 1702–1711.
- 2 Bordiga, S.; Groppo, E.; Agostini, G.; van Bokhoven, J. A.; Lamberti, C. *Chem. Rev.*

- 2013, 113, 1736–1850.
- 3 Laurent, S.; Forge, D.; Port, M.; Roch, A.; Robic, C.; Vander Elst, L.; Muller, R. N. *Chem. Rev.* 2008, 108, 2064–2110.
- 4 Gawande, M. B.; Branco, P. S.; Parghi, K.; Shrikhande, J. J.; Pandey, R. K.; Ghumman, C. A. A.; Bundaleski, N.; Teodoro, O.; Jayaram, R. V. *Catal. Sci. Technol.* 2011, 1, 1653–1664.
- 5 (a) Astruc, D. *Inorg. Chem.* 2007, 46, 1884–1894; (b) Astruc, D.; Lu, F.; Aranzaes, J. R. *Angew. Chem., Int. Ed.* 2005, 44, 7852–7872; (c) Polshettiwar, V.; Baruwati, B.; Varma, R. S. *Green Chem.* 2009, 11, 127–131; (d) Reetz, M. T.; Westermann, E. *Angew. Chem., Int. Ed.* 2000, 39, 165–168; (e) Durand, J.; Teuma, E.; Gomez, M. *Eur. J. Inorg. Chem.* 2008, 3577–3586.
- 6 (a) Dupont, J.; Scholten, J. D. *Chem. Soc. Rev.* 2010, 39, 1780–1804; (b) Precht, M. H. G.; Scholten, J. D.; Dupont, J. *Molecules* 2010, 15, 3441–3461; (c) Migowski, P.; Dupont, J. *Chem. Eur. J.* 2007, 13, 32–39.
- 7 (a) Jairton Dupont, Roberto F. deSouza, and Paulo A. Z. Suarez, *Chem. Rev.* 2002, 102, 3667–3692. (b) Thomas Welton, *Chem. Rev.* 1999, 99, 2071–2083.
- 8 Fernando Fernandez, Beatriz Cordero, Jerome Durand, Guillermo Muller, Francois Malbosc, Yolande Kihn, Emmanuelle Teumaa, Montserrat Gomez, *Dalton Trans.*, 2007, 5572–5581.
- 9 (a) Christopher J. Mathews, Paul J. Smith, Tom Welton, *Journal of Molecular Catalysis A: Chemical* 214 (2004) 27–32. (b) Hengquan Yang, Xiaojing Han, Guang Li, Yunwei Wang, *Green Chem.*, 2009, 11, 1184–1193. (c) Christopher J. Mathews, Paul J. Smith, Thomas Welton, *Chem. Commun.*, 2000, 1249–1250. (d) Yi-Yuan Peng, Jinbiao Liu, Xiaoli Lei, Zenlan Yin, *Green Chem.*, 2010, 12, 1072–1075. (e) Xue Yang, Zhaofu Fei, Tilmann J. Geldbach, Andrew D. Phillips, Christian G. Hartinger, Yongdan Li, Paul J. Dyson, *Organometallics* 2008, 27, 3971–3977. (f) James McNulty, Alfredo Capretta, Jeff Wilson, Jeff Dyck, George Adjabenga, Al Robertson, *Chem. Commun.*, 2002, 1986–1987. (g) Marco Lombardo, Michel Chiarucci, Claudio Trombini, *Green Chem.*, 2009, 11, 574–579. (h) R. Rajagopal, Dilip V. Jarikote, K. V. Srinivasan, *Chem. Commun.*, 2002, 616–617.
- 10 (a) J.G. de Vries, *Can. J. Chem.*, 2001, 79, 1086–1092. (b) D. H. B. Ripin, D. E. Bourassa, T. Brandt, M. J. Castaldi, H. N. Frost, J. Hawkins, P. J. Johnson, S. S. Massett, K. Neumann, J. Phillips, J. W. Raggon, P. R. Rose, J. L. Rutherford, B. Sitter, A. M. Stewart, M. G. Vetelino, L. L. Wei, *Org. Process Res. Dev.*, 2005, 9, 440–450. (c) S. Kotha, K. Lahiri and D. Kashinath, *Tetrahedron*, 2002, 58, 9633–9695.
- 11 (a) Gaikwad, D. S.; Park, Y. K.; Pore, D. M. *Tetrahedron Lett.* 2012, 53, 3077–3081; (b) Patil, J. D.; Korade, S. N.; Patil, S. A.; Gaikwad, D. S.; Pore, D. M. *RSC Adv.* 2015, 5, 79061–79069.

Comprehensive Study on Data Warehousing: Design, Architecture, and Applications

Ms. S.Z. Mullani¹, Dr. R. D. Kumbhar²

¹Assistant Professor, Vivekanand College, Kolhapur, Maharashtra, India

E-mail: samrinmullani@gmail.com

²Assistant Professor, RayatShikshanSanstha's KBPIMSR, Satara, Maharashtra, India

Email: rdk14@rediffmail.com

Abstract: This research paper aims to provide a comprehensive exploration of data warehousing, covering its definition, working principles, design considerations, architecture, and applications. The study delves into topics such as data marts, data cubes, OLAP operations, and the distinctions between data warehousing (OLAP) and operational databases (OLTP). The paper serves as a valuable resource for researchers, practitioners, and students seeking a thorough understanding of data warehousing.

Keyword: Data Warehousing, Data Warehouse Design, Data Warehouse Architecture, Enterprise Data Warehouse (EDW).

1. Introduction

In the modern era of information technology, organizations are inundated with vast amounts of data generated from various sources such as transactional systems, customer interactions, and operational processes. Harnessing this data for strategic decision-making and business intelligence has become imperative, giving rise to the concept of Data Warehousing.

In the contemporary landscape of data-driven decision-making, organizations grapple with an unprecedented influx of information from diverse sources. This wealth of data, while holding the potential to unlock valuable insights, poses the challenge of effective management, integration, and utilization. Recognizing the imperative for a strategic solution, Data Warehousing emerges as a transformative technology, providing a structured framework to harness the power of data for informed decision-making and business intelligence.

The exponential growth in data volume and complexity has catapulted the importance of robust data management systems. The traditional paradigms of data storage and processing, primarily focused on transactional databases, prove inadequate in the face of today's data deluge. As organizations accumulate vast datasets spanning various departments and functions, the need for a centralized repository capable of consolidating, organizing, and facilitating analytical insights becomes paramount. It is within this context that Data Warehousing assumes a pivotal role, promising a comprehensive solution to the challenges posed by the modern data landscape [1-4].

1.1 Defining Data Warehousing

At its essence, Data Warehousing represents a sophisticated and strategic approach to data management. It transcends the transactional nature of traditional databases, offering a purpose-built architecture designed to optimize the analytical processing of data. The fundamental goal is to provide decision-makers with a unified, consistent, and historical view of data across an organization. This research paper embarks on a detailed exploration of the intricacies of Data Warehousing, unravelling its design principles, architectural nuances, and varied applications [5].

1.2 Objectives of the Research

The primary objectives of this research endeavour are multifaceted. Firstly, it seeks to demystify the operational mechanics of Data Warehousing, tracing the journey of data from extraction through ETL (Extract, Transform, Load) processes to its residence in a centralized database. Secondly, the paper delves into the design and architecture of Data Warehousing, dissecting concepts such as dimensional modelling, normalization, de-normalization, and the creation of data marts. Thirdly, it explores the diverse applications of Data Warehousing, illustrating how it serves as the backbone for decision support, business intelligence, trend analysis, and strategic planning [6].

1.3 Navigating the Data Warehousing Landscape

As we navigate the expansive landscape of Data Warehousing, the paper sheds light on various types of Data Warehouses. From the comprehensive Enterprise Data Warehouse (EDW) that serves as the backbone of organizational data infrastructure to the specialized Data Marts catering to specific business units, each type is scrutinized for its unique features and applications. Moreover, alternative types such as Operational Data Stores (ODS), Centralized Data Warehouses, Distributed Data Warehouses, and even the concept of Logical Data Warehousing are explored to provide a holistic understanding of the diverse approaches to data warehousing.

1.4 A Roadmap for Deeper Understanding

This research paper is envisioned as a roadmap for academics, practitioners, and students who seek not merely to comprehend but to deeply understand the intricate workings of Data Warehousing. Each section unfolds layers of complexity, offering insights that bridge the theoretical and practical aspects of this transformative technology.

As we embark on this comprehensive study, we invite readers to immerse themselves in the intricate world of Data Warehousing. It is a journey that holds the promise of transforming raw data into actionable insights, steering organizations towards a future characterized by informed decision-making and strategic excellence.

2. How Data Warehouse Works:

In the intricate landscape of modern data management, the operational mechanisms of a Data Warehouse play a pivotal role in transforming raw, disparate data into a consolidated and analytically accessible resource. This section delves into the operational intricacies, detailing the processes, components, and architecture that define how a Data Warehouse works.

a. ETL Processes: Extract, Transform, Load

At the heart of Data Warehousing lies the Extract, Transform, Load (ETL) process. This tripartite sequence begins with the extraction of data from various source systems. This could include databases, transactional systems, flat files, and other structured or unstructured sources. Once extracted, the data undergoes a transformation phase, where it is cleaned, integrated, and standardized to ensure consistency. This transformation ensures that data from diverse sources can be harmoniously integrated into the Data Warehouse. Finally, the transformed data is loaded into the centralized Data Warehouse database, ready for analytical processing.

b. Data Warehouse Database: Centralized Repository for Analytical Insights

The core of a Data Warehouse resides in its centralized database. This repository is purpose-built for analytical processing, distinguishing it from traditional transactional databases. Structured in a manner conducive to complex queries and reporting, the database is optimized for the retrieval of large datasets and the execution of intricate analytical tasks. It houses both historical and current data, providing decision-makers with a holistic view of organizational information.

c. Data Access Layer: Facilitating User Interaction

The data access layer serves as the interface through which users interact with the stored data. This layer accommodates tools and technologies such as Online Analytical Processing (OLAP), SQL queries, and reporting tools. OLAP, in particular, enables multidimensional analysis, allowing users to explore data from various perspectives. This interactive layer is crucial for extracting actionable insights, enabling users to navigate through the wealth of data housed in the Data Warehouse.

d. Metadata Repository: Managing Information about Information

Integral to the functionality of a Data Warehouse is its metadata repository. Metadata encompasses information about the data, including details about its source, transformations applied, and business rules governing its usage. The metadata repository ensures data governance, providing a comprehensive understanding of the data lineage and aiding in the management and documentation of the entire data process [5-7].

3. Types of Data Warehouse:

There are different types of data warehouses designed to meet specific business needs and organizational structures. The main types include:

1. Enterprise Data Warehouse (EDW): An EDW is a centralized repository that collects and integrates data from various departments and business units across the entire organization.

Characteristics-

- Comprehensive data from different sources.
- Supports broad organizational data analysis.
- Provides a unified view of the entire business.

2. Data Mart: A data mart is a smaller, more focused version of an enterprise data warehouse. It is designed to cater to the specific needs of a particular business unit or department.

Characteristics-

- Contains a subset of data from the enterprise data warehouse.
- Tailored for the requirements of a specific group or business function.
- Easier to implement and manage than a full-scale EDW.

3. Operational Data Store (ODS): An ODS is a database that provides short-term operational reporting and decision support for an organization. It often contains current or near real-time data from multiple sources.

Characteristics-

- Supports day-to-day operational reporting.
- Stores recent and detailed transactional data.
- Acts as a staging area for data before it is transferred to the data warehouse.

4. Offline Data Warehouse: In an offline data warehouse, data is periodically extracted from source systems and transformed for analysis. Users work with a snapshot of the data rather than real-time information.

Characteristics-

- Data is not updated in real-time.
- Suited for scenarios where real-time data is not critical.
- Easier to manage and less resource-intensive.

5. Real-Time Data Warehouse:

A real-time data warehouse updates data continuously, providing users with the most current information for analysis. This type is suitable for businesses that require up-to-the-minute insights.

Characteristics-

- Supports real-time data integration.
- Enables instant decision-making.
- Requires more sophisticated and resource-intensive infrastructure.

6. Cloud Data Warehouse: A cloud data warehouse is hosted on cloud platforms, providing scalability, flexibility, and accessibility. It allows organizations to store and analyse data without investing in on-premises hardware.

Characteristics-

- Leverages cloud computing resources.
- Scales dynamically based on demand.
- Reduces the need for on-site infrastructure.

7. Virtual Data Warehouse: In a virtual data warehouse, data is not physically stored in a centralized repository. Instead, it is accessed and integrated virtually from various source systems when needed.

Characteristics-

- Provides a logical view of integrated data.
- Data is retrieved in real-time from source systems.
- Minimizes the need for data movement and storage.

Each type of data warehouse serves specific organizational requirements, and the choice depends on factors such as the size of the organization, the complexity of data integration, the need for real-time data, and the available infrastructure. Often, organizations use a combination of these types to create a comprehensive data management strategy [8-15].

4. Data Warehouse Applications:

5.1 Decision Support:

Detailing how data warehousing supports decision support processes, providing timely and accurate information for strategic decision-making.

5.2 Business Intelligence:

Exploring the role of data warehousing in business intelligence activities, including reporting, analytics, and data visualization.

5.3 Trend Analysis:

Demonstrating how historical data stored in a data warehouse facilitates trend analysis, enabling organizations to identify patterns and make informed predictions.

5.4 Strategic Planning:

Highlighting the contribution of data warehousing to strategic planning, showcasing examples from various industries.

Conclusion:

Data Warehousing stands as a pivotal tool in the era of data-driven decision-making. By consolidating and organizing data from diverse sources, organizations can unlock valuable insights, drive strategic initiatives, and stay competitive in an increasingly data-centric business environment. In the ever-evolving landscape of data management and analytics, Data Warehousing stands as a pivotal force, enabling organizations to harness the power of centralized, historical data for informed decision-making. The journey through the realms of Data Warehousing, from its fundamental principles to diverse applications, provides a holistic understanding of its significance in the modern business ecosystem.

References:

- [1] Kimball, R., & Ross, M. (2013). *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling*. Wiley.
- [2] Inmon, W. H., & Hackathorn, R. D. (1994). *Using the Data Warehouse*. New York: Wiley.
- [3] Inmon, W. H. (2005). *Building the Data Warehouse*. Wiley.
- [4] Kimball, R., & Ross, M. (2002). *The Data Warehouse Lifecycle Toolkit*. Wiley.
- [5] Golfarelli, M., Rizzi, S., & Cella, I. (2009). *Beyond Data Warehousing: What's Next in Business Intelligence?* Springer.
- [6] Han, J., Kamber, M., & Pei, J. (2011). *Data Mining: Concepts and Techniques*. Morgan Kaufmann.
- [7] Inmon, W. H., Strauss, D., & Neushloss, G. (2008). *DW 2.0: The Architecture for the Next Generation of Data Warehousing*. Morgan Kaufmann.
- [8] Kimball, R., & Caserta, J. (2004). *The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data*. Wiley.
- [9] Vaisman, A., & Zimányi, E. (2014). *Data Warehouse Systems: Design and Implementation*. Springer.
- [10] Turban, E., Sharda, R., & Delen, D. (2010). *Decision Support and Business Intelligence Systems*. Prentice Hall.
- [11] Kimball, R., Reeves, L., Ross, M., Thornthwaite, W., & Becker, B. (2011). *The Data Warehouse Lifecycle Toolkit*. Wiley.
- [12] Imhoff, C., Galembo, N., & Geiger, J. (2003). *Mastering Data Warehouse Aggregates: Solutions for Star Schema Performance*. Wiley.
- [13] Inmon, W. H., & Terdeman, R. (2002). *Building the Operational Data Store*. Wiley.
- [14] Sapia, C., & Stedman, C. (1999). *Data Architecture: From Zen to Reality*. Prentice Hall.
- [15] Hackathorn, R. (1997). *Data Warehousing: Building the Corporate Knowledge Base*. Wiley.

Phytochemicals analysis of some hair care herbs

Abhijeet R. Kasarkar¹, Prachi P. Maskar, Sakshi J. Patil

Department of Botany, Vivekanand College, Kolhapur (Autonomous)- 416 003

kasarkarabhi@gmail.com, 9420494379

Corresponding author: kasarkarabhi@gmail.com (Dr. Abhijeet R. Kasarkar)

Abstract:

The phytochemicals present in plants act as potential source of useful drugs to improve the health status of humans. Phytochemicals analysis is the first step towards discovery of useful drugs. Plants are the richest resources of drugs and useful for the various biological activity. The present investigation includes the phytochemical screening of some plant used in preparation of ayurvedic shampoo. Phytochemical tests were carried out specially for screening secondary metabolites from the selected medicinal plants. The phytochemicals like alkaloids, saponis, carbohydrates, tannin and phenols are present and Lecuoanthocyanine, Phlabotannins are absent.

Keywords: Hair care herbs, Phytochemicals, *Emblca officinalis* Gaertn., *Lawsonia inermis* L., *Ocimum sanctum* L., *Acacia concinna* L., *Hibiscus rosa – sinensis* L., *Bacopa monnieri* L. and *Sapindus mukorossi* Gaertn.

1. Introduction:

The phytochemicals are biologically active chemical compounds naturally occurring in plants. They are non-nutritive plant chemicals that have protective or disease preventive properties. They are a large group of plant derived compounds hypothesized to be responsible for much of the disease protection conferred from diets high in fruits, vegetables , cereals and plant based beverages such as tea and wine.

All around the world, hair care herbs are added to formulations in order to bring plant powered properties to our shampoos, conditioners and hair treatments. A wide range of active principles of various plants including vitamins, phyto hormones, bioflavonoids, enzymes, tannic acids , amino acids, sugars, glycosides and essential oils can potentially be useful in organic haircare formulations.

Traditional knowledge exists worldwide in all communities covering varied areas including health, agriculture and natural resource management. In case of the developing world Africa and Latin America are also rich in traditional knowledge but they are to be found by and large only as oral traditions. Asia in general and India in particular have a distinction that traditional knowledge is found not just as oral tradition but also as classical literature that is

written down with its own theoretical framework and with a clear exposition of the basic principles of world views. (Swaminathan, 1996)

The presence of certain types of phytochemicals in some plants can act as a natural defence system providing protection against such things as attack from insects and grazing animals.

Phytochemicals such as tannins shows strong activity against several plant pathogens and pest.(Pawar 2010) Saponin has insecticidal activity like repellent and deterrent activity . The use of plant compounds like essential oils, flavonoids, alkaloids, glycosides, esters and fatty acids having repellent effects.

2. Materials and methods

Plant collection and identification

Collection of plant material like *Emblca officinalis* Gaertn., *Lawsonia inermis* L., *Ocimum sanctum* L., *Acacia concinna* L., *Hibiscus rosa – sinensis* L., *Bacopa monnieri* L. and *Sapindus mukorossi* Gaertn. These samples were free from disease. Plant materials were identified with stranded literature.

Extraction of plant material

Preparation of aqueous extracts

Samples were weighed using an electronic balance and 10 gm of plant material were crushed in 100 ml of distilled water and filter through muscline cloth. These samples are used for phytochemical analysis.

Preliminary Phytochemical Analysis

The individual extracts were used for the qualitative phytochemical screening for the presence of some chemical constituents. Phytochemical test were carried out adopting standard procedure ^[10, 4].

Test for Alkaloids

A quantity (3 ml) of concentrated extract was taken into test, cooled and filter, the filtrate was used for following test.

Dragen Droff's Test : 2 drops of Dragendroff's reagent were added to 1ml of the extract. The development of a creamy ppt was indicates that presence of alkaloids.

Test for Saponin

5 ml extract was mixed with 20 ml of distilled water then agitated in the graduated cylinder, 15 min formation of foam indicates Saponin present.

Test for Tannin

4ml of extract was treated with 4 ml FeCl_3 formation of green colour indicates that presence of condensed tannin.

Test for Anthocyanin

2 ml of aqueous extract is added to 2 ml of 2N HCl and NH_3 , the appearance of pink red turns blue violet indicates presence of the Anthocyanin.

Test for Coumarin

3 ml of 10% of NaOH was the added to 2 ml of aqueous extract formation of yellow colour indicates the presence of Coumarins.

Test for Proteins

Xanthoproteic Test : Extract was treated with few drops of concentrated HNO_3 formation of yellow colour indicates the presence of Proteins .

Test for Amino Acid

NinhydrinTest : To the 2 ml of extract 2 ml on the Ninhydrin reagent was added and boil the for few minutes, formation of blue colour indicates the presence of the Amino Acid .

Test for Flavonoids

Alkaline Reagent Test : Extract was treated with 10 % of NaOH solution , formation of intense yellow colour indicates the presence of the Flavonoids.

Test for Phytosterol

Salkowski's Test : Extract was treated with chloroform and filtered . The filtered was treated with few drops of concentrated H_2SO_4 and shake, allow the standing appearance of golden red indicates the positive test .

Test for Phenol

Ferric chloride Test : Test extract were treated with 4 drops of Alcoholic FeCl_3 solution . Formation of bluish black colour indicates the presence of Phenols .

Test for Phlobatannins

Deposition of red ppt when aqueous extract of each plant sample is boiled with 10 % aqueous HCl was taken evidence of presence of the Phlobatannins .

Test for Cardial Glycosides

Killer-Killani Test : Plant extract treated with glacial acetic acid containing a drop of FeCl₃ . A brown coloured ring indicates the presence of the positive test.

Test for Carbohydrates

Iodine Test : Take 2 ml of extract were treated with 5 drops of Iodine solution , gives blue colour, indicates the positive test.

Benedict's Test : Filtrate were treated with the Benedict's reagent and heated gently , orange red ppt indicates the presence of reducing sugar.

3. Results and Discussion:

Table : I Phytochemical analysis of plants used in ayurvedic shampoo.

Sr. No.	Phytochemicals	<i>Emblica officinalis</i> Gaertn.	<i>Lawsonia inermis</i> L.	<i>Ocimum sanctum</i> L.	<i>Acacia concinna</i> L.	<i>Hibiscus rosa-sinensis</i> L.
1.	Alkaloids	+	+	+	+	#
2.	Saponin	+	+	+	+	+
3.	Tannin	+	+	+	-	+
4.	Proteins	-	+	+	+	-
5.	Amino Acids	-	+	+	+	+
6.	Flavonoids	-	-	-	+	-
7.	Phenol	+	+	+	+	-
8.	Phlabotannins	-	-	-	-	+
9.	Lecuoanthocyanine	-	-	-	-	-
10.	Cardial Glycosides	-	-	+	-	+
11.	Carbohydrates	+	+	+	+	+

Sr. No.	Phytochemicals	<i>Bacopa monnieri</i> L.	<i>Sapindus mukorossi</i> Gaertn.
1.	Alkaloids	+	+
2.	Saponin	+	+
3.	Tannin	+	+
4.	Proteins	+	+
5.	Amino Acids	-	+
6.	Flavonoids	+	+
7.	Phenol	-	+
8.	Phlabotannins	-	-

9.	Lecuoanthocyanine	-	-
10.	Cardial Glycosides	+	+
11.	Carbohydrates	+	+

Note : [(+)= Positive , (-)=Negative, (#) = Doubtful]

The present study was carried out to investigate the phytochemical profile present in different parts of hair care plants. The plant material was extracted with water. A number of biologically active compounds have been isolated from the plant. The compounds like saponin, alkaloids, carbohydrates, tannins, phenols are present in all these plants and leucoanhocyanine, phlobatannins are absent in all these plants. High concentrations of tannins helps to prevent fungal, bacterial decay and having insecticidal property (Trease 1970).Phytochemicals such as tannins have been possess strong activities against several plant pathogens and pests (Pawar 2010) .Flavonoids and tannins was serve as defence mechanism against several microorganisms (Elmas 1999). Saponins shows activity like fungicide, bactericides, molluscicides and pesticides (Ellen 2007) .

4. Conclusion:

The presence of phytochemicals in plant material shows usefulness for hair care. This plant can be used in the pharmaceutical industries. These plants were used in the different combination for hair care product.

5. Acknowledgement:

Authors are highly thankful to Principal, Vivekanand college, Kolhapur (Autonomous) for laboratory facilities and Dr. D. K. Kulkarni for continuous support.

5. References:

Chaieb I.Saponins as insecticides: a review, Tun. J. Plant Protection, 2010; 5:39-50.

Ellen De Geyter. Novel advances with plant saponins as natural insecticides to control plant pest insects, Pest technology , Global science book, 2007, 1-10.

ElmasOzeker.Phenolic components and their importance. Journal of AARI, 1999; 9(2)114-124.

Kokate CK, Purohit AP and Ghokhale S B .Pharmacognosy, NiraliPrakashan, Pune, India, 1997.

Mila I., Scalbert A., Expert D. Iron with holding by plant polyphenols and resistance to pathogens and rots.Phytochemistry,1996; 42: 1551-1555.

Pawar V, Chavan A M. Incidence of powdery mildew on *Cucurbit* plants and its ecofriendly management. Journal of Ecobiotechnology, 2010; 2(6): 29-43.

- Raskar S S,Wani A G. Promotion of organic farming in tribal farmers of Akole with relation to climate change. International Journal of Current research,2014; 6(01): 46974701.
- SafiaZoubiri,AoumeurBaaliouamer. Chemical composition and insecticidal properties of *Lantana camara* L. leaf essential oils from Algeria. Journal of essential oil research,2012 ; 24(4) : 377-383.
- Schultz J C, M D Hunter , H M Appel. Antimicrobial activity of polyphenol mediates plant herbivore interactions, In. Hemingway R. W. and P. E. Caks (Eds), Plant Polyphenols, Plenum Press, New York, 1992.
- Trease GE , Evan WC. Pharmacognosy , Ed 12, English language Book society, Balliere Tindall, 1970 , 309-315 and 706-708.
- Kulkarni D K, Kumbhojkar M S. Ethno-agricultrual Study of Mahadeokolis in Maharashtra ,India. Asian Agri-History, 2003; 7(4) : 295-312.
- Kulkarni D K and Kumbhojkar M S . Pest control in tribal area- an ethnobotanical approach. Ethnobotany, 1996; 8 : 56-59.
- Kulkarni DK, Bhagat R B, Taware S P , Patil PV. Traditional way of store grain pest control through bio-pesticidesAdvances in organic farming – Crop protection against diseases and pest through plant products/biopesticides, Taylor and Francis publishers, Editor Prof. L. P. Awasthi Ex .Head, Department of Plant Pathology, N. D. University of Agriculture &Technology, Kumarganj, Faizabad, (U.P.) INDIA , 2019, 224 229.
- Roychourdhy S P. Agriculture in Ancient India. Publisher Indian Council of Agricultural Science, New Delhi, 1964.
- Swaminathan M S, Inaugural Address- Ethno-biology in Human Welfare. (Ed. S..K. Jain) Deep publisher, New Delhi,1996, 1-7.
- Gupta A, Goel B. Farmers awareness and participation in integrated pest management in Udham Singh Nagar. Asian –Agri-History. 2013 ; 17(1) : 65-70.

Studies On Non-Symbiotic Nitrogen Fixing Bacteria from Roots of Water Hyacinth (*Eichhornia Crassipes*)

Vinaya N. More¹ and Dr. Nasir R. Shaikh²

1 Department of Biotechnology, Vivekanand College, (Autonomous), Kolhapur

2 Department of microbiology, YCCS Karad, Vidyanagar, KARAD-415 124 (India).

Abstract

Water hyacinth is a free floating, fresh water plant with beautiful lilac violet flowers. As per plant is dependent on nutrient availability for their growth such as C, N, & P source which are major nutrients, search for the association of non symbiotic nitrogen fixing organism if any in the rhizosphere of water hyacinth is of interest. The paper represents a work on the bacterial flora of water hyacinth of its root. The work was carried on for searching if has any nitrogen fixation ability which can be of very of much application agriculturally. These studies included work on three bacterial isolates obtained from roots of water hyacinth. The isolate included N₂ fixing. Bacterial isolates were Gram positive as well as Gram, negative bacteria showing diverse morphological as well as biochemical characters. Salt concentration and different heavy metals were also found to affect growth of the isolates.

Key words – Bacteria of water hyacinth, N₂ fixing bacteria, non symbiotic.

Introduction

The earth's atmosphere contributes of about 78 % of nitrogen but its relative inertness makes it unavailable to plants and animals. This unavailable form of atmospheric nitrogen is made available to plant by nitrogen fixation involving chemical and biological processes. Out of which biological nitrogen fixation is one of the important processes involving microorganisms. This biological nitrogen fixation is more efficient than chemical process.

Like nitrogen plants also requires phosphorus for their growth. Phosphorus is second to nitrogen as mineral nutrient. Plant gets phosphate from soil. Plant are able to utilise from soil only in free available form i.e. phosphate anion (Alexander 1967). Approximately 95-99% soil phosphorus is insoluble phosphate therefore it cannot be utilized by plants. So to increase the availability of phosphorus large amount of phosphate fertilizers are used. Also some microorganisms are able to convert unavailable phosphorus to available form. These microorganisms are cheap, small, safe and eco-friendly as compared to chemical fertilizers. Hence phosphate solubilising microorganisms is best option to fulfil the need of phosphorus required by the plants.

Water hyacinth is a fresh water plant weed which grew at alarming rate to such explosive proportions that all efforts of man to bring it under control have failed carrying eutrophication of the water system.

WATER HYACINTH –

Water hyacinth is free-floating fresh water plant with beautiful lilac violet flowers (photograph no. 1). It is also called as “Demon” , “Blue Devil” , “Bengal Terror”, “curge of Bengal” , “Million dollar weed” and “Cinderella” of the plant world.

There are no definite reports of the time of its entry into India but it had definitely arrived in Bengal before 1900. Biwas and Calder (1954) stated that the weed got established in Bengal near about 1896.

Haines (1924) reported its presence in river Irrawady (Burma) and other rivers in the regions and only sporadic occurrence in Orissa. The water hyacinth has been recorded by Duthie (1911) in his flora the upper Gangetic plants and adjacent Siwalik hill and apparently the weed spread in northern India much later. The water hyacinth is also found at the Rankala Lake at Kolhapur in Maharashtra which is responsible for the eutrophication of that lake.

MORPHOLOGICAL CHARACTERS OF THE WATER HYACINTH-

The plant is a free-floating stoloniferous herb. It is consisting of rosette of leaves and numerous pendulous roots. The plant consists of rhizomatous stem. The stem or the rhizome consists of axes with several short internodes. The node bears the leaves, roots off shoots and the successive axes ending in inflorescence. Stem is erect or floating or solid with numerous air chambers which are also present in petiole.

The roots are adventitious, fibrous, unbranched, and have a conspicuous root cap. The roots produced a large number of laterals of limited growth giving a fine feathery appearance to the roots. Each lateral has prominent root cap. Roots are whitish in total darkness but are usually purplish or pinkish violet when exposed to sunlight due to the development of anthocyanin.

❖ CLASSIFICATION –

Kingdom	- Plantae	(plants)
Sub-kingdom	- Tracheobionta	(Vascular plants)
Super- division	- Spermatophyta	(Seed plants)
Division	- Magnoliophyta	(Flowering plants)
Class	- Liliopsida	(Monocotyledons)
Sub-class	- Liliidae	
Order	- Liliales	
Family	- Pontederiaceae	
Genus	- <i>Eichhornia</i>	
Species	- <i>Eichhornia crassipes</i>	

EUTROPHICATION-

Eutrophication is a process where water bodies as lake and slow moving streams receives excessive nutrients that stimulate excessive plant growth as algae, plant weed. Nutrients came from many sources as fertilizers applied to agricultural field, industrial waste and deposition of atmospheric nitrogen.

Sioli (1954) has noted from an experimental study that roots of water hyacinth eliminate “source of amino acids and carbohydrates in to the surrounding water that excretion of organic substances may be one of the reasons for rich community in aquatic life”.

ESSENTIALITY OF NUTRIENTS-

This plant weed strictly relies on photosynthesis and inorganic nutrients (N, P) for their energy. Through the photosynthesis process plant fulfil their requirement of ‘C’ source by assimilation of CO₂ from atmosphere in the presence of sunlight. Soekisman (1977) found that water hyacinth appears to follow the C₃ pathway but differ from the C₃ plants. It had also been demonstrated that water hyacinth can also utilizes dissolved CO₂ through roots for photosynthesis.

The association of nitrogen fixing organisms with the roots and leaves of water hyacinth and the microbial immobilization of nitrogen during the decomposition of weed and weed parts is also important.

❖ NITROGEN FIXATION –

The earth’s atmospheric nitrogen is in the form of di-nitrogen gas but this gas is extremely inert. Because of strength of triple bond, to break nitrogen atom it requires high amount of energy.

Nitrogen fixation is actually an exothermic reaction with G=-7.98 kcal/mole. Chemical fixation is performed in industry by Haber- Bosch process which involves high heat and pressure of H₂ and N₂.

Biological nitrogen fixation ability is found only in certain group of prokaryotes called as diazotrophs converting nitrogen into biological usable form.

The general reaction of nitrogen fixation is,



Nitrogenase is a metallo-enzyme. The enzyme commission number is 1.18.6.1. It consists of two components encoded by ‘nif’ gene. As;

1. Fe- protein.
2. Mo-Fe protein.

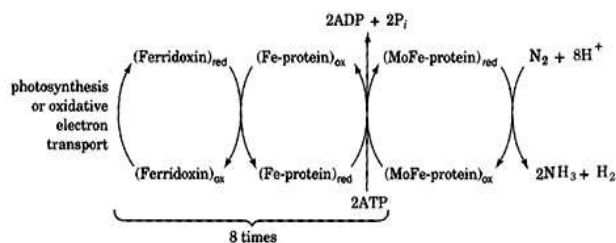
MECHANISM OF BIOLOGICAL NITROGEN FIXATION –

Pyruvate molecule acts as electron donor and as an energy source in phosphorylatic reaction, Pyruvate forms acetyl phosphate which is then in presence of ADP give rise to ATP .The

nitrogen fixing microorganisms contains hydrogenise. This enzyme catalyses transfer of electron from pyruvate and hydrogen to ferredoxin.

Ferredoxin receives electrons and further transfer it to Fe-protein so Fe-protein get reduced and consequently get oxidized. Reduced Fe-protein binds to ATP then Fe-protein transfer electron to Mo-Fe protein with ATP hydrolysis .The Mo-Fe protein donates electron to N_2 and with subsequent reduction.

MECHANISM OF ELECTRON TRANSFER –



This biological nitrogen fixation take place with the help of symbiotic as well as non symbiotic nitrogen fixers occurring in the nature. Symbiotic nitrogen fixers are associated with some plants at their roots or at stems also. But many plants are benefited by the activities of non symbiotic nitrogen fixers. They do not need any kind of association to fix nitrogen.

NONSYMBIOTIC N_2 FIXERS –

The no. of microorganisms found in environment under varing environmental condition and availability of organic matter in the ecosystem. Beijerinck (1901) isolated 1st nonsymbiotic nitrogen fixing microorganism i.e. *Azotobacter chroococcum*.

Several investigators have revealed the association of some nonsymbiotic nitrogen fixing bacteria with the roots and leaves of water hyacinth.

The free living bacteria having ability to fix the nitrogen as,

- **Aerobic bacteria-**

Azomonas, Azotobacter, Beijerinckia, Spirillum, Dersia, Methylomonas, Mycobacteria.

- **Facultative anarobic -**

Bacillus, Enterobacter, Klebsiella, Flavobacterium ,Arthrobacter.

- **Anarobic-**

Clostridium, Desulfotomaculum, Desulfovibrio.

AIMS AND OBJECTIVES

Water hyacinth is well known aquatic weed majorly concern with the eutrophication of the fresh water system. It is floating at the surface of the water with the help of air chamber.

The point of interest is being growth at the surface of water i.e. under diluted condition of nutrients. Its growth rate is higher than other plant. The carbon source for the growth of plant is made available by photosynthesis. The source of nitrogen and phosphate is also important for the growth of plant. Taking this in to account the present work was aimed to see the presence of nonsymbiotic nitrogen fixing and phosphate solubilizing microorganisms in the root of water hyacinth and studying their characteristics.

The project was performed by taking following objectives into account -,

1. Collection of the plant material from the suitable fresh water system.
2. Observation of microorganisms associated with the roots by microscopic method.
3. Isolation of nonsymbiotic nitrogen fixing bacteria.
4. Characterisation of the isolates;
 - a) Colony characterisation.
 - b) Biochemical characterisation.
 - c) Enzymatic properties.
5. Detection of potash mobilizing property of the isolates.
6. Detection of effect of metal on the growth of the isolates.
7. Detection of salt tolerance activity of the isolates.
8. Detection of ability of production of HCN gas of the isolates.

MATERIAL AND METHODS

3.1 Collection of Sample:

The sample of *Eichhornia crassipes* i.e. water hyacinth was collected from the Krishna river water from the area of Narsobavadi, Tal- Shirol, Dis- Kolhapur. The entire plant sample of *Eichhornia crassipes* along with their entire root system was collected in freshly opened new polythene bags. These bags were labelled properly and then brought to the laboratory where they were stored in refrigerator till use for microbiological analysis.

3.2 PREPARATION OF MICROBIAL SAMPLE FOR ISOLATION:

10 gm of root were taken and added in 100 ml of sterile distilled water, then roots were crushed with the help of sterile glass rod. This mixture was allowed to settle then supernatant was centrifuged at 3000 rpm for 15 min. After centrifugation supernatant was discarded and pellet was taken as microbial source for isolation.

3.3 ISOLATION OF NONSYMBIOTIC NITROGEN FIXING BACTERIA:

The isolation of organisms was done by inoculating the sample on Asbhys N₂ free mannitol agar (Dubey). A loopful of microbial sample (pellet) was streaked by four quadrant method on sterile Asbhys N₂ free mannitol agar plate. These plates were incubated at 28^o C for 48-72 hours till visible colonies appeared on it and observed for development of well isolated colonies. The isolated colonies were resuspended in sterile saline water and streaked on sterile Asbhys N₂ free mannitol agar plate for purification.

3.4 CHARACTERISATION OF BACTERIAL ISOLATES:

The obtained nonsymbiotic nitrogen fixing and phosphate solubilising bacterial isolates were studied for following characters,

1. Colony characters.
2. Morphological characters.
3. Biochemical characters.

3.4.1 COLONY CHARACTERS –

A loopful suspension of isolated colonies was streaked by four quadrant streak plate method on the sterile Asbhys's N₂ free mannitol agar plate. These plates were incubated at 28^o C

for 48-72 hours and observed for development of well isolated colonies .The colony characters of well isolated colonies were studied and recorded.

3.4.2. MORPHOLOGICAL CHARACTERS-

The studies of morphological characters included studies on the Gram property, cell morphology and motility of the isolates.

The isolated colonies were suspended in sterile saline water and used for studying following properties;

- a) Gram staining was done by using Hucker's and Conn's modified Gram staining method. (Desai & Desai 1980).
- b) Motility was observed by Hanging drop method. (Desai & Desai 1980).

3.4.3 BIOCHEMICAL CHARACTERS-

3.4.3.1 Hugh and Leifson's test –

The fresh growth of each isolate was stab inoculated into the sterile Hugh and Leifson's medium agar butts in the tube with the help of straight wire loop and incubated at 28⁰ C for 48 hours aerobically and anaerobically by overlaying butt by sterile paraffin oil. After incubation the tubes were observed for colour change Blue to Yellow for fermentative colony.

3.4.3.2. Enzymatic properties –

The production of various extracellular enzymes and their activities were studied by using standard methods.

3.543.2.1. Oxidase test –

A strip of filter paper was soaked with little freshly prepared of 1 % oxidase reagent (N,N,N',N' –tetramethyl P-Phenylindiaminedihydrochloride) and then with the help of wire loop the culture was rubbed on filter paper strip which was previously soaked in oxidase reagent. A positive reaction was indicated by an increased deep purple colour appearing with 6-10 sec.

3.4.3.2.2. Catalase test-

The isolates to be tested were picked up from agar medium using sterile wire loop and a part of growth was immersed in to hydrogen peroxide solution held in small clean tube. The production of gas bubbles from the surface of the solid culture material indicated as positive reaction.

3.4.3.2.3 Amylase test-

The starch agar plates were spot inoculated with the test cultures and incubated at 28⁰ C for 48 hrs. After incubation the plates were exposed to iodine crystals and zone of clearance around the growth indicated positive test.

3.543.2.4. Gelatinase test –

A gelatine agar plates were spot inoculated with the test cultures and inoculated incubated at 28⁰ C for 48 hrs. After incubation the plates were flooded with Fraziers reagent and the zone of clearance around the growth was observed which indicated positive test.

3.4.3.2.5 Caseinase test–

Caseinase hydrolysing property of isolates were tested by spot inoculating them on milk agar plates and incubated at 28⁰ C for 48 hrs. The clear zone around the growth indicated positive test.

3.4.3.2.6. Urea hydrolysis test-

The slants of Christensen's urea agar were streak inoculated with test cultures and they were incubated at 28⁰ C for 48 hrs. After incubation the change in colour from orange to pink indicated positive test.

3.4.3.2.7 Nitrate reduction test-

The peptone nitrate broth tubes were inoculated with the test cultures and incubated at 28⁰ C for 48 hrs. After incubation reduction of nitrate to nitrite was detected by the addition of sulphanilic acid and α -naphthyl amine reagents. The production of dark red colour indicated the positive test. If no colour developed then pinch of zinc dust was added and then developed red colour indicated the positive test.

3.4.3.2.8 Cellulase test –

A loopful suspension of each isolate was spot inoculated on sterile cellulose agar plate and plates were incubated at 28⁰ C for 48 hrs. After incubation plates were observed for clear zone around the growth indicated positive test.

3.4.3.2.9 Lipase test-

A loopful of suspension of each isolate was spot inoculated on sterile Tributylene agar plates and plates were incubated at 28⁰ C for 48 hrs. After incubation plates were observed for clear zone around the growth indicated positive test.

3.4.3.2.10 Phenylalanine Deamination test-

The Phenylalanine agar slants were streak inoculated with test cultures and slants were incubated at 28⁰ C for 48 hrs. After incubation 10% ferric chloride solution was added on the slant surface, formation of green colour in 1-5 min indicated positive test.

3.4.3.2.11 Arginine Hydrolysis test-

The arginine broth tubes were inoculated with the test cultures and tubes were incubated at 28⁰ C for 48 hrs. After incubation the change in colour from orange to yellow indicated positive test.

3.4.3.2.12 Lysine decarboxylase test-

The lysine decarboxylase broth tubes were inoculated with the test cultures and tubes were incubated at 28⁰ C for 48 hrs. After incubation the change in colour from violet to yellow indicated positive test.

3.4.3.3 Production of hydrogen sulphide-

Peptone water broth tubes were inoculated with test culture organisms .Sterilised strips of filter paper impregnated with saturated solution of lead acetate were hangover against the wall of test tubes. To detect the H₂S production. The observations were taken after 48 hrs. onwards .The results for intensity of production of H₂S were recorded as colour change of filter paper strip to black colour.

3.4.3.4 IMViC test-

1. Indol production test-

Ability of organisms to produce indole was detected by growing in 1% tryptone broth. The organisms were inoculated in 1% tryptone broth incubated at 26⁰ C for 48 hrs. Detection of indole production was done using xylene and Kovacs reagent. In positive test there was formation of cherry red colour ring at the surface of broth. All observations were done visually.

2. Vogus Proskaur test-

The cultures were inoculated in the tubes containing G.P.B. The tubes were incubated at 28⁰C for 48 hrs. After incubation, tubes were observed for brown coloured ring formation at upper part of tube shows positive test.

3. Citrate utilisation test-

The test organisms were inoculated in the tubes containing Koser's Citrate broth then tubes were incubated at 28⁰C for 48 hrs. The growth was observed in terms of turbidity shows positive test.

3.4.3.5. Carbohydrate utilization test- (sugar utilization)

Utilization of carbohydrates was studied using P/W broth and 1% carbohydrate such as Sucrose, Glucose, Maltose, Lactose, Arabinose, Sorbitol, Mannitol, Rhamnose, Cellobiose, Trehalose, Galactose, Fructose, Inositol, Raffinose and Milibiose. Sterile tubes containing broth were inoculated with loopful of suspension of each isolates and tubes were incubated at 28⁰ C for 48 hrs. After incubation the tubes were seen for change in colour of the medium from greenish blue to yellow indicating acid production well as utilization of sugar. The tubes were also observed for accumulation of gas bubbles in Durham's tube.

3.4.3.6. Potash Mobilizing Activity –

Potash mobilizing activity of the isolates were checked by using inoculating the suspensions of the isolates on sterile Glucose Yeast Agar medium (Krishan Chandra et.al 2006) plates were incubated at 28⁰ C for 48 hrs. After incubation plates were observed for zone of clearance around the isolates indicating mobilization of potash.

3.4.3.7. Detection of effect of heavy metal on the growth-

Effect of heavy metals were studied by using different concentrations (in mM) of respective heavy metals like lead acetate, mercuric chloride. The suspension of bacterial isolates spot inoculated on nutrient agar containing respective concentration of metals (1mM, 2mM, 3mM and 4mM). The plates were incubated at 28⁰ C for 48 hrs and were observed for growth / no growth.

3.4.3.8 Salt tolerance activity (NaCl) –

The suspensions of the isolates were spot incubated on sterile nutrient agar with various salt concentration NaCl such as 1%, 2%, 3%, 4%, 5% and 6% separately. The plates were incubated at 28⁰ C for 48 hrs. The ability of the isolate of growing / not growing at particular salt concentration i.e. NaCl was observed in terms of visible growth / no growth on the medium.

3.4.3.9. Ability of production of HCN-

The suspension of the isolates was inoculated readily on sterile 10% tryptic soy agar with glycine (4.4gm/l) medium. Then in the lid of petri dish sterile filter paper strip was placed which was soaked in 0.5 % Picric acid and 2 % Na₂CO₃ respectively. The plates were incubated at 28⁰ C for 48 hrs. After incubation the plates were observed for change in colour of filter paper strip

from yellow to orange brown which indicates positive tests

Sr. No.	Colony characters	Isolates		
		A ₁	A ₂	A ₃
1	Size	< 1mm	<1mm	>1mm
2	Shape	Circular	Circular	Ellips

RESULTS AND DISCUSSION

4.1. Collection of sample –

Total of two plant samples namely, S₁ and S₂ of water hyacinth were collected from the river water at Narsobavadi, Tal – Shirol, Dist – Kolhapur. Both the sample were approximately of the same size and same age and contains flowers out of which only one sample i.e S₁ used for microbial analysis .

4.2 Microscopic examination of samples -

The microscopic examination of the centrifuged root extract of samples S₁ and S₂ showed presence of Gram positive as well as Gram negative organisms of cocci, coccobacilli and rod shaped cell morphology in relatively more number.

4.4 Isolation of non symbiotic nitrogen fixing bacteria

The results of isolation of non symbiotic nitrogen fixing bacteria from the sample were as shown in table no 2.

Sr. No	Sample code	Code of isolate obtained
1	S ₁	A ₁ , A ₂ , and A ₃ .

Table no 2: Results of isolation of non symbiotic nitrogen fixing bacteria.

It can be seen from the table that total of three bacterial isolates of non symbiotic nitrogen fixing bacteria were obtained from root extract of water hyacinth. The isolate namely A₁, A₂ and A₃ obtained from sample S₁.

4.5.1 Colony characters – results of the colony characters of all three non symbolic nitrogen fixing isolates were as shown in the table no.4.

			r	oidal
3	Colour	Yellow	White	White
4	Margin	Regular	Regular	Irregular
5	Elevation	Convex	Convex	Convex
6	Opacity	Opaque	Translucent	Translucent
7	Consistency	Moist	Moist	Moist

Table no 4: Colony characters of the bacterial isolates on Ashbys nitrogen free mannitol agar medium.

4.5 Characterisation of bacterial isolates –

It can be seen from the table no.4 that the colonies of the isolates A₁ and A₂ were with size < 1 mm and A₃ was > 1 mm. Colonies of all the isolates were circular in shape except A₃ which was ellipsoidal in shape. Colonies of A₂ and A₃ were white in colour while of A₁ were yellow in colour. Colonies of

A₁ and A₂ were regular in margin while of A₃ showed irregular margin. Colonies of A₂ and A₃ were translucent while colonies of A₁ were opaque. All the isolates gave colonies with moist consistency with convex elevation.

4.5.2 Morphological characters –

The morphological characters of all the bacterial isolates were as shown in table no. 5.

Sr. No.	Isolate no.	Gram nature	Motility	Spore formation
1	A ₁	Gram positive short rods	Motile	+
2	A ₂	Gram negative short rods	Motile	-
3	A ₃	Gram positive coccobacilli	Motile	-

‘-’ No spore formation , ‘+’ spore formation.

Table no. 5: The morphological characters of all the bacterial isolates.

It can be seen from the table that isolate namely A₃ were Gram positive coccobacilli, motile and nonspore forming.. The isolate A₁ were Gram positive short rods ,spore forming and motile while isolate A₂ were Gram negative short rods , non spore forming and motile.

4.5.3. Biochemical characterization-

Biochemical properties of all the isolates were as presented below,

4.5.3.1 Results of Hugh and Leifson test.

Hugh and Leifson test	A ₁	A ₂	A ₃
	-	+	-

‘+’= Oxidative ‘-’= Non saccharolytic

It can be seen from the table that isolate no. A₂ Showed oxidative mode of metabolism and the isolate no. A₁ and A₃ showed non saccharolytic mode.

4.5.3.2 Enzymatic properties –

It can be seen from the table that all the isolates except A₃ showed oxidase test positive. All the isolates showed catalase test positive except A₂. The isolates namely A₁, A₂ and A₃ showed amylase test positive while remaining isolates showed it negative. All the isolates showed gelatinase test negative. The isolates A₁ and A₂ were showed caseinase and nitrate reduction test positive while remaining all isolates showed negative. The isolates A₁, A₂ and A₃ showed urease test negative while remaining all isolates showed positive. All the isolates showed cellulose and lysine decarboxylase test negative. A₂ and A₃ showed lipase test negative while remaining all the isolates showed it positive. Isolates A₁ and A₃ were showed phenylalanine deamination test positive while remaining all the isolates were showed it negative. All the isolates showed arginine hydrolysis property.

‘-’ Negative test, ‘+’

Table no. 6: Results of the isolates.

4.5.3.3 H₂S

Results of H₂S the seven isolates were

Table no. 7: Results of all the isolates.

H ₂ S producti on test	A	A	A
	1	2	3
	-	-	-

‘-’ Negative test.

It can be seen from the isolates showed H₂S

4.5.3.4. IMViCtest –

Results of IMViC test for all the isolates were as shown in table no 8.

Table no 8: Results of IMViC test for the isolates.

Sr. No.	Tests	Isolates		
		A ₁	A ₂	A ₃
1	Oxidase	+	+	-
2	Catalase	+	-	+
3	Amylase	+	+	+
4	Gelatinase	-	-	-
5	Caseinase	+	+	-
6	Urease	-	-	-
7	Nitrate reduction	+	+	-
8	Cellulase	-	-	-
9	Lipase	+	-	-
10	Phenylalanine deaminase	+	-	+
11	Arginine hydrolysis	+	+	+
12	Lysine decarboxylase	-	-	-

positive test.

enzymatic properties of

production test –

production test by all as shown in table no. 7.

H₂S production test of

table that none of the production ability.

It can be seen from the table that all the isolates showed M.R. and V.P. test negative. All the isolates showed indol test negative. All the isolates showed citrate utilization test positive except A₃.

4.5.3.5. Carbohydrate utilization test –

Results of sugar utilization by the bacterial isolates were as shown in the no.9.

Sr.no.	Sugars	Isolates		
		A ₁	A ₂	A ₃
1	Arabinose	-	-	-
2	Mannitol	-	-	-
3	Rhamnose	-	-	-
4	Trehalose	-	-	-
5	Inositol	-	-	-
6	Raffinose	-	-	-
7	Melibiose	-	-	-
8	Sucrose	-	+	+
9	Glucose	+	+	+
10	Lactose	-	-	-
11	Xylose	+	-	-
12	Galactose	-	-	-
13	Fructose	+	+	-
14	Sorbitol	⊕	⊕	⊕
15	Cellobiose	-	-	-
16	Maltose	-	+	-

‘+’ - acid production, ⊕ - acid and gas production,
 - = negative test

Table no.9: Results of sugar utilization by isolates.

It can be seen from table no. 9 that all isolates were could not utilised Arabinose, Mannitol, Rhamnose, Trehalose, Inositol, Raffinose and Melibiose. All the isolates were fermented glucose to the acid only and were fermented sorbitol with production of acid and gas. The isolates n A₁ not fermented sucrose while remaining three isolates were fermented sucrose with acid only. The isolates A₂ and A₃ were not fermented the xylose sugar while remaining isolates were fermented xylose with acid production only. All the isolates were fermented the fructose sugar with acid production only except A₃. isolate A₂ was fermented the maltose with acid production only.

4.5.3.6 Potash mobilizing activity.

Results of potash mobilizing activity given by the isolates were as shown in table no.10.

Table no. 10: Results of potash mobilizing activity given by the isolates.

Potash mobilizing activity.	Isolates		
	A ₁	A ₂	A ₃
	-	-	-

4.5.3.7 Effect of heavy metals on the isolates.

Results of effects of heavy metals on the isolates were as shown in table no. 11.

Table no. 11: Results of effects of heavy metals on the isolates.

Conc. Of metal	Isolates		
	A ₁	A ₂	A ₃
Lead (Pb)			
1mM	+	-	-
2 mM	-	-	-
3 mM	-	-	-
4 mM	-	-	-
Mercury (Hg)			
1mM	-	-	-
2 mM	-	-	-
3 mM	-	-	-
4 Mm	-	-	-

+ = growth, - = No growth

It can be seen from table no. 11 that, all the isolates were showed growth at 1mM lead concentration except A₂ and A₃. All the isolates were failed to grow at remaining concentrations of lead such as 2 mM, 3 mM and mM as well as isolates were also failed to grow at all the different concentrations of mercury like 1 mM, mM, 3 mM and 4 mM.

4.5.3.8. Salt tolerance ability of the isolates-

Results of salt tolerance by the isolates were as shown in table no. 12.

Table no. 12: Results of effects of NaCl concentration on the isolates.

NaCl conc. (%)	Isolates		
	A ₁	A ₂	A ₃
1%	+	-	-
2%	+	-	-
3%	+	-	-
4%	+	-	-
5%	+	-	-
6%	+	-	-
7%	-	-	-
8%	-	-	-

4.5.3.9 Ability of production of HCN:

All the isolate failed to produce HCN when grown on tryptic soya agar with 4.4% glycin.

PHOTOGRAPHS



Photograph 1 – A Water hyacinth (*Eichhornia crassipes*)

SUMMARYANDCONCLUSION

- Total of seven bacterial isolates were obtained from the root wash of water hyacinth collected from river water. Out of which three isolates were non symbiotic nitrogen fixing (A₁,A₂ and A₃) and four were phosphate solubilising.(P₁,P₂,P₄ and P₅)
- The two isolates were Gram positive cocci, two were Gram positive coccobacilli and remaining were Gram negative coccobacilli, Gram positive short rods.
- All the isolates were motile in nature.
- The isolate A₁ was only isolate with spore forming ability.
- All isolates except A₁ and A₃ were found to be oxidative in nature.
- All the isolates showed property of production of varieties of enzymes extracellularly as well as fermenting varieties of sugars.
- All isolates except A₃ showed ability to utilize citrate.
- The isolate P₅ showed indol test positive.
- The isolates P₁, P₂, P₄ and P₅ showed potash mobilizing activity.
- The isolates P₂, P₅, and A₁ showed the growth up to 6 % NaCl concentration.

BIBLIOGRAPHY

- Alexander M (1961) “Introduction to soli microbiology”, Published by Mohinder sejwal for wiley eastern Limited, New Delhi: p.p.333-349.
- Atla, R.M. (1993) “Handbook of Micrological Media” CRC press,inc, Florida.
- Atlas,R.M. and Bartha R. (1993) “ Microbial Ecology ” , 3 rd edition Benjamin / Cummings Menlo Park ,California.
- Buddhi charma walpola and Min –Ho Yoon (2012) “Isolation and characterisation of PSB and their co- inoculation efficiency on tomato plant growth and phosphorus uptake ” African journal of microbiology ,Research volume 7(3) p.p 266-275.
- Dr. Krishan Chandra and Dr. S. Greep “Potash mobilizing bacteria” (2006), Published by Regional director, Regional Centre of Organic Farming No.34, Bangalore.
- Dubey R.C and Maheshwari J.B. (2002). “Practical Microbiology” 1st edition by Rajendra Ravindra printers Pvt. Ltd.
- Katznelson & B. Bose, “Metabolic activity and phosphate dissolving capacity of bacterial isolates from wheat roots, rhizosphere and non rhizospheric soil”, *Canadian J. of Microbiology*, 5(i), pp. 79-85, (1959).
- Kring, N.R. and J.Holt (1984) “Bergeys manual of systematic microbiology”, volume 1, Williams and Wilkins,co,Baltimore.
- Patel, R.K. (2000) “Experimental Microbiology”, Aditya publication, Ahamadabad,India.
- Patil V.D. and Iswaran. V. (1979) “Effect of epiphytic microflora of Water hyacinth (*Eichhornia crassipes*) on wheat. Division of microbiology, Indian Agricultural Research Institute, New Delhi.
- Sharma A.K. (2002) “Biofertilizers for sustainable agriculture”, 1st Ed. Published by Dr. Updesh Purohit for Agrobios (India), Jodhpur.p.p 15, 194-198.
- Subba Rao, N.S. (1977) “Soil microorganisms and plant growth” Oxford and IBH publishing, New Delhi.
- www.els.net/.../refld-a0001386.htmlt

Green and Efficient Synthesis of Pyranopyrazoles: Multi-Component Approach Catalyzed by Ionic Liquid

S. S. Kadam^{a,c}, P. R. Kharade^{b,c}, D. S. Gaikwad^a, S. S. Desai^{*c},

^a Department of Chemistry, Vivekanand College, Kolhapur (Empowered Autonomous) (MS) India.

^b Department of Chemistry, Karmaveer Hire Arts, Science, Commerce, and Education College, Gargoti (MS) India .

^c Research Laboratory in Heterocyclic Synthesis, Devchand College, Arjunnagar (MS) India.

*Corresponding author: savitadesai2010@gmail.com, satishkadam955@gmail.com

Abstract:

The present method involves a simple and highly efficient approach for the synthesis of a series of pyranopyrazole derivatives was achieved *via* a one-pot, four-component reaction of aromatic aldehyde ,hydrazine hydrate, malononitrile, and β -keto ester in EtOH-H₂O by using a Acidic ionic liquid,1-methyl-3-(4-sulfobutyl)-1H-imidazol-3-ium aluminium tetrachloride at ambient temperature.The salient features of this protocol are higher yields, minimum reaction times, easy workup process, and purification of products by non-chromatographic methods.

Introduction:

In modern organic chemistry, The Multicomponent reaction (MCR) is a resourceful and competent synthetic methodology that involves the simultaneous reaction of three or more reactants react to yield a novel complex product in a single step.[1] The distinctive feature of MCRs lies in the fact that the resultant products comprise nearly substrates, resulting in minimal by-products. This feature renders MCRs an exceptionally sustainable and environmentally friendly reaction system.[2] Now a days all the researchers widely explore and utilize MCRs for the synthesis of various compounds across various fields, showcasing the versatility and synthetic potential of this powerful methodology.[3]

Heterocycles are broadly dispersed in nature and play a crucial role in metabolism, as their structural subunits are present in a numerous of natural products, including vitamins, and alkaloids, as well as in pharmaceuticals, agrochemicals, dyes, and various other compounds.[4] These compounds provide as structural frameworks upon which pharmacophores can accumulate, leading to the improvement of potent and selective drugs.[5] Among heterocyclic compounds, those containing both nitrogen and oxygen are fundamental structures in numerous biologically active compounds, playing miscellaneous roles in medicinal chemistry.[6].

Ionic liquids (ILs) have emerged as versatile and inventive catalyst in the field of heterocyclic chemistry, playing a crucial role in the synthesis of heterocyclic compounds.[7]

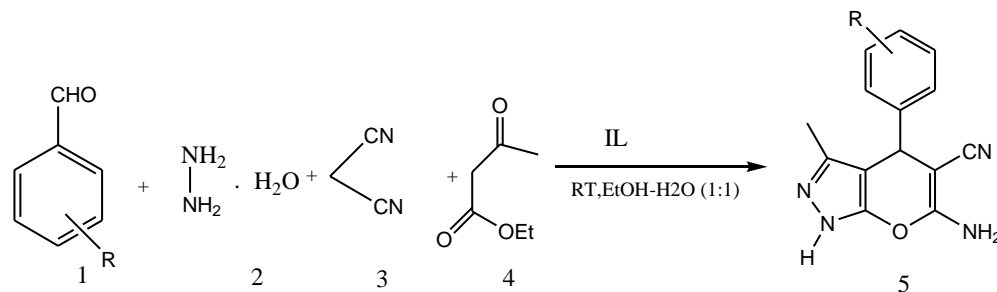
Their versatile nature continues to motivate modern strategies for the synthesis of varied and complex Pyranopyrazoles moiety is an important classes of oxygen-nitrogen heterocyclic compounds .they have broadly occurrence in natural compounds and some synthetic products. Pyranopyrazole are the important scaffold in synthetic medicinal chemistry due to their their various biological activites such derivatives shows diverse biological activities such as anticancer [9],antimalarial[10], anti-proliferative [11], anticoagulant [12],antioxidant [13],

Now a days, a various methods for synthesis of dihydropyrano[2,3-c]pyrazoles have been reported in the previous paper amongst which multicomponent reaction between aldehydes, ethyl acetoacetate, hydrazine hydrate and malononitrile is appropriate methods and they have been achieve by various catalyst such as Urea [14], , choline chloride/thiourea [15], sulphonic acid-functionalized ionic liquid [16], acetic acid [17], meglumine [18], Fe3O4@APTES@isatin-SO3H[19], isonicotinic acid [20]amongst these methods face some drawbacks, including lengthy process hazardous and expensive solvent, less yield of products of heterocyclic compounds.

Experimental Protocols:

Materials and methods

The catalyst synthesis and characterization have been well studied in previous publication. In a 50 ml flask equipped with a magnetic stirrer, a mixture of .aromatic aldehydes (**1**, 1 mmol), hydrazine hydrate (**2**, 1mmol), malononitrile (**3**, 1 mmol), and ethyl aceto acetate (**4**, 1mmol)acidic ionic liquid (10 mol%) in EtOH (5ml)was taken . The resulting mixture was stirred ambient . After completion of the reaction (monitored by TLC), the precipitated product was filtered and washed with aqueous ethanol (5 ml). The crude product was purified by recrystallization from ethanol to afford the desired product. In order to recover the catalyst,the filtrate was dried under reduced pressure and recovered catalyst was washed with diethyl ether (2 ml) twice and reused after drying.



Scheme 1: Synthesis of pyrano pyrazole derivatives

Result and Discussion:

Initially, we have carried out the model reaction in absence of catalyst by using benzaldehyde (1 mmol), hydrazine hydrate (1 mmol), malononitrile (1 mmol), ethyl acetoacetate (1 mmol) at room temperature. it was found trace amount of product was obtained even after prolong time,

this result proves that a catalyst plays a important role in this reaction. When same reaction is carried out in the presence of catalyst such as IL, we got 70% of yield of product.

For searching of the in presence of catalyst on the yield and other reaction conditions, the model reaction was carried out utilizing the different amount of catalyst varied from 5 to 30 mol% under room temperature condition. (Table 1 entries2-7). From Table 1, it can be accomplished by 20 mol% of IL was bring into being to be sufficient to catalyze present transformation, yielded desired product in 90%. Further, an increase in the amount of the catalyst was no progress of yield.

Table1. Effect of catalyst on the reaction

Entry	Catalyst loading %	Temperture (°C)	Time(min)	Yield % ^b
1	No	RT	60	trace
2	5	RT	60	65
3	10	RT	60	78
4	15	RT	40	82
5	20	RT	30	90
6	25	RT	30	90
7	30	RT	30	90

Reaction condition: benzaldehyde (1 mmol), ethyl acetoacetate (1 mmol) malononitrile (1 mmol),and hydrazine hydrate (1 mmol) and IL (20%) Room temperature .^b Isolated yield

Moreover, we focused on the effect of various solvents such as water, ethanol, acetonitrile, PrOH, on the present reaction in the presence of catalyst at room temperature. Among all these solvents, ethanol was found to be the best one and afforded the highest yield.

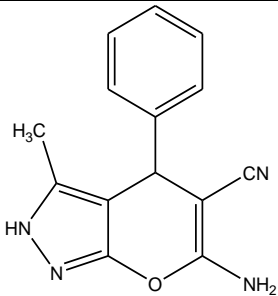
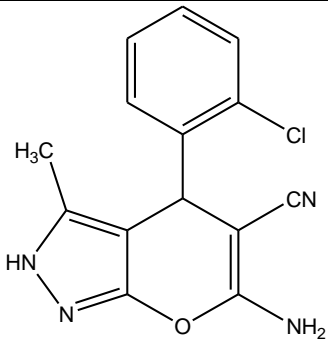
Table2. Effect of solvent on the reaction

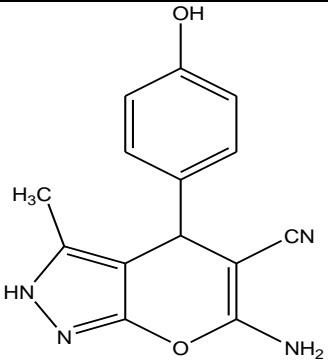
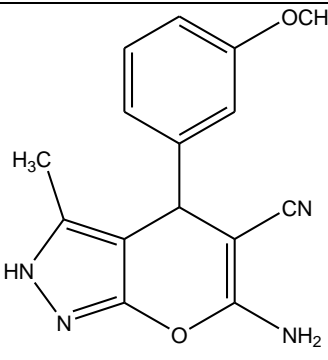
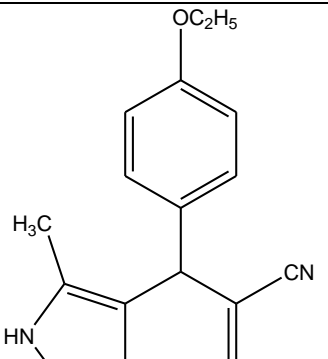
Entry	Solvent	Yield % ^b
1	absence	trace
2	actonitrile	45
3	H ₂ O	70
4	MeOH	78
5	C ₂ H ₅ OH	84

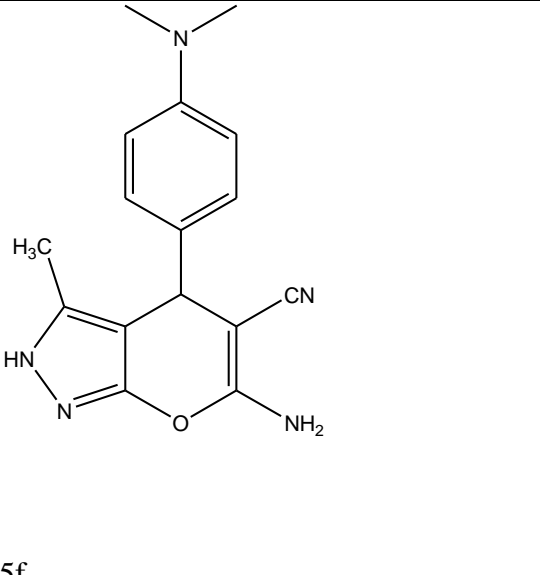
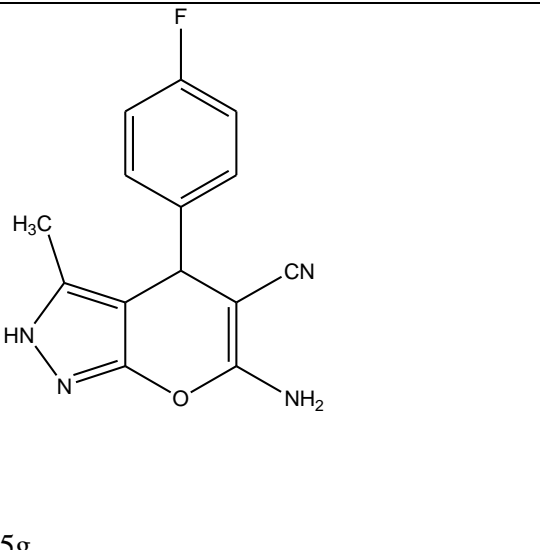
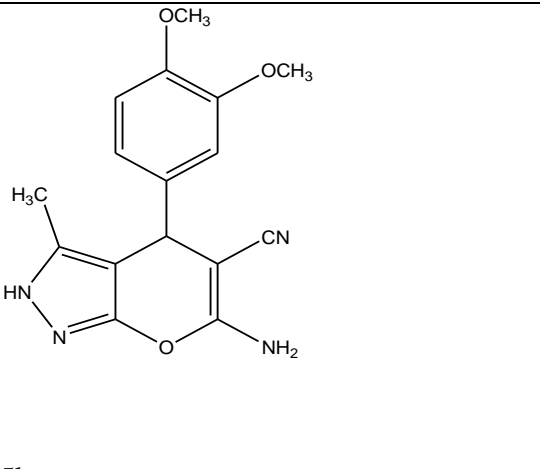
^a Reaction condition: benzaldehyde (1 mmol), ethyl acetoacetate (1 mmol) malononitrile (1 mmol),and hydrazine hydrate (1 mmol) and IL (20%) Room temperature. ^b Isolated yield

After optimized the reaction conditions, we have check the generality and versatility, various substituted aromatic aldehydes reacts with malononitrile, ethyl acetoacetate and hydrazine hydrate at room temperature using Acidic IL as catalyst in ethanol (Table 3, entries 1–8), affording excellent yields. It depicts that our procedure is versatile and can be used to synthesis of diverse structure of pyrano pyrazolone derivatives.

Table3. acidic ILs catalyzed synthesis of pyrano pyrazolone derivatives:

Entry No	Aldehyde	Product	Time	Yield(%)
1	PhCHO	 5a	32	86
2	2-ClC ₆ H ₄ CHO	 5b	32	88

3	4-OHC ₆ H ₄ CHO	 <p>5c</p>	33	86
4	3-OCH ₃ C ₆ H ₄ CHO	 <p>5d</p>	34	82
5	4-OEtC ₆ H ₄ CHO	 <p>5e</p>	35	84

6	4-NMe ₂ C ₆ H ₄ CHO	 <p>5f</p>	32	84
7	4-F C ₆ H ₄ CHO	 <p>5g</p>	30	90
8		 <p>5h</p>	34	84

^a Reaction condition: benzaldehyde (1 mmol), ethyl acetoacetate (1 mmol) malononitrile (1 mmol), and hydrazine hydrate (1 mmol) and IL (20%) Room temperature. ^b Isolated yield

Spectral data for selected compounds:

6-Amino-3-methyl-4-phenyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitrile (Table 4, entry 1)

Solid white . M.p. 243-244 °C. FT- IR cm⁻¹ (KBr): 3406, 3370, 3068, 3030, 2932, 2193, 1645, 1488, 1145. ¹H NMR (400 MHz, DMSO-d₆): δH (ppm) 1.77 (s, 3H), 4.59 (s, 1H,), 6.83 (s, 2H,), 7.15–7.33 (m, 5H, Ar-H), 12.07 (s, 1H,). ¹³C NMR (100 MHz, DMSO): δC (ppm) 9.65, 36.20, 57.2, 97.6, 120.69, 128.37, 144.39, 154.73, 160.82.

Conclusion:

In this research, we have reported proficient synthesis of highly significant of pyranopyrazole derivatives using acidic ionic liquid, i.e. 1-methyl-3-(4-sulfobutyl)-1H-imidazol-3-ium aluminium tetrachloride in aqueous ethanol solvent mixture at room temperature. The present method has the some advantages such as easy procedure, mild reaction condition, no toxic solvents, high yield.

Acknowledgment: One of the authors SSK is very much thankful to vivekanand college (Autonomous) Kolhapur to providing the facilities.

References:

- 1) Beilstein M, H, J. Org. Chem. 12, 1269–1301(2016)
- 2) Wender, P. A. Nat. Prod. Rep 31, 433–440(2014)
- 3) Devi I, Bhuyan, P.J. Tetrahedron Lett. **45**, 8625-8627 (2004)
- 4) Khan M d. Musawwer, Khan S. S and Safia Iqbal RSC Adv **6**, 42045–42061(2016)
- 5) B. Eftekhari-Sis, M. Zirak and A. Akbari, Chem. Rev., 113, 2958–3043(2013)
- 6) Ju Y. and Varma R. S., J. Org. Chem., 71, 135–141(2006)
- 7) D. Za'rate-Za'rate, R. Aguilar, R. I. Hernandez-Benitez, E. M. Labarrios, F. Delgado and J. Tamariz, Tetrahedron, 71, 6961–6978(2015)
- 8) K. Niknam, M. Khataminejad, F. Zeyaei, Tetrahedron Lett. 57, 361-365 (2016)
- 9) J.Y.C. Wu, W.F. Fong, J.X. Zhang, C.H. Leung, H.L. Kwong, M.S. Yang, D. Li, H.Y. Cheung, Eur. J. Pharmacol. 473, 9 (2003)
- 10) Mohd Asyraf Shamsuddin¹, Nur Hanis Zakaria, Mohd Fazli Mohammat, Jufriзал Syahri, Jalifah Latip¹ & Nurul Izzaty Hassan Malaysian Journal of Chemistry 22(4), 52-61(2020)

- 11) A. Venkatesham, R.S. Rao, K. Nagaiah, J.S. Yadav, G.R. Jones, S.J. Basha, B. Sridhar, A. Addla gatta, *Med. Chem. Commun.* 3, 652 (2012)
- 12) J. Albadi, A. Mansournezhad, Z. Derakhshandeh, *Chin. Chem. Lett.* 24, 821 (2013)
- 13) A. Kumbhar, S. Kamble, M. Barge, G. Rashinkar, R. Salunkhe, *Tetrahedron Lett.* 53 (2012) 2756-2760.
- 14) G. Brahmachari, B. Banerjee, *ACS Sustain Chem. Eng.* 2, 411 (2014)
- 15) M.G. Dehbalaei, N. Foroughifar, H. Pasdar, A.K. Amiri, N. Foroughifar, *Res. Chem. Intermed.* 43, 3035 (2017)
- 16) P. Farokhian, M. Mamaghani, N.O. Mahmoodi, Kh. Tabatabaeian, *J. Iran. Chem. Soc.* 15, 11 (2018)
- 17) V.L. Gein, T.M. Zamaraeva, I.V. Kozulina, *Russ. J. Org. Chem.* 50, 691 (2014)
- 18) R.Y. Guo, Z.M. An, L.P. Mo, S.T. Yang, H.X. Liu, S.X. Wang, Z.H. Zhang, *Tetrahedron* 69, 9931 (2013)
- 19) S. Sajjadifar, Z. Gheisarzadeh, *Appl. Organomet. Chem.* 33, e4602 (2019)
- 20) M.A. Zolfigol, M. Tavasoli, A.R. Moosavi-Zare, P. Moosavi, H.G. Kruger, M. Shiri, V. Khakyzadeh, *RSC Adv.* 3, 25681 (2013)

Comparative study of acidity status in some CAM plant

Mr. Suraj Santosh Kadam, Mr. Mohit Sunil Mane, Mr. S. G. Kulkarni

Department of Biotechnology, Vivekanand College Kolhapur, Maharashtra, India

Abstract

The present research paper deals with the comparative study of acidity status in different CAM plants like

Kalanchoe pinnata (bryophyllum), *Cactaceae(cactus)*. the result showed that *Cactaceae(cactus)* shows more acidity level than the others. The TAN value in the morning is more than TAN value in evening. The CAM plants have an modified unique photosynthetic mechanism by which they reduce the loss of water by transpiration process they also show diurnal pattern of organic acid synthesis by this the TAN value of the plant extract collected in morning is more as synthesis of the acids takes place at night and the TAN value of the plant extract at night is low .

Keywords: TAN: Titrable Acid Number, CAM: Crassulacean Acid Metabolism

INTRODUCTION

India represents an important and rich biodiversity of plants. TAN (Titrable Acid Number) relates with the acidic content present in the plant tissue. Actually, TAN is the number of ml of decinormal (0.1 N) alkali required to neutralize the total amount of acids present in 100 g of the plant tissue. Basically, *Kalanchoe pinnata (bryophyllum)*, *Cactaceae(cactus)* are the CAM plants. CAM (Crassulacean Acid Metabolism) is a special mechanism found in xerophytes and succulents. It is for acid metabolism purpose. The main aim is to reduce the loss of the water in the high temperature. In CAM plants during night the CO₂ uptake takes place from the atmosphere when stomata are open and at this time malic acid is formed as a result of respiration. This malic acid is stored in the vacuole of the cells in the mesophyll (Lutige 2004). By this mechanism the loss of the water is reduced due to low temperature in night. In day stomata are closed by this the transpiration of the water is reduced. As CAM plants are growing in xeric habitats, to reduce the rate of transpiration, they close their stomata during day time and open them at night. By using this they fix the CO₂ at night and during day these acids are decarboxylated. CAM plants do not have Dimorphism and Kranz anatomy. In this we use two plants i.e. *Kalanchoe pinnata (bryophyllum)*, *Cactaceae(cactus)*.

Bryophyllum is included in the family Crassulaceae. The leaves are also fleshy (i.e. succulent) and are moreover simple (particularly on seedlings) or emulsion (i.e. trifoliate or pinnate). They're unequally arranged, planed, and the number of leaflets present varies from one near the base of the stems to three or five (i.e. trifoliate or pinnate) advanced up the stems. These leaves

(5- 25 cm long and 2-12.5 cm wide) are green or yellowish-green in colour, furless (i.e. rough), and are borne on stalks (i.e. petioles) 2- 10 cm long. The leaflets are round or hardly round(i.e. elliptic) in shape with rounded tips(i.e. blunt tips), and when further than one leaflet is present the end (i.e. Terminal) leaflet is generally significantly larger than the others. bitsy plantlets may sometimes be formed in the scalloped(i.e. crenate) margins of these leaflets. These plantlets are more frequently produced if the leaves become detached from the stems. It's present in xeric conditions.

Cactus

It the member of the family *Crassulaceae*. Cactus occur in a wide range of shapes and sizes. The photosynthesis of cactus plant is takes place in the stems. Even those cacti without visible photosynthetic leaves do usually have very small leaves, less than 0.5 mm (0.02 in) long .

Here we use simple acid- base titration to estimate the TAN value.this method is proposed by Thomas and Beevers (1949).

Materials and methods

Titration represents the acidity status of the plant tissue it also represents the amount of various organic acids present in the plant tissue. Titration provide a simple estimation of acids present in the plant tissue by routine titration method it cannot differentiate between individual acids therefore Titration is usually stated in terms of predominant acid. There are two way to estimate the acidity i.e

- 1) Total Titration is simple to estimate the total acid content of food.
- 2) Measurement of the PH i.e the H⁺ ion concentration

Total Titration of fresh plant material was determined by method of (Thomas and beevers (1949). Here we have to estimate the TAN value of the plant in morning and evening so we have to prepare the plant extract for two times for each plant .the plant material was collected from the field.the plant material was washed with distilled water by this the dirt and dust particles are removed on the plant material .the leaves are used as sample. after the cleaning ,the leaves are cut into small pieces. The leaves where accurately weighed(5gm),it is then transfer into 50ml of distilled water and boiled it for half an hour and cool it.the aliquot was titrated against standardized N/40 NAOH using phenolphthalein as an indicator. Standardization was done by using the N/40 oxalic acid by same indicator. Basically, the TAN (Titration Acid Number) is the amount of ml required to neutralize the acid content in 100gm of plant material. The TAN value is determined by the following formula

$$\text{TAN} = \frac{\text{Volume of oxalic acid taken for titration(ml)} \times \text{Total volume of extract(ml)} \times \text{Extract titration reading (ml)} \times 100}{\text{Standard titration reading(ml)} \times \text{Standard titration reading(ml)} \times \text{Weight of plant material(mg)} \times \text{Volume of extract taken for titration(ml)} \times 4}$$

RESULT AND DISCUSSION

The following table represent the TAN (Titrable Acid Number) of the two CAM plants (*bryophyllum*, *Catus*). the graph was also showing the cactus have more TAN value than that of the bryophyllum plant. And both plants show more TAN value in morning as compared to night.

Sr no.	Name of the plant	Total titrable acid number (TAN)	
		Morning	Evening
1.	Bryophyllum	1818.18	551.18
2.	Cactus	1931.81	488.69

Hasan et.al(2004)previously estimated the total acidity and ph value of Purslane(*Portulaca oleracea*)plant .Jamkhandi.et.al(2011) previously estimated the acid value by using the potentiometric method by using *Oxalis corniculata* at different geographical conditions.same type of work on the total acidity where done by different workers by using different plants Hew and Wong (1974) noticed that the titrable acidity goes decreasing in the light and increased at night that is they noticed the diurnal changes in the titrable acidity of *Drymoglossam*, *Pyrrrosia* and *Kalanchoe* .

Conclusion

CAM plants have diurnal pattern of organic acid synthesis. These plants fix CO₂ and accumulates C₄ acids (e.g. malic acid) during night and consume these C₄ acids during day. Therefore cytoplasm of the mesophyll cells during night is more acidic and during day is less acidic. Therefore TAN of morning extract is more than that of the evening extract.

Reference

- 1) "comparative study of the acidity status in some wild vegetables" by Varsha Sanjay Khude (June 2020)
- 2) "Seasonal variation in photosynthesis and diel carbon balance under natural conditions in two *Peperomia* species that differ with respect to leaf anatomy" by Nicolas Y. Fondom and Sergio Castro-Nava.

Phylogenetic analysis of SARS-COV-2 from the most widespread variants

Pruthviraj Amar Patil and A.L. Upadhye

Department of Biotechnology, Vivekanand College, Kolhapur, Maharashtra

Abstract

The COVID-19 pandemic, reported for the first time at the end of 2019 in the megacity of Wuhan (China), has spread worldwide three times. It led to the infection of further than 500 million people and about six million deaths. SARS-CoV-2 has proved to be veritably dangerous for mortal health. Thus, several sweats have been made in studying this contagion. In a short time, about one time, the mechanisms of SARS-CoV-2 infection and duplication and its physiological effect on been refocused. Also, different vaccines against it have been developed and capitalized. To date, a further than 11 billion boluses have been invested all throughout the world. Since the morning of the epidemic, SARS-CoV-2 has evolved; it has done so by accumulating mutations in the genome, generating new contagion performances showing different characteristics, and which have replaced the preexisting variants. In general, it has been observed that the new variants show an increased infectivity and beget milder symptoms. The rearmost insulated Omicron variants contain further than 50 mutations in the whole genome and show an infection-folds advanced compared to the wild-type strain. Then, we can assay the SARS- CoV-2 variants from a phylogenetic point of view and hypothecate an unborn script for SARS- CoV-2, by following its elaboration to date.

Keywords: Covid-19; SARS-COV-2

Introduction

Severe acute respiratory syndrome 2 is a new coronavirus responsible for covid-19 pandemic. The virus first detected in end of 2019 in the city Wuhan China.

1. Classification

SARS-COV-2 is a member of coronaviridae family which includes SARS-COV which causes SARS it is responsible for SARS outbreak and MERS-COV which is responsible for Middle east respiratory syndrome outbreak.

2. Structure

SARS-COV-2 is a single stranded RNA virus having envelope. It has crown like appearance so it is called as CORONA. Latin word for corona is crown.

3. Mode of Transmission

The primary mode of transmission is respiratory droplets produced when infected person sneezes, coughs or talks. It is also spread by touching the contaminated surfaces with SARS-COV-2 and then touching to nose or face.

4. Symptoms

COVID-19 symptoms can be mild to severe. It includes shortness of breath, fever, cough, fatigue, body aches. In some cases, it leads to pneumonia, organ failure or death.

5. General information

In world there are more than 150 million peoples are infected and more than three million peoples are dead due to COVID-19 pandemic. There are several vaccines are developed for SARS-COV-2 like m-RNA vaccine, vector vaccine, inactivated vaccine. Some vaccines cleared phase three clinical trials and approved for public use. RTPCR is a method used to identify SARS-COV-2.

6. SARS-COV-2 VIRUS

The genome of SARS-COV-2 is about 30 kb. SARS-COV-2 shows high mutation rate compared to other DNA viruses. It is difficult to measure mutation rate because it is very high. SARS-COV-2 use spike protein to bind host ACE-2 receptor. The spike protein used to develop vaccines. Spike protein s contains N-Terminal region, transmembrane domain and C terminal region.

7. Phylogeny

Phylogeny is like a family tree for all living things, showing how different plants, animals, and microbes are related to each other through evolution. But it's not just about who came from whom – it tells us cool things like when certain species appeared and how they've changed over time.

Material

- ❖ NCBI Link for getting Fasta sequences of SARS-COV-2 VARIANTS: - <https://www.ncbi.nlm.nih.gov/>
- ❖ Link for getting Accession number of variants- [NCBI Virus \(nih.gov\)](#)
- ❖ Clustal Omega link for creating phylogenetic fasta tree of SARS-COV-2 most widespread VARIANTS: - [Clustal Omega < Multiple Sequence Alignment < EMBL-EBI](#)
- ❖ Computer with Internet access.

Methodology

1. Data collection

Firstly, collect the accession number of SARS-COV-2 variants from NCBI VIRUS website. Then gather a set of SARS-COV-2 nucleotide sequences from various variants like Alpha, Beta, Epsilon, Omicron from NCBI website.

2. Sequence Retrieval and Formatting

Copy all selected sequences in FASTA format. Then paste in notepad or text tool. Copy and paste one by one all sequences in notepad. Then select all sequences and copy it .

3. Clustal omega alignment

Paste all copied sequences in clustal omega box. Then select set of that is RNA. Select the output format to Phylip. Then submit your job and run your alignment.

4. Tree Visualization:

Visualize the resulting guide phylogenetic tree. And select the branch length Cladogram or Real. Then check and download the image.

RESULT AND DISCUSSION

Table 1. SARS-CoV-2 variants

Sr.No	Spike Varients	Isolation Country	Accesion Number	Collection Date
1	WILD	CHINA	NC_045512	12/2019
2	EPSILON	USA	OM485491	03/2020
3	ZETA	BRAZIL	OL442124	07/2020
4	BETA	SOUTH AFRICA	OM739160	10/2020
5	20E.EU2	PORTUGAL	OL872364	12/2020
6	20A.EU1	SPAIN	OD938567	2020
7	ALPHA	ENGLAND	OW481195	2020
8	DELTA	INDIA	MZ544373	8/2020
9	KAPPA	INDIA	MZ562758	2/2021
10	A.23.1	UGANDA	MZ287366	11/2020
11	GAMMA	BRAZIL	MZ264787	12/2020
12	IOTA	USA	ON196438	11/2020
13	ETA	Multiple countries	OD913776	12/2020
14	LAMBDA	PERU	MZ275287	01/2021
15	THETA	PHIILIPPIENS	OL989074	03/2021
16	B.1.1.3.18	MULTIPLE COUNTRIES	OD955012	01/2021
17	MU	COLUMBIA	OQ564667	01/2021
18	OMICRON BA.1	SOUTH AFRICA	OM725163	11/2021
19	OMICRON BA.2	SOUTH AFRICA	OM773442	12/2021
20	OMICRON BA.2.12.1	NORTH AMERICA	ON563241	12/2021
21	OMICRON BA.4	SOUTH AFRICA	ON324341	03/2022
22	OMICRON BA.5	SOUTH AFRICA	ON647569	04/2022

The analysis focused on the twenty most common SARS-CoV-2 spike variants discovered between December 2019 to 2023, including wild type, delta, lambda, mu, beta, gamma,

B.1.1.318, kappa, A 23.1, iota, theta, epsilon, 20 A.EU1, 20 A.EU2, zeta, alpha, eta, omicron BA.1, omicron BA.2, omicron BA.2.12.1, omicron BA.4, and omicron BA.5. These variants, sourced from the proteins database at <https://www.uniprot.org>, underwent analysis through multiple sequence alignment, conducted using the Clustal Omega program at <https://www.ebi.ac.uk/Tools/msa/clustalo/>. The resulting phylogenetic tree highlighted 100 mutations, including substitutions, deletions, and insertions, constituting about 8% of the total residues (1273 aa).

Notably, 49 mutations were found in the NTD, and 23 in the RBD domain, representing over 70% of S1 spike subunit mutations. These findings suggested that significant changes occurred in the recognition region of the ACE-2 host cell receptor, while the spike protein domains involved in conformational changes and activation remained constant. The data indicated a correlation between the observed variation in infection rates among these variants and alterations in the binding affinity of the spike protein to the ACE-2 protein.

Of particular interest was the observation that only the residue D614 was consistently mutated in all examined variants, except for variant A 23.1, which maintained D614. This indicated that one of the earliest mutations in the spike protein occurred at position 614, and it is known that this mutation affects the protein's functionality. Among other prominent mutations, positions 452 (in 7 variants), 484 (in 13 variants), 501 (in 10 variants), and 681 (in 12 variants) stood out. Additionally, 51 mutations were unique to specific variants, with 20 identified solely in the Omicron variants.

Table 2. Single mutations in the spike variants

Spike Variants	Mutations
ALPHA	A570D T716I S982A D1118H
BETA	D80A D215G Del241-243 K417N A701V
GAMMA	L18F T20N D138Y R190S T1027I
DELTA	Del156-157 R158G
EPSILON	S13I W152C
ETA	Q52R A67V Q677H F888L
THETA	E1092K H1101Y
IOTA	L5F D253G
KAPPA	E154K Q1071H
LAMBDA	T76I R246N Del247-252 F490S T859N

MU	Ins147N Y147N R346K
20 A.EU1	A222V
A 23.1	R102I F157L V367F
B.1.1.318	T95I
OMICRON BA.1	Del143-144 N211I L212V Ins213-214 V215P G446S G449S T547K N856K L981F
OMICRON BA.2.12.1	S704L
OMICRON BA.4	V3G

Moreover, we noted that the mutations highlighted as "unique" in Table 2 don't necessarily define specific variants and aren't distinct features of SARS-CoV-2 variants. This is because, in most cases, they involve substitutions between amino acids with similar traits, and they don't impact the functionality of the spike protein. Take the 20 A.EU 1 and 2 variants, for instance – the spike protein differs from the wild type by only a single residue (D614G) in both. Additionally, two more mutations were identified: S477N in variant 20 A.EU 2 and A222V in variant 20 A.EU 1. While the S477N mutation was also found in other spike variants, A222V was exclusive to 20 A.EU 1. This suggests that the functional contrast between the two 20 A.EU variants is because of the S477N mutation, not the A222V, which is essentially a conservative substitution of a non-polar amino acid with a similar one.

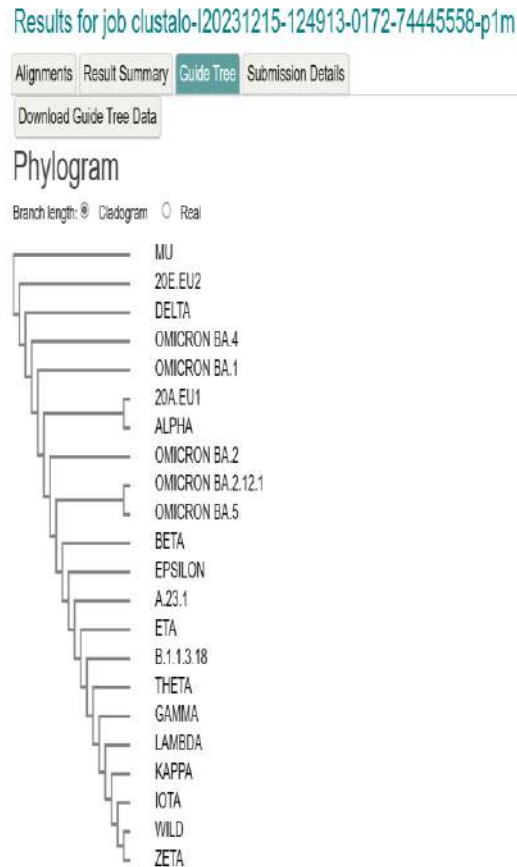
Considering these findings, if the S477N mutation is distinctive between these two variants and is also present in more recent variants, it implies that 20 A.EU 2 could be seen as an older variant where the S477N mutation first emerged. Now, in the case of the variant named Iota, certain mutations overlap with other variants, such as S477N, E484K, and D614G. However, the two mutations unique to Iota – L5F and D253G – can be seen as defining because they impact the spike's functionality. Specifically, the L5F mutation is in the signal peptide (SP) of the spike, and it's known that SP mutations can alter the spike's functionality. The second mutation, D253G, involves swapping polar residues (aspartic, D) with non-polar ones (glycine, G), leading to a notable change.

Furthermore, other defining mutations affecting the spike's functionality include the deletion 156–158 in Delta, the deletion 241–243 in Beta, and the deletion 246–252 in Lambda (as listed in Table 2).

Also, we noted that the mutations pointed as "unique" in Table 2 do not unavoidably define specific variants and are not distinct features of SARS-CoV-2 variants. This is because, in utmost cases, they involve negotiations between amino acids with analogous traits, and they do not impact the functionality of the shaft protein. Take the 20A.EU 1 and 2 variants, for case – the shaft protein differs from the wild type by only a single residue(D614G) in both. also, two further mutations were linked S477N in variant 20A.EU 2 and A222V in variant 20A.EU

1. While the S477N mutation was also set up in other spike variants, A222V was exclusive to 20A.EU 1.

Figure 1. Phylogenetic tree of SARS-COV-2 Of most widespread variants



The illustration you are seeing then was created using a tool called Clustal Omega (you can find it at <https://www.ebi.ac.uk/Tools/msa/clustalo/>). We used the derelection settings for the alignment, which are principally the standard settings for how the sequences are lined up. Now, if you take a look at the nethermost part of Figure 1, you will see different SARS- CoV-2 variants like A23.1, A 20. EU1, A 20. EU 2, and others like Lambda, Kappa, and Epsilon. These variants all partake Common strain and evolved from the original Contagion What is intriguing is that Epsilon was linked and sequenced in the USA back in March 2020, while A23.1 and Lambda were only discovered latterly in October and December 2020, independently, in Uganda and Peru. In these two countries, not as numerous samples were sequenced compared to the USA, conceivably due to specialized and profitable reasons. Delta and Kappa, on the other hand, were both insulated in India in December 2020, and when you look at the family tree, you can see that their elaboration went in different directions. Indeed, though both variants have seven mutations compared to the original protein, only three of them are the same L452R, D614G, and P681R. This suggests there might have been another unknown variant in between that carried these three mutations and also resolve into the two, Kappa and Delta. The tree we have got then paints a enough good picture of how

these variants have evolved. still, it does not show some of the less common variants and any in- between stages, especially when it comes to the Omicron variants, which have a lot further mutations than the others. Their elaboration seems to involve some intermediate variants that we are still in the dark about. You see colourful SARS- CoV- 2 variants like A23.1, A 20. EU1, A 20. EU 2, and others named Lambda, Kappa, and Epsilon. These variants all partake a common strain, evolving from the first interpretation of the contagion. The tree gives us a enough good picture of how these variants have changed and spread. still, there is a bit of riddle especially with the Omicron variants. They've a bunch of more mutations than the others, and the tree does not show the in- between stages.

In simple terms, this study helps us understand how the contagion has evolved over time and

how different performances are related. It's like putting together pieces of a mystification to see the whole picture. These findings are pivotal for scientists to keep up with the contagion and plan how to deal with it. The timing of when these variants surfaced is relatively interesting. For case, Epsilon showed up and was delved in the USA as beforehand as March 2020. On the other hand, A23.1 and Lambda were set up latterly in Uganda and Peru, independently. also, Delta and Kappa, dis covered in India in December 2020, took their own evolutionary paths. The family tree, shown in Figure 4, reveals that although Delta and Kappa both have seven mutations compared to the original contagion, only three mutations are the same (L452R, D614G, and P681R). This hints at the actuality of a mysterious, intermediate variant with these three mutations that latterly resolve into

Delta and Kappa. The family tree gives us a visual timeline of how these variants evolved, helping us piece together the contagion's trip. still, there is a fascinating twist when it comes to the Omicron variants. They are like the revolutionists of the family, carrying a lot further mutations than the others. The tree does not show the way in between, leaving scientists with a bit of a mystification – it's like saying, " We see the major mileposts, but there might be lower, pivotal events we are still unravelling." In simpler terms, this study acts like a inheritable operative story, revealing how the contagion has converted over time. Understanding these connections is pivotal for scientists in prognosticating the contagion's geste and developing strategies to attack it effectively. It's like decrypting the contagion's family secrets to stay one step ahead in the fight against it. While the family tree provides a timeline of the virus's evolutionary journey, the Omicron variants inject a plot twist. They appear as rebels, flaunting a multitude of mutations compared to their viral relatives. The tree, however, lacks finer details about the transitional phases, leaving scientists with an intriguing mystery – a bit like having major plot points without all the connecting scenes. In simpler terms, this genetic detective work not only uncovers the virus's family secrets but also offers a glimpse into its global journey.

Decoding these relationships equips scientists with vital information to anticipate the virus's next moves and devise effective strategies. It's akin to understanding the twists and turns in a gripping story, enabling us to stay ahead in our ongoing battle against the virus.

Conclusion

Three years into the SARS- CoV- 2 epidemic, despite having vaccines for two times, numerous countries are still dealing with extremities and assessing restrictive measures to control the contagion. Indeed, in largely vaccinated nations, new variants are causing fresh outbreaks. This is passing due to a combination of factors the inheritable changes in the contagion, dwindling vaccine effectiveness, and the limitations of current webbing styles. The ongoing elaboration of

the contagion is particularly gruelling in lower rich countries with low vaccination rates and high infection rates, like certain areas in Africa where the Omicron variants began. Vaccine effectiveness is impacted by the inheritable changes in SARS CoV- 2. The vaccines were designed grounded on the original interpretation of the shaft protein, but the most current Omicron variants have further than 30 mutations in this protein. specially, there are three elisions in the subunit S1, which plays a

pivotal part in the vulnerable response by

binding to the host cell receptor. For case, in Italy, despite a significant chance of the population entering vaccines, a swell in diurnal infections were observed in June 2022, with about 80,000 new cases per day. Indeed though utmost of these cases were in vaccinated individualities, reinfections constituted around 8 of the total infections.

Another issue lies with the tests used to descry SARS- CoV- 2. The rapid-fire antigen tests are designed to identify the original interpretation of the spike protein, performing in a high number of false negatives when trying to descry the new variants like Omicron. Developing rapid-fire tests specifically designed for these variants is pivotal to directly identify infections.

Considering the evolutionary and survival aspect, we observe the selection of variants that are more fluently transmittable while causing less severe symptoms compared to the original contagion. The symptoms associated with the earlier phases of the pandemic, similar as loss of taste, smell, skin greenishness, and severe respiratory issues, have lowered in the more recent Omicron variants. This suggests a implicit shift from a epidemic to an aboriginal situation, analogous to other seasonal coronaviruses causing mild symptoms that have been circulating for decades. In conclusion, as saying the structure and elaboration of the SARS-

CoV- 2 spike protein across variants provides pivotal perceptivity into the contagion's geste .

Understanding these complications is essential for developing effective vaccines and conforming strategies for forestalment and treatment, contributing to global sweats in managing the COVID- 19 pandemic.

Reference

1. Emilia Caputo ¹ and Luigi Mandrich
Structural and phylogenetic analysis of SARS-
COV-2 spike glycoprotein from the most
widespread variants.

The Role and Functions of Teachers in Improving Effective Learning in Classes

Dr.Surekha.S.Awate, Mr. Sunny Kale

Assistant Professor

Dept. of Commerce, Vivekananda Collage, Kolhapur (Autonomous).

Abstract: This study aims to describe the role and function of teachers in enhancing effective learning, inhibiting factors and solutions to teacher barriers in carrying out the roles and functions of teachers at the Schools and Colleges. This study used a descriptive qualitative approach with a case study design. Data collection techniques used are observation, interview, and documentation. Which is mentioned that the teacher is a professional educator with the main task of educating, teaching, guiding, directing, training, evaluating, and evaluating students in early childhood education informal education, basic education, and secondary education.

Keywords: Teacher's role, Teacher's function, Effective learning

I. INTRODUCTION

The teacher is one of the important elements and must exist besides students. One of the important elements, when the school is built, is the teacher, the teacher is reputed as a benchmark in creating intelligent and talented generation. The teacher is the key where the student is very depending on them, the existence of the teacher is influenced by the student's life at school. The teacher is also known as the source of knowledge for the student in the class. A good teacher is a person who can make alterations and able to influence the student in some aspects, such as scientific, action, norm, and behavior. One thing that should be owned to be a teacher is the ability to teach the education process, the teacher has an important role as the key in both formal and informal educations. The teacher is also known as the person who has a lot of knowledge in society. So that teacher is respected by the local people because they are reputed as intelligent person. Teacher can be said as the parent of the student in the school which makes them have the authority and duty to guide the student like the parent at home. In elementary education, the student still very needs guidance, so the teacher is demanded to be active and able to build the student's character. The role of the teacher to make fun learning can strive for the teacher being more creative and professional. In the learning process, the teacher has the responsibility to bring and change the student to be an intelligent generation and able to make the student pursue their goal, has been said in his research that education is hoped to be able to make the student achieve happiness for real and back to the natural character of a human being. The research conducted because the researcher observes based on the condition of the ongoing learning process. This is also being the reason why the researcher

conduct the research in beside the total of the students are and the interest of the society in choosing private school, especially on Muslim society as a place to pursue the education than public school which is better.

Learning is like the heart of the education process. Good learning will make an effective class that usually makes a good graduate. The planning of learning is one of goal to make a good result for education at school so that student can receive the subjects as it should be. The teacher as an educator and a person who gives knowledge toward the students should understand well about education policy. Besides that, the teacher also should understand that the teacher is not one of the sources of knowledge, although the duty, role, and function in the teaching-learning process are very important.

II. METHODS

The research used descriptive qualitative, state that qualitative research which resulted in descriptive words both orally and written from the source which is observed. The descriptive approach is research that aims at describing something which relates to the existing phenomenon and happens in the research process which is done.

Meanwhile, states that qualitative research is the analyzing of the pursuit the social life with the social picture which happens as performance interpretation. This research planning uses a case study plan. The descriptive case study generally uses to answer the problem which relates to the what, why, and how to question. So, the implementation of this research is to find out the role and function of the teacher in the class to increase the effectiveness of learning in schools. In the data collection use an intensive interview procedure with 2 interviewees (classroom teacher and Different school teacher), it is done to describe the role and function of the teacher in the learning process to run effectively. Moreover, the observation technique is also used to observe directly how the process of learning is and social interaction between stakeholders at school.

The researcher also uses a documentation study. Supporting document used as proof of data source is an ongoing learning process video. In the process of interview with classroom teacher grade 3 appear that there are many problems happened in doing the function of the teacher such as the existence of students as group special needs children, it happens because there only one teacher in the class which makes teacher confused in guiding the students who has two different characteristic between Special and the normal one. It is also being an obstacle of the teacher is doing their function as an instructor.

III. RESULTS

1. The Role of Teacher

The result of the research about the role and function of the teacher in the class to increase learning effectiveness in the teacher acts actively in the learning process. When the teaching- learning process is ongoing, the teacher plays a role in building the character of the students, teacher able to create the student's behavior and always make student to get used to sit down and not make a noise. Besides that, the teacher also able to

play a role as a parent at school. The teacher shows the togetherness between student and teacher and loves the student wholeheartedly. When there is conversation in the class, the teacher educates and guides them patiently. The teacher does not differentiate students.

In the teacher plays a role actively in the teaching-learning process as its role and functions. The teacher was very enthusiastic about increasing the activeness and courage of the students. After the teacher giving the subject material, the teacher will give some questions to the students and directly ask them to come forward and answer it.

2. The Function of Teacher

Based on the observation in the writer classifies that classroom teacher has done 11 its functions such as: (1) educator, has the responsibility by coming on time during teaching process; (2) teaching, teacher gives a brief explanation at the beginning of learning; (3) mentoring, teacher gives directive to students who less understand about the material; (4) advising, teacher gives advice toward the crowds students; (5) classroom administrator, teacher manages the students who make noise; (6) corrector, teacher gives a value from the learning's result of the student; (7) inspiratory, teacher gives guidance to the students in the teaching-learning process; (9) organization, teacher makes the rules of classroom to make the student disciplines; (9) motivator, teacher motivates the students by telling a success story; (10) facilitator, teacher gives reading book to the students to do the assignment; and (11) evaluator, teacher gives a reflection and additional assignment to be more confident.

In addition, teacher who is in the examination room also have done about 12 functions such as: (1) educator because teacher comes on time before students come; (2) teaching, teacher give an explanation before the examination is started; (3) advising, teacher gives an advice to the students who do not understand yet about the examination; (4) classroom administrator, teacher manages the class by concentrating worksheet in one of center computer; (5) corrector, teacher always give a value after doing examination; (6) information, teacher gives additional information about new knowledge; (7) organization, teacher makes the rules; (8) motivator, teacher act friendly to build up the student's learning desire; (9) initiator, teacher uses technology to make learning process easier; (10) facilitator, teacher gives a source of learning which is computer; (11) mediator, teacher uses IT media for learning process; (12) teacher is being an evaluator in the learning process. So, the teacher plays their role to run its functions that should be done by the teacher in the class and the learning process indirectly.

3. Effective Learning

The result which is gotten by observing shows that the learning process at school is ongoing effectively when there is no disability student both mentally and physically in the class. The observation which was held in resulted that there is one disability student that makes the learning process is not effective. There is a difficulty which is faced by the teacher here due to one disability student that makes the class so noisy.

Besides that, the observation result shows there are differences between the learning

process in the examination situation and the learning process as usual. The huge differences appear because the examination situation force students to be more focus and stay silent, the teacher also more relax in doing their functions as an educator and also as instruction because the class situation is conducive and effective. The sensitivity level of the students toward the instruction that is given by the teacher is also different. The technique of data analysis is used in this research is the analysis of field power, to powers support alteration.

DISCUSSION

The teacher has an important role in achieving the education goal because the teacher is the main role in applying for the learning process and education program in the school. In the teaching-learning process, the teacher has a duty and obligation to guide, motivate, and facilitate the students in studying. The teacher has a responsibility and right in managing the class. Whether good or not and conducive or not the class depends on the teacher on how they control or manage their class. In managing the class, the teacher has to be able to look at everything which happened in the class to help children's development process.

In other words, the teacher is as known as an educator. An educator is a person who can teach and able to help students in solving the problem that is faced. A teacher or educator is a person who tries to improve, help, and guide every potential of students. State that teachers' role in the studying process focus on: (1) educate children by giving guidance and motivation to achieve their both long term and short-term goals; (2) give facilitation, media, and good study experience; and (3) help in building students' characteristics such as attitude, behavior, and norms.

In applying the role of the teacher in the class always give guidance and motivation to create a conducive class. The teacher also plays a role as a facilitator by giving reading books to the students and help the student to be a better student by being polite to the teacher. So, in the teaching-learning process teacher is not only able to give and deliver knowledge but also able to improve development students' behavior. In the learning process, the effectiveness and efficiency of learning very depend on the teacher's role. In the education world, ideal teacher can be an: (1) innovator, the teacher is able to give developing of knowledge toward the students;

(2) transmitter who is able to be a bridging toward the students; (3) organizer, the teacher is able to create an educative process which is able to be responsible formally or informally.

According to generally the role of the teacher in managing the class are: (1) can push the students in developing each responsibility toward the surrounding;

(2) build up the students' understanding in order to understand and adapt the attitude with the class' rules;

(3) able to grow up students' feeling about their obligation to be active in the class. Meanwhile, there are some of the teacher's role in managing the class, those are (1) take care of class condition, (2) guide the intellectual and social of the students in the class, (3) can lead the learning process effectively and efficiently. In the some of the

teachers able to push students to develop their responsibility toward their surroundings such as students aware of keeping clean their school environment. The teacher is also able to lead and give guidance toward the students about the teaching-learning process in the class by doing opening before the class is begun.

The teacher does not only have an important role in the school but also has an important role in the family and society. The role of the teacher in the school, family, and society. In the school, the teacher has roles as a learning planner, learning manager and class, assessor of the students, learning guidance, and adviser of the students. Meanwhile, in the family, the teacher has a role as a family developer. In society, the teacher has roles as a social developer, social innovator, and social agent.

The teacher can do their role in organizing class by a guide and advise the intellectual and social process of the students, the teacher is also able to create the responsibility of the student to do their obligation as the rules and activity in the class. It relates to that have stated in detail about teaching strategies that aim at building the class' norms in reciprocity. Another opinion comes from which declare about teacher's strategies in managing the class is the teacher who makes cooperative situation among the students which have appeared spontaneously as prototypical case and start the discussion all the obligation class and students' wishes. Teacher as control holder in the class has the important functions and duties which are as follows: (1) educator, teacher is educator who is becoming character, research, and identification for the students and its surrounding; (2) instructor means a person who give a guideline in order to make other know about a knowledge or advice; (3) advisor in this case able to be called as an activity in guiding students in their development clearly by giving step and direction which relate to education goal; (4) trainer, education and learning process needs skills training both intellectually so demand on the teacher to do as a trainer; (5) teacher is an consultant for the students; (6) class manager, teacher as the class manager should be able to organize the class well; (7) demonstrator, teacher have to try help student in understanding by demonstrate what teacher taught; (8) teacher as corrector have to differentiate between good and bad values; (9) teacher as inspirator have to be able to give good inspiration for students' improvement; (10) as informant, teacher have to be able to give information the development of knowledge and technology beside some of lesson material for every lesson that is programmed in the curriculum; (11) organizer, teacher also have to play their role as part of school organization who also has the main duty and function to organize academic activity, arrange the school's rules, arrange the academic calendar, etc.; (12) motivator, teacher should be able to motivate the student to be more spirit and active in studying; (13) initiator, teacher should initiate some improvement ideas in education world; (14) as facilitator, teacher should try in providing source of knowledge which support in achieving the goal and learning process; (15) innovator, teacher is a source of idea; (16) as mediator, teacher have to has knowledge and good understanding about education world; and (17) teacher is demanded to be an good and honest evaluator by giving a score in the aspect of attitude and test of the students.

Based on the observation most of the teacher uses some of the functions that have

been explained above but not every function is done by them due to the differences of attitude among the teachers. Based on observation and interview on to difference teachers, the researcher found that they applied 11 to 12 functions of the teacher in the class which is used to be done by the teacher there. On the other hand, 3 teachers that have been interviewed said that being a teacher is one of their pride due to able to give a good example of the students and give an understanding to the students about the lesson. The teacher does not only play a role in the school but also reputed as a teacher outside of the school.

Those are based on ever taught, three words which include understand, feel, and do, remind about every lesson, life goal that we believe is needed an understanding, awareness, and sincerity in doing it. Know and understand is not enough if they do not feel, aware, and there is no meaning if they do not do and strive for it. Just like knowledge without good deed like a tree with no fruit. The teacher based on three main duties, those are professional duty, human being duty, and social duty. Professional duties from the teacher are continuing knowledge, skills, and other values that should be known by the students.

Besides the function of the teacher the teacher is also doing their function in the learning process, those are instructional function, educational function, and managerial function. Instructional function relates to the role of the teacher as an educator that educates their students to have the strong characteristic. Meanwhile, managerial function relates to the role of the teacher as a class manager that is managing class administration to support the learning process.

Teacher is also doing 12 functions of the teacher in the class during the examination which relate to the theory by which explains about 17 functions and teacher's duties which very important. The teacher here has shown 12 functions of the teacher by applying it in the class. It is not only applied in the learning process but also in the examination period. Although all functions cannot be applied altogether the teacher tries to habituate the students to make a good learning process. The example is after using learning media, they have to keep them in its place to make it look good, so this habitable to be applied by the students. The function of the teacher as an educator, advisor, and instructor can be used.

States that effective learning able to be materialized by doing some steps as follows: (1) decide the class' rules (class routine) the teacher has to apply the teacher's functions which relates to the class condition. The teacher may not blame or hate the student because of the students' bad habits. In this case, the teacher can create the new habits of the student by giving the rules in the learning process especially in the first meeting; (2) Start the activity on time. In this case, the teacher has to be responsible because of their profession as a teacher. which make teacher have to keep their good attitude and behavior in front of the students. If the teacher often comes late in starting the learning process, so the learning process will not run effectively; (3) managing the lesson to make effective learning so the teacher has to manage and keep the teaching-learning process. The teacher also has to play the role as class organizer; (4) grouping the student when the teacher plays the role as educator and instructor, the teacher also have to understand about students' characteristic if needed the students have to make a group

so that they can work together and able to manage themselves to socialize with their friends; (5) ending the lesson, in the end of the lesson, students are hoped to give feedback toward the material have been taught by the teacher, so that the teacher has to do the function as reflector and corrector for the students.

Based on the theory that has been explained above, has done the steps that should be done to create the learning process effectively. Unfortunately, there is a problem while doing those steps, that is grouping student, in this step teacher has difficulty when grouping the students to make them work as a team because it is applied in and also there is 1 disability student who is different from others who are very active. It blocks the teacher because this student is very hard to be controlled and often disturbs his friends.

In this case, the teacher has to play double roles because the teacher has to look after the different students. To make it easier, the school should prepare the shadow teacher to make the learning process more effective. Unfortunately, based on the observation the school did not prepare the shadow teacher yet to solve this problem, but the teacher only asks for help toward the helping teacher or other class' teacher to join in looking after the different students.

IV. CONCLUSION

The role of the teacher in the teaching-learning process in the class is one of the success benchmarks or the effectiveness of learning for the students. It can be proved by the result of group observation where the role of the teacher as a learning controller conductively to make the teaching-learning process effective and easy to be understood by the students. There are some of the students' characteristics that should be controlled by the teacher as a controller in the class. in this school found one disability student who should be solved by the teacher to make an effective situation in the learning process and able to be understood by all the students.

The role of the teacher in the teaching-learning process in the class can be related to some of the teacher's functions. This function can be proved by the result of the observation. The group finds out some functions in the 2 different classes, a class teacher can uses 12 functions that relate to the theory. The function is from the educator to the motivator.

The effective learning able to be happened by doing some steps as follows: (1) decide the class rules; (2) start the learning process on time; (3) organize the lesson; (4) grouping the students; and (5) end the lesson. Based on the comparison between the theory and the observation there are some problems because of grouping students which consist of one disability student and the school did not have a shadow teacher to solve the problem.

REFERENCE

- [1] Sudaryono. 2017. *Methodology Penelitian*. Depok: Raja Grafindo Persada.
- [2] Ulfatin, N. 2013. *Metode Penelitian Kualitatif di Bidang Pendidikan*. Malang:

Bayumedia Publishing.

- [3] Mulyasa, E. M. 2005. *Menjadi Guru, Menciptakan Pelajaran Kreatif dan Menyenangkan*. Bandung: Remaja Rosdakarya.
- [4] Abrashy, A. A. 1970. *Dasar-dasar Pokok Pendidikan Islam*. Jakarta: Bulan Bintang.
- [5] Ahmadi, A., and Supriyono, W. 2004. *Psikologi Belajar*. Jakarta: Rineka Cipta.
- [6] Syamsuddin, M. A. 2003. *Psikologi Pendidikan*. Bandung: Remaja Rosda Karya.
- [7] Nurabadi, A. 2016. *Manajemen Kelas Berbasis Peserta Didik*. Malang: Universitas Negeri Malang.
- [8] Surya, M. 1997. *Psikologi Pembelajaran dan Pengajaran*. Bandung: PPB-IKIP Bandung.
- [9] Yamaji, A. 2016. Teacher Discourse Supporting Peer Collaboration in Mathematics. *International Journal for Lesson and Learning Studies*, 5(3), 255-270.
- [10] Wardani, K. 2010. *Peran Guru dalam Pendidikan Karakter menurut Konsep Pendidikan Ki Hajar Dewantara*. Proceedings of the 4th International Conference on Teacher Education, Bandung, Universitas Pendidikan Indonesia.
- [11] Rahmaniar, F. A. 2016. *Tugas Guru Pendamping Khusus (GPK) dalam Memberikan Pelayanan Pendidikan Siswa Berkebutuhan Khusus di Sekolah Inklusif SD Negeri Giwangan Jogjakarta*. Research report. Yogyakarta: Universitas Negeri Yogyakarta.

Sir Jagadish Chandra Bose: Pioneering Contributions to Radio Waves and Wireless Communication

Pravin R. Bagade*, Dr. Milind S. Patil, Namdev P. Mote, Dr. Poonam S. Jadhav, Dr. Chandrakant B. Patil

Department of Electronics, Vivekanand College, (Autonomous) Kolhapur, Maharashtra, India

* Correspondence:pravinbagade333@gmail.com

Abstract:

Sir Jagadish Chandra Bose demonstrated the electromagnetic wave capabilities with generation, transmission and reception of electromagnetic waves at 60 GHz frequency in Calcutta, India about 130 years back during 1890s. He developed delicate and precise equipment's such self-recovering coherer detector, spark transmitter, rectangular waveguide, horn antenna and microwave absorber in India more than 130 years ago when there were no modern laboratory facilities available anywhere in the world. Highlighting the contributions of Sir J. C. Bose in Microwaves, millimetre waves, and their contemporary applications in wireless application is very significant work. The purpose of this article is to present scientific contribution of J.C. Bose in the field of wireless communication.

Keyword: Electromagnetic wave, Semiconductor diode detector, millimetre wave.

1. Introduction

The history of Wireless Communications explicitly involves experimentation, observation, understanding and formulating equations on magnetic and electric phenomena of electromagnetic signals. Scientists worldwide contributed to pioneering advancements, shaping the evolution of wireless technology from its inception [1]. In the year 1864, Scottish scientist James Clerk Maxwell (1831–1879) presented his “Dynamical Theory of the Electromagnetic Field”, wherein he gives only theoretical observed that electromagnetic wave moves at the speed of light in free space. He suggested light as a transverse electromagnetic wave. While Maxwell's equations hinted the idea of electromagnetic waves and he focused mostly on light and didn't explore their generation through electrical or magnetic means [2]. In 1888, Heinrich Hertz (1857–1894) validated Maxwell's theory by generating, radiating, and receiving electromagnetic waves at 60 cm wavelength along free space. Hertz's experiments not only confirmed Maxwell's electromagnetic theory, but also initiated the discipline of microwaves communication technology [3] .

2. Sir J.C. Bose Research on millimetre wave

The millimeter-wave (mmWave) frequency spectrum in telecommunications ranges 30-300 GHz, which correlating with 10-1 mm wavelengths [4]. J.C. Bose developed the World's first wireless communication link remote control at 5-millimeter wavelength (at 60 GHz) during the last 3 years of 1894. In 1895, he demonstrates the experiment on

electromagnetic waves by ringing a bell remotely and to explode some gunpowder at Calcutta in front of the Lt. Governor Sir Wdham Mackenzie. With invitation of Prof. Lord Rayleigh in 1897, he delivered the public lecture with demonstration of to the Royal Institution in London. For this work, he used spark generator, waveguides, horn antennas, dielectric lenses, polarizers, and a Galena detector up to 60 GHz for diverse applications in high-frequency technology. He used circular waveguide, pyramidal electromagnetic horn antenna, and used semiconductor diode device first time [5] [6].

3. Sir J.C. Bose Research on Semiconductor Device

On December 12, 1901, G. Marconi achieved a revolutionary transatlantic wireless communication experiment at Signal Hill, St. John's, Newfoundland. He send the signal of successive Morse code letter "S" from Cornwall in England to new Foundland across the Atlantic Ocean using a temporary makeshift receiving system consisting of a wire antenna flown 400 ft. In this communication, he used a new "mercury coherer" detector in series with a telephone headset. This revolutionary diode detector device was invented by Sir J. C. Bose in the April 27, 1899, Royal Society meeting, London [7]. Sir J.C. Bose developed Galena (lead sulphide, PbS) crystal detector for microwave, the first semiconductor device, for which he applied US patent "Detector for electrical disturbances" in 1901 and sanctioned in 1904. He used it to detect microwaves (range 12-60 GHz) generated by a spark transmitter from his first historic experiments with millimetre waves. This was semiconductor diode detector. Up to this time the terminologies such as "diode" and "semiconductor" were unknown. Later this detector was used as a receiver for demodulation of continuous wave radio signals. In 1954, W.H. Brattain (co-inventor of the transistor and Nobel Prize in Physics 1956) and G.L Pearson gave priority to J.C Bose for the use of a semiconducting crystal as a detector of radio waves [8] . Also, Neville F. Mott, Physics Nobel Laureate in 1977 for his contribution in the electronic structure of magnetic and disordered systems remarked that "J.C. Bose was at least 60 years ahead of his time" and "In fact, he had anticipated the existence of P-type and N-type semiconductors" [5] .

4. Impact of Sir J.C. Bose's on Modern Electronics Communication

In 1895, Pioneering physicist J. C. Bose laid the groundwork for mmWave technology by publicly demonstrating wireless signalling at 60 GHz. His innovations included the use of early versions of microwave components like horn antennas and detectors [4]. Millimeter wave (mmWave) communications in mobile networks especially for 5G and beyond has attracted significant research attention, since the huge available bandwidth holds promise for achieving multiple Gbps rates per user. Recently, intensive research focuses on mmWave wireless local area networks (WLAN) technology, particularly Wi-Fi (IEEE 802.11ad) operating at 60 GHz. In May 2013, Samsung achieved 1 Gbps data transmission at 28 GHz. Google also put substantial research efforts to explored mmWave technology for faster communication [9].

5. Conclusion

Sir J.C. Bose's pioneering work in radio waves marked a breakthrough in microwave devices and wireless communication, shaping the foundation of modern technology. J.C. Bose significantly contributed in millimetre-wave technology, creating spark transmitter, coherer, polarizer, dielectric lens and horn antenna components for groundbreaking advancements. Bose developed a Galena-based solid-state detector for highly sensitive millimetre waves and infrared waves, which will be pioneering work on wave detection technology. This was the first semiconductor device and first patent on semiconductor device. Bose's notable contributions in this field were recognized by eminent figures like Neville F. Mott, W.H. Brattain and Lord Rayleigh, highlighting his distinction.

References:

- [1] Magdalena Salazar-Palma, *2010 Second IEEE Region 8 Conference on the History of Telecommunications*.
- [2] D. L. Sengupta' and T. K. Sarka, "Maxwell, Hertz, the axwellians, and the Early History of Electromagnetic Waves."
- [3] T. K. Sarkari, D. L. Sengupta, "An Appreciation of J. C. Bose's Pioneering Work in Millimeter Waves." *IEEE Antennas and Propagation Magazine*, Vol. 39, No. 5, October 1997.
- [4] Y. P. Zhang and D. Liu, "Antenna-on-chip and antenna-in-package solutions to highly integrated millimeter-wave devices for wireless communications," *IEEE Trans. Antennas Propag.*, vol. 57, no. 10 PART 1, pp. 2830–2841, 2009, doi: 10.1109/TAP.2009.2029295.
- [5] D. T. Emerson, *The work of Jagadis Chandra Bose: 100 years of mm-wave research 1997 IEEE MTT-S International Microwave Symposium Digest*. IEEE, 1997.
- [6] A. K. Sen "Sir J.C. Bose and millimeter waves," *Phys. Today*, vol. 51, no. 6, pp. 63–64, 1998, doi: 10.1063/1.882260.
- [7] P. K. Bondyopadhyay, "Sir J. C. Bose's Diode Detector Received Marconi's First Transatlantic Wireless Signal of December 1901 (The 'Italian Navy Coherer' Scandal Revisited)," 1998.
- [8] J. C. BOSE, "US755840-Detector for electrical disturbances."
- [9] M. Xiao *et al.*, "Millimeter Wave Communications for Future Mobile Networks," *IEEE Journal on Selected Areas in Communications*, vol. 35, no. 9. Institute of Electrical and Electronics Engineers Inc., pp. 1909–1935, Sep. 01, 2017. doi: 10.1109/JSAC.2017.2719924.

Enzymatic study of gut micro flora of *Eudrilus euginae* used for solid waste management of sugar industry.

Ms. S. V. Sarnaik¹ and Mrs. G. V. Utekar²

1 Department of Biotechnology, Vivekanand Collage, Kolhapur (Autonomous)

2 Department of Microbiology, Yashwantrao Chavan Institute of Science, Satara

Abstract

The sugar industry in India, the world's second-largest producer after Brazil, is vital for rural development and contributes significantly to the nation's economy. With 453 mills producing around 3000 million tonnes of waste annually, including bagasse and press mud, environmental and health concerns arise from disposal methods like ocean dumping and incineration.

To address these issues, vermicomposting is proposed as an eco-friendly solution. This process, involving earthworms and microorganisms, converts organic waste into nutrient-rich vermicompost. *Eudrilus euginae*, known for its high growth rate and prolific feeding, is selected for its efficiency in producing biomass.

The enzymatic activities of *E. euginae*, including amylase, cellulase, nitrate reductase, xylanase, and caseinase, play a crucial role in organic matter decomposition. Vermicomposting offers a sustainable approach to waste management, producing valuable organic fertilizers and mitigating environmental concerns associated with traditional disposal methods.

Introduction

Sugar industry in India plays vital role in the development of rural areas. Sugar industries development is backbone to economic development of the nation (G.V.Utekar, 2011). Indian tradition also supports that the sugar and sugarcane is originally origin in India. In India, sugar industry is second largest agro-based industry and it contributes significantly to the socio economic development of the nation. Indian sugar industry is also a major sector to create employment probably 7.5% in Indian economy.

Vermicomposting offers a solution to organic waste that are incinerated or dumped in ecofriendly manner. Vermicomposting is now widely accepted for solid waste managent [Manyuchi *et.al*]. Vermicomposting is a decomposition process involving the combine action of earthworm and microorganism [G.V.Utekar].

During this process there is bioconversion of organic wastes into a biofertilizers. Vermicompost have nutrient in such forms that are readily available for plant uptake. For the biological stabilization of solid organic waste vermicomposting is best known process. Mesophilic bacteria and fungi are predominant in vermicomposting .

Earthworms are the most important invertebrates of the soil ecosystem in terms of biomass and activity [Rombke *et.al*, 2005] and are considered as engineers of ecosystem [Lavelle, 1998]. Earthworms are known as key organisms in organic matter decomposition, modifying soil structure, soil texture, soil nutrients [G.V.Utekar]. Earthworms are invertebrates belonging to the phylum Annelida and Oligochaeta.

Gut of the earthworm is an effective bioreactor that maintains constant temperature through temperature regulatory mechanism, hence increasing rate of bioprocess. This also prevents enzyme inactivation caused by rise in temperature.

Amylase is an extracellular enzyme which act on starch and decompose it to glucose. Amylase present in the saliva of humans where it begins chemical process of digestion. The pancreas and salivary glands make amylase to hydrolyse dietary starch into di and trisaccharides. All amylases are glycosidic hydrolyses and act on α -1, 4-glycosidic bonds. There are three types of amylases: α -amylase, β -amylase, γ -amylase. α - amylases breakdown long chain saccharides α -amylase act faster than β -amylase. α - amylases are also found in plants, fungi and bacteria β -amylase hydrolyse the second α -1, 4-glycosidic bond.

Cellulase is used for commercial food processing in coffee. They are widely used in textile industry and in laundry detergents. Cellulases are also used in paper and pulp industry, and even in pharmaceutical applications .Xylanase is any of a class of enzymes that degrade the linear polysaccharides xylan into xylose. That is the breakdown of hemicelluloses. This enzyme plays important role in degradation of complex plant matter into usable nutrients. Xylanase are produced by fungi, bacteria, yeast, protozoa. Xylanases are used in paper and pulp industry for bleaching of wood pulp. They are also used as food additives to poultry and in wheat flour for improving quality of product.

Materials and Methods-

Earthworm Collection:

- Eudrilus eugeniae collected from a vermicomposting unit in Ajinkya Krushi Seva Padali, Dist. Satara.

Earthworm Culture:

- Mass culture in pots with urine-free cow dung from a local cattle shed.

Raw Material Collection:

- Bagasse and press mud from Kisan Veer Sahakari Sugar Factory Pvt. Ltd. Bhuij, Dist. Satara, chopped and stored for 15 days.

Pre-composting:

- Shade-dried sample blended, mixed with cow dung and urine, and kept for three weeks.

Vermi Bed Preparation:

- Beds with 1:1:1 ratio of pre-decomposed cow dung, bagasse, and press mud. Moisture adjusted to 60-70%. Introduced *Eudrilus eugeniae*.

Specimen Collection:

- Earthworms from vermi beds washed, placed in sterile petriplates for 24hrs, cleaned externally with 75% ethanol, and dissected.

Dissection:

- Longitudinal incision, separation into foregut, midgut, and hindgut. Sections washed in sterile distilled water.

Isolation of Microorganisms:

Midgut contents suspended, serially diluted up to 10^{-5} . Dilutions plated on Nutrient agar, Actinomycetes isolation agar, and Sabouraud Dextrose Agar for bacteria, actinomycetes, and fungi isolation. Plates incubated at room temperature for 24hrs. Enumeration conducted at regular intervals up to 60 days.

Isolated Strains:

- a) EMG 12
- b) EMG 7a
- c) EMG 4b
- d) EMG 3a
- e) EMG 7c
- f) EMG 11
- g) EMG 5

Screening and Enzymatic Assays for Gut Flora of Earthworms:**Amylase Production:**

- Strains EMG 4b, EMG 3a, and EMG 12 showed growth on 1% starch medium.
- Enzymatic assays revealed highest amylase activity in EMG 4b (0.13 mg/ml/min).

Cellulase Production:

- EMG 7c and EMG 11 displayed growth on CMC medium.
- EMG 7c exhibited cellulase activity (0.012 mg/ml/min).

Xylanase Production:

- EMG 4b, EMG 3a, and EMG 12 grew on minimal medium +1% xylan.
- EMG 3a demonstrated highest xylanase activity (0.21 mg/ml/min).

Nitrate Reductase Production:

- Six strains (EMG 4b, EMG 3a, EMG 7a, EMG 7c, EMG 11, EMG 12) showed growth on minimal medium +1% KNO₃.
- EMG 3a exhibited the highest nitrate reductase activity (0.11 mg/ml/min).

Caseinase Production:

- EMG 4b, EMG 3a, EMG 5, EMG 7c, EMG 11, and EMG 12 grew on milk agar. EMG 5 displayed the highest caseinase activity (1.40 O.D at 510 nm).

Assay for enzyme activity

Enzymatic assays were conducted on strains of organisms isolated from earthworm gut flora. Protocols for amylase, cellulase, xylanase, nitrate reductase, and caseinase were followed. Results were measured at specific wavelengths, and the data were presented in tables and graphs, showing enzyme activities of different strains. The comparative analysis graph highlights the highest enzyme activities across the studied enzymes.

Test result:-

Table No. -3.1 Qualitative enzymatic assay

Sr No.	Test	EMG 7a	EMG 4b	MG 5	EMG 7c	EMG 3a	MG 12	MG 11
1	Amylase	-	+	-	-	+	+	-
2	CMC	-	-	-	+	-	-	+
3	Xylanase	-	+	-	-	+	+	-
4	Nitrate reductase	+	+	-	+	+	+	+
5	Caseinas e	-	+	+	+	+	+	+

Protocol for enzymatic assay

Table No. –3.2 Standard protocol for enzymatic assay

Sr. No.		Substrate (in ml)	Distilled water (in ml)	Enzyme (in ml)		DNSA (in ml)		O.D
1	Enzyme control	1 ml	2 ml	-	Incu bate the tube	1 ml	Sub strate for	
2	Substrate control	-	2 ml	1 ml	or 10 min	1 ml	mi n in	
3	Reaction mixture	2 ml	-	1 ml	At 37° C	1 ml	Boi ling wa ter	
4	DNSA control	-	3 ml	-		1 ml	bat h	

STANDARD FOR AMYLASE, XYLANASE, CMC, GLUCOSE

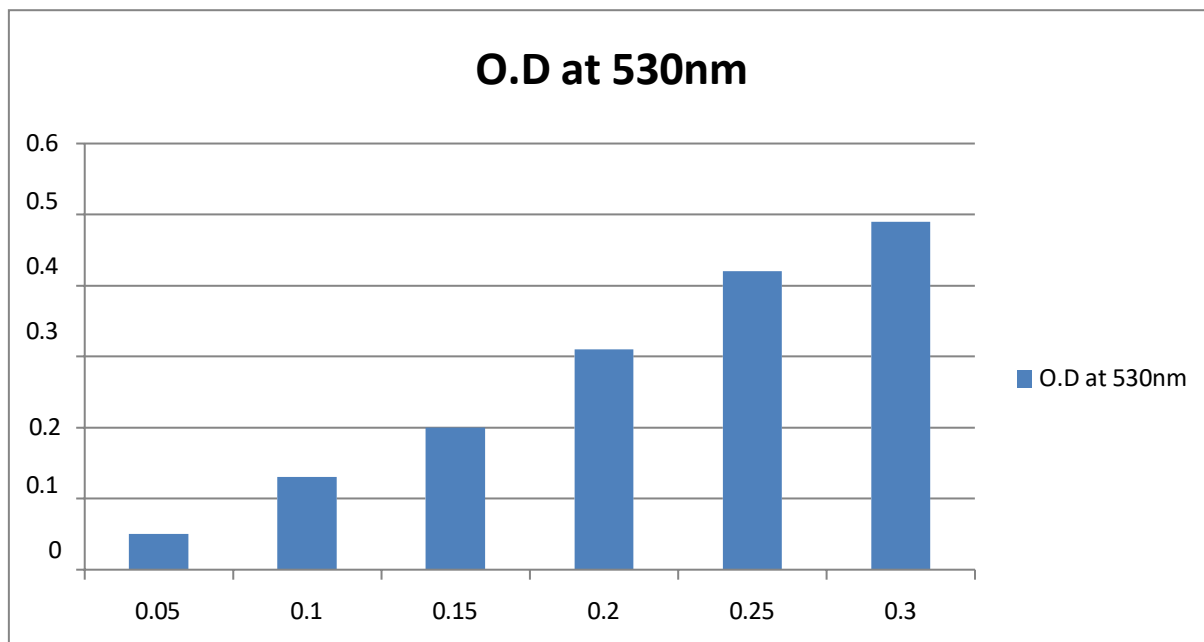
Table No. –3.3 Glucose standard

Sr. No.	Glucose concentration Mg/ml	Glucose solution (in ml)	Distilled water (in ml)	DNSA (in ml)		O.D at 530 nm
1	0.05	0.1	0.9	1	Keep	0.05
2	0.10	0.2	0.8	1	In	0.13
3	0.15	0.3	0.7	1	Boiling	0.20
4	0.20	0.4	0.6	1	Water	0.31

5	0.25	0.5	0.5	1	Bath	0.42
6	0.30	0.6	0.4	1	For	0.49
7	Blank	-	1	1	10 min	-

Standard concentration-0.5mg/ml

Graph No. – 3.1 Glucose standard



NITRATE STANDARD

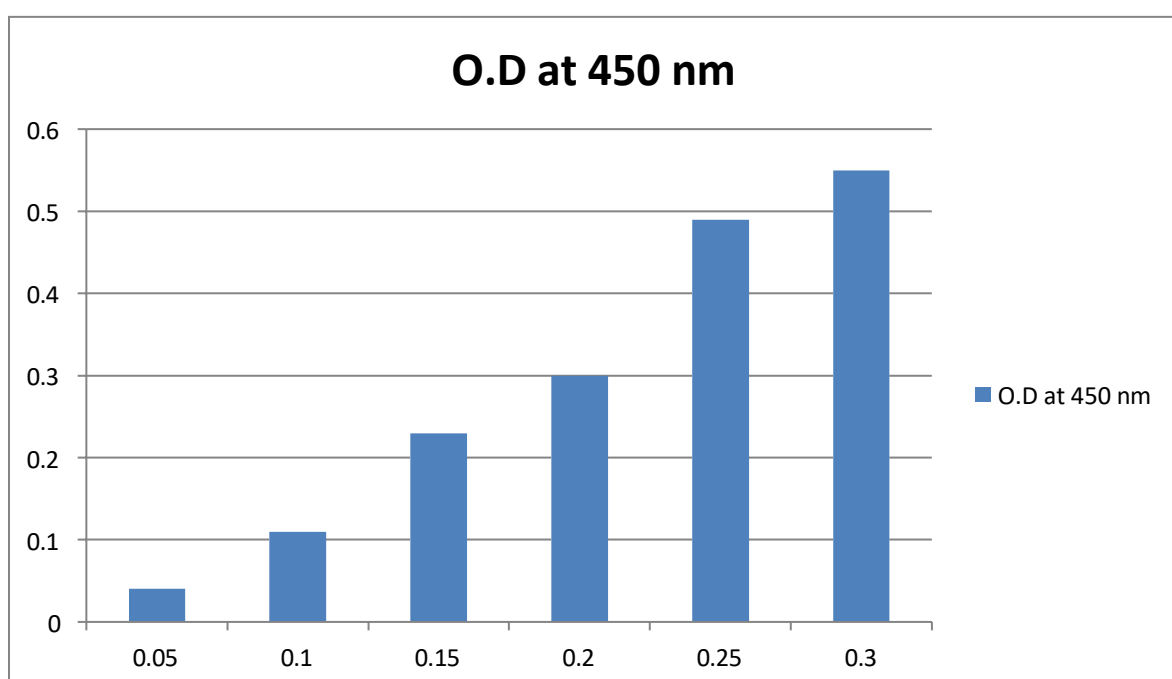
Reagent A- 1% sulphanilamide in 3N HCL Reagent B- 0.02% α naphthol

Table No. –3.4 Nitrate Standard

Sr. No.	KNO ₃ concentration Mg/ml	KNO ₃ solution (in ml)	Distilled water (in ml)	Reagent A and reagent B (in ml)		O.D at 450
1	0.05	0.1	0.9	1	Keep	0.04
2	0.10	0.2	0.8	1	In	0.11

3	0.15	0.3	0.7	1	Boiling	0.23
4	0.20	0.4	0.6	1	Water	0.30
5	0.25	0.5	0.5	1	Bath	0.49
6	0.30	0.6	0.4	1	For	0.55
7	Blank	-	1	1	10 min	-

Graph No. – 3.2 for Nitrate Standard

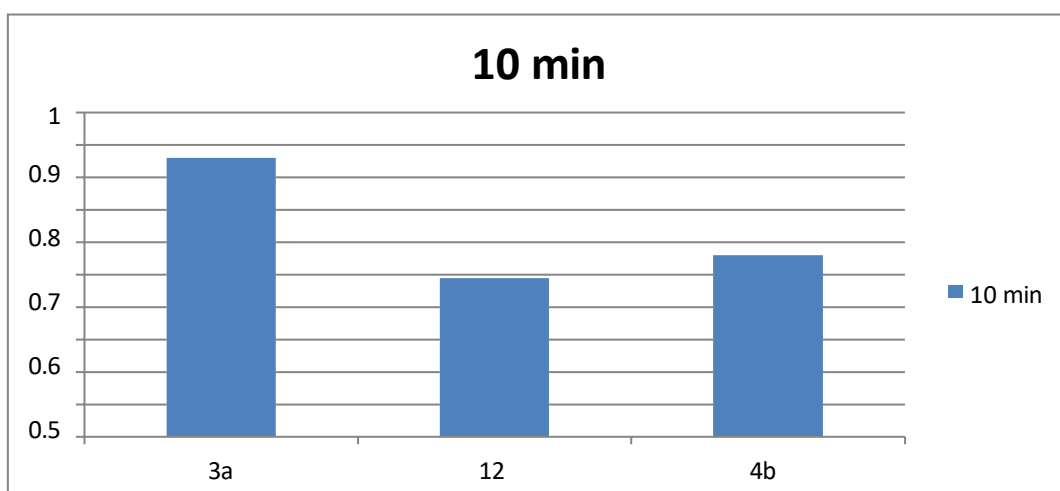


For amylase activity-

Out of 7 strains of organisms, 3 strains shown growth on 1% starch medium. These 3 strains were EMG 4b, EMG 3a and EMG 12. These strains were further taken for enzymatic activity. Its mass culturing was done by inoculating them in 100 ml of 1% starch broth. The enzyme source was obtained as supernatant on centrifuging the culture broth at 5000 rpm for 15 min. To this supernatant equal amount of substrate (1% starch) was added and incubated at 37°C for 10 minutes. 1ml DNSA reagent was added to the above tube. And was kept in boiling water bath for 10 minutes. It was then cooled to room temperature. The absorbance was measured at 520 nm using colorimeter.

Table No. – 3.5 Quantitative Enzyme Assay of Amylase

Sr. No.	Organism	Enzyme control (EC)		Substrate control (SC)		Reaction mixture (RM)	
		10 min	30 min	10 min	30 min	10 min	30 min
1	4b	0.16	0.13	0.06	0.10	0.78	0.68
2	12	0.09	0.10	0.052	0.62	1.10	1.16
3	3a	0.04	0.05	0.063	0.74	1.53	1.40



Graph No. – 3.3 Amylase assay

For amylase enzyme activity of organism at 520 nm for 10 min

For cellulase activity-

Out of 7 strains of organisms 2 strains shown growth on CMC medium. These 2 strains were EMG 7c and EMG 11. These strains were further taken for enzymatic activity. Its mass culturing was done by inoculating them in 100 ml of CMC broth. The enzyme source was obtained as supernatant on centrifuging the culture broth at 5000 rpm for 15 min. To this supernatant equal amount of substrate (CMC) was added and incubated at 37°C for 10 minutes. 1ml DNSA reagent was added to the above tube and was kept in boiling water bath for 10 minutes. It was then cooled to room temperature. This was done to stop the reaction. The absorbance was measured at 520 nm using colorimeter.

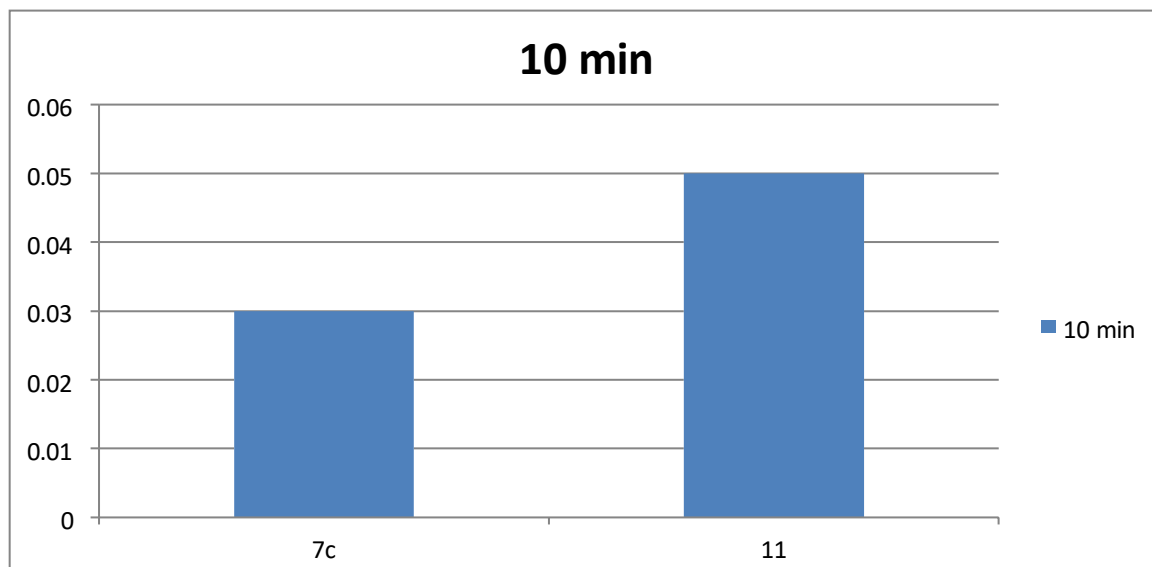
Enzymatic assay of Cellulase

Table No. – 3.6 Quantitative Enzyme Assay of Cellulase

S r . N o .	Organ ism	Enzyme control(EC)		Substrate control(SC)		Reaction mixture(RM)	
		10 min	30 min	10 min	30 min	10 min	30 min
1	7c	0.08	0.09	0.10	0.11	0.21	0.2 4
2	11	0.11	0.02	0.09	0.06	0.25	0.3 1

For cellulose enzyme activity of organism at 520 nm for 10 min

Graph No. – 3.4 assay of Cellulase

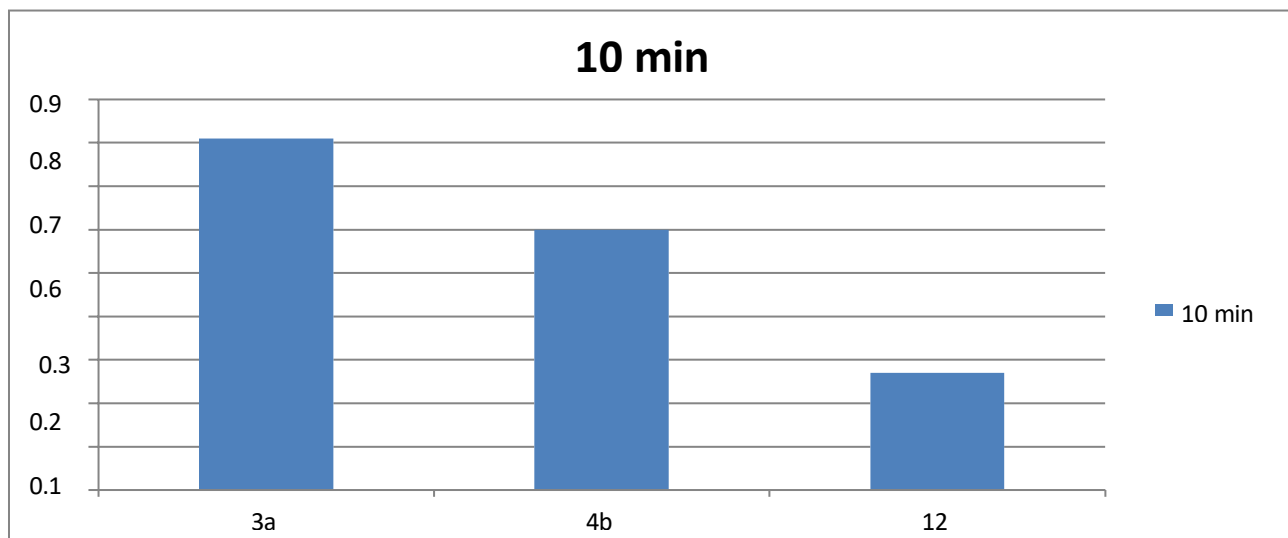


For xylanase activity-

Out of 7 strains of organisms 3 strains shown growth on minimal+1% xylan medium. These 3 strains were EMG 4b, EMG 3a and EMG12. These strains were further taken for enzymatic activity. Its mass culturing was done by inoculating them in 100 ml of 1% xylan broth. The enzyme source was obtained as supernatant on centrifuging the culture broth at 5000 rpm for 15 min. To this supernatant equal amount of substrate (1% xylan) was added and incubated at 37°C for 10 minutes. 1ml DNSA reagent was added to the above tube and was kept in boiling water bath for 10 minutes. It was then cooled to room temperature. This was done to stop the reaction. The absorbance was measured at 520 nm using colorimeter.

Table No. – 3.7 Quantitative Enzyme Assay of Xylanase

S r. N o.	Orga nism	Enzyme control (EC)		Substrate control (SC)		Reaction mixture (RM)	
		10 min	30 min	10 min	30 min	10 min	30 min
1	3a	0.06	0.06	0.30	0.50	1.17	1.12
2	4b	0.03	0.09	0.99	0.94	1.62	1.32
3	12	0.03	0.07	0.65	0.61	0.95	0.96



Graph No. – 3.5 assay of xylanase

For nitrate reductase activity-

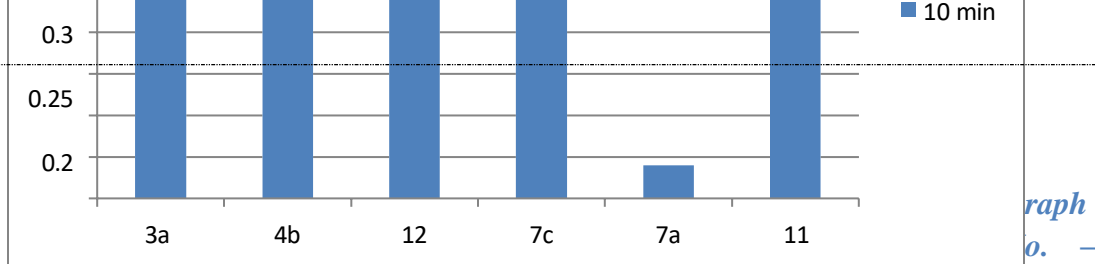
Out of 7 strains of organisms 6 strains shown growth on minimal+1%KNO₃ medium. These 6 strains were EMG 4b, EMG 3a, EMG7a, EMG7c, EMG11 and EMG12. These strains were further taken for enzymatic activity. Its mass culturing was done by inoculating them in 100 ml of 1% KNO₃ broth. The enzyme source was obtained as supernatant on centrifuging the culture broth at 5000 rpm for 15 min. To this supernatant equal amount of substrate (1% KNO₃) was added and incubated at 37°C for 10 minutes. α-naphthol reagent was added to the above tube and was kept in boiling water bath for 10 minutes. It was then cooled to room temperature. This was done to stop the reaction. The absorbance was measured at 450 nm using colorimeter.

4	7c	0.08
5	7a	0.10
6	11	0.07

Graph No. – 3.6 assay of nitrate reductase

Table No. – 3.8 Quantitative Enzyme Assay of nitrate reductase

S r. N o.	Org anis m	Enzyme control(EC)		Substrate control(SC)		Reaction mixture(RM)	
		10 min	30 min	10 min	30 min	10 min	30 min
1	3a	0.07	0.04	1.14	1.00	1.63	1.83
2	4b	0.04	0.06	1.02	1.03	1.51	1.50
3	12	0.06	0.02	1.13	1.04	1.59	1.48



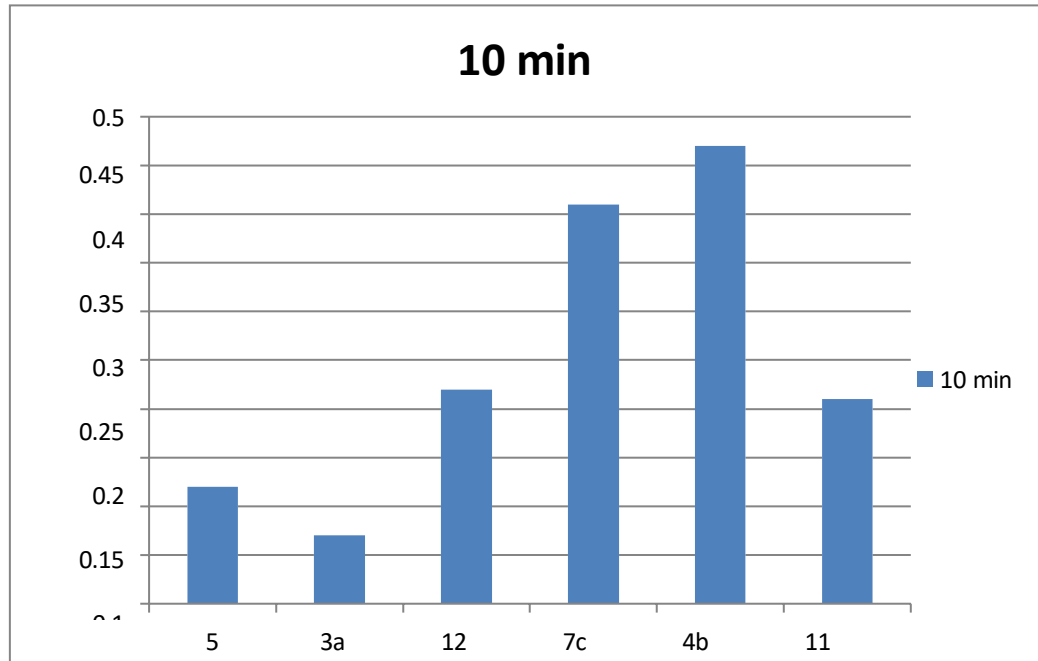
Graph
o. –
3.7
Assay
of
Casein
ase

For caseinase activity-

Out of 7 strains of organisms 6 strains shown growth on milk agar medium. These 6 strains were EMG 4b, EMG 3a, EMG 5, EMG 7c, EMG 11 and EMG 12. These strains were further taken for enzymatic activity. Its mass culturing was done by inoculating them in 100 ml of milk broth. The enzyme source was obtained as supernatant on centrifuging the culture broth at 5000 rpm for 15 min. To this supernatant equal amount of substrate (1% casein) was added and incubated at 37°C for 10 minutes. Follin reagent was added to the above tube and was kept in boiling water bath for 10 minutes. It was then cooled to room temperature. This was done to stop the reaction. The absorbance was measured at 510 nm using colorimeter.

Table No. – 3.9 Quantitative Enzyme Assay of caseinase

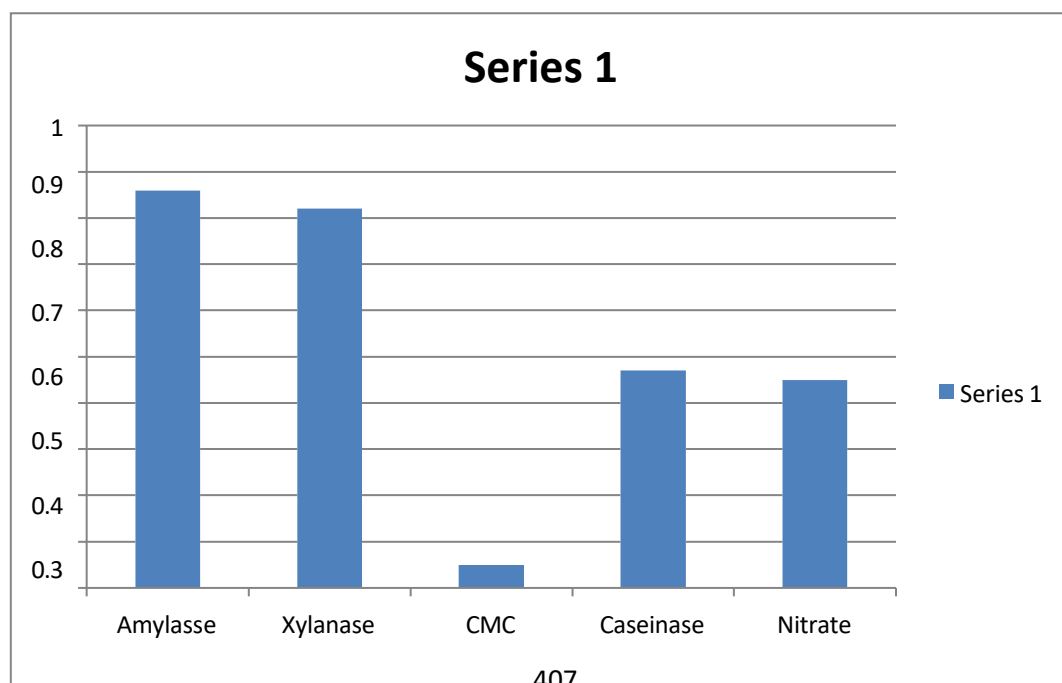
Sr. No.	Organism	Enzyme control(EC)		Substrate control(SC)		Reaction mixture(RM)	
		10 min	30 min	10 min	30 min	10 min	30 min
1	5	0.40	0.60	0.55	0.61	1.07	1.40
2	3a	0.70	0.59	0.81	0.50	1.58	1.50
3	12	0.30	0.49	0.45	0.60	0.97	1.38
4	7c	0.44	0.35	0.70	0.75	1.55	1.20
5	4b	0.55	0.51	0.59	0.43	1.61	1.21
6	11	0.19	0.18	0.50	0.55	0.90	0.99



Comparative analysis of highest enzyme activities of gut flora of earthworm

Graph No. -3.8 Comparative graph of all enzymes

Result



& Discussion

For amylase

Starch agar plates were spot inoculated with different strains isolate from gut of earthworm species. These plates were incubated for 24 hours at 37° c. After incubation, iodine reagent was added on plate and possible formation of zone was observed.

Photograph No. –4.2 Qualitative test and Analytical data for Amylase



S r. n o.	Organism	Final O.D for amylase	
		10 min.	30 min.
1	EMG 4b	0.56	0.45
2	EMG 12	0.49	0.44
3	EMG 3a	0.86	0.61

For cellulose

CMC plates were spot inoculated with different strains isolate from gut of earthworm species. These plates were incubated for 24 hours at 37° c. After incubation, 1% congo red reagent was added on plate and possible formation of zone was observed.

Photograph No. –4.3 Qualitative test and Analytical data for Cellulase



Sr. no.	Organism	Final O.D for cellulase	
		10 min.	30 min.
1	EMG 7c	0.03	0.04
2	EMG 11	0.05	0.23

For xylanase

xylane plates were spot inoculated with different strains isolate from gut of earthworm species. These plates were incubated for 24 hours at 37° c. After incubation, iodine reagent was added on plate and possible formation of zone was observed.

Photograph No, - 4.4 Qualitative test for xylanase

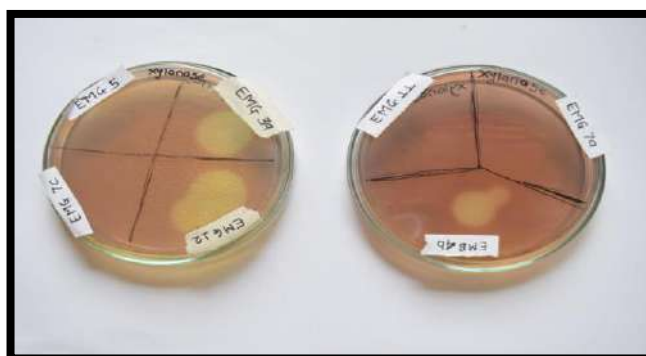


Table No. – 4.12 Analytical data for xylanase

S r . n	Organism	Final O.D for xylanase	
		10 min.	30 min.

0			
1	EMG 3a	0.81	0.56
2	EMG 4b	0.60	0.29
3	EMG 12	0.27	0.28

For nitrate reductase

Nitrate reductase tubes were loop fully inoculated with different strains isolate from gut of earthworm species. These tubes were incubated for 24 hours at 37° c. After incubation, α -naphthol sulphanilic acid reagent was added in tubes and colour change was observed.

Photograph No. –4.5 Qualitative test for nitrate reductase



Table No. – 4.13 Analytical data for Nitrate Reductase

Sr. no.	Organism	Final O.D for nitrate reductase	
		10 min.	30 min.
1	EMG 3a	0.42	0.79
2	EMG 4b	0.45	0.41
3	EMG 12	0.40	0.42
4	EMG 7c	0.35	0.37
5	EMG 7a	0.04	0.2
6	EMG 11	0.33	0.36

For caseinase

Table No. –4.14 Analytical data for Caseinase

Sr. no.	Organism	Final O.D for caseinase	
		10 min.	30 min.
1	EMG 5	0.12	0.19
2	EMG 3a	0.07	0.41
3	EMG 12	0.22	0.29
4	EMG 7c	0.41	0.1
5	EMG 4b	0.47	0.27
6	EMG 11	0.21	0.26

As per above readings taken at 520nm for 10 min and 30 min reaction time, readings of 30min reaction activity were comparatively low than 10min reaction activity. This might have taken place due to unavailability of the substrate to interact with enzyme for 30min of time span.

Table No. - 4.15

Sr. No.	Enzymes	Name of bacteria	Final O.D	Amount of product from graph	Enzyme activity (mg/ml/min)
1	Amylase	EMG 4b	0.56	0.34	0.13
		EMG 12	0.49	0.29	0.11
		EMG 3a	0.86	0.52	0.20
2	Cellulase	EMG 7c	0.03	0.03	0.012
		EMG 11	0.05	0.01	0.004
3	Xylanase	EMG 4b	0.81	0.03	0.012
		EMG 12	0.60	0.17	0.068
		EMG 3a	0.27	0.52	0.21
4	Nitrate reductase	EMG 3a	0.42	1.12	0.11
		EMG 4b	0.45	1.16	0.11
		EMG 12	0.40	1.04	0.10
		EMG 7c	0.35	0.92	0.09
		EMG 7a	0.04	0.08	0.008

Conclusion-

Major findings of the project are- earthworm species *Eudrilus euginae* contains 7 different strains of microorganisms in its gut. These strains are named as- EMG 12, EMG 11, EMG 5, EMG 7a, EMG 7c, EMG 3a and EMG 4b. This all strains secrete various types of enzymes. This enzymes includes amylase, xylanase, caseinase, nitrate reductase, cellulase. Microorganism present in the gut of earthworm species act on complex biomolecules by secreting these enzymes.

Enzyme activity of all 7 strains was estimated by performing enzymatic assay. Enzyme was extracted by centrifugation of broth in which organism was inoculated .Supernatant was collected as a source of enzyme. Every organism's ability for secretion of amylase, xylanase, caseinase, and cellulase and nitrate reductase enzymes was studied.

From enzymatic assay and ability of organism to act upon substrate, it is concluded that, there is high number of the caseinase and nitrate reductase enzyme secreting organism in the gut of species used *Eudrilus euginae*. And there is very low number of the organisms that are able to secrete cellulase enzyme. There is presence of moderate number of organism that can secrete amylase and xylanase enzyme.

Bibliography

1. Abdullah Adil Anasari, Sirpaul Jaikishun, 2010. **An Investigation into the Vermicomposting of Sugarcane Bagasse and Rice Straw and its Subsequent Utilization in Cultivation of *Phaseolus vulgaris* L.** In Guyana.
2. Aigbodion V. S. **potential of using bagasse ash practical in metal matrix composite**, Ph. D. work on going. Department of Metallurgical and Material Engineering, Ahmadu Bello University, Samaru, Zaria, Nigeria, 2008.
3. Brune A., D. Emerson, J. A. Breznak. **The termite gut microflora as an oxygen sink: microelectrode determination of oxygen and pH gradience in guts of lower and higher termides.** Appl. Environ. Microbial. 61: 2581- 2687.
4. Byzov B. A., M. V. Khomyakov, S.A. Kharin, Kurakov A. V. **Fate of soil bacteria and fungi in the gut of earth worms.** Eur. J.soil. Biol. 43: 149-156.
5. C. Lattaud*et al. **Activities of the digestive enzymes in the gut and in tissue culture of a tropical geophagous earthworm, *Polypheretima elongate*.**
6. Contreras E. **studies on the International Actinomycetes Flora of Eisenia lucens (Annelida, Oligochaeta).** Pedobillogia 20: 411-416.
7. Edwards C. A, Bohlen P. J. **biology and ecology of earth worm.** Chapman and Hall, London.
8. G.V.Utekar., H.V.Deshmukh.2016. **Optimization of parameters for preparation of vermicompost from bagasse and press mud by using *Eudrilus eugeniae*.**
9. G.V.Utekar., H.V.Deshmukh.2014. **Chemical characterization of sugar industry waste used for bioenergy production.**

10. G.V.Utekar., H.V.Deshmukh. **Feasibility study of sugar industry vermicomposting.**
11. *G.V.Utekar., H.V.Deshmukh. Physicochemical and microbial characterization of vermicompost prepared from bagasse, press mud admixture by using earthworm *Eudrilus eugeniae*.*
12. G.V.Utekar., H.V.Deshmukh. **The quantitative study of different micro organism present in gut flora of earthworm *Eudrilus eugeniae*.**
13. Gajalakshmi S. and Abbasi S.A., **Effect of the application of water hyacinth compost/vermicompost on the growth and flowering of *Crossandra undulaefolil*, and on several vegetables, *Bioresour Technol*, 85 (2002) 197- 199.**
14. Gajalakshmi S. and Abbasi S.A., **Neem leaves as a source of fertilizer- fum- pesticide, vermicompost, *Bioresour Technol*, 92(2004)291-296.**
15. Hartenstein.R, Neuhauser E F , Kaplan.D.L, **Reproductive potential of the earthworm *Eisenia fetida*, *Oecologia(Berl)*, 43(1979) 329-340**
16. Horner S. J., M. J. Mitchell. **Effect of earthworm *E. fetida* (oligocheata) on fluxex of volatile carbon and sulfur compounds from sewage sludge. *Soil bio. Biochem.* 13: 347-372.**
17. Khambata S. R., J. V. Bhat. **Studies on a new oxalate decomposing bacteria, *pseudomonas oxalaticus*. *J. Bacterial.* 66 : 505-507.**
18. Khwairakpam Meena and kalamdhad Ajay S. 2011. **Vermicomposting of vegetable wastes amended with cattle manure.**
19. Kristufek, V. K. Ravasz, V. Pizl. **Changes in densities of bacteria and micro fungi during gut transit in *Lumbricus rubellus* and *Aporrectodea caliginosa* (oligocheata: *Lumbricidae*). *Soil Boil. Biohem.* 24: 1499-1500.**
20. *Kumar.C.A., State of the art report on vermiculture in India(Council for Advancement of People's Action and Rural Technology, New Delhi) 1994, 1-60*
21. Lores, M., Gomez-Brandon, M., Perez, D., Dominguez .J. **Using FAME profiles for the characterization of animal wastes and vermicompost. *Soil Biol. Biochem.* 38, 2993-2996.**
22. Lavelle P. **Earth worms and the soil system. *Biol. Fertile. Soil.* 6 :237- 251.1998**
23. Lee K. E., **earth worms their ecology and relationship with soil and land use. Academic press, Sydney, Australia.**
24. M Lakshmi Prabha, Indira A Jayaraaj.2007. **Comparative studies on the digestive enzymes in the gut of earthworms, *Eudrilus_eugeniae_* and *Eisenia fetida*.**
25. M Lakshmi Prabha et al. **Microorganisms in the gut of earthworm *Eudrilus eugeniae*.**
26. Mythili Sathivelu and Sathivelu A et al. **Isolation and screening cellulose degrading microorganisms from the gut of composting earthworms and its industrial application.**
27. M.M. Manyuchi and A.Phiri, **“Effective separation of *Eisenia fetida* earthworms from vermicasts using a cylindrical rotary trammel separator”.*International journal of innovative research in science. Engineering and technology.* 2 (8), pp. 4069- 4072, 2013.**
28. M.M. Manyuchi and A.Phiri, P.Muredzi and S. Boka., **“Composition of vermicompost and vermiwash from vermicomposting waste corn pulp.”**

- World Academy of science, Engineering and technology,78,pp. 365- 368,2013.
29. Paya J. Monzo, Borracharao M. V., Diaz Pinzon. L. Ordonez L. M: **sugarcane bagasse ash (S C B A): studies on its properties for reusing in concrete production.** Journal of Chemical Technology and Biotechnology, 77(3), 21-32.
 30. Pedersen, J. C.and Hendriksen, N. B. **Effect of passage through the intestinal tract of detritivore earth worms (Lumbricus sp.) on the number of selected Gram negative and total bacteria.** Biology and fertility of soils 16: 227-232. 1993.
 31. Pehlivan E., H. T. Tran., W. K. I. Ouedraoga, C. Schimidt, D. Zachmann, M. Bahadis. **Sugarcane bagasse treated with hydrous ferric oxide as potential absorbent for removal of AS (V) from aqueous solutions.** Food chemistry 138, 133-138.
 32. Reagan Mudziwapasi et al. **Isolation and molecular characterization of bacteria from the gut *Eisenia fetida* for biodegradation of 4, 4 DDT.**
 33. Reinecke.A.J, Venter.J.M, **Moisture preferences, growth and reproduction of the compost worm *Eisenia fetida* (Oligochaeta),** Biol fertile soils, 3 (1987) 135-141.
 34. Romke .J. S. Jansch , Didden, W. **The use of earthworms in ecological soil classification and assessment concepts.** Ecotoxocological. Environ. Saf.62: 249-265.
 35. Sen B., Chandra T. S. **chemplitic and solid states spectroscopic evaluation of organic matter transformation during vermicomposting of sugar industry waste.** Bioresour. Technol., 98 (8). 1680-1683. 2007.
 36. S Gajalakshmi and S A Abbasi **Earthworms and vermicomposting** 2003.
 37. Sharma A. K. **biofertilizers for Sustainable Agriculture.** Agrobios, Jodhpur, India, pp- 77-112.
 38. **Changes in the microbial population from sugarcane press mud after vermicomposting.** Karnataka J. Agric. Sci., 23(3) : (511-513) 2010

A review on Induced Mutations in Plants

Ms. V. B. Kankekar , Ms. S.J.Kharade, Dr. Sushama Patil

Department of Biotechnology, Vivekanand college, (Autonomous) Kolhapur

Department of Biotechnology, Shivaji University, Kolhapur

Abstract:

The continued increase in the world population is resulting into increase in demand for agricultural produce, so plant breeders have to be more precise in developing crops with desirable features that will benefit both the farmers and consumers worldwide. The opportunity of obtaining novel traits exists through induction of mutations. Induced mutations have played a significant role in meeting challenges related to world food and nutritional security by way of mutant germplasm enhancement and their utilization for the development of new mutant varieties. This review focuses on the past and recent developments in mutation breeding for crop improvement. Mutations are now artificially induced by physical (e.g. gamma radiation, fast neutron irradiation, X-rays Thermal etc.) and chemical (ethyl methane sulphonate, Sodium azide, etc.) mutagen treatment of both seeds and vegetative parts of crops. The emergence of genome manipulation methods promises a real revolution in biotechnology and genetic engineering. . There are various novel genome editing systems; these include zinc finger nucleases (ZFNs), transcription activator-like effector nucleases (TALENs), and clustered regularly interspaced short palindromic repeats/Cas9 (CRISPR/Cas9). These exciting new methods, briefly reviewed herein, have proved themselves as effective and reliable tools for the genetic improvement of plants. The most important part after induction of mutation is screening of mutant varieties. Various screening methods are developed. In this chapter, various aspects of mutation induction, applications and examples of successful use of induced mutants in crop improvement programs are presented.

Introduction:

Green plants are the ultimate source of resources required for the human life, food, cloths & energy requirements etc. Existing germplasm resources of the plants may not be adequate to meet the all needs of ever-increasing human population (Green et al. 2005). This problem can be overcome by producing genetic variation in plants to increase their productivity & to become resistant to various environmental stresses. Naturally occurring mutations called spontaneous mutations have very low frequency, so they are insufficient to meet current needs.

The means of developing new plant varieties for cultivation & use by humans has come to be called plant breeding. It requires genetic variation of useful traits for crop improvement. Induced mutation has become a proven way of creating variation. At the beginning of the 20th century the technique of induced mutagenesis for crop improvement

was used. The main advantage of induced mutations is that, sometimes there is possibility of inducing desired traits either cannot be found in nature or have been lost during evolution.

The wide spread use of mutation in plant breeding program throughout the world led to the development of huge amount of mutant plant varieties. This large no. of mutant varieties are developed and mostly cultivated in developing countries and is greatly improving the food security in the countries. So the use of induced mutation played major role in the development of various crop varieties all over the world Ahluwalia and Kaszynski 2001; Kaszynski et al. 2004; Jain 2005). This developed varieties increase the biodiversity and provide breeding material for conventional plant breeding . Actually, the concept of induced mutation was discovered in 1927. But the first attempts to induce mutations for improvement of plants were not successful due to lack of sufficient knowledge about the biological processes involved in mutation. Thereafter, due to improvement of knowledge, scientists got successful results in this area. There were number of varieties of induced mutant crop plants such as wheat, rice, barley, oats, soybeans and other legumes, various fruit trees & ornamental plants have been released and being grown on millions of acres throughout the world. Noticeable point is that some of these varieties have played a part in the "Green revolution" & helped to improve crop yield.

Physical & chemical mutagenesis have proven useful for increasing the frequency of mutations & variation. Radiations includes X-rays, Gamma rays, alpha particles, fast neutrons, UV and cosmic rays; and chemical mutagens: sodium azide, ethyl methane sulphonate, methyl methane sulphonate, hydroxylamine and N-methyl-N-nitrosourea. Primarily X-rays & gamma rays were used but thereafter neutrons & ion beams were also used for induction of mutations (Shu, Q.Y.; Forster, B.P.; Nakagawa, H.2012). Radiation induced mutations depends on many factors such as radiation type & dose, linear energy transfer, plant tissue type etc. Mutagens cause random changes in nuclear DNA or cytoplasmic organelles, resulting in gene, chromosomal or genomic mutations.(e.g. deletions, translocations, duplications, aneuploidy etc.)

Agrobacterium mediated gene transfer was discovered by Marc Van Montagu and Jozef Schell at University of Ghent (Belgium) & that technique became very helpful to generate desired characteristics into the plants. Afterwards Afterwards, a team of researchers led by Dr. Mary-Dell Chilton proved that virulence genes could be removed without affecting the ability of *Agrobacterium* to insert its own DNA into the plant genome. Two methods have been developed for transport of foreign genes in the form of exogenous DNA fragments into plants. First method is direct transfer of exogenous DNA into plant cells (direct transformation). Second method involves the gene transfer mediated by soil bacteria *Agrobacterium tumefaciens* and *A.rhizogenes*. By taking the advantage of natural ability of gene transfer of *Agrobacterium* , scientists attempted DNA- induced mutations in transgenic plabts. They worked on various traits like plant height(Chiang, H.H., Hwang, I., and Goodman, H.M.1995), size and shape of leaf blades(Ogarkova, O.A., Tomilovaand et al.2001), flower structure(Yanofsky, M.F., Hong, Ma, Bowman, J.L., et al.1990)etc. So, *Agrobacterium*- induced plant mutations became novel source of generating plant mutations. Very firstly T-DNA induced mutations were generated in *Arabidopsis thaliana* by a research team headed by Feld-mann(Feldmann, K.A., Marks, M.D., Christianson, A., et al.1989).

Afterwards new breeding technologies are developed that include: Zink Finger Nuclease(ZFN), Oligonucleotide- directed mutagenesis (ODM) etc. (Inger & et al. 2019)The ZFN technique is a site directed nuclease (SDN) tool, which produce a mutation as a predetermined position in the plant genome. Since 2007, a number of new SDN tools have emerged, from them CRISPR/Cas technology is more advanced & popular.

Ornamental plants have economically important traits, so they are ideal for application of mutations. In this case specific DNA constitution is altered mostly by treatment with chemicals and ionizing radiations because the use of T-DNA mediated mutagenesis is still restricted to a few varieties.

The working of induced mutation in ornamental plants had done for the traits such as altered flower characters (colour, size, morphology, fragrance); leaf characters (form, size, pigmentation); growth habit (compact, climbing, branching); and physiological traits such as changes in photoperiodic response, early flowering, free-flowering, flower keeping quality, and tolerance to biotic and abiotic stresses (A. SCHUM and W. PREIL).

The review involves the mechanism, methods & examples of induced mutations plants. Various techniques are discovered for induction of mutation which includes primary techniques to advanced techniques.

HISTORY:

The term plant mutation has a brief history. From the discovery of mutation, still new technologies are developing. In the book of "Mutation Breeding - Theory and Practical Applications" Van Harten (1998) described important historical discoveries that led to development of new techniques for the maturation of mutation breeding as a scientific research. History of plant mutation can be divided into five periods:

Period I: Observation and documentation of early spontaneous mutants

According to Van Harten history of plant mutation could be started back to 300 BC with reports of mutant crops in China & the proof is the ancient Chinese book "Lulan" which provide the first documentation of mutant selection in plant breeding(Haung and Liang , 1980).In 1590 the first spontaneous plant mutant described called 'incisa' mutant of Greater calendine. "Waare Oefeninge der planten" is the one of the oldest publication by A. Munting which described variability in trees, shrubs & herbaceous plants (see van Harten1998). 1774 onwards taxonomist Linnaeus described various mutants in wild and cultivated species. In 1859 Charles Darvin published "The Origin of Species ". English biologist William Bateson published "Materials for the Study of Variation, treated with special regard to Discontinuity in the Origin of Species".

Period II: Conceptualization of mutation and mutation breeding

Actual the concept of "Induced mutation" was arose in this period. Various radiations like X-rays, alpha rays, gamma rays discovered in betwwn 1895-1900. In 1900 the work of Mendel on laws of inheritance was accepted by the scientific establishment. Then the use of these radiations for the plant mutations attempted. The study of physiological effects and damage to nuclei and cell division of plant cells after the irradiation was done in1897-1908.

In 1901 Dutch botanist Hugo de Vries coined the term "mutation" and he published "Die Mutationstheorie". The first proof of mutations induced by chemicals in bacteria was found in 1901 and 1911. Then the study on induced mutations geared up. In 1904 and 1905 Hugo de Vries suggested artificial induction of mutations by radiations. Cramer published extensive examples of spontaneous mutant in crop plants in 1907. W. Johannsen described spontaneous mutation effect on seed index with respect to drastic and slight mutations. Actual experiment of mutation with *Drosophila melanogaster* was done by Thomas Hunt Morgan in 1910. Then in 1920 N.I. Vavilov proposed the law of "homologous series of variation".

Period III: Proof of induced mutations and release of the first commercial mutant varieties

N.I. Vavilov proposed a theory on gene diversity centers in 1926. In 1927 C. Stuart Gager and A. F. Blakeslee gave the first proof of induced mutation. They used radium rays for treatment of *Datura stramonium*. Then Muller provided the proof of induced mutation by X-rays in *Drosophila*. At that time Muller indicated the possibility of genetic improvement in plants, animals and man by using X-rays and he opened the new era in genetics and breeding research field. In 1928 Lewis John Stadler successfully induced mutations in barley and maize. D. Tollenar released the first commercial mutant variety 'Chlorina' in 1936 by application of X-radiation on tobacco. Freisleben and Lein reported that disease (mildew) resistance was induced in barley (1942) and then they coined the term 'Mutation breeding' in 1944. At that time only Auerbach and Robson released reports of chemicals induced mutation. In 1953, Sparrow and Singleton did first plant mutation experiment by using ⁶⁰Co gamma rays and it became a standard tool in induced mutation experiments of crop plants. Watson and Crick proposed the model of gene in 1953. E.R. Sears successfully transferred the resistance *Aegilops* to wheat. For that he used radiation induced translocatin (1956). After 1958 use of chemical mutagens was started on higher plants.

Period IV: Large-scale application of mutation breeding

In 1964 joint division of FAO/IAEA was established to encourage the induced mutation programs for food security issues in developing countries. Then numerous national research institutes were established to specific to study Nuclear Techniques in Food and Agriculture. In USA first chemically induced mutant variety was released that is Luther of barley (1966). The major conference was organised by FAO/IAEA at Vienna, Austria on the topic 'Use of induced mutations as a Tool in Plant Research'. That conference was reorganized in 1990 for the discussion of '25 years of applied mutation breeding'.

Period V: Use of biotechnology and genomics in plant mutation

The first genetically modified plant was developed in 1983. For this they used T-DNA insertion system of *Agrobacterium tumefaciens*, and their efforts resulted into development of antibiotic resistant tobacco plant. By using the technique of transposon mutagenesis Fedoroff and et al. firstly isolated and sequenced Ac and Ds transposable elements by insertion of Ac and Ds into well studied waxy gene in 1983. The set up for the registration of plant mutant variety was established by FAO/IAEA in 1993, which became the mutant variety genetic

stock database (<http://mvgs.iaea.org>) in 2008. Then the first plant genome (*Arabidopsis* genome) was sequenced in 2000. TILLING (Targeting Induced Local Lesion In Genome) technique was also discovered in 2000, which is used for targeted screening of induced mutation. Between 2002-2005 genome sequencing of rice species *indica* and *japonica* was successfully done. In between 2000- 2009 high throughput genotyping and phenotypic techniques were discovered mainly based on automated, robotic and computerized systems. In 2012 George Church, Jennifer Doudna, Emmanuelle Charpentier, and Feng Zhang discovered that the CRISPR Cas9 tool can be used as a "cut and paste tool" to modify genome and for this discovery they won the nobel prize in chemistry in 2020.

Mechanism:

While performing induced mutation we must consider some factors that are vital for mutation breeding :1) plant material and 2) Dose of mutagen 3) Mutagenic treatment and selection of mutant varieties

1) Plant material selection-

To carry out induced mutation the first process is to select a plant in which we are going to perform mutation. So here the plant parts are exposed to some chemical and physical mutagen (Bhagwat 2009; Mba et al 2010). Mostly plant material used are the seeds of seed propagated crops and the plant part such as pollen grains, bulbs, buds, tuber, twigs and stem cuttings. The selection of plant part varies with the crop plant. In some of the plant tissues the water content is high and that are more sensitive to radiation damage, for this the dose intensity, type of mutagen and concentration of mutagen is important. So now a days, invitro cultures are used as starting material for mutation induction(Prasanna et al 2012).

2) Dose of mutagen-

A proper dose of mutagen should be given to induce mutation as it significantly effect both qualitatively and quantitatively on the result obtained. The dose and treatment duration of mutagen varies with crop and plant part and type of mutagen used. As if the dose is too high then it can damage the cells and tissue so the dose should be optimized for maximum success rate. Optimum dose of mutagen is expressed as LD50 and it will kill 50% of individuals.

3) Mutagenic treatment and Selection of mutant varieties:

M1 : In M1 generation there is need to treat the seeds (5000-10000) with mutagenic agents (chemical or physical mutagens). The seeds treated with physical mutagen can be stored before sowing and the seeds treated with chemical mutagens should be washed thoroughly and then sown in the field under optimal condition to produce M2 seeds by following all cultivation practices and later harvest the first two to five pods, capsule etc. The M1 plants can be harvested individually if M2 will be grown in progeny row, or in bulk if M2 grown in bulk.

M2 : In M2 generation 30-50 plants from each M1 plants in which traits expressed and visible are grown and the remaining seeds can be stored for sowing in next season. For harvesting purpose all the morphological and physiological changes are observed in M2 plants from seedling stage to harvest stage and then selected plant is harvested. The trait expressed at the seed level, the part of the seed is cut or seeds are germinated and cut one cotyledon for fatty acid analysis then proceeding cultivating the seeds with desired fatty acid

composition and if the traits are not expressed at single plant level, then multiply seeds of M2 plant and harvest single plant for row evaluation in M3.

M3 : In M3 generation selected mutants are grown as single plant progenies and then checked for segregation of desired trait. The selection for desired trait such as resistance to stress and quality, are taken under consideration.

M4 : In M4 generation the expression of selected traits and yield of bulk lines in comparison with parent are evaluated. Observation on all agronomic parameter, disease and pest resistance are compared with parent varieties are recorded. Mutants with valuable traits but undesirable characters are backcrossed with parent or used in crosses.

M5 : In M5 generation and further all the plant breeding protocols are followed with selected progenies; preliminary yield trials, multi-location evaluation of mutants derived from crosses with mutants, submission of one or two best lines at the time for national or regional evaluation trials, or to local farmers in participated breeding programme. Then initiate the seed multiplication to meet the demand of the mandatory trials for official approval and release of the variety.

Mutagenic agents:

Agents of artificial mutations are called mutagens. They are generally grouped into two broad categories, namely chemical mutagens and physical mutagens (: Wiley-Blackwell; 2006, John Wiley & Sons, Ltd.; 2010. p. 111 130.). Traditionally, to induce mutations in crops, planting materials are exposed to physical and chemical mutagenic agents. Mutagenesis can be performed with all types of planting materials, e.g. whole plants, usually seedlings, and in vitro cultured cells. Nevertheless, the most commonly used plant material is seed. Multiple forms of plant propagules, such as bulbs, tubers, corms and rhizomes (Wani MR, Kozgar MI, Tomlekova N, et al. Springer; 2014. p. 217 248)and more recently, the induction of mutations in vegetatively propagated plants is becoming more efficient as scientists take advantage of totipotency (ability of a single cell to divide and produce all of the differentiated cells in an organism to regenerate into whole plants) using single cells and other forms of in vitro cultured plant tissues (Mba C.2013;3(1);200 231.). The starting materials for the induction of mutations are vegetative cuttings, scions, or in vitro cultured tissues like leaf and stem explants, anthers, calli, cell cultures microspores, ovules, protoplasts, etc. Gametes, usually inside the inflorescences, are also targeted for mutagenic treatments through immersion of spikes, tassels, etc.(Wani MR, Kozgar MI, Tomlekova N, et al.Springer; 2014. p. 217 2480.). Whereas chemical mutagens are preferably used to induce point mutations, physical mutagens induce gross lesions, such as chromosomal abbreviation or rearrangements.

Chemical mutagens :

Chemical mutagen shows high mutation rate and it mostly induce point mutation. Chemical mutagenesis is most efficient and convenient approach in many plants species. As it has proven extremely useful to create new variants that can be used in further studies /plant breeding. So chemical mutagen show high mutation rate and its mostly induce point mutation. These mostly include alkylating agent ,nitrous acid, acridine dyes, sodium azide etc.

The use of chemical as mutagens was since 1940's by treating drosophila melanogaster with mustard gas (Auerbach, 1946, Auerbach & Robson 1946) These chemicals shows mutagenic effect on organism (animal plants & micro-organism) There are only few chemicals used for crop breeding.

1) Alkylating agents:

Alkylating agents are mostly used mutagen in plant breeding for producing new mutant varieties in perspective of producing new cultivars due to their, ease of handling, effectiveness and can do convent detoxification process. Alkylating agents transfer the alkyl group to biological molecule (DNA). Alkylating agents are widely used to induce single base pair change to alter the protein function and structure. The major DNA alkylation mechanism present in host plant have reviewed by Ieitao (2012). Some examples of Alkylating agents are EMS, EES, NTG Mustard gas etc. Lee et.al (2014) reported that Ems induce alkylation on guanine resulting in GC > AT transition which shows nucleotide mutation.

2) Sodium azide - (SA):

Sodium azide is also used as chemical mutagen for crop improvement. This has proven effective mutagen in many crops like barley, rice, soybean & maize. Sodium azide is considered as pro-mutagen as it is metabolized in vivo to powerful chemical mutagen through organic intermediate. The type and no. of mutation induced by Sodium azide has been studied in barley (talame et.al 2008; Kurowska et al. 2011) and recently in rice (Tai et. al., 2016) & showed that it is powerful mutagen for inducing pt. mutation it shows GC to AT transition.

3) Other chemical mutagens :

There are other chemical mutagen in addition to Sodium azide & alkylating agent. As given in second edition of IAEA manual on mutation breeding their are following chemical mutagen.

i) Base analogue ii) Acridine dye iii) Nitrous acid iv) Hydroxylamine

These mutagen are not mostly use in plant breeding because they show less effect and still there is not more study done on these and as they are challenging in handling from safety perspective.

Advantage of chemical mutagenesis :

1. Well characterized mutation spectrum producing mainly point mutation
2. Less chromosomal damage than physical mutagen
3. High mutation frequency to create variation
4. can be equally applied to in vitro tissue or explant.

Physical mutagens:

The discoveries that radiation (X-rays) induced changes in the genome of fruit flies (Muller, 1927) and plants such as *Zea mays* and *Hordeum vulgare* (Stadler, 1928a; Stadler, 1928b; Stadler, 1930; Stadler, 1931) are considered as landmark achievements. These discoveries proved to be watershed moments in mutation breeding as they offered the impulsion for the successive widespread implementation of this technique in crop improvement and very recently as a tactic to ascertain genes and illuminate their roles. The ionizing radiations are the most widely used mutagens in addition to the alpha (α) and beta (β) particles and neutrons (Mba *et al.*, 2012; Mba and Shu, 2012). These radiations are part of the electromagnetic

spectrum (EM) and by virtue of their high energy levels dislodge electrons from the nuclear orbits of the atoms. Ultraviolet (UV) rays, classified as non-ionizing, are capable of penetrating tissues thereby inducing a high frequency of mutations. The mutagens induce nucleotide dimers and reactive species formation which in turn cause deletion, insertion, substitution, gross chromosomal breakages and rearrangements. Physical mutagens are used for the development and official release of more than 2500 mutant varieties. When X rays pass through tissue, they ionize atoms in it by detaching electrons from them. The result may be are grouping of the molecules along the track of ions left by the X rays. Such regrouping can lead to gene mutations or to chromosomal breaks and rearrangements. The X rays can also bring about chemical changes in the environment of the chromosomes. Most important is the production of hydrogen peroxide and free radicals, which are highly reactive and can lead to mutational changes in the genetic material.

Gamma rays have effects almost identical with those of X rays. Neutrons, however, are more densely ionizing than X rays and gamma rays and are therefore more effective in inducing mutations at the same dosages. This difference can be significant, because high dosages of radiation not only affect the genetic material but also damage the organism physiologically. In plants high dosages of radiation result in less frequent germination, stunted growth and reduced vigor. With X rays and gamma rays attention must be paid to various physiological conditions of the seed in order to achieve the maximum rate of induced mutation with minimum physiological damage. In contrast, the effect of irradiation with neutrons is less dependent on the physiological condition of the seed. Adopted and modified from Mba et al. (2010)

Genetic changes that can be induced by radiation or chemicals include alteration of the triplet code of DNA so that a new sequence (color) is created. Mutations also arise from changes in chromosomes, such as translocation, inversion and deletion.

Genome editing tools :

Plant breeding is a discipline for targeted and continuous development of new plant varieties. It utilizes the genetic variation between individuals within a plant species and combines the desired properties into new and improved varieties. Plant breeding is dependent on genetic variation, and new variation is fundamentally important for introduction of new traits in breeding programs. However, in cases where a specific genetic trait is not immediately available to be crossed into breeding materials, the genetic variation in a crop species can be expanded by other means. For decades this has been achieved by, e.g., chemical or physical treatments, translocation breeding, synthetic hexaploids, etc; techniques that involve comprehensive changes of the plant's genome. Due to its long safety record, organisms obtained by physical and chemical mutagenesis are exempt from the provisions of the GMO legislation in the EU. Nevertheless, the methods incite hundreds or even thousands of random mutations with unknown effects and consequences. New Breeding Techniques (NBT) include several new technologies for introduction of variation into crop plants.

The most widely used NBT mutation tool in plants is CRISPR/Cas9. This is mainly because it is highly efficient and easy to design and because it is possible by multiplexing to make more than one targeted mutation at a time (Bortesi and Fisher, 2015). However, ZNF,

TALENs, and ODM are also currently used. ZFN was developed in 2003 (Bibikova et al., 2003), TALENs in 2011 (Bogdanove and Voytas, 2011) and CRISPR/Cas9 in 2012 (Jinek et al., 2012), so the SDN-tools are less than 20 years old. ODM, on the other hand, is a tool that has been used for a long time across mammalian, microbial, and plant systems to induce mutations at a specific site in the genome and ODM started to be successfully used in plants around 20 years ago (Breyer et al., 2009). Thus, NBT mutagenesis is almost 80 years younger than conventional mutagenesis.

Mechanism of genome editing tools:

Novel genome editing tools, also referred to as genome editing with engineered nuclease (GEEN) technologies, allow cleavage and rejoining of DNA molecules in specified sites to successfully modify the hereditary material of cells. To this end, special enzymes such as restriction endonucleases and ligase can be used for cleaving and rejoining of DNA molecules in small genomes like bacterial and viral genomes. However, using restriction endonucleases and ligases, it is extremely difficult to manipulate large and complex genomes of higher organisms, including plant genomes. The problem is that the restriction endonucleases can only “target” relatively short DNA sequences. While such specificity is enough for short DNA viruses and bacteria, it is not sufficient to work with large plant genomes. The first efforts to create methods for the editing of complex genomes were associated with the designing of “artificial enzymes” as oligonucleotides (short nucleotide sequences) that could selectively bind to specific sequences in the structure of the target DNA and have chemical groups capable of cleaving DNA (D. G. Knorre and V. V. Vlasov. *Russian Chemical Reviews*, vol. 54, no. 9, pp. 836–851, 1985). Targeted approach to address this challenge was the design of chimeric nucleases which are complex proteins containing one or two structural units, one of which catalyzes the cleavage of DNA, and the second is capable of selectively binding to specific nucleotide sequences of target molecule, providing the nuclease action to this site (N. J. Palpant and D. Dudzinski, *Gene Therapy*, vol. 20, no. 2, pp. 121–127, 2013. , R. Jankele and P. Svoboda, *Briefings in Functional Genomics*, vol. 13, no. 5, pp. 409–419, 2014). These chimeric nucleases can be “produced” directly in the cell: to this end, appropriately engineered vectors encoding nucleases need to be introduced into cell. Such vectors are also supplied with nuclear localization signal which enables the nuclease to enter the cell nucleus thereby getting access to genomic DNA.

1. Zinc Finger Nucleases (ZFNs):

ZFNs were the first generation of genome editing tools that use chimerically engineered nucleases which were developed after the discovery of the working principles of the functional Cys2-His2 zinc finger (ZF) domain (Y.-G. Kim, J. Cha, and S. Chandrasegaran, T. Gaj, C. A. Gersbach, and C. F. Barbas III). Each Cys2-His2 ZF domain consists of 30 amino acid residues, which are folded up to configuration (C. O. Pabo, E. Peisach, and R. A. Grant, J. F. Petolino, N. P. Pavletich and C. O. Pabo). Crystallographic structure analysis showed that the Cys2-His2 ZF proteins bind to DNA by inserting an α -helix of the protein into the major groove of the DNA-double helix (N. P. Pavletich and C. O. Pabo). Each ZF protein has the ability to recognize 3 tandem nucleotides in the DNA. Generalized ZFN monomer consists of

two different functional domains:artificial ZF Cys2-His2 domain at the N-terminal region and a nonspecific *FokI* DNA cleavage domain at the Cterminal region. *FokI* domain dimerization is critical for ZFN enzymatic activity (Y.-G. Kim, J. Cha, and S. Chandrasegaran).

Since the first report on zinc fingers in 1996, they have been successfully used in several organisms including plants (T. Gaj, C. A. Gersbach, and C. F. Barbas III). Examples include targeted inactivation of endogenous genes in Arabidopsis (K. Osakabe, Y. Osakabe, and S. Toki,J. A. Townsend, D. A. Wright, R. J. Winfrey et al.), high frequency modification of tobacco genes (J. A. Townsend, D. A. Wright, R. J. Winfrey et al.), and precise targeted addition of a herbicide-tolerance gene as well as insertional disruption of a target locus in maize (V. K. Shukla, Y. Doyon, J. C. Miller et al.,) ZFNs have also been used for trait stacking in maize(W. M. Ainley, L. Sastry-Dent, M. E. Welter et al.,J. F. Petolino, A. Worden, K. Curlee et al.).

Zinc finger nucleases have revolutionized the field of genome editing by demonstrating the ability to manipulate genomic sites of interest and opened the gates for both basic and applied research. ZFNs provide advantages over other tools with respect to efficiency, high specificity, and minimal nontarget effects and current efforts are focused on further improving design and delivery as well as expanding their applications in diverse crops of interest.

2. Transcription Activator-Like Effector Nucleases (TALENs):

Recently, transcription activator-like effector nucleases (TALENs) have rapidly emerged as an alternative to ZFNs for genome editing and introducing targeted DSBs. TALENs are similar to ZFNs and comprise a non-specific *FokI* nuclease domain fused to a customizable DNA-binding domain. This DNA-binding domain is composed of highly conserved repeats derived from transcription activator-like effectors (TALEs), which are proteins secreted by *Xanthomonas* bacteria to alter transcription of genes in host plant cells.

The fundamental building block used to engineer the DNA-binding domain of TALENs is a highly conserved repeat derived from naturally occurring TALEs encoded by *Xanthomonas* proteobacteria. These TALEs are injected into host plant cells via a Type III secretion system and bind to genomic DNA to alter transcription in these cells, thereby facilitating pathogenic bacterial colonization(DBoch J, Bonas).DNA binding by these TALEs is mediated by arrays of highly conserved 33–35 amino acid repeats flanked by additional TALE-derived domains at the amino- and carboxy-terminal ends of the array.

3. Oligonucleotide-Directed Mutagenesis (ODM):

After first successful exploitation in mammalian systems, oligonucleotide-directed mutagenesis (ODM) has become another novel gene editing tool for plants (N. J. Sauer, J. Mozoruk, R. B. Miller et al.,I. Y. Abdurakhmonov). ODM, a tool for targeted mutagenesis, uses a specific 20- to 100-base long oligonucleotide, the sequence of which is identical to the target sequence in the genome except that it contains a single base pair change (intended mutation to be inserted in the genome) towards achieving site-directed editing of gene/sequence of interest (CropLife International). When these synthetic oligonucleotides or repair templates with homology to a specific region of the target gene are transiently exposed

to the plant cells by using a variety of specific delivery methods, they bind to the targets and activate cell's natural repair machinery which recognizes the single mismatch in the template and then copies that mismatch or mutation into the target sequence through repair process (CropLife International). This produces the desired targeted single nucleotide or base editing in the plant genome that confers novel function or trait while the plant cell degrades the repair template oligonucleotide. Using tissue culture methods, cells with edited sequences are subsequently regenerated and genome edited novel varieties with improved traits/characteristics are developed through traditional breeding (N. J. Sauer, J. Mozoruk, R. B. Miller et al. I. Y. Abdurakhmonov, CropLife International).

4. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR):

Another novel genome editing system that has emerged recently and has become widely popular is the clustered regularly interspaced short palindromic repeats (CRISPR)/CRISPR associated (Cas) protein system with the most prominent being the CRISPR/Cas9 (based on Cas9 protein). This is a method that utilizes adaptive bacterial and archaeal immune system, the mechanism of which relies on the presence of special sites in the bacterial genome called CRISPR loci. These loci are composed of operons encoding the Cas9 protein and a repeated array of repeat spacer sequences.

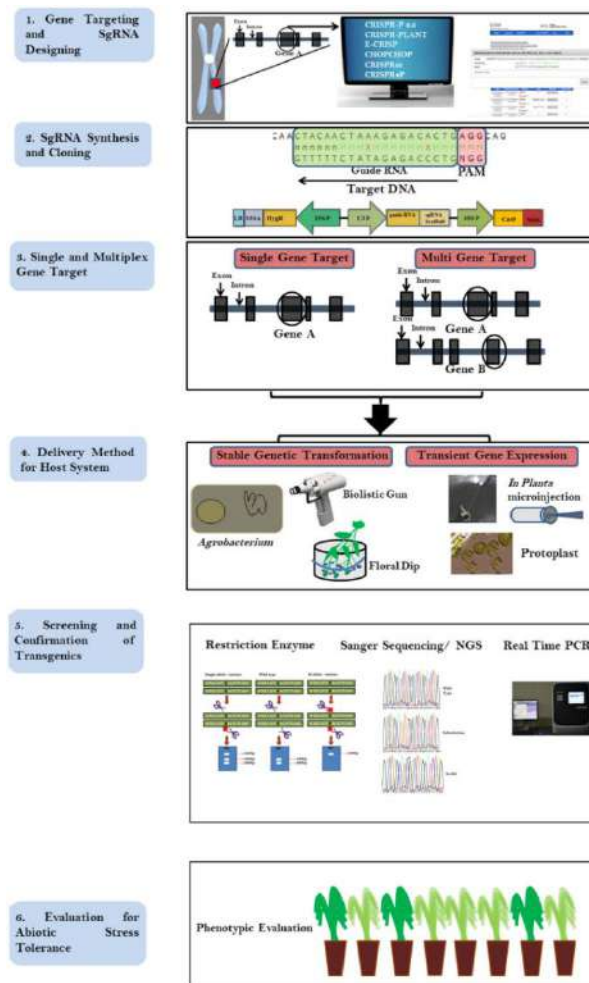


Figure 1. Flow chart describing the steps involved in CRISPR/Cas9 based genome editing. Step 1 describes the selection of gene and designing of gRNA, Step 2 describes the cloning of the gRNA in a suitable binary vector. Step 3 Shows the availability single and multiplex editing. Step 4 describes methods of transformation, Step 5 explains screening methods of edited crops and Step 6 demonstrates the evaluation and selection of the desirable transgene-free plant for the target trait.

The discovery of CRISPR/Cas9 gene editing system has revolutionized research in animal and plant biology with its utility in genome editing being first demonstrated in 2012 in mammalian cells (Jinek et al., 2012). Unlike ZFNs and TALENs, CRISPR genome editing is more straightforward and involves designing a guide RNA (gRNA) of about 20 nucleotides complementary to the DNA stretch within the target gene.

The CRISPR cleavage methodology requires (i) a short synthetic gRNA sequence of 20 nucleotides that bind to the target DNA and (ii) Cas9 nuclease enzyme that cleaves 3–4 bases after the protospacer adjacent motif (PAM; generally 50 NGG; Jinek et al., 2012). The Cas9 nuclease is composed of two domains, (a) RuvC-like domains and (b) a HNH domain, with each domain cutting one DNA strand. Implementing a CRISPR project involves simple steps viz. (i) identifying the PAM sequence in the target gene, (ii) synthesizing a single gRNA

(sgRNA), (iii) cloning the sgRNA into a suitable binary vector, (iv) introduction into host species/cell lines transformation followed by (v) screening and (vi) validation of edited lines. The simple steps involved in CRISPR/Cas9 mediated genome editing (CMGE) allows even a small laboratory with a fundamental plant transformation set up to carry out genome editing projects. CRISPR/Cas9 techniques have been used more extensively to edit plant genomes in the last half decade compared to ZFNs/TALENs and are reflective of its ease of use.

Application of CRISPR/Cas9 approach in plants:

In 2013, CRISPR was demonstrated on rice, wheat, and maize. Whereas, in 2014, the technique was applied to tomato, soybean, and citrus. It was adopted in cotton and potato during 2015. Followed by watermelon, grapes, and alfalfa in 2016. CRISPR/Cas was also applied to cassava, ipomoea, and legumes during 2017. Its is also applied to carrot, cacao, salvia, and lettuce during 2018 and many more crops yet to be reported.

Screening Methods and Tools Used for Screening:

In induce mutation in plants, there is need to screen the mutant varieties of plants. For this purpose, use of proper screening methods are important to achieve effective results. So large no. of individual plants are screened in M2 generation. It is easier to screen the population for mutation in plant height, flowering date to notice the comparison the original parent should be planted in sufficient no. Various screening methods to identify and select desired mutant are developed.

1. Visual method of selection for identifying mutant phenotype are common and are efficient. Visual selection is often the prime basis for selecting for disease resistance, plant height, colour change, non shattering, climate, adaptation to soil, growing period etc. However, with mutation breeding, ancillary techniques can be used as aids to visual selection and must be stringent and efficient for concentrating the breeders attention on few specific individuals from large population. Mass screening techniques are particularly suited to maintain breeding. some advances in screening methods such as laboratory and green house technique enhances efficiency of visual of mutant.

2) Mechanical or Physical method can be used very efficiently in screening for seed size, shape, weight, density etc., This can be done by using sieving machinery which is effective and adaptable for processing of large quantities of seeds. Mostly this processes are carried out to the seeds produced from M2 plants and most adapt to M1 bulk population method of managing M2 material. The processing of the M2 plants individually can be feasible but costlier.

3) Other selection methods, such as chemical , biochemical , physiological, and various specific methods may be required for selecting certain type of ,mutants. Low alkaloid content may be sought by using colorimetric test on M2 seeds or plants or M3 seeds; So the protein analysis can be done by colorimetric , chromatographic or electrophoresis techniques that is conducted on individual seed from M1 plants, on seeds from M2 plants. So for screening of herbicide or fungicide in susceptible variety the chemical treatment applied to M2 seedling in lab or even field by using higher concentration. For such herbicide tolerance screening a large M2 population sown in the field and then herbicide is applied to entire population and

observing any survivors for further testing as this provide a efficient screen, it means that rest of the population is sacrificed in order to identify desired mutants. It has been used to develop the imidazolinone tolerant barley 'Scope' in Australia (Moody,2015). In seed viability and germination testing, change in phenol reaction of seed coat tissue may simply involve exposure of seed from M2 plants to given conc. of phenol and then visually selecting the individual seed for appropriate change.

4) Screening for abiotic stresses such as drought, salinity, heat, etc., require proper adjusting of selection pressure and maintaining a uniform stress over the M2 and M3 population. As the recent advances in hydroponics and laboratory techniques have led to the development of different screening methods for abiotic stresses for conventional plant breeding programme to handle mutant population of larger size with greater efficiency to identify phenotypic mutants in M2 or M3 generation (Sarsu, et al., 2017 in press; Bado et al.,2016).As in recent years there have been huge advance in high throughput phenotyping, now it is known as phenomics. It often involve optical imagining including red green blue colour model and multi spectral camera attached to software. Advance phenomics can involve automated, robotised greenhouse, nursery and field plat-forms. In this, field trails can be imaged remotely at multiple levels (by hand, by drone or outer space) These method offers outstanding throughput which have huge potential in increasing efficiency of mutation detection both in terms of accuracy and the increased no. of mutants that can be screened. These technique is more expensive ,more sophisticated system , but hand held imaging camera are also available which are simple and cheap system.

TILLING:

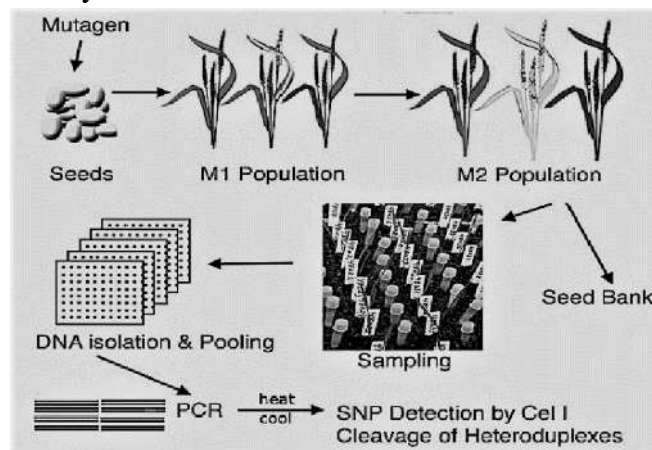
In the last decade new molecular biological tools have been developed that can screen mutants at the gene level. Although the genome sequencing is considered as the gold standard for mutation detection as it can reveal exact location of mutation, but applying this procedure to large population is costly and it is rarely used in practical mutation breeding. So some techniques are used for screening purpose one of them is TILLING.

TILLING (Targeting Induced Local Lesion IN Genome) is well known reverse genetics approach and relies on the detection of sequence alteration in target gene to identify allelic variation among mutant plants. The development of high throughput and low cost method for the discovery of natural and induced mutation has given novel approach for reverse genetics. Its aim to identify SNPs(single nucleotide polymorphisms) and INDELS (insertion / deletion) in gene of interest. TILLING population are developed by chemical mutagenesis covering the entire genome and then using enzymatic detection method in combination with gel electrophoresis or denaturing high performance liquid chromatography. In 2000, the denaturing high performance liquid chromatography (DHPLC) was used in TILLING for SNPs identification. Then in 2003, the LI-COR4300 DNA analyser was used instead of DHPLC to screen mutation in *Arabidopsis thaliana* and the efficiency of TILLING was much improved. At present, TILLING has been successfully used to screen mutation of target gene in wide variety species including maize, legume, rice, canola, tomato, potato, oat, sunflower, peanuts, wheat and barley etc., With this improvement of technology many studies showed that TILLING could be combined with next generation sequencing and increased the

efficiency of this technique in rice and wheat. In comparison with other techniques for the production and screening of mutant in plants TILLING showed many advantages : Mutants can be easily obtained by TILLING ; low cost, more accessible, time saving.

General steps in TILLING process:

1. Creation of mutated population : In this seeds are treated by mutagen and development of M1 and M2 generation M1 plant are self fertilized to produce M2 and then M2 plants are used for DNA extraction for mutational screening and then DNA are pooled eight fold and arrayed in 2-D format on 96 well plate.
2. Detection of mutation in targeted sequence : PCR amplification of targeted DNA region with forward and reverse primer. Denaturation and Annealing to allow formation of heteroduplex at the site of mutation.
3. Digestion of heteroduplex with the CEL- I nuclease. Cut strands are then separated by denaturing polyacrylamide gel electrophoresis and visualized by fluorescence detection by using a LI-COR DNA analyser.



Major Traits Improved in Plants by Induced Mutation :

The mutation breeding program are mostly same as other breeding methods , but the advantages are that the mutation breeding aims to improve desirable and specific characteristic. So the strategies to select and improve vary with plant species, the environment where plant are to be cultivated, farmer cultivation method and utility and demand of end product (Bado et.al., 2015).

1) Yield improvement:

The most important objective of plant breeding is to obtain stable and high yield potential over the range of environmental conditions. As we all know yield is complex trait and strongly influenced by other breeding objectives, such as plant architecture, maturity, nitrogen utilization efficiency, resistance to biotic and abiotic stresses etc. Thus, when planning mutation induction for yield improvement large population are needed to increase the probability of finding yield mutants. Positive yield mutation are formed at low frequency in M2 population (Saeed and Hassan, 2009).Selection method deserved more attention for isolating mutants for qualitative characters. There are two selection methods for mutants with improved yield 1st method -Mutants for qualitative characters are selected and isolated e.g.

erectoides mutant in barley, erectoides character is associated with high yielding in some case, especially under heavy nitrogen fertilization, this character is control by many loci in which mutation can occur, but not all of them are associated with high yield. 2nd method- In this selection start with progeny testing of individual plant and group of plants are needed to detect yield mutants, this testing start in M3 population. When selection is continue in following generations, more seeds are available and the plot size increase. Number of mutant varieties with increase yield are given in following table.

3) Tolerant to abiotic stress:

Abiotic stresses include several unfavourable environmental condition such as soil salinity, drought, extreme pH, flooding and harsh weather. The approaches utilized in plant mutation breeding for such traits are often quite simple. Recently, two salt tolerant rice lines induced using carbon and neon ion beam have been reported (Abe et al., 2007). Drought – Climate change is responsible not only for global temp increase but also for region specific increase or decrease in rainfall. Water storage has negative impact on agriculture production in developing countries.

Salinity – Two ways are carried out to develop new mutant varieties with salinity tolerance, one is to mutate variety that is high yielding but susceptible to salinity, and other to mutate variety that is low yielding but tolerant to salinity. It is important to carefully choose most suitable mutagen and technique to achieve breeding goal.

Temperature – In past decade much work is done on tolerance to low temperature, in cereals, potato, fruits. The genetic basis of frost resistance is very complicated and not uniform considering different type of cultivated plants. In barley winter hardness is controlled not only by dominant but recessive gene. The action of seven dominant gene influencing the character tolerance to low temp in rice has been identified (Cruz et al., 2013). It is shown that gene causing certain tolerance to low temp are even present in genome of cultivated plants that grow in warm zone of earth.

Table 1. Examples of mutants with improved abiotic stress tolerance.

Crop	Trait	Method	Landmark mutant/cultivar (country)	Reference
Rice	Salt tolerance	Gamma ray	NEAR IRRI-9 (India)	MRNI. Nu. 45, 2001
Rice	Salt tolerance	Ion beam. Irradiation	Japan	Abe et al., 2007
Rice	Salt tolerance	Gamma	VND95-20	Do et al. 2009
Bread wheat	Drought tolerance	Gamma	Njoro BWI (Kenya)	IAEA Bulletin, 50-

				1
Maize	Drought tolerance	Gamma ray	Kneja 698W (Bulgaria)	PMR, 2012
Rice	Tolerance to cold	Gamma ray	Kahmir Bastrati (Pakistan)	Ahluwalia, Maluszynski and Nichterlein, 2004
Rice	Tolerance to heat	Gamma ray	Nagina 22 (India)	Poli et al., 2013
Soybean	Tolerance in cold, drought and water logging	Gamma ray	Heinong 26 (China)	Khan and Tyag, 2013

3) Tolerance to biotic stress:

Biotic stress are caused by fungi, bacteria, and viruses and damage due to insects, animals, nematodes, weed etc. Mutation breeding has been successful in improving disease resistance, tackling pest resistance. No. of mutants have been develop through mutation induction, showing enhanced resistance to various disease like virus, bacteria, fungi (Lebeda and Svabova,2010).Recently there has been some progress in identifying resistance gene to brown plant hopper in rice (Fujita, Kohli and Horgan,2013) it may be possible to induce resistant rice mutant efficiently by targeting the identified gene related to resistance mechanism. The discovery of genetic resistance in plant is attributed to Orton and selected cotton for resistance to wilt caused by *Fusarium oxysporum f. sp. Vasinfectum* as cited by Epstein et al.,(2017).But disease is the product of interaction between the host organism and pathogenic organism, genetic variability can be expressed in former as well as latter. First report on induction of mutation for disease resistance is attributed to Freis and Lein, 1942 as cited by Gupta(1998). These author isolated mutant in Haisa barley resistance to powdery mildew in Germany, as a result of treatment with X-rays. Both physical and chemical agents have been employed successfully for inducing disease resistant mutants, irradiation has been used more frequently. In 2010, the FAO/IAEA Joint Division published a compilation of studies realized under CRPs, relating to screening mutant and non mutant crops for tolerance to disease (Lebeda and Svabova,2010).

Table 2. Examples of mutants with improved biotic tolerance/resistance

Crop	Traits	Method	Landmark mutant/cultivar (country)	Reference
------	--------	--------	------------------------------------	-----------

Rice	Resistance to blast and virus disease	Gamma ray	Camago 8 (Costa Rica)	MBNL No. 43, 1997
Bread wheat	Resistance to black stem rust (Ug99)	Gamma	EldoNgano-I (Kenya)	PBGNL Nos. 32 and 33, 2014
Chick pea	Blight resistance	Gamma	11assam-2K Pakistan	Hassan et al. 2001
Barley	Mildew resistance	EMS	Betina (France)	Sigurbjornsson and Micke, 19741
Japanese pear	Black spot resistance	Gamma	Gold Nijissciki (Japan)	Saito, 2016
Pepermint	Wilt disease. resistance	Neutron irradiation.	Murray Mitcham; (USA)	Todd, Green and Horner, 1977

4) Quality, Nutrition and Functionality:

With respect to food, quality usually refers to composition of organic compounds produced and stored by plants, such as starch, protein, fatty acid, vitamins and other nutrients. The main objective of plant breeding is to enhance the nutritious value of harvestable products. The simple method for modifying quality trait using mutation is by inducing knock out in gene involved in the metabolic pathway, e.g. altered fatty acid composition of many oil crops via mutating gene. All oil crops are improved by mutation(Vollman and Rajcan,2009).Canola and other oil producing brassicas have been mutagenized by chemical or physical mutagen for improvement of several important traits including high quality edible oil obtained through reduction of level of toxin and erucic acid (Cheng,2014; Singh and Verma,2015).IN japan rice mutant variety with low glutelin content have been developed for people who must restrict protein intake,and it case of patient with kidney disease.In Indonesia a mutation induction program on sorghum improvement presented high nutritional value in terms of protein and starch content so it could be used as alternative source(Soeranto et al,2001). In addition to nutritional trait quality also relate to medical and industrial traits.

Starch – Most of the diversity is reflected in nutritional characteristics such as digestibility, suitability for bread making and malting and cooking characteristics. Cell wall polysaccharide of cereal grains contribute dietary fibre intake and are important health factor(Lafiandra, Riccardi and Shewry,2014).Rice variety with high content of resistant starch are being develop in china for dietary therapy of patient with type 2 diabetes.

Protein – Cereals grains are low in protein content and their amino acid composition in general does not suit human requirement. Increasing the quantity and nutritional quality of grain protein.

Pea is used in some parts of India for human consumption but contain neuro-toxic component that seriously injures children causing the disease Lathyrism. The toxic factor have been studied and success in isolating mutant devoid of neurotoxic principle beta N- oxalyamino alanine have been reported (van Harten,1998).

Table 3. Examples of mutants with improved quality

Crop	Traits	Method	Landmark mutant/cultivar (country)	Reference
Rice	Grain quality	Gamma ray	VND95-20 (Vietnam)	Du et al. 2009
Rice	Glutinous endosperm	Gamma ray	RD6 (Thailand)	Ahluwalia, Maluszynski and Nichterlein, 2004
Bread wheat	Grain colour	Gamma ray	Jauhar 78 (Pakistan)	MBNL No. 2, 1973
Cassava	Cooking quality	Gamma ray/MNU	Tekbank ve (Ghana)	MANT No. 44, 1999
Sorghum	Grain colour	Gamma ray	Djeman (Mali)	MBNL No. 44, 1999
Sunflower	High oleic acid	Gamma ray	NuSun (USA)	Ahluwalia, Maluszynski and Nichterlein, 2004
Tobacco	Pale green	X-ray	Chlorina Fr (Indonesia)	Sigurbjornsson and Micke, 1974
Grape fruit	Red fruit flesh and juice	EMS	Rio Star (USA)	MBNI. No. 37, 1991

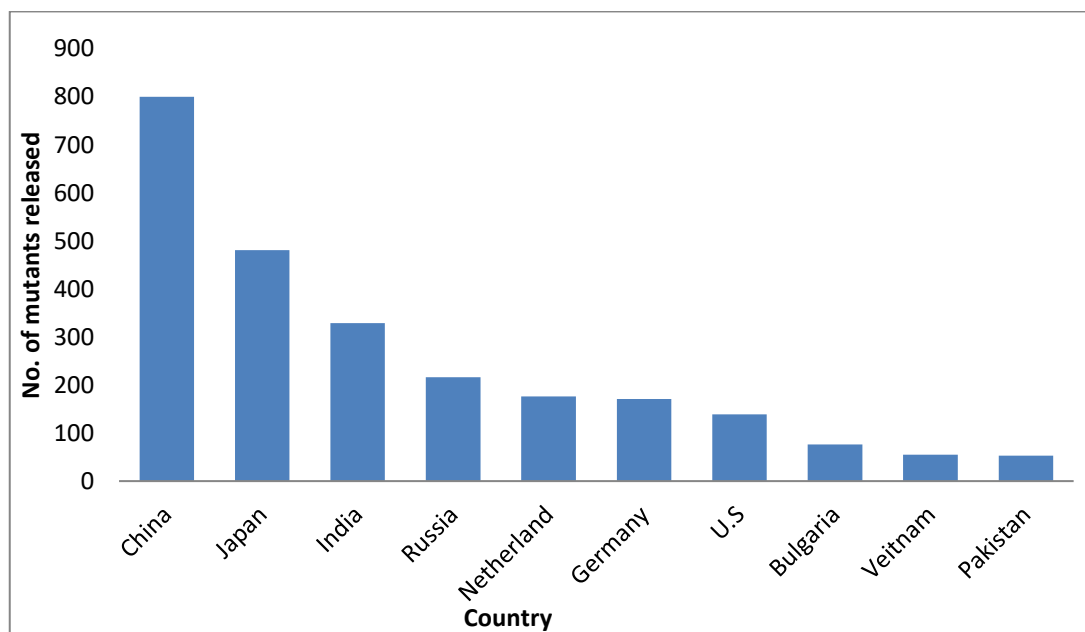
Chrysanthemum	Reduced axillary buds	Ion beam	Aladdin (Japan)	2	Shiran et al, 2013
Various flowers, Canna Moss	New colours and forms	Gamma ray	Golden Creman Cream Prapanpong: Orange Siranul; Pink peeranuch; Yellow arunce (Thailand)		MHNI. Nos. 33 and 34. 1989, Wongpiyasatid, Huchan et al, 2000

Global Status and Impact of Mutant Crop Varieties:

Induced mutation by various mutagen has contributed to modern plant breeding. Over the past decade it has played a major role all over the world in the development of plant varieties with characteristics of high yield, early maturity, lodging resistance among other.

Global impact of developed & released varieties in major crops all over the world (Ahloowalia et.al) Several achievement in crop improvement through mutation breeding have resulted in two major outcome improved varieties that are directly used for commercial cultivation & new genetic Stock with improved character. The traits could be increase yield, enhanced nutritional quality, resistance to pest & disease, early maturity, drought & salt tolerance etc.

The international Atomic energy Agency (FAO-IAEA) host the mutant variety database (MVD) which provide comprehensive information on induced mutation suitable for breeding program & genetic analysis MVD collect information on crop mutant varieties mutagen used & character improved. Since 1960 several mutant varieties has been officially released in 60 countries. The top countries are China, India Russia Netherland, Japan, USA .



Global status of officially released mutant varieties in top 10 countries.(FAO-IAEA mutant variety database 2014)

IAEA has categorized its mutant variety database of 3222 varieties according to four breeding method that are :

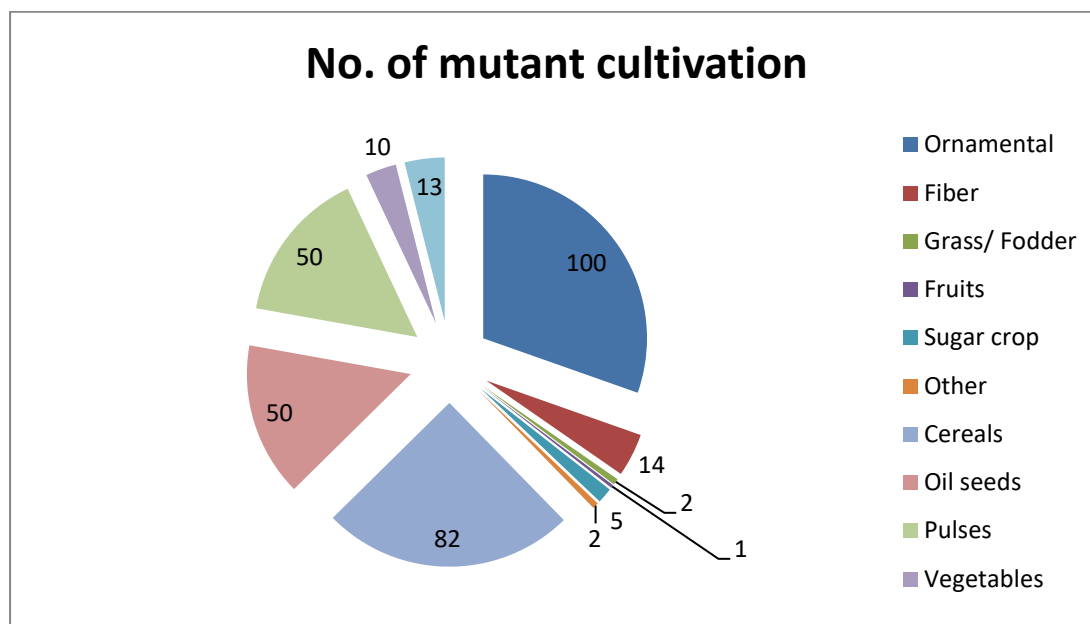
- a) Indirect use of mutant lines which are used as parental varieties in cross breeding.
- b) Direct use of mutant lines that is developed through physical & chemical mutagenesis.
- c) use of mutant gene allele (trait).
- d) use of wild specie gene translocate into plant genome through irradiation facilitated translocation.

As reviewed by (kharkwal & shu) induced mutation have contributed to significant increase in crop production at location people could directly access. The world wide use new varieties derived directly or indirectly from induced mutant are rice in China, Thailand, Vietnam & USA ; barley in European countries; wheat in Bulgaria & Italy, China; Soybean in China & Vietnam as well as other food legumes in India & Pakistan. The advancement in plant mutation have significant socio-economic impact that an international Symposium was especially dedicated to topic of Induced Plant mutation in genomics era.

The country that rank first in development of new varieties through induced mutagenesis is china. In China there have been developed major commercial mutant varieties of rice, wheat soybean, pepper, cotton, tomato & groundnut etc. In view of practical breeding many success have been made in Japan over past years. About 242 direct use mutants varieties generated by mutagenesis have been registered.

In India 1st attempt to induce mutation date back to in 1930 & Some mutant varieties were released in 1940s, but the genetic improvement of crop plant were started in late 1950, from 1950 to 2007 India had developed about 329 mutants varieties of different crop through direct

mutagenesis of which major varieties have been developed for rice, wheat, barley, jute groundnut, soybean, chickpea, cowpea, black gram, sugarcane, tobacco, chrysanthemum. The primary research Centre & Institute in India that participated in the development & release of various mutants include the Indian Agricultural Research Centre Institute (IARI), The Bhabha Atomic Research Centre (BARC), Tamil Nadu Agriculture university & National botanical Research institute.



In India several mutants varieties were approved released. The largest no. of mutant varieties produced in ornamental followed by cereals, legumes & oilseeds many of these induced mutants were released directly as new varieties. Mutation breeding of cereals, legumes, oil crops, ornamental & fruit trees have produce a significant benefit. E.g. A mutated durum wheat variety 'Creso & other varieties used for pasta in Italy (Ahloowalia et. al 2004). Rice varieties derived from mutation are grown in Asia & Australia generating billions of us dollar annually (Mba 2013). The mutant barley. "Golden Promise' & 'Diamant & varieties derived from them have been important to brewing industry in Europe (Ahloowalia et al. 2004). Induced mutation could play an imp role in inducing mutation for enhancing nutritional quality in crop plant.

Conclusion:

Mutations can be induced by physical or chemical mutagens. This is an ideal approach to broaden genetic variation for application in functional genomics and plant breeding. Genetic variability is very slow with conventional breeding techniques; It may take long years of waiting before the variability can be achieved. New breeding techniques provide scientists the ability to precisely and quickly insert the desired traits than conventional breeding. Genome editing tools are becoming popular molecular tools of choice for functional genomics as well as crop improvement. These tools have several attractive features such as simplicity, efficiency, high specificity, and amenability to Multiplexing. Mutant

identification/selection at the genotypic level, using new, high-throughput technologies, has changed the way mutations are now used in genetics and breeding. Induced mutations are poised to play a more significant role in the times to come.

References:

1. *Inger B. Holme, Per L. Gregersen and Henrik Brinch-Pedersen** Plants by Random or Targeted Mutagenesis: Convergence and Differences, Department of Molecular Biology and Genetics, Research Center Flakkebjerg, Aarhus University.
2. Suprasanna Penna ,Shriram Mirajkar, and S. G. Bhagwat Induced Mutations and Crop Improvement, Springer India 2015
3. *Deepa Jaganathan*, Karthikeyan Ramasamy, Gothandapani Sellamuthu, Shilpha Jayabalan and Gayatri Venkataraman** ,CRISPR for Crop Improvement: An Update Review,*Plant Molecular Biology Laboratory, Department of Biotechnology, M. S. Swaminathan Research Foundation, Chennai, India, 2018.*
4. Venera S. Kamburova,¹ Elena V. Nikitina,¹ Shukhrat E. Shermatov,¹ Zabardast T. Buriev,¹ Siva P. Kumpatla,² Chandrakanth Emani,³ and Ibrokhim Y. Abdurakhmonov¹ ,Genome Editing in Plants: An Overview of Tools and Applications,International Journal of Agronomy, 2017.
5. *¹Mohammed Babagana, ²Aliyu Abdulkadir Ndabokun., ³Mohammed Alhassan., ⁴Hauwa Shehu, ⁵Kabaraini Maryam Alfa,^A Review on the Role of Induced Mutation in Crop Improvement ,International Journal of Recent Research in Life Sciences (IJRRLS) , 2020.
6. Acquaah G. Principles of plant genetics and breeding. Chichester: Wiley-Blackwell; 2006.
7. Mba C, Afza R, Bado S, et al. Induced mutagenesis in plants using physical and chemical agents. In: Davey MR, Anthony P, editors. Plant cell culture: essential methods. Chichester: John Wiley & Sons, Ltd.; 2010. p. 111 130.
8. Wani MR, Kozgar MI, Tomlekova N, et al. Mutation breeding: a novel technique for genetic improvement of pulse crops particularly Chickpea (*Cicer arietinum* L.). In: Parvaiz A, Wani MR, Azooz MM, Lam-son PT, editors. Improvement of crops in the era of climatic changes. New York (NY): Springer; 2014. p. 217 248.
9. Bortesi, L., and Fischer, R. (2015). The CRISPR/Cas9 system for plant genome editing and beyond. *Biotechnol. Adv.* 33, 41–52. doi: 10.1016/j. biotechadv.2014.12.006

10. Bibikova, M., Beumer, K., Trautman, J. K., and Carroll, D. (2003). Enhancing gene targeting with designed zinc finger nucleases. *Science* 300, 764. doi: 10.1126/science.1079512
11. Bogdanove, A. J., and Voytas, D. F. (2011). TAL effectors: customizable proteins for DNA targeting. *Science* 333, 1843–1846. doi: 10.1126/science.1204094
12. Breyer, D., Herman, P., Brandenburger, A., Gheysen, G., Remaut, E., Soumillon, P., et al. (2009). Commentary: Genetic modification through oligonucleotide mediated mutagenesis. A GMO regulatory challenge? *Environ. Biosafety Res.* 8, 57–64. doi: 10.1051/ebr/2009007
13. Jinek, M., Chylinski, K., Fonfara, I., Hauer, M., Doudna, J. A., and Charpentier, E. (2012). A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. *Science* 337, 816–821. doi: 10.1126/science.1225829
14. Voytas, D. F. (2013). Plant genome engineering with sequence-specific nucleases. *Annu. Rev. Plant Biol.* 64, 327–350. doi: 10.1146/annurev-arplant-042811-105552
15. D. G. Knorre and V. V. Vlasov, “Reactive derivatives of nucleic acids and their components as affinity reagents,” *Russian Chemical Reviews*, vol. 54, no. 9, pp. 836–851, 1985.
16. N. J. Palpant and D. Dudzinski, “Zinc finger nucleases: Looking toward translation,” *Gene Therapy*, vol. 20, no. 2, pp. 121–127, 2013.
17. R. Jankele and P. Svoboda, “TAL effectors: Tools for DNATargeting,” *Briefings in Functional Genomics*, vol. 13, no. 5, pp. 409–419, 2014.
18. Y.-G. Kim, J. Cha, and S. Chandrasegaran, “Hybrid restriction enzymes: zinc finger fusions to Fok I cleavage domain,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 93, no. 3, pp. 1156–1160, 1996.
19. T. Gaj, C. A. Gersbach, and C. F. Barbas III, “ZFN, TALEN, and CRISPR/Cas-based methods for genome engineering,” *Trends in Biotechnology*, vol. 31, no. 7, pp. 397–405, 2013.
20. C. O. Pabo, E. Peisach, and R. A. Grant, “Design and selection of novel Cys²His² zinc finger proteins,” *Annual Review of Biochemistry*, vol. 70, pp. 313–340, 2001.
21. T. Cathomen and J. Keith Joung, “Zinc-finger nucleases: the next generation emerges,” *Molecular Therapy*, vol. 16, no. 7, pp. 1200–1207, 2008

22. J. F. Petolino, “Genome editing in plants via designed zinc finger nucleases,” *In Vitro Cellular and Developmental Biology - Plant*, vol. 51, no. 1, 2015.
23. K. Osakabe, Y. Osakabe, and S. Toki, “Site-directed mutagenesis in Arabidopsis using custom-designed zinc finger nucleases,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 107, no. 26, pp. 12034–12039, 2010.
24. F. Zhang, M. L. Maeder, E. Unger-Wallaced et al., “High frequency targeted mutagenesis in *Arabidopsis thaliana* using zinc finger nucleases,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 107, no. 26, pp. 12028–12033, 2010.
25. V. K. Shukla, Y. Doyon, J. C. Miller et al., “Precise genome modification in the crop species *Zea mays* using zinc-finger nucleases,” *Nature*, vol. 459, pp. 437–441, 2009.
26. W. M. Ainley, L. Sastry-Dent, M. E. Welter et al., “Trait stacking via targeted genome editing,” *Plant Biotechnology Journal*, vol. 11, no. 9, pp. 1126–1134, 2013.
27. J. F. Petolino, A. Worden, K. Curlee et al., “Zinc finger nucleasemediated transgene deletion,” *Plant Molecular Biology*, vol. 73, no. 6, pp. 617–628, 2010.
28. Boch J, Bonas U. Xanthomonas AvrBs3 family-type III effectors: discovery and function. *Annu Rev Phytopathol.* 2010;48:419–436. [[PubMed](#)] [[Google Scholar](#)]
29. N. J. Sauer, J. Mozoruk, R. B. Miller et al., “Oligonucleotide directed mutagenesis for precision gene editing,” *Plant Biotechnology Journal*, vol. 14, no. 2, pp. 496–502, 2016.
30. I. Y. Abdurakhmonov, “Genomics Era for Plants and Crop Species—Advances Made and Needed Tasks Ahead,” in *Plant Genomics*, I. Abdurakhmonov, Ed., InTech, Croatia, Balkans, 2016.
31. CropLife International, “Oligonucleotide-Directed Mutagenesis (ODM),” *LJournal*, 2017
32. Ahloowalia B.S. Maluszynski M.. Nichterlein K.(2004). Global impact of mutation-derived varieties, Kluwer Academic Publishers Printed in the Netherlands. *Review Euphytica* 135: 187-204
33. Anonymous (1977). *Manual on Mutation Breeding (Second Edition)*. Technical Reports Series, No. 119. Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria. 288-290

34. Dong C, Dalton-Morgan J, Vincent K, Sharp P (2009). A modified TILLING method for wheat breeding. *Plant Genome* 2:39-47
35. Maluszynski M (2001). Officially released mutant varieties-the FAO/IAEA database. *Plant Cell Tiss Org Cult* 65:175-177
36. Maruyama K, Araki H, Kato H (1991). Thermosensitive genetic male sterility induced by irradiation. *Rice genetics II*: 227-35.
37. Mashenkov A (1986). Induced mutation process as a source of new Mutants; *Maize Genetics Cooperation newsletter* 60, 70-71
38. Mha C (2013). Induced mutations unleash the potentials of plant genetic resources for food and griculture. *Agronomie* 3:200-231
39. Mat C, Afra R, Jain SM (2007). Induced mutations for enhancing salinity tolerance in rice. In: Jenks MA, Hasegawa PM, Jain SM (eds) *Advances in molecular breeding towards drought and salt tolerant crops*. Springer, Berlin, pp 413-45
40. Mis C, Guimanes PE, Ghosh K (2012h). Re-orienting crop improvement for the changing climatic conditions of the 21st century. *Agric Food Sect* 1:7
41. Raychowdhury R, Tah I (2013). Mutagenesis-a potential approach for crop improvement. In: Hakeen KR, Ahmad P, Öztürk O (eds) *Crop improvement*. Springer, New York. pp 149-187
42. Zhong-hua W, Xin-chen Z, Yu-lin J (2014). Development and characterization of rice mutants for Junctional genomics studies and breeding. *Rice Sci* 21(4). doi: 10.1016/S1672-6308(13)60188 2
43. Active crop improvement related Coordinated Research Projects managed by the Plant Breeding and Genetics Section of the Joint FAQ/IAFA Division of Nuclear Techniques in Food and Agriculture Available online: <http://www.nawchtaca.org/nafa/phg/erp/active-cerps-pbg.html> (accessed on 2 November 2012).
44. Rosegrant, M.W. Impacts of climate change on food security and livelihoods. In *Food Security and Climate Change in Dry Areas, Proceedings of an International Conference*,

- Amman, Jordan, 1-4 February 2010, Solh, M, Saxena, MC Eds; International Center for Agricultural Research in the Dry Areas: Aleppo, Syria, 2011, pp. 24-26.
45. von Wettstein D. Mutants pave the way to wheat and barley for celiac patients and dietary health. In: *Induced Plant Mutations in the Genomics Era. Proceedings of an International Joint FAO/IAEA Symposium*. International Atomic Energy Agency, Vienna, Austria; 2009. p. 168–71.
 46. Parry MAJ, Madgwick PJ, Bayon C, Tearall K, Hernandez-Lopez A, Baudo M, et al. Mutation discovery fo crop improvement. *Journal of Experimental Botany* 2009;60(10):2817-25.
 47. Zhou JP. Selection at the cell level of disease-resistant mutants in higher plants. *Hereditas, China* 1983;5(6):46-8.
 48. Xin ZG, Wang ML, Barkley NA, Burow G, Franks C, Pederson G, et al. Applying genotyping (TILLING) and phenotyping analyses to elucidate gene function in a chemically induced sorghum mutant population. *BMC Plant Biology* 2008;8:103.

Cancer -A Threat to Life

Shweta A Pise*¹

Department of Microbiology, Vivekanand College, Kolhapur

shwetapise29@gmail.com

What is Cancer?

Cancer is a group of disease where rapid creation of abnormal cells that grow beyond their usual limits & then invade adjacent cells of body and organs.

Cell is basic & fundamental unit of life. In the human body about 10^{13} cells of different types are found organs. To make an organ, cell needs nutrients to divide & grow. These cell division happens in most controlled manner. If this control over cell division is lost or deviate from normal rule will result in chaos in respective areas. This loss of control over cell division & unnecessary production of contagious mass of cells is called as “Tumor”.

Tumors are of two types such as ‘benign tumor’ & ‘malignant tumor’

Benign tumor :

Benign tumor are not cancerous tumors. Benign tumor forms if cell divides when it should not, but stays within normal location. It do not spread to other parts of body & are surrounded by a containing membrane. Benign tumors can be removed by surgeries if it becomes larger. Usually these tumors are not threat to life. But sometimes can cause serious symptoms or belief threatening such as benign tumor in a brain E.g. Warts, a tumor of skin A mole is a small tumor on variety of tissues.

Malignant tumors :

“Malignant tumors are cancerous”. Cells of cancer begins to divide and also acquire the ability to invade & damage tissue or organs nearby and also sometimes these cells can break away from malignant tumor and enter lymphatic system or blood stream and spread to other body organs(Commonly this process is called as “Metastasis”).The main feature of these cells is cell’s ability to grow rapidly, uncontrollably & independently from the tissue where it started. There are over 200 different types of cancer which are named after cell type & origin. E.g. Hepatomas are cancer of liver. Carcinomas are cancer of epithelial cells.

Characteristics	Benign Tumors	Malignant Tumors
Differentiation	Tumors cells are similar to original mature cells	Tumor cells might not be similar to original mature cells.
Growth Rate	Slow, might stop or regress	Rapid, autonomous; usually does not stop or regress
Type of Growth	Expand and displace	Invalidate, destroy and replace
Metastasis	Not seen	Seen in each case
Health Effect	Usually does not cause death	May cause death if not diagnosed and treated.

History of Cancer -

Cancer has existed for all human history. Though cancer existed in animal in prehistoric time, even before men appeared on earth. The earliest written information regarding cancer can be found in Egyptian Edwin Smith Papyrus dated circa 1500 BC & it refers to breast cancer. Father of medicine and Greek physician Hippocrates referred cancer with Greek word 'Karkinos' (Crab) as appearance of cut surface of malignant tumor was resembled to Crab with its feet. Later Celsius, a Roman physician translated Greek term Karkinos into a Cancer, a Latin word for crab. Another roman physician Galen used term 'Oncos' ,a for Greek word for swelling to describe tumor & so nowadays it is used as name for cancer specialist i.e. "Oncologist"

Common Types of Cancer :

- **Breast Cancer** -Breast cancer is the most common type of cancer. Breast cancer is the cancer that forms in cells of breast. It can occur in both & men, but women are most likely to be affected by this type of cancer. About 1% of all breast cancer cases affected by men.
- **Lung Cancer** – Lung cancer is the type of cancer that begins in the lungs. Lung cancer is of two types; non-small cell lung cancer & small cell lung cancer. Smoking causes most of lung causes, but non smoker can also develop lung cancer.
- **Prostate Cancer** – Prostate cancer is cancer of prostate gland, a small walnut shaped gland in men that produce seminal fluid that nourishes and transport cells. Prostate cancer usually grows slowly and are confined to prostate gland ,where they may not cause serious harm. However while some types of prostate cancer grow slowly and may need minimal or even no treatment, other types are aggressive and can spread quickly.
- **Colorectal Cancer** – Colorectal cancer is that cancer that develops in tissues of colon and rectum, parts of large intestine. Colorectal cancer typically affect older adult, though it can happen at any age.
- **Blood cancer** – Blood cancer is type of cancer that affect your blood cells. Leukemia ,Lymphoma & Myeloma are most common types of blood cancer. leukemia occurs most often in adult older than 55 , but it is common in children younger than 15.

Causes of Cancer:

The following are the most well studied known or suspected causes of cancer. By limiting the exposure to such factors can reduces the chances of developing cancer.

1. Age Factor:

The major risk for many specific types of cancer, is growing older. Overall, cancer incidence rates rise consistently with age, from fewer than 25 cases per 1,00,000 people in age groups under 20 to around 350 cases per 1,00,000 people in age groups 45-49, and more than 1,000 cases per 1,00,000 people in age group 60 and older.

According to most recent statistical research data, the half of total cancer cases occurs in age group above 50 years.

2. Obesity:

It is been observed that, obese people are more likely to develop cancer of breast, rectum, endometrium (uterine lining), esophagus, kidney, pancrease and gall bladder. There are some

measures that can help minimize the risk of certain cancers like consuming a good diet, physical fitness, maintaining a healthy weight etc.

3. Tobacco:

Tobacco is one of the major cause of cancer and cancer related mortality. The tobacco contains many carcinogenic chemicals that damages the structure of DNA. So, the people who use tobacco products or regular smoking of tobacco products are at greater risk of cancer.

Tobacco is associated with many types of cancer including lung cancer, tracheal cancer, mouth cancer, throat cancer, bladder cancer, kidney cancer, liver cancer, cervical cancer, pancrease cancer, colon cancer etc.

4. Infectious agents:

Many microorganisms are often considered as a cause of different diseases in human beings. The microorganisms like viruses, bacteria and parasites are the infectious agents, which can raise the risk of cancer development. Especially viruses have been designated as the major cause of cancer, accounting about 16-20% of total human cancer.

The oncogenic viruses can be transmitted from one person to another via blood or other body fluids or can also be transferred vertically from infected mother to fetus.

5. Radiations:

Ionizing radiation is a type of radiation that has enough energy to damage DNA and causes cancer. X-rays, radon, gamma rays are some examples of ionizing radiations, These types of radiations can be emitted in nuclear power plant accidents as well as during development, testing and use of atomic weapons.

Who's affected by Cancer?

The exact cause of cancer is yet to be known. However, certain risk factors have been demonstrated to raise a person's chances of developing cancer in research studies.

The exposure to certain chemicals or other substances are all cancer risk factors. Some factors which can not be controlled like age and family history can also be responsible for cancer development. A family history of some malignancies may indicate the presence of an inherited cancer.

The development of cancer depends upon several factors like habits, family history, health conditions and surrounding environment.

- a. **Age:** Cancer can take decades to develop. That's why most people are diagnosed with cancer are of 65 or older. It is more common in older adults, but cancer isn't exclusively an adult disease. It can be diagnosed at any age.
- b. **Habits:** Certain lifestyle choices are also responsible for increased risk of cancer. Smoking, drinking more than one drink a day for women and up to two drinks a day for men, excessive exposure to sun or blistering sunburn, being obese and having unsafe sex can increase chances of cancer.
- c. **Family history:** Cancer is not a disease which is inherited commonly. Having family history with cancer does not necessarily cause cancer in all generations. It in necessary to get genetic testing to see whether you have inherited mutations that might increase risk of certain cancers.

Why are cancer cases rising in India?

The total number of cancer cases in India is

It is projected to go up from 14.6 lakh in 2022 to 15.7 lakh in 2025, according to the Indian Council of Medical Research- National Cancer Registry Programme (ICMR-NCRP). The statistical report by NCRP in 2020, the cancer incidence in men is estimated to be 679,421 in 2020 and 763,575 in 2025, while among women, it is estimated to be 712,758 in 2020 and 806,218 in 2025. The report further highlighted that oral, lung and colorectal cancers were the most common cancers among men.

In India tobacco was found to be responsible for 25-40% of cancers and dietary habits may be responsible for about 10-20% of cancers. Dr. Mehul Bhansali, Director Surgical Oncology, Jaslok Hospital and research Center highlights that the increased cases of breast cancer, which is a major type of cancer in India. According to Dr. Bhansali poor lifestyle, longer working hours, increasingly stressful lives, smoking, alcohol consumption, use of contraception, are all contributing to breast cancer cases.

The major concern about cancer in India is that, many cancer cases go undetected until they reach advanced stages. According to Dr. Vijay Patil, Consultant (Medical oncology) at PD Hinduja Hospital and Medical Research Center, Khar, the risk factors which are high in Indians that can lead to cancer are:

- a. Alcohol
- b. Obesity
- c. Infection
- d. Tobacco

Preventive Measures –

- Exercise regularly
- Eliminate or reduce stress and enhance the ability of effectively cope with stress
- Go to annual health check up
- Learn to practice self-examination (Breast & testicular)
- Eat a balanced diet that includes vegetables, fresh fruit, whole grains & adequate amount of fibres.
- Take at least 6-8 hours of rest per night
- Reduce exposure to known or suspected carcinogen.
- Quit smoking & drinking.
- Avoid eating preserved food.

References :

- ["Cancer"](#). *World Health Organization*. 12 September 2018. Retrieved 19 December 2018
- ["What Is Cancer?"](#). *National Cancer Institute*. 17 September 2007. Retrieved 28 March 2018.
- [Cancer Fact Sheet](#)". Agency for Toxic Substances & Disease Registry. 30 August 2002. Archived from [the original](#) on 13 August 2009. Retrieved 17 August 2009

- [Prostate cancer - Symptoms and causes - Mayo Clinic](#)
- [Colon cancer - Symptoms and causes - Mayo Clinic](#)

Isolation and characterisation of Pesticide (chlorpyrifos) Degrading Microorganisms from soil

Supriya Dinanath Potdar¹, Mr. S. G. Kulkarni²

1 MSc Biotechnology, Department of Biotechnology, Shivaji University, Kolhapur

2 Vivekanand College, Kolhapur (Autonomous)

ABSTRACT

In developing nations like India pesticides play an important role in agricultural. Their importance in crop yield improvement is understood and well accepted. But their highly toxic nature poses a fatal environmental threat. Present study is directed towards development of biodegradation method to reduce the environmental burden of the pesticide. Chlorpyrifos is major spectrum organophosphate insecticide used in agricultural field. A soil bacterial isolates capable of degrading chlorpyrifos was isolated by selective minimal salt media (MSM)

Keywords: Bacterial Isolates, Environmental Pollution, Pesticides, chlorpyrifos, organophosphate insecticide, Biodegradation.

INTRODUCTION

The pesticide contaminants causing ecological problems leading to imbalance in nature is of global concern. In addition, the use of pesticides constitutes an important aspect of modern agriculture, as they are absolutely necessary for economical pest management. The most promising opportunity for maximizing benefits and minimizing risks is to invest time, money, and effort into developing a diverse toolbox of pest control strategies that include safe products and practices that integrate chemical approaches into an overall and ecologically based framework which will optimize sustainable production, environmental quality, and human health. However, the application of pesticides may cause adverse effects among the different forms of life and among the ecosystems; this will depend on the sensibility grade of the organisms and the pesticide. Approximately 90% of agricultural pesticide application never reaches its target organisms but is, instead, dispersed through the air, soil, and water. As a result, they are routinely detected in air, surface and ground water, sediment, soil, vegetable, and to some extent in foods. In addition, many soil-applied pesticides are also intentionally introduced into the soil environment for the control of soil borne pests and pathogens, which results in the accumulation of their residues and metabolites in soil at unacceptably high levels. The inadequate application practice is one of the most important ways of pollution, which has a profound impact not only on the soils of the areas in which they are applied. Pesticides are washed into aquatic ecosystems by water runoff and soil erosion. Pesticides also can drift during application and contaminate aquatic systems. Some soluble pesticides are easily leached into streams and lakes. Wild birds and

mammals are damaged and destroyed by pesticides and these animals make excellent “indicator species”. Deleterious effects on wildlife include death from the direct exposure to pesticides or secondary poisonings from consuming contaminated food; reduced survival, growth, and reproductive rates from exposure to sub-lethal dosages; and habitat reduction through the elimination of food resources and refuges. Pesticides easily find their way into soils, where they may be toxic to arthropods, earthworms, fungi, bacteria, and protozoa. Small organisms are vital to ecosystems because they dominate both the structure and function of ecosystems. Like pest populations, beneficial natural enemies and biodiversity (predators and parasites) are adversely affected by pesticides. Bioremediation is described as the use of microorganisms to destroy waste materials. This process of detoxification targets the harmful chemicals by mineralization, transformation, or alteration. For centuries, civilizations have used natural bioremediation in wastewater treatment, but intentional use for the reduction of hazardous wastes is a more recent development. The present study focuses on the isolation and characterization of bacterial cultures for biodegradation of pesticides commonly used in the agriculture.

MATERIALS AND METHOD

Pesticide used

Commercial grade of chlorpyrifos (EC 50%), a type of organophosphorus pesticide was used for this study. It was purchased from local agrochemicals shop in Kolhapur.

Collection of soil samples

Soil samples were collected from agricultural areas of Kolhapur District, Maharashtra, with history of continued farming activities for 2-3 years. Surface soil from 0-15 cm were collected, placed in plastic bags, transported on ice to the laboratory and stored at 4°C until analysis. Soil samples were air dried and sieved through a 10 mm mesh prior to bacterial screening.

Media

Minimal salt medium (MSM) enriched with pesticide(chlorpyrifos) was used for isolation of chlorpyrifos degrading bacteria

Screening and isolation of Pesticide degrading bacteria

Ten grams of soil sample were added to 100 ml MSM and enriched with an addition of 25 ppm pesticide. Samples were incubated on rotary shaker (150 rpm) at 30°C for 7 days and then transferred to a fresh medium and incubated at the same conditions, after which, the cultures were regularly transferred every 3-4 days or until increased turbidity were evidenced. After 3-4 times of repeated sub-culturing, 0.1 ml culture broth was pipetted and spreaded on MSM +pesticide agar. Single colonies were selected and streaked on nutrient agar (NA) supplemented with 25, 50 and 100 ppm of the pesticide. Cultures were incubated at 30°C for 3 days. Pesticide degrading isolates were selected from isolates which developed clear zone

surrounding their colonies when grown on NA supplemented with 25, 50 and 100 ppm of the pesticide.

Biodegradation of Pesticide by bacterial isolates

Selected bacterial isolates were grown in MSM + pesticide and incubated on rotary shaker at 150 rpm, 30°C for 10 days. Samples were collected every 24 hrs for the determination of pesticide degradation by measurement of absorbance at 300 nm

Characterization of bacterial isolates

Morphological studies

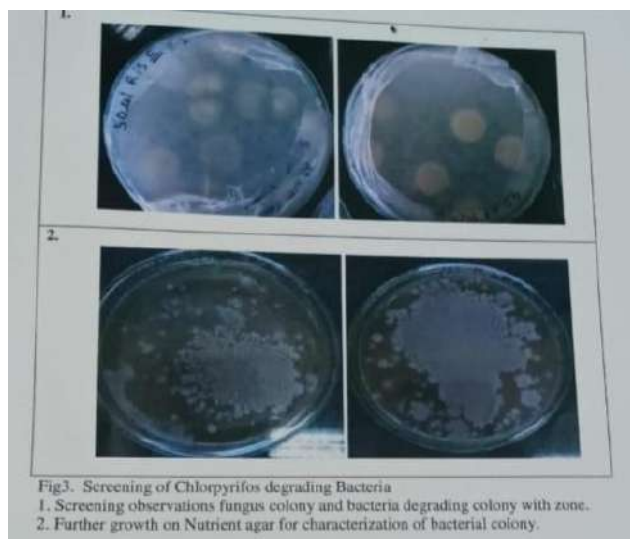
Bacterial isolates were grown in MSM +pesticide and incubated at 30°C until either turbidity or colony was observed. Gram’s stain and cell morphology was investigated under microscope

RESULT AND DISCUSSION

Screening of Chlorpyrifos degrading Bacteria

Screening observations show fungus colony and Bacterial colony with clear zone around colony that grows on media plates. Further growth of this colonies on nutrient agar for characterisation.

The Bacterial isolates were studied for their various characters such as:



Colony Morphology:-

Size	Shape	Colour	Margin	Elevation	Opacity	Consistency	Gram Nature	Motility
0.5-1mm	Circular	White	Regular	Convex	Opaque	Moist	Gram Positive	Non-motile

Gram Staining:-



Fig4. Gram Staining;

Gram positive cocci shaped isolates were seen by microscopic observation.

Biochemical tests (IMViC) of Bacterial isolates

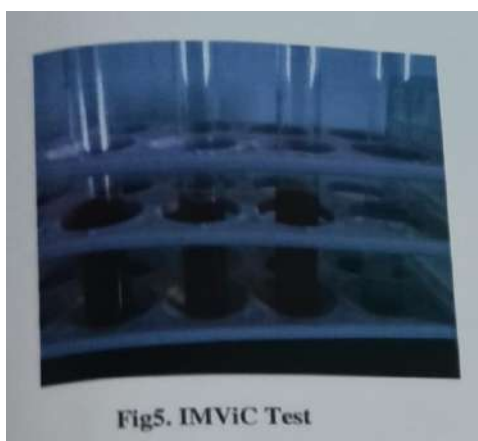
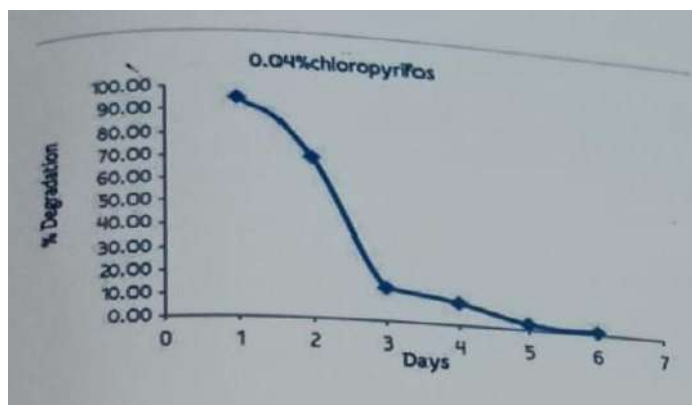


Fig5. IMViC Test

Biochemical Tests	Result
Indole Test	Positive
Methyl Red Test	Positive
Voges Proskauer Test	Negative
Catalase Test	Negative

Spectrophotometric Analysis:-



Days	Control 0.04%	Test	% Control	% degradation
1	0.927	0.880	100	94.93
2	0.921	0.644	100	69.92
3	0.918	0.134	100	14.60
4	0.918	0.091	100	9.91
5	0.918	0.025	100	2.72
6	0.918	0.012	100	1.71

CONCLUSION

Identification of Bacterial isolates were carried out by routine bacteriological methods by using these results the isolate is similar to *Streptococcus spp.* Degradation study of chlorpyrifos pesticide shows 94.93% degradation. Isolated micro- organism can be useful further for pesticide pollution control.

REFERENCES

1. Damalas C. A. (2009). Understanding benefits and risks of pesticide use. Scientific Research and Essay. 4(10), 945-949.
2. FAO (2002). Código internacional de conducta para la distribución y utilización de plaguicidas. Adoptado por el 123° Período de Sesiones del Consejo de la FAO. Roma, pp 31.
3. Gouma S. (2009). Biodegradation of mixtures of pesticides by bacteria and white rot fungi. Ph.d. Thesis. School of Health Cranfield University. 416 p.
4. CICOPLAFEST (2004). Catalogo Oficial de Plaguicidas. Comisión Intersecretarial para el Control de Proceso y Uso de plaguicidas, Fertilizantes y Sustancias Tóxicas. compounds. In Sasek V. et al. (Eds.) The utilization of bioremediation to reduce soil contamination: Problems and Contam. Toxicol. 44, 141–151.
5. Gamón M., E Sáez E., Gil J. & Boluda R. (2003). Direct and indirect exogenous contamination by pesticides of ricefarming soils in a Mediterranean wetland. Arch. Environ. Contam. Toxicol. 44, 141–151.
6. Shalaby Sh. E.M.& Abdou G. Y. (2010). The influence of soil microorganisms and bio- or - organic fertilizers on dissipation of some pesticides in soil and potato tube. Journal of Plant Protection Research. 50 (1). 86-92.
7. Shanahan, Peter. (2004) Bioremediation. Waste Containment and Remediation Technology, Spring, Massachusetts Institute of Technology, MIT OpenCourseWare. <http://ocw.mit.edu/NR/rdonlyres/Civil-andEnvironmental-Engineering/1-34Spring2004/335613D5-6D6F-413F-9098-453E8AC20BC2/0/lecture12.pdf>
8. Shannon, M.J. and Unterman, R. (1993) Evaluating bioremediation: distinguishing fact from fiction. Annual Review of Microbiology v47 pp715(24).

9. US Microbics. (2003). Annual Report FY-2003. [http://www.bugsatwork.com/USMX/BUGS%20Report %20PRINT%20\(07-13- 04\)%20Hawaii%20\(paginate%201-8\).pdf](http://www.bugsatwork.com/USMX/BUGS%20Report%20PRINT%20(07-13-04)%20Hawaii%20(paginate%201-8).pdf).

Education as a Vital source of human capital formation then and Now:

Dr. Revati R. Patil

Asst. Prof. Department of Commerce.

Vivekanand College Kolhapur, (Autonomous)

Introduction:

Although India is considered an emerging country, the Indian economy is already one of the five largest economies in the world in terms of GDP. Economic growth has remained constant at over 7 per cent in recent years. This means that India's economy is growing faster than China's and is also outperforming growth in Germany. Indian politicians have set themselves the goal of developing the country into the third largest economy in the world by 2025. Although India is often overshadowed by the Chinese economy, the subcontinent offers a wealth of opportunities in various economic sectors.

The steady growth of the population and the improvement in infrastructure are contributing to economic development. In addition, political stability and the introduction of various reforms have encouraged investment from abroad. The country is currently undergoing a transformation between a developing country and an emerging economy. Rapid economic growth in recent years, Emerging middle class with growing purchasing power, Modern sectors such as IT, pharmaceuticals and the automotive industry are strongly represented, Political stability and democratic structures, Large population with well-educated skilled labour, Increasing integration into the global economy, Member of the G20 group of the most important industrialised and emerging countries characterise India as an emerging market

This impressive development has been due to a growth in inputs (capital and labour) as well as factor productivity. If growth continues, India could achieve the status of an industrialized country in the next few years. This exciting emerging economy in the world on the other hand, has to consider contemporary challenges in the context of the corporate world, good Leadership practices, Staffing and ethics. Most of the practices followed now a days are inherited from western societies, which are not focused towards following ethics in management or leadership. Our ancient literature gives us various insights in to such practices through characters and stories. This chapter makes an attempt to explore the Human Capital Management practices like Staffing, Ethics and leadership strategies from ancient India and compare them with the modern Management practices.

Education and human capital formation

Proper education will play a significant role in making youth future-ready and increasing economic growth by providing skilled persons which will also boost industrial development. In the modern era of education, every institution or university is adapting new teaching methods using their teaching methodologies. Indian education is the biggest and well-known education systems in the world. *During ancient education*, there were 5 big well-known universities like Takshashila, Nalanda, Vallabhi, etc., which focus on the all-round development of students. *In modern education*, there are well known autonomous institutes like IITs and IIMs which are famous all around the world. During ancient education, students live away from their parents, their education comprises of subjects like physical education, mental education, politics, economics, etc. They were shaped in a way that they can live in any condition considering how difficult the situation will be? In today's modern era of big institutes like the Indian Institute of Technology (IITs) and Indian Institute of Management (IIMs), everything is changed like the living standard of students, curriculum, all-round development. The principle objective of the student has been to just achieve its goal and be successful. Only the big institutes like IITs, IIMs, and some other private and aided universities have adopted modern methods of learning. There is a difference in curriculum, teaching methods, and living standards of students in every institute.

The main purpose of this chapter is to convey what all the things need to adopt in our current education system from ancient and also some new trends associated with it. The chapter is mainly categorized into Ancient education system, including sub-sections such as curriculum, method of learning, the aim of education, characteristics of education, educational institutes, higher educational institutes, advantages, and disadvantages of the particular education system.

Ancient education

During the ancient period, two systems of education were developed, Vedic, and Buddhist. The medium of language during the Vedic system was Sanskrit, while those in the Buddhist system were pali. During those times the education was of Vedas, Brahmanas, Upnishads, and Dharmasutras. From the Rigveda onwards, our ancient education started with the objective of developing the students not only in the outer body but also on the inner body. The ancient education focused on imparting ethics like humility, truthfulness, discipline, self-reliance, and respecting all creations to the students. The education was mostly imparted in ashrams, gurukuls, temples, houses. Sometimes pujaris of the temples used to teach students. The education system of ancient India has some special features and uniqueness which was not found in any other ancient education system of the other countries. The education was mostly given in forests under the blue sky, which keeps the student's mind fresh and alive. During ancient times people used to live a simple life and doing their work with devotion and hard work

Aim of education

The main objective of education was to equip the students with a good quality of education. The education mostly focused on the enrichment of noble ideals. The objective was gaining the mental, physical, and intellectual personality of students, to make the students future-ready and survive in any situation

Characteristics of education

During the ancient period, the state government and the people did not

interfere in designing curriculum, payments of fees, regulation of teaching hours. There was a strong bonding between teacher and student. Every student was allotted with one teacher and more emphasis was given to the student-teacher relationship, each student used to meet teachers personally to learn and gain instructions from them. During ancient times, royal families, as well as kings of states, used to donate their wealth to improve the education system and quality. The syllabus was designed in accordance with the demands of that era. At that time students used to leave their houses and went to live with their gurus until their education was completed. During the early Vedic period, women's education was also given more emphasis. The education focuses on the physical and mental development of students. The course duration was about 10–12 years, as there were no books so students used to memorize all things, memory played a crucial role during learning. The education was imparted in forests away from cities and peoples to give students a pleasant and silent environment of study.

Curriculum

Curriculum plays an essential role in the education system. It was dynamic and not static; it was made up of different stages. The fundamental goal of building a good curriculum was to develop students physically and mentally. The curriculum consists of four Vedas, six vedangas, Upnishads, darshanas, Puranas, Tarka Shastra. The six vedangas were Shiksha, Chhandas, Vyakarana, Nirukta, Jyotisha, and Kalpawhile the darshanas were Nyaya, Baiseshika, Yoga, Vedanta, Sankhya, Mimasa. Algebra, Geometry, and grammar were also given more importance at that time. Panini was famous in the domain of grammar at that time. The curriculum of the Buddhist system consists of pitakas, Abhidharma, and sutras. Besides this medicine, Vedas were also given importance. Hindu learning was a part of Buddhist learning, although more emphasis was given to Buddhist learning. Both the systems were going hand in hand at that time. The education was totally through orals and debates, and the exams were conducted every year. The education system of the ancient period focused on subjects like warfare, military, politics, religion.

Methods of learning

The teachers at that time paid special focus to their students and teach them according to their knowledge and skill level. Teaching was basically via orals and debates, and the different methods were as follows:

- At that time books were not there, so students had the habit to learn and memorize all the things taught in the class, and teachers also helped them in memorizing.
- The students used to deep dive into the concepts taught by their teachers and explore new methods to learn it.
- Listening, Contemplation, and concentrated contemplation were some new methods of exploring the way of learning.
- The teachers used the storytelling methods to teach the students.
- Students used to ask questions about the topics taught by the teachers and these topics were discussed and then answered to the students.
- The education of that time mainly focused on practical knowledge of the topics taught in the class.
- The students got plenty of knowledge through seminars and debates conducted at frequent intervals.

Educational institutions

Gurukul was the hometown of teachers where students come after completing their initiation ceremony and learn until the completion of their study. The parishads or academies were the places of higher learning and education where students learn through discussions and debates. Goshti or conferences were the places where the kings of the states used to invite scholars from every institute to meet and exchange their views. Ashramas or hermitages were the other learning centers where students from various parts of the country used to come and learn from saints and sages. Vidyapeeth was the place of spiritual learning founded by great Acharya, Sri Shankara in places like Sringeri, Kanchi, Dwarka, and Puri, etc. Agraharas was an institution of Brahmins in villages where they used to teach. Viharas were the educational institutions founded by Buddhists where the students were taught the subjects related to Buddhism and philosophy.

Higher educational institutions

1. ***Takshashila or Taxila***: Takshashila was the famous center of learning, including religion and teaching of Buddhism in ancient times. It was famous for his higher education learning comprising of subjects like ancient scriptures, law, medicine, sociology, astronomy, military science, and 18 Silpas, etc. The well-known scholars from the university were great grammarian Panini, he was an expert in his subject of grammar and published his work on Ashtadhyayi, Chanakya who is skilled in statecraft both studied here. Students from Kashi, Kosala, Magadha,

and also from different countries flocked into the university despite a long and arduous journey. Takshashila was an ancient Indian city currently situated in north-western Pakistan was the well-known center of learning and has been declared as an archeological site and world heritage by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1980.

2. **Nalanda:** When Xuan Zang came to Nalanda it was called Nala, which was the center of learning in many subjects. The students used to come here from different parts of the country and the world to study here. Different subjects were taught, including the Vedas, fine arts, medicine, mathematics, and astronomy. Xuan Zang himself became the student of Yogashastra. Nalanda which is currently situated in Rajgir, Bihar, India was also declared as a world heritage site by UNESCO. The other famous institutes around ancient times were Vallabhi, Vikramshila, Ujjain, and Benaras.

Discussion & Conclusion:

Considering the above discussion on the ancient education system we can infer that the ancient education system focuses on the all-round development of students. More emphasis was given to practical knowledge rather than theoretical knowledge. The students were not just involved in bringing the ranks, but their main focus was on knowledge. Classrooms were built-in forests which provide a pleasant study environment to the students. There was no pressure laid on students related to studies so that they can learn effectively. The government did not interfere with the formation of curriculum, kings at that time helped in the development of education. On the other hand we have to note that Women were not admitted to the Gurukuls. There was caste discrimination as only Kshatriya was allowed, Eklavya was not given admission to the Gurukul.

In spite all the lacunas from the ancient education system we can explore existence of the Human Capital formation practices like Staffing, Ethics and leadership strategies from ancient Indian education system. Humility-truthfulness-discipline-self-reliance-respecting all creations to the students were distinctive features of ancient education. Students were habitual to simple life doing their work with devotion and hard work. Educational practices were trying to the enrich students noble ideals. The main objective of education was gaining the mental, physical, intellectual personality of students. Ancient education system was believing in strong bonding between teacher and student accordingly every student was allotted with one teacher. Syllabus were designed as per the demands of that era and curriculum was dynamic and not static. The education was totally through orals and debates. The examinations were conducted every year. The teachers focus to their students according to their knowledge and skill level. Listening, contemplation, and concentrated contemplation were the methods of learning. The storytelling, discussion and question answers after teaching every concept was routine. Not only theoretical but practical knowledge based on class learning was insisted. The Parishads- were including discussion & debates on learned concepts, Goshti or Conferences-were common which was intending to invite scholars from various disciplines. Spiritual learning- was integrated for the all-round .development of students. Practical knowledge rather than theoretical knowledge.

Students were pursuing not just the ranks, but knowledge. Pleasant study environment to the students was sarcasm of the institutes. No pressure laid on students related to studies, freedom and flexibility to choose the study area were the main aspects of learning process.

Thus the current chapter exhibits ancient education system was too flourished and always caring for human capital formation which was directly indirectly contributing to ancient economic development.

REFERANCES:

1. Radhakrishnan pillai, “chanakya in you –adventures of a modern kingmaker” , JAICO PUBLISHING HOUSE-Mumbai.
2. [Samir R. Chatterjee, Research and Practice in Human Resource Management](#)(Vol. 15, Issue 2) Singapore Human Resources Institute & Curtin University of Technology, Dec. 2007
Alka Jain, Inclusion Of Ancient Indian Management Techniques In Management Courses
3. Shubham Gaur Evolution of HRM in INDIA Published May 27, 2020
4. <http://www.whatishumanresource.com/hrm-in-india>
5. <https://www.api-network.org/wp-content/uploads/2019/04/OMAM-Increment-Trend-India-2019.pdf>
6. <https://www.ukessays.com/essays/business/human-resource-management-practices-in-india-business-essay.php>
7. <https://www.yourarticlelibrary.com/human-resource-management-2/human-resource-management-in-india/99674>
8. <https://www.leverist.de/en/insights/indias-economy-development-growth-andprospects#:~:text=economic%20growth%20has%20remained%20constant,in>

Yoga Is the Tonic of Human Welfare

Prof. Havaldar Shri Narayan Rajaram Sangar (Retd) Indian Army
Director of Physical Education, Vivekanand College, Kolhapur (Autonomous)

Introduction : - "Yoga" is indeed a tradition that has been going on since ancient times. Since 5000 years ago, this tradition has been enjoyed by the whole of India. First of all, the mention of the word yoga is what we find in the sacred Indian Veda Purana such as the Rigveda. At that time, this period, which is very important for the practice of yoga on human life, in fact, human life was full of happiness, peace and contentment. It would not be possible to say that, but with the progress of human beings in this middle age, this art (human happiness) also disappeared. The life expectancy of human beings has decreased and now as a solution to this same lifestyle, our same tradition seems to be coming into Indian practice from abroad. As time/society moved forward, so did the lifestyle, which became faster and more busy, the machinery of human life changed and yoga once again came in the need of time. Now people have started doing yoga, meditation again, today's generation is going to understand this changing history and lifestyle about yoga.

The practice of yoga has been going on since very ancient times, almost millions of years ago, when man (man/ soul) was created, we see that yoga is being practiced for some reason or the other, and in ancient times, yoga practice was very widespread and in the mythological book Veda Purana, we see that yoga has gained a special importance. There are different asana in forests from where the human race seems to be benefiting in some way or the other. In mythological times, the saints were living in the Himalayas, in the forests, behind where yoga has acquired a unique significance because the saints lived for almost a hundred days without eating anything, it is only on the strength of the yoga instrument that pure air is found in the mountain ranges / forests. Also, in earlier times, people's lives were very high because the environment was clean. The world of today has become very complicated. People have started living a busy life and we see that medicines are harmful to the body, so we can see that they have a specific impact on the body. You see that yoga has drawn the attention of the world in the intervening period. 21st June is celebrated as World Yoga Day. We understand that yoga started in India. The originator of yoga is India. We have been seeing different changes in yoga over time. In the meantime, this art was disappearing, but over time, it seems to be waking up, we see that yoga has given a solution to many of the diseases of human beings, and the person who practises yoga is seen to be enjoying a long life, so now the whole world is realizing the importance of this art. People think that this art has come to India from other countries but the reality is - Yoga originated in India and we are seeing the benefit of yoga education for all.

The need for yoga in recent times:- Human life is getting very busy so there is no time for human beings to pay attention to our body and human beings are very much engrossed in their daily activities and we are see less physical activity today sitting on a chair in front of

the computer, so obesity in the body is increasing sugar Blood pressure (heart disease) Brain diseases it also leads to the control of the mind is no longer there. So even if we practice yoga at home for an hour every day, we can live a healthy life and if people who have diseases practice yoga strictly on a daily basis, they can get rid of the diseases and reduce the rate of the disease.

U.S. Table :- (Sugar Patient)

SR No.	Years	Patients(Millions)
1	1960-1980	3-5 (30 – 50) Lakhs
2	1980-2000	5-10 (50 – 100) Lakhs
3	2000-2015	10-24 (1 Crore – 2.4 Crore)

The above-mentioned chart is from the UNITED STATES The patients with diabetes are found in a very large number in the US because obesity seems to be on the rise there in a very big way.

Diet :- In the past, yoga practitioners' diet was very simple, they used to eat various fruits of the forest, tubers, so their body was getting a lot of protein as well as calcium, and because of like this eating, you see that there were no body ailments as well as now we see a lot of delicious dishes which are very different from the previous ones but these dishes are seen to be reducing the life of human beings and inviting diseases in a big way. The yoga journey has been going on since very ancient time. If the human does yoga for one to two hours every day, then it will help the human being to stay healthy and that's why, yoga has attracted the attention of the whole world. So you can see people becoming aware of yoga. Importance of Yoga: Due to yoga, we see that the mental balance of people is getting better and the intellectual level is increasing and the memory in the brain is seen to be very sharp, the face looks bright, the confidence seems to be increased, So if the modern world is practicing yoga for one to two hours every day, then in the coming days there will be of peace in the world.

References: -

- 1) Krida Dyankosh – Dr. Johnson M. Borges – Diamond Publications
- 2) Yogabhashya – Baba Ramdev
- 3) Raj Yoga – Porf. Dr. Narayan Shashtri Dravid – Ramakrishna Math

Skill Enhancement Courses for Undergraduate Degree Programme in Chemistry

Dr. S. D. Shirke

Department of Chemistry, Vivekanand College, Kolhapur (Autonomous)
sds.orgchem@gmail.com

ABSTRACT

National Education Policy (NEP) 2020 has given emphasis on over all development of students studying at various levels. One of the components in NEP is to provide skill-based education to the students through skill-based courses. These courses will make a student as a job ready candidate in this competitive world. The set of skills to be provided to students will depend on the domain of his study. In the present article we discuss and recommend some skill-based courses for Chemistry students who are studying at undergraduate level. The courses recommended in this article include some of the basic courses and some courses, which demand skills of Information Technology (IT).

1. Introduction

University Grants Commission (UGC) has issued guidelines and regulations for designing curriculum for undergraduate (UG) and postgraduate programme being offered in colleges/Universities across the country. There are various types of courses, which include Major courses, Minor courses, Generic/ Open Electives, Skill Enhancement Courses, Vocational Skill Courses, Ability Enhancement Courses, courses on Indian Knowledge System (IKS) and Value Education Courses. A minimum of 9 credits are suggested for a three/four year undergraduate degree programme by UGC for skill enhancement courses. These credits can be distributed over the total duration of the programme.

A student pursuing UG programme with Chemistry as a major, need to be provided with useful skill related education. The skill education, if provided to students it will enhance his employability. The leading institutions in India, which are active in Chemistry related research have also prepared some skill education courses. Some the institutions have prepared E-contents for the course being offered, which attract course fees. A large number of students pursuing their UG programme with Chemistry as a major can be provided with skill education as a part of their curriculum as per UGC guidelines. They may also be provided with add-on courses in addition to the courses in the curriculum. It will be proper to first identify areas, where a graduate student will have job opportunity. After having done survey of sectors the following are some of the major industries, institutions where a Chemistry graduate student can be placed.

- Drug Industry

- Beverage Industry
- Food Industry
- Pharmaceutical Industries
- Chemical Industries
- Agro-based industries
- Dairy Industries
- Foundries
- Cosmetic industries
- Fertilizer industries
- Polymer / Rubber industries
- Leather industries
- Textile industries
- Sugar industries
- Pesticide industries
- Perfume Industries
- Research and Development institutions/organizations
- Research Institutions
- Quality Control Departments in Industries
- Oil and Gas Companies
- Paint industries
- Paper industries

Different roles, positions and posts which are available for the aspiring Chemistry Graduate candidates are as below where they can be placed.

- Chemist
- Lab Assistant
- Pharmaceutical Sales Executive
- Chemical Technicians
- Forensic Assistant Scientists
- Quality Control Chemists
- Hazardous Material Management Chemist
- Analytical Chemists
- Organic Chemists
- Junior Research Associates
- Medical representatives
- Research Assistants in different Research Institutes

In order to enhance the employability of the Chemistry Graduate candidates, they have to be provided with the skill which are required for executing the given role in the targeted industry. In the following list we recommend some of the skill enhancement courses that can be integrated with the curriculum while designing in line with NEP 2020. We provide a brief information about the recommended courses in the following section.

2. Some Non-IT Skill Enhancement Courses

2.1 Synthetic Organic Chemistry

In pharmaceutical industry, food, agriculture, polymers and materials, dye, perfumes cosmetics and similar industries, organic synthesis is very essential part for producing the target molecules. Therefore, a course providing practical knowledge about organic synthetic procedure and handling of those chemicals, state of the facilities is the pre requirement in these industries. A course in Synthetic Organic Chemistry will provide a hands-on experience of how the planning, designing, execution, and analysis are done to achieve synthetic goals. A student, if provided such an experience will be able to plan, decide and carry out the required organic transformations or chemical processing.

2.2 Industrial Catalysis

In any industry the chemical process can be accelerated, if a suitable catalyst is used in the reaction. Most of the products produced in the chemical industries are made in catalytic processes. A catalyst offers an alternative, energetically favorable mechanism to the noncatalytic reaction, which helps processes to be carried out under favorable conditions of pressure and temperature. The recommended course will give in depth knowledge on theory and hand-on training in industrial catalysis such as catalyst synthesis; catalyst characterization; catalytic batch reaction, its analysis and catalytic continuous reaction.

2.3 Quality Control Chemist

Quality of any product plays a very important role in progress and brand name of the manufacturing company. Further chemical products have to meet certain standard as mentioned by regulatory bodies. Therefore quality control aspect is an essential part to ensure the desired quality of the products being manufactured. The role and responsibilities of a Quality Control Chemist become crucial in any manufacturing as well as in research unit. Quality control of any product can be assured by qualitative and quantitative research methods. In any organization quality assurance/control Department implements the quality control with the help of team of quality control chemists. During such exercise the quality control chemists prepares lists of tests to be performed and their sample size. Maintaining raw data and its documentation is very essential in this process. A course providing various quality control tests, their protocol, methods of documentation will definitely enhance the employability of students.

2.4 Gas Chromatography-Mass Spectrometry (GC-MS)

Sophisticated instruments are available in various laboratories and research and development organizations useful for the identification and characterization of organic compounds, bio-molecules, agricultural fertilizers, industrial gaseous samples as well as Impurity profiling, etc. Instrument useful for GCMS has been widely used in the market and results obtained using this instrument are accepted globally. If students are provided with the knowledge of the GCMS and are given an opportunity to handle the

instrument they will have placement in industries/organizations. A course dealing with basics to various applications such as reaction monitorization, Headspace Sample Analysis, Qualitative and Quantitative analysis will be very useful for students to enhance their employability.

In addition to these whatever sophisticated instruments the institution is having a course on handling these instruments may be prepared and the same be offered to the students. These courses can be made available to other technicians working in industries. The course can also be regarding to mobilize resources.

2.5 Design of Experiments

In any industrial, it is not affordable to experiment in a trial-and-error manner, where the outcome of the experiment depends on number of factors. Experiments by changing one factor at a time will not only increase the cost of experimentation, but also gives no idea about setting of levels of various factors. In such cases a scientific approach to experimentation is that considers all factors simultaneously. This approach is known as Design of Experiments (DoE) DoE provides information about the interaction of factors and the way the total system works, something not obtainable through one factor at a time experiments. DoE also shows how interconnected factors respond over a wide range of values, without requiring the testing of all possible values directly. The course will empower students to implement DoE in their work to more efficiently improve their processes in all aspects.

2.6 Intellectual Property Rights

The Government of India has been giving importance to protection of Intellectual Property Rights (IPR) and has directed educational institutions to create awareness about IPR among students and research scholars. The Government policy strongly encourages researchers in public funded academic and Research and Development institutions in IPR creation by linking it with research funding and career progression. Also, this decade has been declared as the Decade of Innovations. In accordance with national focus, a course on IPR will provide basic understanding of patents for students and researchers to enable them to make the best use of the patenting system. Students will have knowledge about learn how to seek protection for their inventions, secure rights in various jurisdictions and license/ commercialize patents. Students should also be given knowledge about types of IPR and importance with regard to national economy. They should also be trained in writing patents, publishing patents and filing the patents also.

3. Some IT based Skill Enhancement Courses

3,1 IT Skills for Chemists

In the era of Information Technology all the students require a minimum knowledge of application software along with software in their domain. Students

pursuing undergraduate programme with Chemistry as major needs to be trained in a word processor, spread sheet applications and presentation software along with basic knowledge of any operating system useful in creation of document, saving document and retrieving document. Students should also be trained in creating their email account and handling the same. Besides this, students have to be trained in some important software in Chemistry, useful to understand various concepts in Chemistry.

There are plenty of software available in the market, useful for a students studying Chemistry. Out of these we recommend to study open source software to enhance skills of the Chemistry students. In the present section we recommend a few important software along with their uses.

3.2 Jmol

Jmol is an open-source Java viewer for chemical structures and biomolecules in three dimensions. Three dimensional models created by using Jmol may be used as a teaching tool or for research in chemistry and biochemistry. It is free and open source software. There is a standalone application and a development tool kit that can be integrated into other Java applications, such as Bioclipse and Taverna. A course on Jmol is available on SWAYAM portal, which is administered under the Spoken Tutorial project by Indian Institute of Technology, Bombay. Using this software we can perform the following.

- To create and visualize chemical structures in 3D.
- To render secondary structures of proteins and nucleic acids.
- View crystal structure and unit cell parameters.
- It displays structures in various display formats
- We can change the thickness of bonds, color of atoms and bonds.
- Rotate and view the molecule from various angles.
- Displays interatomic distances, bond-angles, dihedral-angles, dipoles, charges and symbols.
- Surfaces, atomic and molecular orbitals can be displayed.
- We can produce animations and create GIF files.
- Images can be used in print media-journals/ publications/books.
- Useful for presentations in classrooms and lectures

Students can be encouraged to join to this course through the SWAYAM portal. If this course is made as a skill enhancement course then credits earned by the student can be adopted and shown on the score sheet of the student. Alternatively, this software can be taught by the faculty and examination can be conducted in college itself. This is a feasible option for both the students as well as college.

3.3 Molecular Docking using Open-Source Software

Molecular Docking is an area to learn various types of docking. Molecular docking studies are used to determine the interaction of two molecules and to find the best orientation of ligand, which would form a complex with overall minimum energy. It is a vital tool in structural molecular biology and computer-assisted drug design and successful docking methods search high-dimensional spaces effectively and use a scoring function that correctly ranks candidate dockings. AutoDock is a suite of free open-source software for the computational docking and virtual screening of small molecules to macromolecular receptors. The suite currently includes several complementary tools. DataWarrior is a desktop chemically intelligent spread-sheet and data analysis tool that combines spreadsheet filtering and interactive plotting. The website provides downloadable installers for Mac, Windows, and Linux. It comes with comprehensive help and there are several introductory videos available. PyMOL is an open-source biomolecule viewer that can be used to view proteins and their ligands. It can be installed by downloading a compressed file or by using Anaconda. SMINA is a fork of AutoDock Vina. There are many different docking software packages; most require familiarity with the command line and defining the binding site can be daunting for inexperienced users.

3.4 ChemDraw and alternatives

This is not an open source software. It is useful to acquire skills to draw the chemical structures. The software is also useful to predict physical and chemical properties like bond angles, bond lengths, stereochemistry, polarity, H-NMR, C-13 NMR and Mass Spectral Data. In literature alternative open source software have been suggested. These include ChemistryLab, MolView, Gnome Chemistry Utils, BKchem and JChemPaint.

3.5 Chemoinformatics and Chemometrics

Cheminformatics is an emerging scientific discipline in the Chemistry discipline that uses computers and informatics techniques to perform various tasks using variety and volume of chemical data. This discipline includes collection of relevant data, methods of storage of the data, search techniques, retrieval of the data, transformation of data, analysis and visualization of the data and other data related activities. Basically cheminformatics techniques are used in the process of drug discovery in the pharmaceutical industry. However these techniques are also used in number of industries, where chemical data need to be handled. Naturally employer would expect Computer and informatics skills in analysing chemical data from the candidate seeking job. In a broader sense, this represents a long-perceived gap in the chemistry curriculum. Therefore, cheminformatics education is receiving importance within the chemical education community.

Chemometrics techniques are applied to solve descriptive and predictive problems in chemistry. In descriptive applications, properties of chemical systems are modelled with the intent of learning the underlying relationships and structure of

the system. In predictive applications, properties of chemical systems are modelled with the intent of predicting new properties or behaviour of interest. Chemometric techniques are particularly heavily used in analytical chemistry and the development of improved chemometric methods of analysis also continues to advance the state of the art in analytical instrumentation and methodology. It is an application-driven discipline, and thus while the standard chemometric methodologies are very widely used industrially, academic groups are dedicated to the continued development of chemometric theory, method and application development. RDKit is an open source software that can be introduced for Chemometrics. The Chemistry Development Kit (CDK) is a scientific, LGPL-ed library for bio- and cheminformatics and computational chemistry written in Java.

4. Conclusion

Institutions while implementing NEP 2020 should keep in mind that the curriculum of any programme has to be designed in such a way so as to enhance employability of the students. Keeping this in mind in the present article we have made an attempt to recommend some courses, which can be integrated in the undergraduate programme with Chemistry major. These courses can be put into a basket of skill enhancement courses. Students can be given a choice to opt for some of these course. We have avoided to recommend the courses, which are commonly being made available to the students. Such courses may be related to soil analysis, water analysis, testing of adulteration in foods and beverages etc. basically two types of courses are recommended. One set of courses does not require knowledge of Information Technology while the other set does. Besides the recommended courses there are other courses which will help in enhancing employability of students. We hope that the recommended course will open doors to other such courses.

***Ten Days* by Gillian Slovo : A Political Thriller**

Ms. Madhuri Pawar, Dr. Kavita Tiwade

Assistant Professor, Vivekanand College, Kolhapur (Autonomous)

Abstract:

Gillian Slovo's works has always stood out what might be called political unrest and social upheaval. She has earned a tremendous place in the Contemporary British Literature and present novel *Ten Days* is a powerful novel in British Fiction, published in 2016 and inspired by her play *Riot* 2011. It is a political thriller, which is vast and encircling pressure on the lives of characters that penetrates significantly accurate picture of London civilian's life during the riot in British society. Her novel plays out political drama that begins inside her character's heads but seep into a variety of British settings. By blending the fact and fiction, she explores how politics, power dynamics, social inequalities, corruption, and violence that crafted in the novel skillfully. The present research paper endeavors to analyze socio-political issues which predominantly figure out in the novel. The novel serves as a lens to underpin the human stories that led to riot and its aftermath on the people who play political games during it. Gillian Slovo is a South African novelist who is a worldwide famous and acclaimed as an international writer in British Literature. Being a daughter of political activists, she skillfully depicts real life story with fictional characters through her works. She is emerged as a second to politics due to what she comes from political background. In her works, she shows her ability to weave complex narratives around social and political issues. The aim of the paper is to understand the concept of political thriller and to study the novel *Ten Days* under the light of politics and its aftermath on the lives of London civilians. The conflation of power and politics with riot in London city underpins the negative facets of human society through characters which debunks social and political anxiety in a disastrous manner.

Key term: *Ten Days*, Political thriller, politics, death, race, corruption etc.

Introduction:

The works of South African novelist Gillian Slovo have a life-enhancing effect on her readers that makes her global phenomenon. Her work covers major events, political upheavals, current affairs, crimes and social concerns. Gillian Slovo is a virago brilliant, prolific British writer and playwright has written 13 novels, 2 plays and a memoir. She is a contemporary by her personal background of being born and grown up in South Africa. South Africa had caused her a considerable amount of pain, so she adopts political edge in her literary works and uses most of her insight into human mind with each character and waves into story. She understands the live

experience of individual and the present research paper focuses on the study of novel in the light of politics which causes amount of pain that shapes their lives. The present novel is the best example of political thriller, marked significant period that explores new contemporary social issues of nationhood such as crime, power politics, death, corruption, racism, identity crisis, inequality etc.

Political Thriller:

The term 'political thriller' is emerged as a fairly new form of literature, film or television which has come into the 20th century period. It is a thriller set against the backdrop of a political power struggles. It mainly deals with conflicts, corruption, terrorism, warfare, political engagement and power dynamics etc. It is known as a sub-genre of thriller novels that incorporate political element as major part of the plot. In this form, the story revolves around the socio-political issues such as crime, political upheavals, death, riot, robbery, family affair etc that set against the backdrop governmental institutions. The aim of this genre is to provide suspenseful stories with multilayered plots with thought-provoking twists and turns which gives tumultuous impact of power politics on civilian's lives, hopes and fears which gives tense-filled experience to the readers.

Ten Days is also considered as a rich and ambitious family drama inspired by the 2011 London riot. It is a political thriller set in an imaginary town Rockham which navigates the tense and unveiling political climate during the Riot. The story of the present novel centers of three individual characters Cathy Mason, a single white mother and a member of Liaison committee, Home Secretary Peter Whiteley and the new Met commissioner Police Joshu Yares. The novel opens with Cathy being woken up by the noise of police helicopter flying over for the surveillance of Lovelace building. Cathy Mason, a white woman is a heart of the novel. She is living with her 14years daughter in a Lovelace estate where she spent whole night with her lover, a man called Banji(black) in her own flat in Lovelace Estate, is photographed by a passing police helicopter. As she wakes up and sees her lover has gone away without informing her. She drags herself from the bed and goes in the balcony. She sees the terrible scene and witnesses the incident between local police and Ruben, a black man, another resident of Lovelace estate who goes to the community centre in a distressed manner and caught up in police custody. 'Cathy only now noticed- two policemen making straight for Ruben' (page 4). It is observed by Cathy and narrated through her eyes that the police requested him to remove face covering hoodie under section 60 of public order. They do know his mental health problem. Local police came at Lovelace Estate, a housing society that is being pulled down and doomed for demolition. She becomes a witness of Rockham Street between the police and Ruben, mentally ill black man unintentionally dies at the hands of police. The residents of Lovelace are almost black. Banji, a black man also present there was trying his best to release Ruben from the police custody but he failed and things deepened in a serious way due to racism. The tension arises in London when the news spread about the death of Ruben. And as a result, the riot starts after his death that spread across the country. "When we went to the police station to ask them what had happened, they didn't offer to seat us' Ruben's father continued 'we can't say nothing, they told us, except

that someone has phoned them to complain about Ruben's behavior". (Page53). After knowing the news about his death, immediately his grieving family decided to go to police station and speak to Commissioner Yares. They visited the Rockham police station to ask for the reason behind his death. But no communication was done from station staff. They waited outside the station for many hours. But no one was giving response to them. Instead of communicating with them, they behave rudely and arrogantly. They made a big mistake that the public saw it and angered due to police attitude and riot develops. Consequently, a peaceful demonstration turns into violent riots due to bad politics of police towards the black community. This is the significant incident shows the class ridden and political flaws in the society. Meanwhile, instead of protecting society, police were making their career.

Things become serious when police didn't disclose to Ruben's parents that how exactly he dies. Due to this people decided to give justice to Ruben's family and everything has worsened. This demonstration became a riot at Lovelace Estate. This riot forms a background to a story that spans unpredictable 10 days and covers the themes such as political intrigue, racism, inequality, corruption, broken relationship etc. As a result, police cars and buses were burned. Shops were looted, broken paving stones, petrol bombs, many people were trapped in burning premises and became fearful, caught up in the middle of the disturbances, robbery and crime scene arson. At that time, Metropolitan Police Commissioner Joshua just promoted to this post when the riot begin. He was in charge to handle the situation as well as political drama. Apparently, the devious Home secretary has an eye on this post that is trying to get this post and taking the advantage of this riot for his own purpose. Thus, the new commissioner was under the pressure from both the mayor of London and the Home Secretary who has an affair with his personal assistant under the nose of his wife. The Met is forced by Home secretary to resign the job over his son's culprit and to leave his wife for leaking his affair. He was backed by the PM against the wish of Home secretary that he was in pressure to handle the riot or resign the job. This riot has become a main background for political leaders to fight for their ambitions and ruin each other's career with the help of riot. Apparently, this unforgettable story of a London civilian's riot has changed the social norms and political conditions which make character to suffer a lot. After the death of Ruben, Banji became a most wanted man and the new commissioner focuses on finding this man who has become a tabloid face of the London riot. Cathy suffered a lot in her life due to disappearance of her lover and broken relationship with him. 'If you don't tell me everything you know about this man, you will leave me no choice but to arrest you on suspicion of conspiracy to commit arson in relation to the throwing of a bottle of burning petrol' (page177). Cathy was struggling with her relationship with Banji who became a wanted man by the police for throwing a bottle of burning petrol. Cathy's normal day became disastrous one as she and her daughter Lyndall are arrested by police for inquiry. But they didn't know anything about him and they both frightened because hiding the true identity of her daughter Lyndall. She was distressed and lost in a grief. Finally, they came to know the news about the death of Banji from the Detective Constable Julius Jibola that he killed himself by hanging. There was another death of PC Keith at the hand of mob in Broadwater Farm. 15

people were died in police custody due to the power politics. Every corner of the city is blocked by the riot and the dark shadows caused by the fire. 'Politics was such a cruel game' (Page 73). There was another tension that explodes due to politics. PM's son Theodore was arrested for driving under the influence of alcohol and the suspicion of having possession of drug. The PM hands over his son to police because he wanted the country to know that all those who break the law and rules including his son for their wrong behavior will be punished. Later he faced difficulties in his own life for corruption. He was trying to downgrade his own corruption into the Teddy's business. At the end of the novel another character Anil Chahda who pulled the arrest warrant against PM's son faced such an ignominious end to his career. When he was inquired by Joshua Yares, it is proved that he changed the record. It was a great mystery of his resignation under the pressure of ruling class. In the end, after one year later, when election before ten days ago, the reporter was telling about the last year's riot was serious to stop onward march of the government and PM has proved himself as a strong political leader in times of crisis.

Conclusion:

Thus, the novel captures skillfully the political turmoil of riot in London that faces by multifaceted characters and mirrors the social and political unrest of that time. These characters grapple with unveiling complexities of political turmoil and aggressive riot that probes the human struggle and tensions, injustices and social disturbances of that time. In this thriller, the death of black man becomes a tactic to play political game during riot at the highest level that resulted into harsh criminal activities. The author painstakingly details frustrated and powerless community, dynamics of power, corruption, inequality, politicians and broken relationships and family rife through her characters which highlights politics of time and its bad consequences on the lives of ordinary people in the present novel. The threat of violence also looms largely throughout the novel which depicts causes and motivations behind the riot that explores the atrocities and political condition of the country.

Bibliography:

1. Slovo, Gillian. *Ten Days* Random House, London 2016. Print.
2. Abraham, M.H. *A Glossary of Literary Terms*
3. Horsley, Lee, *Twentieth-Century Crime Fiction*. Oxford: Oxford University Press, 2005. Print.
4. Webster, Roger, *Studying Literary Theory: An Introduction*, Second Edition, 1990. Print.
5. Greedy, Paul, *Novel Truths: Literature and Truth Commissions*, London University Press, 2000. Print.

***Aegiceras corniculatum* L. (Blanco): Potential source of saturated fatty acids**

¹Priya D. Patil

¹Department of Botany, Vivekanand College, Kolhapur (Autonomous)

E-mail: ppriya.patil@rediffmail.com / priya.patil8798@gmail.com

ABSTRACT: In present investigation, fatty acids (FAs) were estimated from the leaves of *Aegiceras corniculatum* (L.) Blanco. It was found that in leaves of the species showed more saturated FAs than unsaturated FAs. Arachidic acid, Heneicosanoic acid, Myristoleic acid, Linolelaidic acid, Linoleic acid and cis-4,7,11,14,17-Eicosapentaenoic acids are major FAs present in leaves. The mixture of saturated and unsaturated FAs present in the leaves of *A. corniculatum* suggests that the leaves are rich source of FAs and therefore, it can be used as alternative source of FAs in different industries for various purposes.

Keywords: Aegiceras corniculatum, Leaves, Fatty Acids (FAs), Arachidic acid

INTRODUCTION: A fatty acid is a carboxylic acid, often with a long aliphatic tail, either saturated or unsaturated. Fatty acids are required in the body for cell membrane function and integrity, healthy skin, cholesterol metabolism and prostaglandin production. They are also necessary for the function of thyroid and adrenal glands. Fatty acids are used in cosmetics as emollients, thickening agents and mixed with glycerin, cleansing agents. They are also used in production of soaps, detergents and are a component of some low toxicity pesticides. The most common fatty acids are myristic acid (C14:0), palmitic acid (C16:0), stearic acid (C18:0), oleic acid (C18:1) and linoleic acid (C18:2) [1]. The present work was carried out on fatty acid extraction of the leaves *A. corniculatum*. Fatty acids are saturated, monounsaturated or polyunsaturated.

Fatty acids are the constituents of all plant cells, where they function as membrane components, storage products, metabolites, and as a source of energy [2]. Saturated FAs include butyric, capric, myristic, palmitic arachidic acids. Polyunsaturated FAs include linoleic, linolenic, Arachidonic acids. Oleic acid is an example of monounsaturated FA. Capric acid widely used in perfumes, cosmetics and creams. Myristic acid is used in the food industry as a flavoring agent. Both capric and myristic acid are used as raw material for emulsifiers, in toiletiries soaps & detergents anionic and nonionic surfactants. Palmitic acid is used in the manufacture of pharmaceuticals, cosmetics, lube oils, water proofing and food grade additives. Stearic Acid is used widely in cosmetics, candles, rubber industries, lubricants, hardening of soaps, shoe & metal polishes. Arachidic acid is used for the production of detergents, photographic materials and lubricants. Linolenic acid is an unsaturated FA, considered essential to the human diet, which is an important component of natural drying oils such as linseed oil,

and used in making paints and synthetic resins. For cosmetic products, linoleic acid is the most frequently essential FA. It prevents barrier and cornifications disorders, lowers the transepidermal water loss and increases skin moistness. Caproic, caprylic and capric acids have similar biological activities. Both caprylic and capric acid have antiviral activity against HIV [3, 4]. Caprylic acid has also been reported to have antitumour activity in mice [5]. However, fewer data are available for the fatty acids of mangroves & sediments in mangrove swamps [6, 7]. The present work was attempted to profiling the fatty acids from leaves of *Aegiceras corniculatum*, which shows rich source of saturated fatty acids. These fatty acids are used as various industrial as well as pharmaceutical purposes suggesting the potentiality of mangrove species as a bioresource.

MATERIALS AND METHODS: For the extraction of fatty acids, leaves of mangrove *Aegiceras corniculatum* were collected from west coast of Maharashtra (Sindhudurg District). Collected fresh leaves were washed and blotted to dry. Then the samples were then subjected to extraction in methanol by using Soxhlet Apparatus. To analyze fatty acids from the oil fractions by gas chromatography technique, the oil was subjected to transesterification to obtain the fatty acid methyl esters. The fatty acid methyl ester fraction was eluted with petroleum ether: diethyl ether= 50:50 (v/v), the fractions were redissolved in hexane and subjected to GC analysis. GC-FID analysis Fatty acid methyl esters were analyzed by GC-FID. A SHIMADZU GC17-A- gas chromatograph with flame ionization detector (FID) was used. Fatty acid methyl esters were separated on CHROMOPACK WCOT 25mX 0.25 mm ID, 0.2 μ m film thickness capillary column using temperature programme from 150C/5 min, 40C / min until 2350C and 50 min at 2350C with the following conditions: Injector temperature 2600C, FID temperature 2600 C and carrier gas-Helium. The identification of fatty acids was done by comparison with the methyl esters of standard fatty acids.

RESULTS AND DISCUSSION: The different types of oils possess different properties according to their saturated and unsaturated fatty acids. Present investigations showed that leaves of *A. corniculatum* comprises the mixture of saturated and unsaturated FAs with no trans FAs. In the leaves, saturated FAs (53.90%) are more than unsaturated. The leaves show presence of Arachidic acid, Heneicosanoic acid, Myristoleic acid, Linolelaidic acid, cis-5, 8, 11, 14, 17-Eicosapentaenoic acid are in quite higher amount while Caproic acid, Oleic acid and Linolenic acid are in least amount (Table-1). Linolenic acid seems to be the major fatty acid, and arachidic acid was present in much lower amounts in fresh leaves of some mangroves [8, 9]. But in leaves of *A. corniculatum*, Arachidic acid is found in higher amount (42.30%). Arachidic acid is also called eicosanoic acid, is the saturated FA with a 20 carbon chain, which mainly useful in the production of soaps, detergents, for making phographic material and also in lubricants. Leaves of *A. corniculatum* also show presence of some important PUFAs like Linolelaidic acid and Linoleic acid. PUFAs mostly referred as essential FAs, because humans cannot make these acids on their own so it must be obtained from food. Linoelaidic acid is an omega-6 trans fatty acid and is a geometric isomer of linoleic acid, it is found in partially hydrogenated vegetable oils. Linoleic acid belongs to essential fatty acid that humans and animals must ingest for good health,

because the body requires them for various biological processes, but cannot synthesize them from other food components [10]. The key function of Linoleic acid is to maintain the integrity of the skin. It is an important FA mostly used in cosmetic products. Linoleic acid has become increasingly popular in the beauty products industry because of its beneficial properties on the skin. Linoleic acid is anti-inflammatory, acne reductive, and moisture retentive properties when applied topically on the skin [11, 12]. Thus, in the leaves of *A. corniculatum* showed abundant amount of saturated FAs. Saturated oils are more stable and do not become rancid as quickly as unsaturated oils.

Sr. No.	Name of the Test	FAs in Leaves of <i>A. corniculatum</i>
1.	Caproic acid methyl ester (C 6:0)	0.10%
2.	Arachidic acid methyl ester (C 20:0)	42.30%
3.	Heneicosanoic acid methyl ester (C 21:0)	11.50%
4.	Total of Fatty Acids : Saturated	53.90%
5.	Myristoleic acid methyl ester (C 14:1)	17.50%
6.	Oleic acid methyl ester (C 18:1n9c)	0.80%
7.	Total of Fatty Acids : Monounsaturated	18.30%
8.	Linolelaidic acid methyl ester (C 18:2n6t)	7.80%
9.	Linoleic acid methyl ester (C 18:2n6c)	4.30%
10.	Cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C 20:5n3)	15.60%
11.	Total of Fatty Acids : Polyunsaturated	27.70%
12.	Total of Trans Fat	--

Table 1: Fatty acids of leaves of *A. corniculatum*

Rich source of different fatty acids are oils like sunflower, safflower, coconut, linseed, cottonseed, palm oil, olive oil etc. FAs of standard oils compared with the FAs in leaves of *A. corniculatum*, the leaves showed highest amount in all except coconut oil, (Table-2) [13]. So, the present investigation clearly provides the baseline idea that justifies the use of leaves of *A. corniculatum* as a rich source of saturated fatty acids.

Sr. No.	Name of the oil	Saturated (%)	Monounsaturated (%)	Polyunsaturated (%)	Trans Fat (%)
1.	Coconut oil	85.2	6.6	1.7	0
2.	Palm oil	45.3	41.6	8.3	0
3.	Cottonseed oil	25.5	21.3	48.1	0
4.	Olive oil	14	69.7	11.2	0
5.	Rapeseed oil	5.3	64.3	24.8	0
6.	Leaves of <i>A. corniculatum</i>	53.90	18.30	27.70	0

Table 2: Saturated Fatty Acids of Standard oils in comparison with leaves of *A. corniculatum*

CONCLUSION: The role of fatty acids in our body is significant, which determines and regulates proper body functions. FAs extracted from leaves of *A. corniculatum* have a great commercial value. The mixture of saturated and unsaturated FAs present in the leaves of *A. corniculatum* suggests potentiality of species, which provides alternative source of saturated FAs for various industries like soaps, detergents, cosmetics etc.

REFERENCES:

1. Christie, W. W. Lipid analysis: Isolation, Separation, Identification and Structural Analysis of Lipids. (Publ.) The Oily press, Bridgewater, pp: 1-416 (2003).
2. H. Wada, Z. Gombos, and M. Murata, Contribution of membrane Lipids to the Ability of the Photosynthetic Machinery to Tolerance Temperature Stress, Proc. Natl. Acad. Sci., USA. (1994).
3. Thormar H, Isaacs EE, Kim KS, Brown HR. Inactivation of visna virus and other enveloped viruses by free fatty acids and monoglycerides. Ann. N Y Acad. Sci.; 724, 465-71 (1994).
4. Neyts J., Kristmundsdottir T., De Clercq E., Thormer H, Hydrogels containing monocarbin prevent intravaginal and intracutaneous infections with HSV-2 in mice: impact on the search for vaginal microbicides. J. Med. Virol. 61, 107-10 (2000).
5. Burton, A.F. Oncolytic effects of fatty acids in mice and rats. American J. clin. Nutr. 53(suppl.): 1082S-6S (1991).
6. Cooper, W. J., Geochemistry of lipid components in peat forming environments of the Florida Everglades [M. S. Thesis]: University Park, Pa., The Pennsylvania state uni. 258pp.
7. Eglinton, G., Maxwell, J. R. and Philp, R. P., Organic geochemistry of sediments from contemporary aquatic environments: in Tissot, B. and Bierner, F., eds., Advances in organic geochemistry, 1973: Paris Editions Technip, P. 941-961 (1974).
8. Patil P.D. and Chavan N.S. Potential testing of fatty acids from *Aegiceras corniculatum* (L.) Blanco. *Int J Pharm Pharm Sci, Vol 4, Suppl 3, 569-571*(2012).
9. Johns, R. B., and Onder O. M., Biological digenesis: dicarboxylic acids in J. recent sediments: geochim. Et Cosmochin. Acta, 39, 129-136 (1975).
10. I. D. Weete, W., G. Rivers, and D. J Weber, Phytochemistry, 25, 1083 (1986).
11. Burr, G.O., Burr, M.M. and Miller, E. "On the nature and role of the fatty acids essential in nutrition". *J.Biol.Chem.* 86 (587), 1-9 (1930).
12. Letawe C, Boone M, Pierard GE , "Digital image analysis of the effect of topically applied linoleic acid on acne microcomedones". *Clinical & Experimental Dermatology.* 23 (2): 56-58 (1998).
13. S. Misra, A. Choudhury, P. K. Pal, and A. Ghosh., Phytochemistry, 25, 1083 (1986). Baynes, John W.; Marek H. Dominiczak., Medical Biochemistry 2nd. Edition. Elsevier Mosby. pp.555 (2005).

A Research on Hotel Management System

Dr.Surekha.S.Awate

Dept. of Commerce, Assistant Professor,
Vivekananda College,Kolhapur (Autonomous)

Abstract: The system aims the maintenance and management of the different Hotels are available in the different parts of the world. This paper designs the Hotel Management System, the overall task of system development is to make the office staff can quickly and easily complete the hotel guest room management task. Hotel management helps you manage booking guest and agents. The system provides the information regarding the different hotels that are available and their status specifies to availability. The guest is scheduled information of the availability of the units they have requested the time. The guests can visit the site and register themselves with the essential information that is expected by the system. Each registered guest can raise a request for the unit booking. The Guests are scheduled with the info of the availability of the units for they have requested the time. For database connection we are using JDBC (Java Database Connectivity).

Keywords: Hotel management, System Modeling, Requirementsanalysis.

1. Introduction

Hotel management project provides room booking, Staff management and other needed hotel management features. The entire project has been established keeping in view of the distributed client server computing technology in mind. We are creating a desktop application using java it is a hotel management system application. Hotel industry is facing the increasingly fierce competitive environment, on the other hand the traditional hotel industry is difficult to get rid of low price, low occupancy rate and low profit. The Hotel Management System project is a desktop application that allows a hotel manager to manage all hotel operations online. This system is incredibly adjustable and convenient because of the interactive GUI and the ability to manage numerous hotel bookings and rooms. A Hotel System Java is created using the Java programming language and the Net Beans IDE, and it uses a SQL database as its back-end to keep records available for future use. This is a straightforward yet complete hotel management system. This system finishes all of the tasks that a hotel software program must complete.

2. The Requirements Analysis of System Functional

Hotel management system mainly used in the hotel daily information set, entry and question at the same time in between customer writers, administrator's owner set up an interactive platform for a visit. Hotel management major functionalist are customer Information, rooms, food, other items, check out and payment.

3. Hotel Management System Java

A hotel management system is a collection of hotel software applications that keep things running efficiently. Accounting software, customer relationship management (CRM) software, and a confusing assortment of industry-specific software are all available.

4. Business Requirements Analysis

Room booking ability can handle customer bookings by various means, such as phone book, online bookings, and reservations at the front desk. Rooms of the hotel have different grades, and require the system to be able to classify the room management, and according to book different types of rooms to offer available prices, booking discount timing function settings such as lowest price, easy to fit individual traveller and collection reservations.

Goal: To make a responsive, easy to operate, fast and efficient recovery of information as per the user's convenience. To provide all information about Rare Material to User and Maintain payments of supplier and buyer. To provide comfort in the maintenance of different types of Raw Material Requirement. To make a database that is consistent and secure. To provide correct, whole, ongoing information. To develop a well-organized information storage system. To make good documentation so as to facilitate imaginable future enhancements.

The hotel information management need-The hotel management include the following functional requirements such as personal information related to maintenance counter, management and business information analysis.

The key features are required in this system are, Room category, Room, Facility, Room Facility, Guest, Booking, Search, Report.

Room Category: Rooms are categorized into their respective infrastructure and number of portion that divide the room.

Room: This shows the number of rooms available in the hotels.

Facility: It is the feature that shows the facilities providing by the hotels.

Room Facility: This shows the providence of room facility such as rooms that are contains additional features.

Guest: This shows the data of guest customers.

Booking: This shows the both online and offline booking of the customers and guests.

Search: This is provided the search options of the system that can search any

connected information of the system.

Report: it shows the reports in different fields of the system.

5. Importance of Hotel Management System in Java

The hotel sector, sometimes known as the people's industry, is currently experiencing a qualified and knowledgeable people shortage. More than lakhs of workers are expected to be wanted in this industry during the next five years, according to projections. Based on this hypothesis it can be decided that the chances of landing a reputable position in this industry are extremely high.

The objectives of hotel management system,

A front-office system for a hotel, motel, or resorts main goal is to increase income, streamline operations, and remove human labour. The scope of hotel management system- The Hotel management is one of the extremely job oriented field. it covers a wide range of services with food service, accommodation and catering. The main job fields in the hospitality sector include Hotels, resorts, fast food chains, restaurants, etc.

The System Requirements for Hotel Management System

Hardware Requirements, Multi-core – 1.8 GHz processor or better., 4GB RAM., Windows 7, 8, 8.1, 10, or 11.

80 GB hard drive or more 160 GB highly recommend Mouse. Monitor with 1024 X 768 resolution or advanced. Windows compatible printer (laser printer recommended) Gigabit Ethernet port and router for networking computers.

The future scope of hotel management,

This sector is expected to grow extremely, roughly 7.5% of our GDP by 2025. Today, Hotel Management is not only limited to hotels but has gone a long way to catering, clubs, food and beverage industry, resorts, airlines, cruise and many more.

7. Database Access Technology

This system can combine uses Java JDBC technology achieve connection of Java with MySQL. DBC (Java Data Base Connectivity Java database connectivity is a Java API for executing SQL statements, and can provide unified access to multiple relational databases, which consists of a set of classes and interfaces printed in the Java language. JDBC provides a standard API for database developers, can build more advanced tools and interfaces according to it that enables database developers to use pure Java API to write database applications. JDBC structures include a connection to the database, send a statement of the operational database and process the results. Java has a sturdy, safe, easy to use, easy to understand and can be automatically downloaded from the network properties, it is an outstanding language in writing database applications. All you need is Java application and the method of dialogue between different databases and JDBC is a mechanism for this purpose. JDBC extends the functionality of Java. This is called a

client/server configuration, in which users' computers are clients, provides database's computer as a server. In a three-tier model, the command is sent to the service's middle-tier, and then it sends SQL statements to the database. Database process SQL statements and the results are sent back to the middle tier, middle tier and then sent the results back to the user.

8. Principle of Database Design

Hotel management information's main task is to manage the needs of information obtained through large amounts of data, which must store and manage large amounts of data. Therefore, establish a good data structures and databases can make the whole system be quickly, easily, and accurately to manage the data you need is one of the main indicators to measure a hotel management information system development work well or bad. A good data structure and database should fully reflect the evolving situation, fully meet regulatory requirements at all levels of the Organization, should also make subsequent systems development work convenient, fast, overhead is small and comfort of maintenance.

Operator set up module: This module is used to succeed the hotel operator information, add new operator, edit existing operator information, and delete operative information functions.

9. Conclusion

From a proper analysis of positive points and constraints on the component, it can be safely concluded that the project is a highly efficient GUI based component. This desktop application is working properly and meeting to all user requirements. This component can be easily worked in many other systems. The system should also serve as an important kit to improving the efficiency in hotel management system.

References

- [1] <https://projecttunnel.com/Online-Hotel-Management-Project-in-Java>
- [2] <https://sourcecodehero.com/hotel-management-system-java-with-source-code/>
- [3] <https://tourismconference.co/research-paper-topics-in-hospitality-industry/>
- [4] http://www.cmnt.lv/upload-files/ns_8art50_CMNT1806-124_BHS_Guo.pdf



Chief Editor
Dr. S. R. Kattimani
Kolhapur Maharashtra



978-93-5980-212-1