An International Edition

ISBN- 978-81-970663-8-2

Research and Reviews in Ethnobotany and Pharmacognosy

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Dr. Swati Kharade

Dr. Ahilya Waghmode

Nature Light Publications

An International Edited Book *ISBN-978-81-970663-8-2*

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Editors

Dr. Poonam Panaskar
Assistant Professor
Dapoli Urban Bank Senior Science College,
Dapoli, Dist.-Ratnagiri, (MH), India

Dr. Kamlakar Patil
Assistant Professor
Rayat Shikshan Sanstha's Sadguru Gadage Maharaj College,
Karad, Dist.- Satara, MH, India

Dr. Swati Kharade
Assistant Professor
AIJ Degree College of Science,
Murud-Janjira, Dist. Raigad, MH, India.

Dr. Ahilya Waghmode
Assistant Professor
Botany and Co-Ordinator of Food Science
Rayat Shikshan Sanstha's Sadguru Gadage Maharaj College,
Karad, Dist.- Satara, MH, India

Published By

Nature Light Publications, Pune

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First Edition: September, 2024

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Published by:

Nature Light Publications, Pune
309 West 11, Manjari VSI Road, Manjari Bk.,
Haveli, Pune- 412 307.
Website: www.naturelightpublications.com
Email: naturelightpublications@gmail.com
Contact No: +91 9822489040 / 9922489040

Preface

We are happy to welcome the idea of publishing a book on relevant topic, "Research and review in Ethnobotany and Pharmacognosy". Further, it is good that the articles from various sub-disciplines are included in the book. The scholars from Botany or biological science have attempted to identify the current research and to provide ideas to doing the recent study in Ethnobotany and Pharmacognosy.

The Cultural Dimensions of Ethnomedical Practices, Mutational studies in Fenugreek, Vitro Antioxidant and Anticancer Properties of Bauhinia Purpurea Leaves, Cancer Vaccines, Phytosociology, Ethnobotany Past and Present, Ethnomedicinal and Pharmacognostical Investigations on Roots, Heritage and Healing, Bioactive potential of Cajanus cajan, Ethnopharmacology, An ethnobotanical study, Natural Resources and Sustainable Development etc.

This exhibits how variety of topics have been discussed in the book. The book provides open forum for the scholars and even graduate students to discuss further so that they can think about strategic planning to use emerging strategies in sciences.

Renowned researchers, scientists, educators, and business professionals have contributed pieces to the book. We would especially want to express our gratitude to the researchers and specialists whose contributions have made this book better.

Date: *30 September 2024*

Editors

Research and review in Ethnobotany and Pharmacognosy

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

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The Cultural Dimensions of Ethnomedical Practices of the Lepcha Tribe of Darjeeling District

[1]Dr. Abhay Sagar Minz,

[2]Diksha Singh,

[3]Dr. Arpana Premi Oraon.

[1]Assistant Professor, University Department of Anthropology. DSPM University Ranchi.

[2]Researcher, International Documentation Centre for Endangered Indigenous languages and Cultures, DSPM University Ranchi.

[3]Associate Professor & Dean, KISS, Bhubaneshwar.

Email: minz.abhaysagar@gmail.com and dikshaa98576@gmail.com

Article DOI Link: https://doi.org/10.5281/zenodo.13905997

DOI 10.5281/zenodo.13905997

Abstract

Cultures among human beings made them a distinct entity. Humans have been interacting with the environment through culture for their survival for ages. This accumulated knowledge has been passed down from generation to generation. This accumulated knowledge, continuous unending interaction with the environment actually turned the biological human being to cultural human being. In India, the tribes reside in an environmentally rich flora and fauna. These tribal communities being so called self-sufficient extracted resources for their natural surroundings. The rich plant diversity in due course of time, with the trial-and-error method, closely observing the patterns of birds and animals adapted the environment accordingly. The present book chapter focuses on the Lepcha tribe traditional knowledge system and makes an effort to study and understand the cultural dimensions of the ethnomedicine that surrounds their habitat and its role in sustainability. The difficult and inaccessible terrain of the field area has kept the community relatively isolated from mainstream society. The modern health system was out of reach for centuries. The Lepchas who were located in a highly rich diversity extracted the medicinal plants and utilised their accumulated traditional knowledge system to heal many of their local ailments. The usage of the ethnomedicinal plants were culturally driven. The Lepchas formulated the knowledge system of usage of these ethnomedicines which included the knowledge of availability, seasons, socio

religious sanctity, etc. amalgamated with cultural practices. The present book chapter makes an effort to unravel these cultural dimensions of ethnomedicine plants.

Keywords: Culture, Traditional Knowledge System, Ethnomedicine, Lepcha tribe, Sustainability.

Introduction:

Indigenous communities have inhabited difficult and challenging terrains in mountains and dense jungles since time immemorial. These habitations are also home to most of the natural resources of the world. Tribal communities have maintained a relation of mutual coexistence and symbiotic association with nature, which has resulted in large scale protection of these resources in the tribal belts across the world.

Plant diversity forms an essential part of these natural resources. Members of the tribal communities have immense knowledge about the use of these plants and their parts. Simple societies across the globe have chiefly relied on the use of plant parts or whole plants for preventing and healing most of the ailments. These range from treating simple problems like headaches, stomach aches, nausea, cuts, and burns to complex ones like curing piles, bone fractures, or preventing heart conditions, and kidney issues, among others.

Anthropology, as a discipline, concerns itself with the study of man and culture since the origin of man on earth. Medical anthropology is a sub-branch of anthropology that is concerned with the study of health, illness and treatment. This branch keenly looks into the role of culture in the understanding of health and diseases and the understanding of associated healing processes.

In simple societies, healing processes mostly include reliance on natural plant resources, as opposed to allopathy in modern societies. Simple societies have lived in symbiotic association with nature for a long time, which has led to an increase in their knowledge regarding medicinal properties of locally available plants and trees. This knowledge can be attributed to experience gained over time.

India is home to a total of 705 tribal communities according to the Government of India census 2011. Today this number would be much more. One of these is the Lepcha tribe, which is found living in Nepal, Bhutan and India. In India, this tribe can be traced primarily in the states of Sikkim and West Bengal. In West Bengal state, they are found in Darjeeling and Kalimpong districts.

Being located in the foothills of the Himalayas, these regions are endowed with a rich heritage of flora and fauna. Consequently, the Lepcha people are well versed with the medicinal properties of plants found in their vicinity. They rely on the use of these plant resources to treat most of the health problems. This forms a part of their traditional or indigenous knowledge system, and has been transferred orally from one generation to the next.

Today, this traditional heritage is under great threat owing to various reasons. Loss of the indigenous knowledge is one of the major factors. Competition from modern market forces and availability of modern health facilities coupled with a feeling of inferiority regarding the traditional medicinal practices prevalent

among the members of Lepcha tribe, have only accelerated the shrinkage of reliance on plant resources for treating diseases and other health problems.

Objectives

The present chapter will deal with the following objectives-

1. To discuss the concept of medical anthropology
2. To discuss the perception of health and disease among simple societies
3. To list the medicinal plants known to the Lepchas and their use
4. To discuss the cultural dimensions of these traditional medicine practices
5. Present scenario and decline of reliance on traditional medicine system
6. What can be done to conserve the traditional system

Data Collection and Methodology

For the present chapter, data has been collected through intensive fieldwork conducted among the Lepcha tribe people residing in Plungdung Basti of Sukhia Pokhari in Darjeeling district of West Bengal state. The fieldwork has been conducted over a span of 1.5 years from January 2023 to August 2024.

Plungdung Basti has a total of 65 houses, out of which 43 belong to the Lepchas. After a pilot survey, a total of 22 informants were identified for our research method. Out of these, 10 were identified as key informants. Identification of informants was done based on a purposive sampling method. Due care was taken that the selected sample included informants from all generations and both genders. Those families were focussed on which had at least one elderly member.

A schedule was first formulated, which was then followed by the observation method, both participant and non-participant. Both individual and group interviews were conducted with the identified sample. A camera and tape recorder were also employed for gathering relevant data. We adopted extensive use of internet from highly authentic sources where we compared and assist the botanical names with that of its medicinal chemical properties.

Result and Discussions

1. **Halhale (*Rumex nepalensis*):** This plant's roots contain anthraquinones with anti-inflammatory, anti-bacterial, anti-viral, and anti-fungal properties. These are also known to ease constipation, treat piles and cure cancer as well.
2. **Pakhanbed (*Bergenia ciliata*):** Its roots contain a bioactive compound called bergenin, which is released by boiling the root in water. This water when drunk helps cure cough and sore throat. It also has anti-diarrhoeal properties.
3. **Athanijaar (*Centella asiatica*):** Its leaves contain triterpenes like asiaticoside and madecassic acid. Asiaticoside has anti-diabetic, antipyretic and anti-ageing properties. Crushing its leaves between palms and applying over cuts helps in quick healing of the wounds. Madecassic acid as an antioxidant. It thus has anti-ageing properties. It also aids in wound healing. Its leaves have analgesic properties and they are also helpful in curing coughs.
4. **Banmara (*Lantana camara*):** Its leaves and stems contain alkaloids

with anti-inflammatory properties. It also contains flavonoids and terpenoids. In addition to these, it contains valencene and saponins. Valencene is an antioxidant and helps reduce stress, tension and depression. Saponins have anti-bacterial and anti-inflammatory properties. It is also known for its anti-coagulant properties. Thus, the leaves of banmara are crushed and its juice is applied over cuts and wounds.

5. **Titepati (*Artemisia vulgaris*):** It has phenolic compounds like gallic acid and luteolin. Gallic acid is an antioxidant. It prevents acne and also cardiovascular diseases. Luteolin has anti-inflammatory properties. It effectively deals with obesity as well. It also has coumarine compounds like esculin and scopoletin which are antibacterial and anti-hypertensive. It is also an anti-coagulant. Its leaves are crushed and inserted in the nose to stop nose bleeding.
6. **Sisnu (*Urtica parviflora*):** Its leaves are rich sources of amino acids, vitamins and minerals like iron, zinc, potassium, etc. It is rich in vitamin C, which makes it an antioxidant and also provides it with anti-aging properties. Its oil also contains cadina which treats skin issues and coughs. Polyphenols found in sisnu are powerful antioxidants and help control blood sugar levels. It also helps in digestion. It has anti-hypertensive properties and is effective in treating fractures.
7. **Siru (*Imperata cylindrica*):** It contains phenolic compounds like coumarins and flavonoids. Both have antioxidant and anti-inflammatory properties. Coumarins are also anti-coagulants. Terpenoids and phytosterols are also found in situ. Terpenoids are antibacterial and also reduce stress and anxiety. Phytosterols control cholesterol levels in the body and also protect against cardiovascular diseases. In addition, it also contains saponins and glycosides. Saponins are anti-coagulants. Glycosides are anti-hypertensive and also function as analgesics. Roots of siru are crushed and eaten to get rid of intestinal worms induced stomach ache.
8. **Lali guras (*Rhododendron arboreum*):** Its flowers contain phenolic acids, flavonoids and anthocyanins. Phenolic acids are antioxidants and antibacterial. Flavonoids reduce risk of diabetes. Anthocyanins are anti-oxidative and anti-inflammatory. Anthraquinones and saponins are found in the stem of lali guras. Anthraquinones are antimicrobial and anti-inflammatory. Saponins are anticoagulants. Guras flowers also cure pneumonia. Dries flowers, on swallowing, help take out fish hooks stuck in the throat.
9. **Abijalo (*Drymaria cordata*):** It contains phenols, flavonoids, saponins and terpenoids. These provide abijalo with anti-oxidative and anti-inflammatory properties. It is also helpful in curing headaches, coughs, colds and fever.
10. **Betlauri (*Cheilocostus speciosus*):** It contains compounds like diosgenin, costunolide, flavonoids, beta carotene and glutathione. Diosgenin is anti-inflammatory and prevents the spread of tumours.

Costunolide is anti-diabetic and anti-inflammatory. Beta carotene is skin and eye health. Glutathione is an antioxidant and strengthens the immune system. It is also effective against urinary tract infections.

11. **Kurkurejhar (*Equisetum debile*):** It contains apocarotenoids which have anti-inflammatory properties. These also prevent cancer. It also contains phenyl glycosides which are antibacterial, anti-diabetic and also help treat obesity. In addition, silicic acid present in it is good for skin health. Applying crushed leaves causes the warts to fall off.
12. **Simrayo (*Nasturtium officinale*):** It contains glucosinolates which protect the body against cancer and cardiovascular disorders. These are also anti-diabetic. It also contains isothiocyanate which is also anti-cancer. In addition, it is a rich source of vitamins like B complex, C and E. It contains high calcium content and is thus beneficial for elderly people and women around menopause. Its leaves can treat tuberculosis. Leaves along with roots can cure jaundice and liver disease.
13. **Rosemary (*Rosmarinus officinalis*):** It has rosmarinic acid which is antibacterial, anti-diabetic and anti-oxidative properties. It also protects the kidneys. Phenolic diterpenes like carnosic acid, carnosol and rosmanol are antimicrobial and anti-inflammatory. In addition, it also contains flavonoids and phenolic acids. Chewing its leaves controls white discharge from the vagina and also cures cervical cancer.
14. **Aiselu (*Rubus ellipticus*):** It contains phenolic acids, flavonoids, ascorbic acid, kaempferol, catechin, ellagic acid and ursolic acid. Ascorbic acid is anti-oxidative and good for skin health. Kaempferol prevents cancer and catechin is good for heart health. Ellagic acid is anti-diabetic and also improves cognitive abilities. Ursolic acid is antibacterial and treats liver disorders. It also kills intestinal worms.
15. **Totola (*Oroxylum indicum):*** It contains flavonoids like chrysin, baicalein, apigenin and oroxylin. These are anti-oxidative and anti-inflammatory. Chrysin prevents diabetes mellitus and also protects against cardiovascular disorders. Baicalein and oroxylin A prevent cancer. Apigenin is anti-hypertensive. Seeds from its flowers cure sore throat and typhoid.
16. **Tara phool (*Matricaria chamomilla*):** It contains sesquiterpenes, flavonoids, coumarins, phenolic acids, etc. In addition, it also contains chamazulene, apigenin and alpha bisabolol. Chamazulene is anti-oxidative and good for skin health and liver health. It also functions as an analgesic. This means it suppresses pain. Apigenin is anti-hypertensive. Alpha bisabolol is anti-oxidative and anti-fungal. It is good for skin health and also reduces stress.
17. **Mulethi (*Glycyrrhiza glabra*):** It contains a triterpenoid saponin called glycyrrhizin that is anti-oxidative, antiviral and anti-inflammatory. It is also good for liver health. It also contains liquiritin

apioside which cures cough and cold. In addition, it also contains flavonoids like glabridin, coumarins and terpenoids. Glabridin is anti-oxidative, antibacterial and anti-diabetic. It prevents cancer. Boiling crushed stems in water reduces toothache.

18. **Fokfoke (*Physalis heterophylla)*:** It contains carotenoids, phenolic compounds and ascorbic acid. These make it anti oxidative and anti-inflammatory. Rich in vitamin C, it is good for the skin. Its leaves can cure sore throat and also heart problems.
19. **Chimphing (*Heracleum wallichii*):** It contains coumarins like bergapten and pimpinellin. Bergapten is used in the treatment of skin diseases, cancer and diabetes. Pimpinellin is anti-inflammatory. It also contains furanocoumarins like xanthotoxin and imperatorin. Xanthotoxin is useful in treating skin disorders. Imperatorin cures headache and toothache. It also protects against cardiovascular disorders. Dried flowers help treat nausea. Seeds can cure stomach disorders and gastric troubles.
20. **Phachyang (*Zingiber zerumbet*):** It contains zerumbone and linalool. Zerumbone is antibacterial, anti-inflammatory and anti-hypertensive. It is both an analgesic(painkiller) and an antipyretic (controls fever). It also maintains liver health. Linalool is helpful in managing stress and anxiety. In addition, it also contains flavonoids, terpenoids, saponins and alkaloids. It also cures headache, nausea and travel fatigue.
21. **Pinasalahra (*Clematis buchananiana*):** It contains flavonoids, triterpenoids, saponins, coumarins, alkaloids, etc. These make pinasalahra anti-oxidative, anti-inflammatory, anti-diabetic, anti-diarrhoeal and also an analgesic. Thick paste prepared from its stem is tied in a white cloth. Inhaling it cures nose pain.
22. **Amliso (*Thysanolaena latifolia*):** It is also known as Aisan Broom Grass. It contains phytol which is antioxidative, antibacterial and also reduces inflammation in joints. It is also useful for arthritis patients.
23. **Timbur (*Zanthoxylum acanthopodium*):** It contains flavonoids, terpenoids, alkaloids and glycosides. These are anti-oxidative and anti-inflammatory. Flavonoids and terpenoids are useful in cancer treatment. Alkaloids protect against cardiovascular diseases. Glycosides are good for heart health. They work as analgesics, anti-diabetic and anti-hypertensive. It also cures gastric issues.
24. **Ghiu kumari (*Aloe vera)*:** Its leaves contain anthraquinones which have anti-bacterial, anti-fungal, and anti-viral properties. It also contains polysaccharides like glucomannan which controls blood sugar levels and cures type 2 diabetes, and acemannan which helps in healing wounds and removing scars.
25. **Alaichi (*Elettaria cardamomum)*:** Its oil contains cineole, which has antiseptic properties. It kills bacteria in the respiratory tract and thus removes bad breath. Cardamom also contains terpenoids and phenolic compounds which prevent heart and

kidney problems. Chewing its seeds relieves toothache.

26. **Mewa (*Carica papaya*):** Its leaves contain an enzyme called papain which helps in wound healing and teeth whitening. It also contains ascorbic acid which boosts the immune system. Its leaves and seeds are rich in flavonoids which have antioxidant properties that help prevent cancer. Flavonoids also have anti-bacterial and anti-diabetic properties. Eating raw fruit cures liver infection.
27. **Khakra (*Cucumis sativus*):** It contains cucurbitacins which are known to have anti-cancer properties. It can cure a variety of cancers like breast cancer, liver cancer, ovarian cancer, etc. It also contains vitexin which has anti-aging properties and which also prevents diabetes mellitus. In addition, khakra also contains orientin which is a flavonoid. It arrests cell proliferation and thereby prevents the spread of tumours. Raw fruits and seeds help treat urinary disorders.
28. **Dubo ghas (*Cynodon dactylon*):** It contains sterols like beta-sitosterol which controls cholesterol levels in the body and also reduces swelling of the prostate gland. In addition, it also contains glycosides which have anti-hypertensive and anti-diabetic properties. Triterpenoids present in dubo ghas are known to protect against kidney damage and are also known to treat cancer. Its roots are eaten to cure piles.
29. **Dhaniya (*Coriandrum sativum)*:** It contains sterols that help control cholesterol levels. It also contains tocols which are antioxidants and that protect against cardiovascular diseases. Carotenoids present in it reduce skin ageing and protect the skin against UV radiation, thereby reducing risk of skin cancer. Coriander also helps in digestion and treating gastric disorders.
30. **Kimbu (*Morus australis*):** Its fruit contains flavonoids like kaempferol with antioxidant and anti-diabetic properties. It also helps treat cancer. In addition, it also has anthocyanins which are anti-inflammatory and protect the skin from damage caused by exposure to UV radiation. It also protects the heart.
31. **Rambhera (*Lycopersicon esculentum*):** It contains a glycoalkaloid called tomatine which has anti-bacterial, anti-fungal, and anti-viral properties. It also has ascorbic acid which is an antioxidant. It also helps in quicker healing of wounds and boosts the immune system. Phenolic compounds like naringenin are good for diabetic patients and also protect against non-alcoholic fatty liver issues.
32. **Bhui champa (*Kaempferia rotunda*):** Its oil contains zingiberene which has antioxidant, anti-bacterial, anti-fungal, and anti-viral properties. It also has flavonoids and curcuminoids. Curcuminoids are good for eye health, skin health and kidney health. It also has abietane which prevents the spread of tumours in the body. Its rhizome is crushed into a paste which helps heal fractured bones.

33. **Padina (*Mentha spicata*):** Its oil contains carvone and limonene. Carvone has antibacterial properties which helps in producing fresh breath. Limonene, on the other hand, helps in reducing obesity. It also contains flavonoids, terpenes, and coumarins. Terpenes have antimicrobial properties. Coumarin has anti-diabetic properties. Fresh leaves help in digestion.
34. **Majito (*Rubia cordifolia*):** It contains anthraquinones like alizarin, rubiadin, and purpurin. Alizarin has anti-diabetic and anti-inflammatory properties. Rubiadin is an antioxidant and it also protects kidney damage. Purpurin has antibacterial and anti-carcinogenic properties. It also contains naphthoquinones which function as analgesics. These are also rich in vitamin K which is essential for blood clotting.
35. **Sakarkanda (*Ipomoea batatas*):** contains bioactive compounds like flavonoids, anthocyanins, coumarins, sterols, glycoproteins etc. These provide it with antioxidative and anti-inflammatory properties. It is useful in treating cardiovascular diseases and also constipation.

On interaction with the key informants, the Lepchas informed that the traditional knowledge was based on meticulous observation of animals and birds. The animals and birds would choose for consumable environmental produce. Such consumable produce gradually became the diet of the Lepcha tribe. The community also informed that the age-old trial-testing-error methods were significant in identifying the ethnomedicines. Few of the sacred plants were culturally aligned with religious beliefs. In our findings, we found that such plants like amliso, phachyang, etc. had great medicinal properties.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 10 - 19 |

Features and Life Cycle of the Angiosperm

Dr. Prem Kumar Gautam

Jayshree Subhash Nayka

Department of Botany, NTVS'S G.T. Patil Arts, Commerce and Science College, Nandurbar 425412, M.S. Affliated to Kavyitri Bahinabai Chaudhari North Maharashtra University, Jalgaon.

E-mail: premunnat@gmail.com)

Article DOI Link: https://doi.org/10.5281/zenodo.13906019

DOI 10.5281/zenodo.13906019.

Abstract

Although ethnopharmacological knowledge is prevalent and crucial in tribal communities, a large portion of it is, at most, subjective and has not been verified by science. Even though plant resources are widely used in conventional drugs, only few plant species have had bioassay analyses done to look into their medicinal qualities and confirm the safety and effectiveness of conventional treatments.[1]

This paper examines the current role of ethnopharmacological research in drug discovery (particularly in relation to the American and European markets) and the advancement of these phytotherapeutical resources for local use in their countries of origin. It also discusses some examples of ethnopharmacological studies carried out in the past 200 years.[2]

Keywords: Ethnopharmacology, Thymus SatureioidesCoss, Aloe-vera, Drug discovery.

Introduction

The word Angiosperm is derived from two Greek words: angio (covered) and sperma (seed). are also known as Anthopsida (antho = a flower or a bright colour.) or Magnoliopsida. Flowering plants, which make up about 80% of all living plants, are characterized by their ability to produce both flowers and seeds, with the seeds being enclosed within the fruits.

Angiosperms are typically known by that name because, as the name suggests, their seeds are enclosed within a carpel. This group is usually referred to as angiosperms because, as their name implies, their seeds are enclosed in a carpel. The carpel is the primary feature that distinguishes angiosperms from gymnosperms.

Angiosperms live in all terrestrial and aquatic habitats on earth. Except for conifer forests and moss-lichen tundra's, angiosperms dominate all the major terrestrial zones of vegetation. The angiospermae are the youngest of the

major plant groups, having evolved or diversified 141-65 million years ago. Yet, now they are the largest class of ‘plants with 13,000 genera and 2,40,000 species (Taklltajan1980). Flowering plants reign over the earth and play a crucial role in upholding the planet's life support system. They also fulfil most of the economic needs of mankind.

Angiosperms vary in size from that float on water to Any duckweeds such as Lemna and Wolffia (2mm across) that float on water to huge trees like banyan and eucalyptus (almost 100 m tall). angiospermae are most easily recognised by their flowers which consist of sepals, petals, stamens and carpels. The flowers pollinated by insects or birds are sizable, decorative, and occasionally emit a pleasant aroma. On the other hand, flowers pollinated by wind or water are small with inconspicuous sepals and petals. Angiosperms can also be recognised by their net- veined leaves and by their characteristic fruits which enclose the seeds. The fruit, which may be dry or fleshy, is adapted to protection and effective dispersal of seeds at the appropriate time.

Terms

Herbaceous: A plant composed of soft, non-woody tissue.

Herb: A plant that lacks a permanent above-ground woody stem, with the stems dying back to the ground at the conclusion of the growing season.

Annual: a plant that completes its life cycle within a single year or growing season.

Biennial: a plant that completes its life cycle within two years, producing only vegetative growth in the first year, and flowering the second.

Perennial: A plant that lives for a number of years.

Dicotyledonous plant: (Magnoliopsida) Flowering plants that have two cotyledons. The reproductive parts typically come in multiples of 4 or 5; the leaf veins usually have a dichotomous or digitate pattern; the roots generally maintain a persistent taproot; they can be either herbaceous or woody in growth form; and the vascular bundles are commonly arranged in a ring.

Monocotyledonous plant: Flowering plant with only one cotyledon. Their flowering parts are usually arranged in multiples of 3s and 6s; their leaf venation is usually parallel to the midrib; roots are often fibrous; their growth form is mostly herbaceous; their vascular bundles are usually scattered throughout the ground parenchyma, not in a discernible ring.

Diversity of Angiosperms

Angiosperms are classified in a single phylum: the Anthophyta. Angiosperms, part of the Anthophyta phylum, boast a diverse classification based on the structure of cotyledons, pollen grains, and other features. Monocots encompass grasses and lilies, while eudicots or dicots represent a polyphyletic group. Additionally, basal angiosperms, displaying traits from both monocots and eudicots, are considered a separate group in various classification systems, indicating that they may have branched off before the divergence

General characters of angiosperms

The angiosperms are a large and varied group, with its members occupying diverse habitats and differing in details of their morphology, internal structure, metabolism and life cycle. However,

they share certain characters in which they are different from other plants. These peculiar features not only define the group, but also explain its extraordinary success. The characteristics of angiosperms are as follows:

- Their main plant body is diploid.
- Sporophyte is divided into stems, leaves, and roots.
- All angiosperms plants have flowers; flowers are concerned with sexual reproduction that helps in exchanging genetic materials.
- Most angiosperms are heterotrophs, some are autotrophs.
- The vascular system is well developed and consists of xylem and phloem.
- Xylem consists of tracheids and vessels, and phloem consists of companion cells.
- Archegonia are absent.
- Reproduction takes place by indirect pollination, i.e., the pollen grains are received at stigma found at the tip of carpels.
- The flower consists of stamens (microsporophyll) and the carpels megasporophyll); each microsporophyll has four microsporangia.
- The ovules are covered by the ovary at the base of the carpels.
- The process of double fertilization and triple fusion results in the creation of diploid zygotes and triploid endosperms, playing a crucial role in the development of angiosperms.
- The intricate root system of angiosperms includes the xylem, phloem, cortex, and epidermis, contributing to their overall complexity.
- The production of endosperms stands out as a significant advantage of angiosperms, serving as a vital food source for the growing seed and seedling.

Morphology/ Anatomy of Angiosperms:

Angiosperms are consisting of flowers, leaves, stems, and roots, with flowers serving as the reproductive organs and the other parts functioning for non-sexual reproduction. Angiosperms are typically categorized into the root system, which is situated underground, and the shoot system, which is located above the soil.

[A] Angiosperms Root system:

- The root system of a plant consists of the primary root as well as lateral or branching roots.
- These underground, non-green, brown parts are essential components of the plant.Root systems serve multiple vital functions, including storing water, anchoring the plant, and absorbing essential minerals from the soil to nourish the entire plant.
- The root that emerges from the embryo's radicle is known as the primary root. Secondary roots then develop as lateral branches off the primary root. The roots have unicellular root hair.
- The root tip is protected by a thin, cap-like structure known as the root cap.
- The origin of lateral roots is endogenous nature.
- The root is positively geotropic but negatively phototropic.

- Angiosperms typically exhibit two main types of root systems: the taproot and the adventitious root.

1. Taproot

- The taproot emerges from the radicle, which is the embryonic root of a germinating seed.
- It is always underground and penetrates very deep into the soil.
- The plant features a prominent, persistent primary root that gives rise to numerous thin branches.
- The tap root system is mainly found in dicotyledonous plants such as mangoes, mustard seeds, and banyan.

2. Adventitious root system

- Plants can develop adventitious root systems that originate from any part of the plant except the radicle (primary root).
- These adventitious roots may grow underground or emerge above the soil surface without penetrating deep into the ground.
- Clusters of these roots often grow together from a single point.
- The original primary root is short-lived and becomes replaced by the more extensive adventitious root system.
- This root system is mostly found in monocotyledonous plants such as maize, oak, trees, and horsetails. Functions of adventitious root systems are vegetative propagation and mechanical supports.
- Fibrous adventitious roots were found in wheat, carrot, onion, grass, and paddy. This type of root system, characterized by thin, primary, or moderately branching roots growing from the stem, is commonly observed in ferns and monocotyledonous plants.

[B] Angiosperms Shoot system:

1. Stems

- The stem is the vital part of the plant and functions as an above-ground axis in nature.
- Stems support the growth of flowers, fruits, and leaves.
- The stem's role is to transport minerals and water.
- The hypocotyl serves as the link between the seedling's root system and the continuous flow of nutrients. Let me know if you need further assistance.
- Steams develops from the plumule of germinating seeds
- Young stems are typically green and turn woody and brown as they mature into trees.
- It provides axial stability to plants.
- The terminal part of the stems contains the terminal bud.
- In angiosperms, stems are differentiated into nodes (points where the plant bears leaves) and internodes (area between the two nodes).

2. Leaves

- The leaves of angiosperms are typically flat and horizontally oriented, playing a vital role in photosynthesis, light absorption, and gas exchange through the stomata.
- The leaf base, petiole, stipules, and lamina, also called a blade, are the main part of a leaf.
- The main components of a leaf are the leaf base, petiole, stipules, and lamina.

- A pair of stipules are present at the base of the leaf, which is connected to the lamina via the petiole.
- The leaf emerges from the node and has a bud located at the axil.
- The leaves are green due to the presence of chlorophyll and have a tiny pore or opening called stomata.
- Venation refers to the arrangement of veins and veinlets in a leaf.
- Leaves can be categorized into simple and compound leaves based on the pattern of leaf lamina, as well as other classifications based on the arrangement of leaves, venation, and the shape of the leaf.
- Leaves serve crucial functions such as storage, photosynthesis, transpiration, guttation, and defense.
- The leaf's fundamental structure varies across plant species depending on its function and the presence or absence of petioles and stipules, resulting in a variety of leaf forms including leaf tendrils, spines, storage leaves, and insect-catching leaves.

According to phyllotaxy, we can study the arrangements of leaves on the stems as follows:

- The leaves on plant are arranged in a spiral pattern, with one leaf emerging from each node.
- The alternate leaf arrangement features one leaf per node, with a divergence of 180 degrees between each leaf.
- Plants can exhibit two different leaf arrangements on their stems. When two leaves emerge at each node, they are in an opposite arrangement. However, if more than two leaves grow at a node, they are in a whorled arrangement.
- Plant stems exhibit various modified structures, including suckers, runners, climbers, tubers, tendrils, thorns, bulbils, cladodes, and rhizomes. These modifications help the plant adapt to changing conditions by providing protection, enabling food synthesis, facilitating vegetative propagation, and supporting overall plant health and growth.

3. Flower

- Flowers, the reproductive structures of angiosperms, contain micro- and megaspores that may be arranged in bisexual or unisexual configurations.
- The arrangement of flowers on the floral axis is known as an inflorescence, which can be classified into two main types: racemose and cymose.
- Flowers are often visually appealing, with vibrant colors and pleasant fragrances that attract insects and birds. These pollinators play a crucial role in the reproductive process of plants, transporting pollen from the anther to the stigma, enabling pollination. This essential ecological function supports the growth and propagation of diverse plant species.
- Pollens, stamens and carpels are main parts of flower. The pollen grain is produced by stamens; it is the male gamete that unites with the female gamete ova present in the ovary.
- Flowers consist of several key components, including pollen, stamens, and carpels. The stamen

produces pollen grains, which are the male reproductive cells that fuse with the female reproductive cells (ova) present in the ovary.

- Carpel is the female part consisting of stigma, style, and ovary, and the stamen is the male part consisting of anther and filament.
- Pollination can be self-pollination (within the same flower) or cross-pollination (between different flowers), aided by wind, insects, birds, etc.

The flowers contain four distinct whorls, which are:

Calyx:

The calyx is the outermost part of the flower.

Corolla:

The corolla comprises the petals.

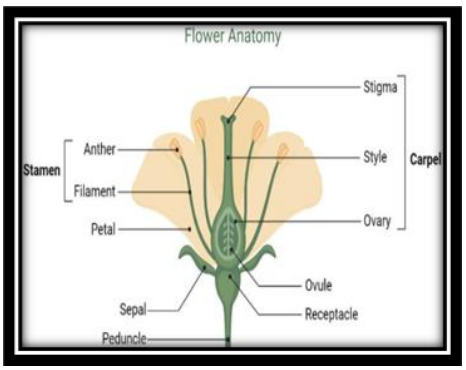
Androecium:

The androecium consists of the stamens.

Gynoecium:

The gynoecium is composed of one or more carpels.

The primary functions of flowers are reproduction, the production of diaspores without fertilization, the development of gametophytes, attracting insects and birds for pollination, and the development of fruits containing seeds.



Angiosperm – Flower Anatomy

4. Fruits

- In flowering plants, the fruit is the characteristic feature, consisting of the ripened or mature ovary. The seed develops from the ovules after fertilization. Fruit that develops without fertilization is known as parthenocarpic.
- There are three main types of fruits, classified based on their mode of development.
- Simple Fruits (developed from the monocarpellary or multicarpellary)
- Aggregate Fruits (developed from the multicarpellary) and,
- Composite Fruits (developed from the entire inflorescence rather than from a single flower example are blackberries, strawberries, etc.).

Parts of a Fruit: A fruit comprises the following parts:

Pericarp

- The pericarp is the wall of the ovary that develops into the fruit. The pericarp can be fleshy, as in guava and mango, or dry, as in mustard and walnut. The pericarp is further differentiated into three distinct layers:

Epicarp:

Outermost layer, forms the peel.

Mesocarp:

The middle, fleshy and edible portion of the fruit.

Endocarp:

The innermost layer, where the seed is accommodated, often with a rough texture.

Seeds

- A plant's seed, which is enclosed within the fruit, consists of a seed coat and an embryo. As the fruit develops, the ovary wall transforms

into the pericarp. While the ovary wall dries out completely in some plants, it remains fleshy in others.

- **Origin:** Seeds develop from fertilized ovules after pollination and fertilization in flowering plants.
- **Structure:**
  - **Seed Coat:** Protects the seed from environmental conditions.
  - **Embryo:** The developing plant within the seed, consisting of the radicle (root), hypocotyl (stem), and cotyledons (seed leaves).
  - **Endosperm:** Stores nutrients for the embryo.
- Seeds are classified as either monocotyledonous or dicotyledonous, based on the number of cotyledons (seed leaves) they possess.

Classification of Angiosperms on the bases of cotyledons

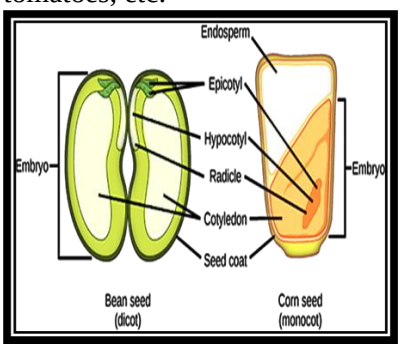
Angiosperms are divided into two classes depending on the number of cotyledons present in their seeds.

[1] Monocotyledons

- The seeds contain a single cotyledon.
- This group has adventitious roots only. Roots contain 8 to 20 vascular bundles. In a stem, vascular bundles are scattered.
- Stems lack cambium, preventing secondary growth.
- The leaves are isobilateral, simple, and linear, with parallel venation.
- Each flower's whorl is typically trimerous, with three members.
- Usually, calyx and corolla are undifferentiated. The perianth is present instead of them,
- Usually, they are pollinated by wind.
- Generally, fruits are trilocular. Examples: sugarcane, banana, lilies, etc.

[2] Dicotyledons

- Dicotyledonous seeds typically contain two cotyledons.
- While these plants often develop tap roots, some species also produce adventitious roots.
- The root contains 2 to 6 vascular bundles.
- The vascular bundles within the stem are arranged in a circular pattern.
- Secondary growth is possible because of cambium present in vascular bundles of stems.
- The leaves are dorsoventrally flattened, depict, and have reticulate venation.
- Flowers are usually tetramerous or pentamerous.
- Usually, calyx and corolla are distinct.
- They usually are pollinated by insects.
- Fruits are usually pentalocular. Examples: grapes, sunflowers, tomatoes, etc.



Monocotyledons and Dicotyledons

Life cycle and reproduction of Angiosperms

The angiosperm life cycle is a complex process that revolves around the concept of alternation of generations. This biological process alternates between two distinct phases: the haploid gametophyte and the diploid sporophyte. Angiosperms, or flowering plants, exhibit a highly reduced gametophyte stage, and their life cycle is dominated by the sporophyte. In this essay, we will explain the key steps of the angiosperm life cycle, highlighting the significance of alternation of generations and how it underpins the reproductive strategy of these plants.

1. Introduction to Alternation of Generations

Alternation of generations refers to the cyclical process in plants where they alternate between two phases: a multicellular haploid gametophyte and a multicellular diploid sporophyte. These two phases are distinguished by their chromosome number. In angiosperms, the gametophyte generation is highly reduced and exists entirely within the reproductive organs of the flower, while the sporophyte phase constitutes the majority of the plant's life cycle.

[A] Gametophyte [B] Sporophyte

[A] Gametophyte:

The haploid phase (n), which produces gametes (eggs and sperm) through mitosis.

[I]Formation of Male Gametophyte:

The formation of the **male gametophyte** occurs within the anthers and is divided into two stages:

[a]. Microsporogenesis:

Microsporogenesis begins with the formation of **microspores** within the anther. The anther contains microsporangia, also known as pollen sacs, where **diploid microsporocytes** undergo **meiosis** to produce haploid microspores. Each microsporocyte gives rise to four microspores.

[b]. Micro gametogenesis:

- Each microspore undergoes mitosis to form a **pollen grain**, which represents the immature male gametophyte. This pollen grain consists of two cells:
- The **generative cell**, which will later divide to form two sperm cells.
- The **tube cell**, which will grow into a pollen tube after pollination.
- Thus, the pollen grain is the male gametophyte in its immature form, and it is ready for transport to the female reproductive organs via various pollination mechanisms.

[II]. Formation of Female Gametophyte:

The formation of the **female gametophyte** occurs within the ovule and is also divided into two stages:

[a]. Megasporogenesis:

Inside the ovule, a single **megaspore mother cell** (megsporocyte) undergoes meiosis, resulting in four haploid **megaspores**. However, typically only one of these megaspores survives, while the other three degenerate.

[b]. Mega gametogenesis:

The surviving megaspore undergoes a series of mitotic divisions to form the embryo sac, which is the mature female gametophyte. The mature embryo sac consists of seven cells organized into eight nuclei:

- **Three antipodal cells** at one end of the embryo sac.

- **Two synergid cells** at the micropylar end, flanking the egg cell.
- **One egg cell** at the micropylar end, which will fuse with the sperm cell during fertilization.
- **One central cell** in the middle, containing two polar nuclei, which will later fuse with a sperm cell to form the triploid endosperm.At this stage, the female gametophyte is ready for fertilization.

[III]. Pollination and Fertilization:
Pollination is the process by which pollen is transferred from the male anther to the female stigma. Pollination can occur through a variety of mechanisms, including wind, water, and animals (particularly insects). Once a pollen grain lands on a receptive stigma, it germinates, and the pollen tube grows down the style toward the ovary.

[IV]. Double Fertilization:
Angiosperms exhibit a unique process known as double fertilization. As the pollen tube reaches the ovule, two sperm cells are released: One sperm cell fuse with the egg cell to form a diploid zygote (2n), which will develop into the embryo. The second sperm cell fuses with the two polar nuclei in the central cell to form a triploid endosperm (3n), which serves as a nutrient source for the developing embryo. This process ensures that both the embryo and the endosperm are formed simultaneously, which is crucial for seed development.

[V]. Seed Formation and Germination
Following fertilization, the ovule develops into a seed, and the surrounding ovary tissue develops into the fruit. The seed contains the embryo, endosperm, and seed coat. The fruit serves as a protective structure for the seed and aids in its dispersal.

[VI]. Seed Dormancy:
After seed formation, many seeds enter a period of dormancy, during which their metabolic activities slow down. This dormancy period helps seeds survive unfavourable conditions and ensures that germination occurs under optimal conditions for seedling survival.

[VII]. Germination:
When environmental conditions become favourable, the seed absorbs water and undergoes germination. The seed coat breaks open, and the embryo begins to grow into a seedling. The primary root, or radicle, emerges first, followed by the shoot, which develops into the stem and leaves.

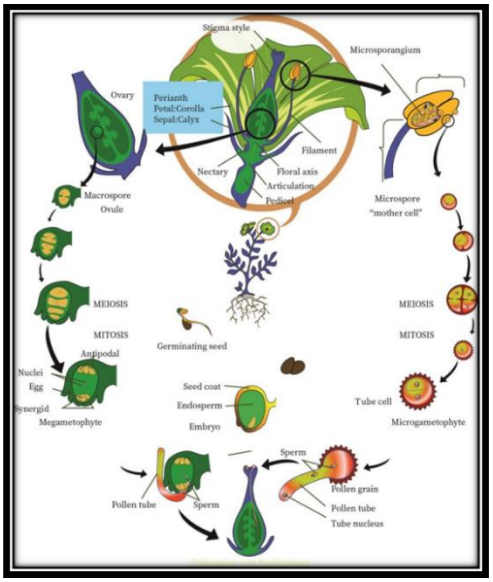
[2]. Sporophyte Phase
The diploid phase (2n), which results from the fusion of male and female gametes and produces haploid spores through meiosis. The sporophyte phase is the most prominent and visible part of the angiosperm life cycle. The sporophyte consists of roots, stems, leaves, and reproductive structures (flowers). It begins as a zygote, formed by the fusion of gametes (sperm and egg). This zygote undergoes mitotic divisions to form a multicellular embryo, which later develops into the mature sporophyte.
The mature sporophyte possesses specialized structures for sexual reproduction, typically organized within a flower. The flower serves as the reproductive hub, housing the organs responsible for the production of both male and female gametophytes

[I]. Development of the Sporophyte

The seedling develops into a mature sporophyte, completing the life cycle. The sporophyte grows through mitotic divisions, eventually reaching reproductive maturity, when it can produce flowers and begin the cycle a new.

Summary of Life cycle and reproduction of Angiosperms

The angiosperm life cycle, characterized by alternation of generations, represents a highly specialized and efficient reproductive strategy. By alternating between the diploid sporophyte and the haploid gametophyte, angiosperms ensure both genetic diversity and ecological adaptability. The development of flowers, seeds, and fruits has given angiosperms a competitive edge, allowing them to become the most diverse and widespread group of plants on Earth.



Life Cycle of an Angiosperm

From the formation of pollen grains and embryo sacs to the processes of pollination, fertilization, seed formation, and germination, each step in the angiosperm life cycle is intricately designed to ensure successful reproduction and survival. This complex life cycle, refined over millions of years, is central to the ecological success and evolutionary dominance of flowering plants.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 20 - 33 |

Mutational studies in Fenugreek (*Trigonella Foenum - Gracecum* L.)

S.M. Sangle

Pallavi Thale

Aau yelikar

Department of Botany, PG department and research center, Government Institute of Science Aurangabad 431004, India

Email: sunilsangle10@gmail.com

Article DOI Link: https://doi.org/10.5281/zenodo.13906077

DOI 10.5281/zenodo.13906077.

Abstract

This study investigates the mutational effects on fenugreek (Trigonella foenum-graecum), a crucial legume valued for its nutritional and medicinal properties. Utilizing chemical mutagens such as SA (Sodium azide) and physical mutagens like gamma rays, we aimed to induce variability in key agronomic traits, including seed yield leaf morphology and biochemical analysis. The study employed a randomized block design to assess the mutational impact across multiple generations. Observations indicated significant phenotypic variations, with some mutant lines exhibiting enhanced traits compared to the control. In the current study, results show that a higher dose of sodium azide (0.04%) significantly reduced all the recorded parameters and the lower dose of sodium azide is more suitable for the fenugreek. In Physical treatments low doses of gamma rays increase growth, yield character and some biochemical constituents.

Introduction

Fenugreek (*Trigonella Foenum-Gracecum* L.) belongs to Fabaceae family; it was named Trigonella, from Latin language that means little trangle due to its yellowish white trangular flower (Flammang et al., 2004). The family Fabaceae or leguminosae (also known as pea and bean family) is the third largest flowering family. The family includes 727 genera with 19,235 species (Lewis et al., 2005). Fenugreek (*Trigonella Foenum-Gracecum* L) is one of the oldest medicinal plants from Fabaceae family originated in central asia (Altuntas et al., 2005). The biological and pharmaceutical properties of fenugreek are attributed to the variety of constituents namely steroid, N-compound polyphonic substance, volatile constituents, amino acid etc. (Mehrafarin et al., 2010). Fenugreek seed contains 45-60% carbohydrates, mainly mucilaginous fibre

(galactomannans), 20-30% protein high in lysin and Tryptophan, 5- 10% fixed oils (lipids), Pyridine alkaloids, mainly trigonelline (0.2 - 0.38%) ,choline (0.5 %), free amino acid, such as 4-Hydroxyisoleucine (0.09%), arginine, histidine and lysine, calcium and iron, saponins (0.6 - 1.7%), glycosides yielding steroidal sapogenins on hydrolysis (diosgenin, yamogenin), cholesterol and sitosterol, vitamin A,B1,C and nicotinic acid (Budavari, 1996;Newall et al.,1996., Mehrafarin et al., 2010). Fenugreek, an annual legume cash crop of India (Fazil and Hardman, 1968) is cosmopolitan in distribution. In several parts of Asia, the young plants are used as pot herbs and the seeds as a spice or as herbal medicine (Lust,1986; Petropoulos,2002). The species name *'foenum-gracecum'* means "Greek Hay" indicating its use as a forage crop in the past (Petropoulos, 2002). Fenugreek has been referred to as a medicinal herb both in Indian Ayurvedic and Traditional Chinese Medicines (Tiran, 2003). According to Lust (1986) fenugreek is one of the oldest known medicinal plants in the recorded history.

Mutation breeding helps in inducing greater magnitude of variability in various plant traits in a comparatively shorter time. One through a careful screening and selection Programme the magnitude of genetic variability induced by physical and chemical mutagens could be explained for obtaining the desirable lines. Mutation provides an opportunity to create hitherto unknown alleles so that the plant breeder does not remain handicapped because of limited allelic variation at one or more gene loci of interest. The induction of mutation has been accepted as a useful tool in the plant breeding programme. The success in plant improvement programme, however, depends basically on controlling and directing the induced mutation process for the production of desired mutations. One of the chief advantages of mutation breeding is its ability to improve a single feature in a variety without significantly altering the otherwise desirable make up of agronomic character. Another advantage of mutation breeding is the creation of genetic variability which enhances the scope for selection. The polygenic traits such as grain yield, early maturity, quality characters, grain quality, abiotic stress and biotic resistance have been improved by mutagenesis (kharakwal, 1996). In fenugreek, several workers have tried for artificial induction of mutation through the use of mutagens (Laxmi and Datta, 1986). Mutagenesis, a key area of genetical research occupies prime position in biological researches from viruses to the plants, animals and humans in every country not only because of the understanding of the mechanism of mutation and the factors (internal or external) that has helped to elucidate the basic aspects of life phenomenon but also because it has profitably been utilized in raising a large number of economically superior and desirable genotypes of crop plants.

"Mutations are heritable alterations in an organism's phenotype". Chemical alterations at the gene level are the cause of these modifications. These modifications have the potential to give rise to new and heritable character alternatives in crop plants. These chemicals can be used to cause variation in crop plants, and the desired variants

that result can be chosen. (Lamo et al. ,2017).

Mutagens can be physical including X-rays, UV rays, extreme heat or chemicals. Sodiumazide and EMS. Mutations Correlated with cancer are often explored to recognize and prevent cancer genetic compounds, protein prions are not. The human gene PRNP codes have not been replicated, yet are also seen as prone to have additional types of duplication as they are likely to lead to disease producing prions (Punnett et al. ,1915).

Materials and methods:

Physical mutagens like as Gamma rays were used to treat the experimental seed of the fenugreek. Healthy uniform and dry seed 900 counted and divided in to batches of 250 for each dose and 150 seed separate out together with the control (untreated seed) The remaining 750 seed are distributed three different doses of the Gamma ray such as 5kR 10kR 15kR the three-polythene bag The Gamma radiation electromagnetic ionization radiation was applied from Cobalt 60 source of irradiation Gamma radiation was carried out at the government Institute of science Aurangabad Maharashtra. For three hours, the seeds were submerged in distilled water. Post soaking increased the rate of mutagen absorption by increasing cell permeability and also started metabolism in the seed for the treatment of a batch of 200 post-soaked seed. 100 seeds from each treatment were dried between treatments and germination in petri dish to record the germination percentage. The remaining 150 seeds from each dose were sown in the field using a randomized block design (RBD) with three replications of 50 seeds with control in the M1 generation. The seed was spread at a spacing of 5cm between the plant and 10cm between the rows, and all recommended cultural measures, such as watering, weeding, and plant production technique, were carried out during the growth period of the crop plant. Percentage of seed germination, seedling height frequency of plant carrying chlorophyll deficient sectors and leaf morphological changes in M1 generation of *Cyamopsis tetragonoloba* (L.) Taub are measured during the present investigation.

Biochemical test:

Chlorophyll estimation

Requirements:

1. Apparatus: Mortar and pestle, muslin cloth, glass rod, beakers, test tubes, volumetric flask (100 ml), cotton, weighing balance, centrifuge, spectrophotometer, etc.

2. Chemicals: MgCO3 powder, 80% Acetone (pre-chilled), etc.

3. Plant material: Spinach leaves

Principle: The chlorophyll is extracted in 80% acetone and the absorption at 663 nm and 645 nm are read in a spectrophotometer. Using the absorption coefficients, the amount of chlorophyll is calculated.

Procedure:

1. 1 g of fresh spinach leaves were crushed in mortar and pestle with a pinch of MgCO3 powder.
2. 20 ml of 80% acetone was added.
3. The extract was then centrifuged at 5000 rpm for 5 min., and the supernatant was transferred to a 100 ml volumetric flask.
4. The residue was grounded with 20 ml of 80% acetone, centrifuged and

the supernatant was transferred to the same volumetric flask.

5. Above procedure was repeated until the residue becomes colourless.
6. Finally, the mortar and pestle were washed thoroughly with 80% acetone and the washings were collected into the same volumetric flask.
7. The volume was adjusted to 100 ml with 80% acetone.
8. The absorbance of the solution was read at 645 nm and 663 nm against the solvent (80% acetone) blank.

$$\text{mg chlorophyll-a/g plant tissue} = 12.7\,(A_{663}) - 2.69\,(A_{645}) \times \frac{V}{1000 \times W}$$

$$\text{mg chlorophyll-b/g plant tissue} = 22.9\,(A_{645}) - 4.68\,(A_{663}) \times \frac{V}{1000 \times W}$$

$$\text{mg total chlorophyll/g plant tissue} = 20.2\,(A_{645}) + 8.02\,(A_{663}) \times \frac{V}{1000 \times W}$$

Where,
A = absorbance at specific wavelength,
V = final volume of chlorophyll extract in 80% acetone,
W = fresh weight of tissue extracted

Proteins estimate by Lowry's method.
Requirements:
1. Apparatus: Test tubes, mortar and pestle, pipette, measuring cylinders, beaker, weighing balance, spectrophotometer, etc.

2. Chemicals:
a) Solution A: 2% Sodium Carbonate (anhydrous) in 0.1N NaOH.
b) Solution B: 0.5% Copper Sulphate ($CuSO_4.5H_2O$) in 1% Sodium Potassium Tartarate
c) Solution C (Alkalline Copper Solution): Mix 50ml of Solution A with 1ml of Solution B just prior to use.
d) Folin-Ciocalteu Reagent (FCR): Dilute the commercial reagent with an equal volume of distilled water (v/v).
e) Stock Standard Protein Solution: 50mg of Bovine Serum Albumin (BSA)/50ml of Distilled water
f) Working Standard Solution: Dilute 10ml of the stock solution to 50 ml with distilled water to obtain 200µg protein/ml.
g) Distilled water

3. Plant material:
Fenugreek leaves.

Principle: Proteins react with the Folin-Ciocalteu reagent (FCR) to give a blue-coloured complex. The colour so formed is due to the reaction of alkaline copper with the protein and reduction of phosphomolybdic-phosphotungustic components in the FCR by the amino acids tyrosine and tryptophan. The intensity of the blue colour is measured colorimetrically at 660nm. The intensity of blue colour depends on the amount of these aromatic amino acids present and thus varies for different proteins.

Extraction of proteins from sample

1. 0.5 g of the germinating seeds were grinded with 10 ml of chilled distilled water in a clean mortar and pestle.
2. It was then centrifuged for 5 min at 4500 rpm and the supernatant was used as a protein sample.
3. 0.2, 0.4, 0.6, 0.8 and 1.0ml of the working standard solution was pipetted in to series of test tubes.
4. 0.1ml and 0.2ml of the sample extract was pipetted out into two other test tubes.
5. In all the test tubes final volume was made to 1ml with distilled water. A tube with 1ml distilled water served as a blank.

6. 5ml of Solution C was added to each test tube and after well mixing they were incubated at room temperature for 10 min.
7. After 10 min 0.5ml of FCR was added, well-mixed immediately and incubated again at room temperature in dark for 30 min.
8. After incubation period the absorbance was observed for each tube at 660nm against the blank.
9. A standard graph was plotted and the amount of protein in the sample was calculated.

Estimation of Ascorbic Acid by volumetric method

Ascorbic acid otherwise known as Vitamin C is antiscorbutic. It is present in citrus fruits, gooseberry, bitter gourd etc. in high amount. Generally, it is present in all fresh vegetables and fruits. It is water soluble and heat-labile vitamin. The method described below is easy, rapid and a large number of samples can be analyzed in a short time.

Materials

1. Oxalic Acid (4%)
2. Dye Solution: Weigh 42mg sodium bicarbonate into a small volume of distilled water. Dissolve 52mg 2,6-dichlorophenol indophenol in it and make up to 200ml with distilled water.
3. Stock Standard Solution: Dissolve 100mg ascorbic acid in 100ml of 4% oxalic acid solution in a standard flask (1mg/ml).
4. Working Standard: Dilute 10ml of stock solution to 100ml with 4% oxalic acid. The concentration of working standard is 100ug/ml

Principle

Ascorbic acid reduces the 2, 6-dichlorophenol indophenol dye to a colorlss leuco-base. The ascorbic acid gets oxidized to dehydroascorbic acid. Though the dye is a blue coloured compound, the end point is the appearance of pink coloured. The dye is pink colour in acidic medium. Oxalic acid is used as the titrating medium.

Procedure

1. Pipette out 5ml of the working standard solution into a 100ml of conical flask.

2. Add 10ml of 4% oxalic acid and titrate against the dye (V1 ml). End point is the appearance of pink colour which persists for a few minutes. The amount of dye consumed is equivalent to the amount of ascorbic acid.

3. Extract the sample (0.5-5g depending on the sample) in 4% oxalic acid and make up to a known volume (100ml) and centrifuge.

4. Pipette out 5ml of this supernatant, add 10ml of 4% oxalic acid and titrate against the dye (V2 ml).

Calculations

Amount of ascorbic acid mg/100ml sample

$$\frac{0.5mg}{V1ml} X \frac{V2ml}{5ml} X \frac{100ml}{Wt.of\ the\ sample} X\ 100$$

Estimation of carbohydrate by the Anthrone method

Theory/Principle: Carbohydrates are dehydrated by conc.H2SO4 to form furfural. Active form of the reagent is anthranol, the enol tautomer of anthrone, which reacts by condensing with the carbohydratefurfural derivative to give a green colour in dilute and a blue colour

in concentrated solutions, which isdetermined colorimetrically. The blue - green solution shows absorption maximum at 620 nm'

Reaction:

- **Hydrolysis** to monosaccharide

Disaccharide → Monosaccharide

- **Dehydration**---product is a furfural

Monosaccharide → Furfural

- **Reaction** of furfural with anthrone

Furfural + Anthrone reagent → Blue green complex

Methodology:

- **Anthrone reagent:** Dissolve 2g of Anthrone in 1 litre of concentrated H2SO4. Use freshlyprepared reagent for the assay
- **Glucose stock solution:** 200µg glucose per mL distilled water.

Note: Can include other carbohydrates of the same concentration if desired.

Procedure:

1. Pipette out into a series of test tubes different volumes of glucose solution from the supplied stock solution (200µg /ml) and make up the volume to 1 ml with distilled water.
2. Consider tube 1 as blank and tubes 2 through 9 for construction of a standard curve. Tubes 10-15 are for the unknown samples.
3. To each tube add 5 ml of the Anthrone reagent (supplied) and mix well by vortexing.
4. Cool the tubes.
5. Cover the tubes with marbles/ Caps on top and incubate at 90o C for 17 minutes or boiling water bath for 10 minutes.
6. Cool to room temperature and measure the optical density at 620 nm against a blank.
7. Prepare a standard curve of absorbance vs. µg glucose.

Calculation: Determine the amount of glucose in the unknown sample by plotting a standard curve of A620 on Y-axis and µg of Glucose on X-axis.

Lipid estimation:

Principle

The tissue is extracted in chloroform, methanol and distilled water mixture, filtered and re-extracted. The chloroform layer is vaporized to dryness, weighed and total lipid is calculated.

Procedure

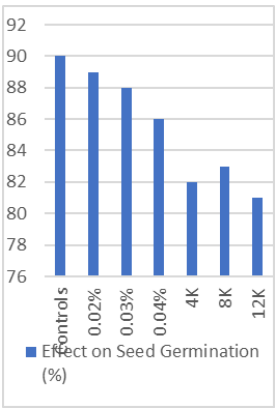
1. 500 mg of Fenugreek leaf sample was finely crushed in chloroform - methanol - distilled water mixture
2. Extract is collected in centrifuge tubes.
3. Extract is centrifuged for 5 minutes at 5000 rpm.
4. Tubes are shakes and again centrifuged for 5 minutes at 5000rpm.
5. 200microlitreof the supernatant is collected in Eppendorf tube.
6. Again, centrifuged for 5 minutes at 5000 rpm
7. 100µg of supernatant is collected in pre weighed Eppendorf tubes.
8. Tubes are kept opened until the mixture get evaporated and then the remaining lipid precipitate is calculated.

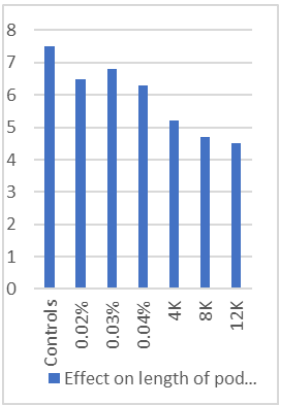
Observation:

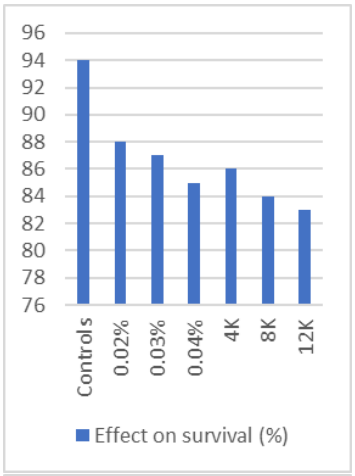
Sr. No Controls

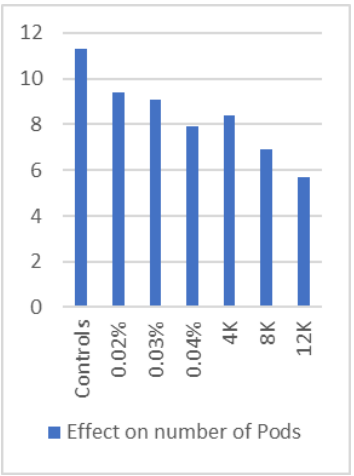
Chemical treatment with Sodium

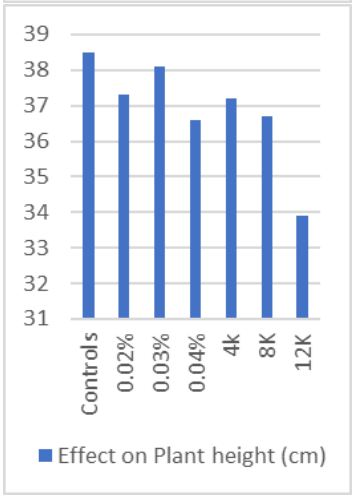
Sr. No		Controls	Chemical treatment with **Sodium azide**			Physical treatment with **Gamma radiation**		
		Controls	0.02 %	0.03 %	0.04 %	4K	8K	12K
01	Effect on Seed Germination (%)	90	89	88	86	82	83	81
02	Effect on length of pod (cm)	7.5	6.5	6.8	6.3	5.2	4.7	4.5
03	Effect on survival (%)	94	88	87	85	86	84	83
04	Effect on Plant height (cm)	38.5	37.3	38.1	36.6	37.2	36.7	33.9
05	Effect on number of leaves	26.8	25.2	22.8	21.6	24.1	23.9	21.8
06	Effect on number of Pods	11.3	09.4	09.1	07.9	08.4	06.9	05.7
07	Effect on chlorophyll	6.9	6.3	6.2	5.8	6.1	5.4	4.4
08	Effect on protein contain	8.2	7.9	6.5	6.8	7.1	6.4	5.9
09	Effect on carbohydrate	0.58	0.49	0.34	0.32	0.38	0.36	0.29
10	Effect on Vitamin C	3.1	2.7	2.3	2.1	2.8	2.5	2.2

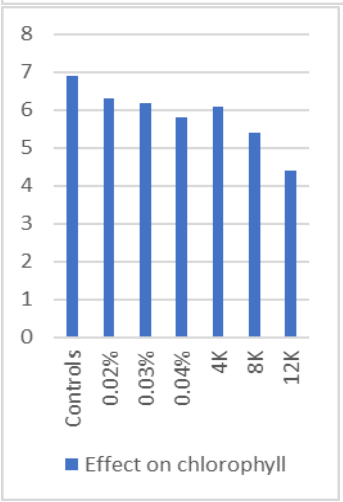


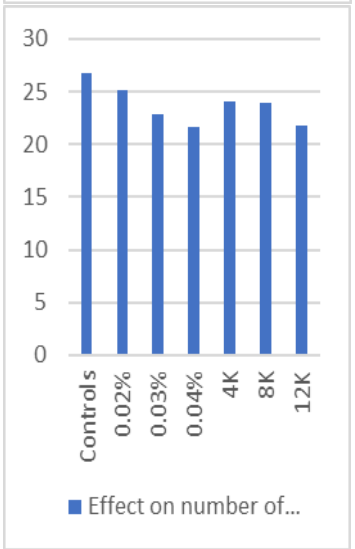



96
94
92
90
88
86
84
82
80
78
76
Controls
0.02%
0.03%
0.04%
4K
8K
12K
Effect on survival (%)


12
10
8
6
4
2
0
Controls
0.02%
0.03%
0.04%
4K
8K
12K
Effect on number of Pods


39
38
37
36
35
34
33
32
31
Controls
0.02%
0.03%
0.04%
4k
8K
12K
Effect on Plant height (cm)


8
7
6
5
4
3
2
1
0
Controls
0.02%
0.03%
0.04%
4K
8K
12K
Effect on chlorophyll


30
25
20
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10
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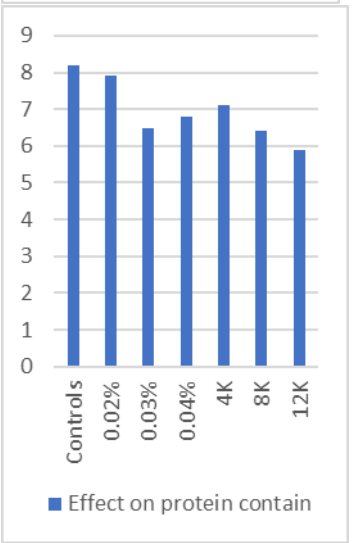
Controls
0.02%
0.03%
0.04%
4K
8K
12K
Effect on number of...


9
8
7
6
5
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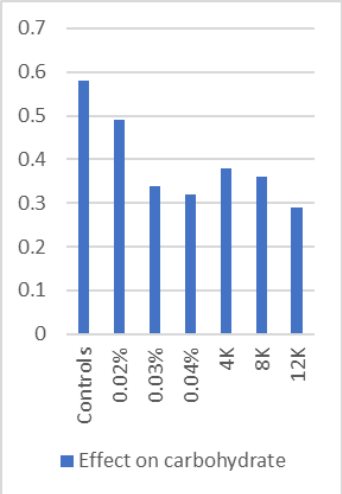
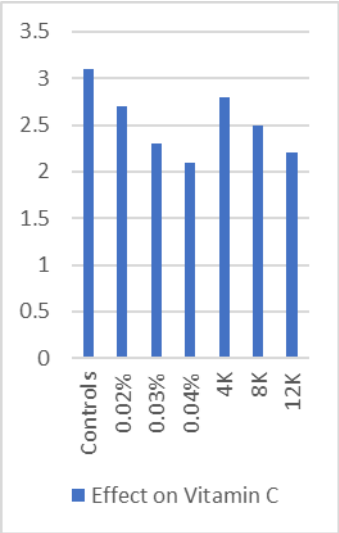
3
2
1
0
Controls
0.02%
0.03%
0.04%
4K
8K
12K
Effect on protein contain





Result

In chemical treatments effects of sodium azide on seed germination in the control group, about 90 % of seeds germinated after 24 h. When the seeds were treated with lower doses of sodium azide (0.02 and 0.03%), a marginally lower (non-significant) percentage of seed germination was observed compared to control groups. However, at above a dose of 0.04%, sodium azide treatment resulted in a significant reduction in percentage of seed germination compared to control in a dose-dependent manner at all the time intervals. The lowest germination percentage was observed in seeds treated with 0.04%, sodium azide.

The reduced germination due to inhibitory effect of the chemical Mutagen in Trigonella foenum graecum seeds has been reported earlier in by, Jain and Agarwal (1994) and Siddiqui et al. (2007, 2009). Survival percentages, plant height, length of leaf and length of pod of the plants in 0.03% indicated high result. The present results are in concordance with the earlier reports of Mensah and Akomeah (1992). The decrease in the percentage of seed germination and seedling survival has been attributed to the physiological disturbance and/or chromosomal damage caused to the cells by the mutagen administered. Contrary to the general reduction, number of seeds per pod showed increased mean value over control with all the doses of sodium azide applied for 4 and 6 hours. Of all the treatments, 4.5 mM for 4 hours proved most useful for selection in breeding programme with a maximum score of 22.53% increase in the coeff

icient of variation. The increase in the variability for number of pods per plant following mutagenic treatments has been reported in Lathyrus sativus (Waghmare and Mehra, 2000), Vigna mungo (Singh et al., 2000) and Vigna radiata (Khan et al., 2004).

Number of leaves and the number of pods is a good result of 0.02 %. All treatments reduced the number of primary branches with increasing concentrations except the lowest dose used. Contrarily, however, increase in the number of branches has been reported by Singh and Chaturvedi (1990)

in Lathyrus sativus applyingNMU mutagen and Khan et al. (2004) in Vigna radiata applying sodium azide. In the phytochemical analysisin 0.02% concentration show hight result as compair to other tretment and control seed. As well as result of biochemical analysis such as Chlorophyll estimation, protein estimation, Ascorbic acid and carbohydrate give good result in low concentration dose. Among Physical mutagenic treatments, the maximum seed germination was notice in 12kr whereas the minimum seed germination was recorded in control. Plant height maximum in control whereas minimum in 12 kr. Similarly, number of leaves and number of pods are maximum in control and minimum in 12 kr. Maximum chlorophyll present in the 4kr. Likewise maximum protein present in control and minimum protein present in the 12kr. Maximum carbohydrate present in the control whereas minimum carbohydrate presentin the 12kr. Likewise maximum vitamin c present in the 4kr and minimum in the 12krs.

Conclusion

In the present study, results show that a higher dose of sodium azide (0.04%) significantly reduced all the recorded parameters and the lower dose of sodium azide is more suitable for the fenugreek. In Physical treatments low doses of gamma rays increase growth, yield character and some biochemical constituents.Gamma radiation at 4kr was sutaible in enhancement of growth and yield whereas,high dose of gamma radiation 12kr caused decrease in growth and yield.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 34 - 42 |

Evaluation Of In Vitro Antioxidant and Anticancer Properties of *Bauhinia Purpurea* Leaves.

Dr. Kavita Mane,

Prof. Swati Burungale

Delonix Society's Baramati College of Pharmacy, Barhanpur, Baramati, Maharashtra, 413102, India

Email: *kavitamanebcop@gmail.com*

Article DOI Link: https://doi.org/10.5281/zenodo.13906093

DOI 10.5281/zenodo.13906093.

Abstract

"Cancer is one of the most life-threatening diseases, with over 100 different types arising from molecular changes within cells. It is the third leading cause of death globally, following cardiovascular and infectious diseases. In recent years, there has been growing interest in protecting humans against oxidative damage caused by free radicals, which contribute to aging and diseases such as diabetes and cancer. Many medicinal plants have been traditionally used to treat various ailments, but scientific validation of these effects is often lacking. Based on a literature review, we have selected the medicinal plant Bauhinia purpurea (family: Fabaceae) for further study. This plant has been traditionally used to treat a range of conditions, including diarrhea, dysentery, amoebic dysentery, inflammatory swelling, hemorrhage, and skin diseases."

Keywords: Cancer, Free radicals, Medicinal Plants, Swelling, hemorrhage.

Introduction

Cancer is the second leading cause of death after heart disease, with breast cancer being the most common type among women aged 40-44. This life-threatening disease encompasses over 100 different types, all resulting from molecular changes within cells. Cancer ranks as the third leading cause of death worldwide, following cardiovascular and infectious diseases, and it is estimated that 12.5% of the global population succumbs to cancer (WHO, 2004). The disease is prevalent, especially in Western countries, where nearly one-third of the population is expected to develop cancer at some point in their lives. Cancer is not a single disease but a group of diseases that share a common characteristic: the uncontrolled growth of cells. Though cancer is an ancient disease, the incidence of malignant cancers and cancer-related mortality is on the rise.

According to the International Agency for Research on Cancer (IARC), the incidence of cancer is expected to increase by about 50% over the next 20 years. In low- to middle-income countries, cancer accounts for a quarter of all disease-related deaths. It is estimated that around 50% of cancer patients in the United States use medicinal agents derived from various plant parts or nutrients, either alone or in conjunction with conventional treatments like chemotherapy or radiation. Since the 1940s, numerous anticancer drugs have been developed, with about 73% of them being traced back to natural products.

Methodology

Selection of plant material

Many medicinal plants have been traditionally used to treat a variety of diseases, though scientific evidence supporting these uses is often lacking. Based on a literature review, we have selected the medicinal plant Bauhinia purpurea (family: Fabaceae) for further investigation. This plant has traditionally been used to treat a range of conditions, including diarrhea, dysentery, amoebic dysentery, inflammatory swelling, hemorrhage, and skin disease.

Collection of plant material

This plant was selected and collected from tirumala hills, Tirupati, Andhra Pradesh for the present study.

Authentication of plant material

The leaves of bauhinia purpurea were collected and authenticated by Dr.N.Savithramma professor of Botany, Co- Ordinator DDE Botany , Sree Venkateshwara University, Tirupati.

Extraction of plant material

The leaves were shade-dried at room temperature for 10 days and then milled into a powder using a mechanical grinder. This powder was sequentially extracted with acetone, following increasing polarity. The extract was then left to stand for 24 hours to allow for the isolation of phytoconstituents. After 24 hours, the extract was filtered, and the filtrate was collected and subjected to phytochemical screening. This extract was subsequently used to study its in vitro antioxidant and anticancer activities.

SEM Analysis

The scanning electron microscope (SEM) utilizes a focused beam of high-energy electrons to produce various signals at the surface of solid specimens. These signals, generated from electron-sample interactions, provide detailed information about the sample, including its external morphology (texture), chemical composition, and the crystalline structure and orientation of the materials comprising the sample. The surface characteristics of the acetone-water extract of Bauhinia purpurea were analyzed using SEM (Vega 3 TESCAN).

Invitro Antioxidant Activity

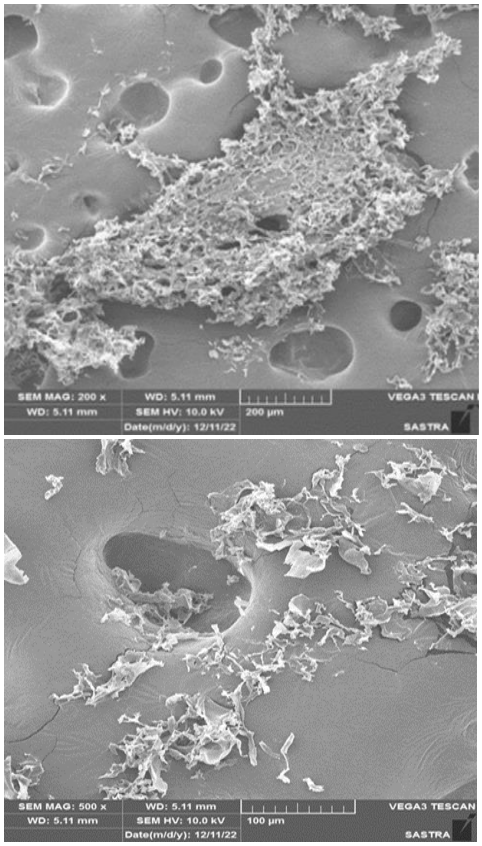
Antioxidants are commonly used in oils and fatty foods to slow down autoxidation. However, the use of synthetic antioxidants, such as butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA), is limited in foods due to concerns over their potential carcinogenicity. As a result, there has been a growing

emphasis on finding natural antioxidants. Ethnomedical literature documents a vast number of plants that may be effective against diseases where reactive oxygen species and free radicals play a significant role. In our current study, we evaluate the antioxidant activity of Bauhinia purpurea through in vitro assays, specifically by assessing hydroxyl radical scavenging activity, nitric oxide radical scavenging activity, and total phenol content.

Results And Discussion

Scanning Electron Microscopy (SEM)

When a specimen is scanned with an electron beam at an acceleration potential of 10 kV in a Scanning Electron Microscope (SEM), the resulting images are produced by detecting secondary electrons (SEs).



Evaluation of Invitro Antioxidant Activity By Invitro Techniques

Hydroxyl radical scavenging activity

The hydroxyl radical scavenging activity of Bauhinia purpurea, as presented in Table 1, reached a maximum of 48.01% at a certain concentration (µg/ml), while the standard ascorbate showed a similar activity of 48.04% at 100 µg/ml. The IC50 values for Bauhinia purpurea and ascorbate were determined to be 600 µg/ml and 100 µg/ml, respectively.

Table 1: Hydroxyl radical scavenging activity of *Bauhinia purpurea*

S.No	Concentration (µg/ml)	% of activity(±SEM) *	
		Sample (*Bauhinia purpurea*)	Standard (Ascorbate)
1	25	22.32 ± 0.012	28.06 ± 0.017
2	50	26.12 ± 0.021	34.22 ± 0.076
3	75	30.12 ± 0.014	40.08 ± 0.014
4	100	35.28 ± 0.012	48.04 ± 0.033
5	200	37.07 ± 0.011	52.23 ± 0.048
6	400	43.22± 0.069	56.11 ± 0.031
7	600	48.01 ± 0.014	62.22 ± 0.014
		IC50 = 600 µg/ml	IC50 = 100 µg/ml

**All values are expressed as mean ± SEM for three determinations.*

Nitric oxide radical scavenging activity

The reduction of nitric oxide radicals by Bauhinia purpurea and ascorbate is illustrated in Table 2. The maximum nitric oxide scavenging activity at 600 µg/ml was found to be 76.19% for Bauhinia purpurea and 76.23% for ascorbate. The IC50 values for Bauhinia purpurea and ascorbate were recorded as 600 µg/ml and 100 µg/ml, respectively.

Table 2: Nitric oxide scavenging activity of *Bauhinia purpurea*

S.No	Concentration (µg/ml)	% of activity(±SEM) *	
		Sample (*Bauhinia purpurea*)	Standard (Ascorbate)
1	25	25.22 ±0.013	39.22 ± 0.026
2	50	32.13 ± 0.040	48.28 ± 0.069
3	75	40.18 ± 0.032	56.14 ± 0.021
4	100	46.17 ± 0.037	76.23 ± 0.022
5	200	58.21 ± 0.019	82.20 ± 0.027
6	400	64.11 ± 0.022	91.24 ± 0.044
7	600	76.19 ± 0.012	102.32 ± 0.041
		IC50 = 600 µg/ml	IC50 = 100 µg/ml

**All values areexpressed as mean ± SEM for three determinations.*

Table 3: The total Phenolic content of *Bauhinia purpurea*

S. No	Extracts	Total phenol content (mg/g Gallic acid) (±SEM) *
1	*Bauhinia purpurea*	1.38 ± 0.080

Based on the result the *Bauhinia purpurea* was found higher content of phenolic components.

In Vitro Anticancer Activity

MTT assay of AGS cell lines

Sample ID
Cell lines: AGS
Incubation Time: 48hr

Fig 1: Cell Viability Data Analysis

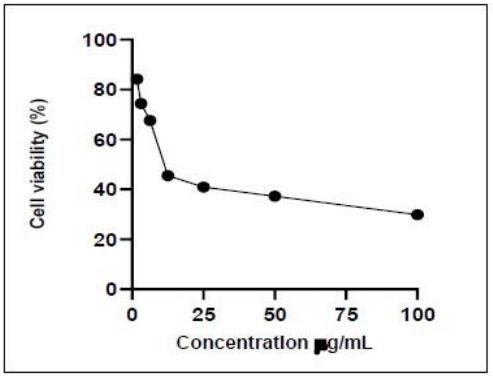
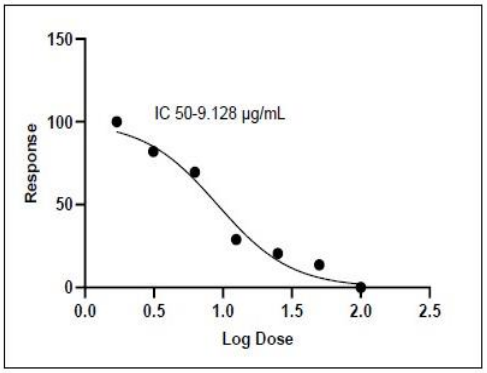
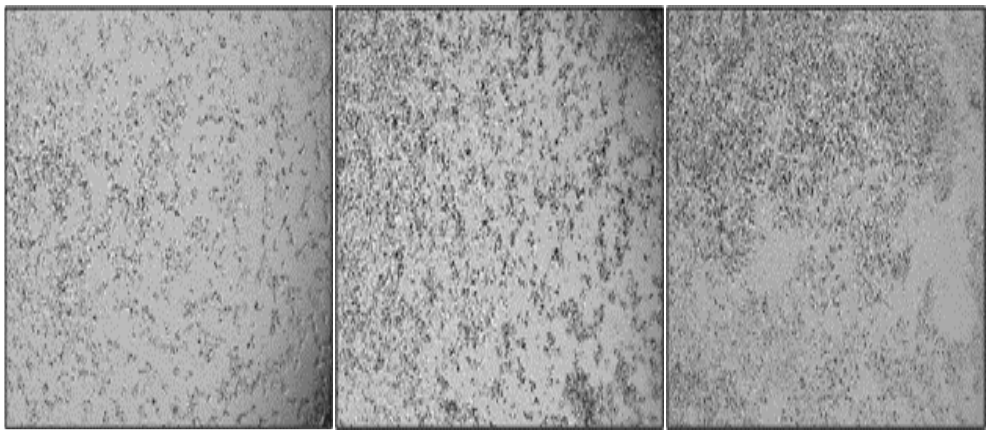


Fig 2 Non-Linear Regression Curve Fit

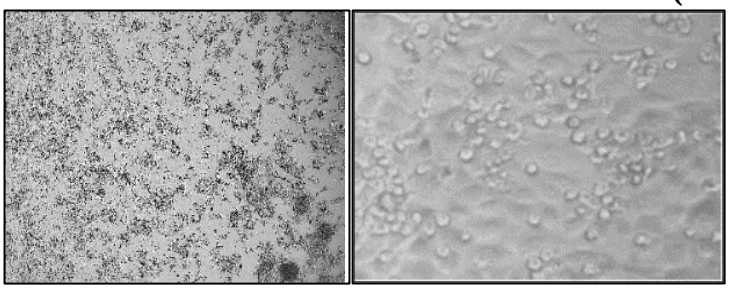


Concentration (ug/mL)	OD1	OD2	OD3	% Cell Death			Mean	SD	SEM	% Live Cells
100	0.096	0.102	0.102	71.34328	69.55224	69.55224	70.14925	0.344687	0.199005	29.85075
50	0.125	0.124	0.126	62.68657	62.98507	62.38806	62.68657	0.298507	0.172343	37.31343
25	0.135	0.145	0.132	59.70149	56.71642	60.59701	59.00498	1.950689	1.126231	40.99502
12.5	0.145	0.144	0.169	56.71642	57.01493	49.55224	54.42786	3.789377	2.187798	45.57214
6.25	0.221	0.224	0.235	34.02985	33.13433	29.85075	32.33831	1.712869	0.988925	67.66169
3.125	0.235	0.265	0.248	29.85075	20.89552	25.97015	25.57214	2.821967	1.629264	74.42786
1.7	0.269	0.278	0.299	19.70149	17.01493	10.74627	15.8209	3.328503	1.921712	84.1791
Control	0.325	0.325	0.356							100
Control Mean	0.335333									

100µg/mL **50µg/mL** **25µg/mL**



12.5µg/mL HT-29 **cell lines (untreated)**



MTT assay of HT-29 cell lines

Sample ID
Cell lines: HT-29
Incubation Time: 48hrs

Concentration (ug/mL)	OD1	OD2	OD3	% Cell Death			Mean	SD	SEM	% Live Cells
100	0.052	0.059	0.069	85.75342	83.83562	81.09589	83.56164	1.508923	0.871177	16.43836
50	0.085	0.096	0.098	76.71233	73.69863	73.15068	74.52055	0.689483	0.394073	25.47945
25	0.166	0.152	0.154	54.52055	58.35616	57.80822	56.89498	0.738165	0.42618	43.10502
12.5	0.198	0.201	0.211	45.75342	44.93151	42.19178	44.29224	1.433334	0.827536	55.70776
6.25	0.202	0.212	0.221	44.65753	41.91781	39.45205	42.00913	1.450685	0.837554	57.99087
3.125	0.265	0.245	0.265	27.39726	32.87671	27.39726	29.22374	2.79	1.610807	70.77626
1.7	0.289	0.296	0.258	20.82192	18.90411	29.31507	23.0137	5.243791	3.027504	76.9863
Control	0.366	0.389	0.365							100
Control Mean	0.373333									

Fig 1: Cell Viability Data's Analysis

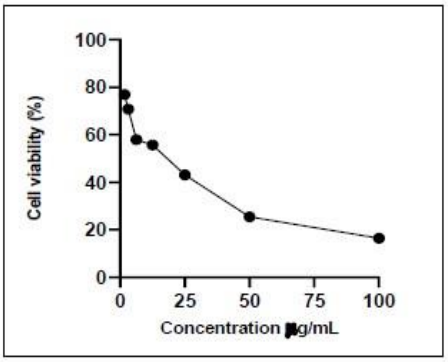
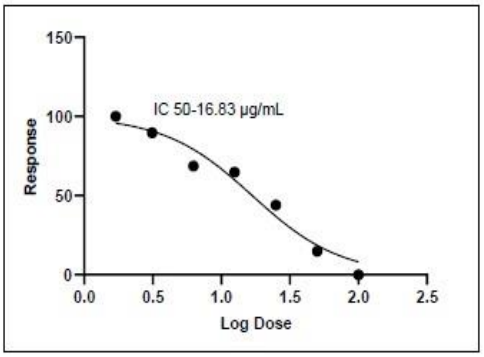
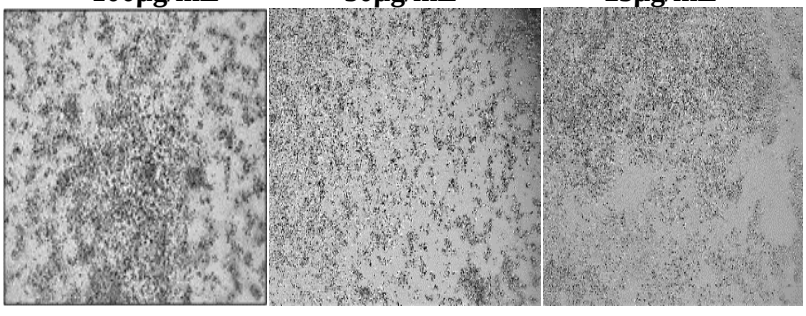


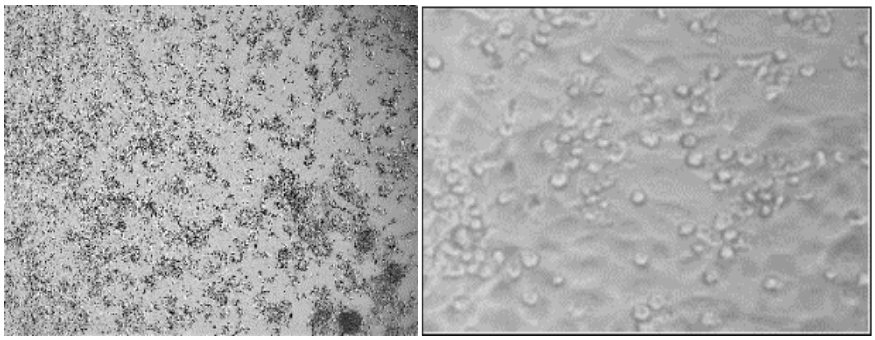
Fig 2 Non-Linear Regression Curve Fit



100µg/mL **50µg/mL** **25µg/mL**



12.5µg/mL HT-29 **Cell lines (untreated)**



Summary conclusion

Natural products derived from medicinal plants have played a crucial role in cancer treatment. The present study highlights the antioxidant and potential anticancer activities of the acetone extract of Bauhinia purpurea. The leaves of Bauhinia purpurea were collected and authenticated by Dr. N. Savithramma, Professor of Botany and Coordinator of DDE Botany at Sree Venkateshwara University, Tirupati. First, we collected the leaves from surrounding plants and allowed them to dry for 20 days. After drying, the leaves were powdered, and an acetone extract of Bauhinia purpurea leaves was prepared. We then performed phytochemical screening tests, which yielded positive results for flavonoids, tannins, steroids/terpenoids, glycosides, and saponins.

Conclusion

The present study clearly indicates that Bauhinia purpurea exhibits strong antioxidant activity by inhibiting hydroxyl radical scavenging and nitric oxide radical scavenging activities, comparable to the standard ascorbate. Additionally, Bauhinia purpurea was found to contain a significant number of total phenols, which play a major role in its antioxidant properties. Further investigations are necessary to isolate and identify the antioxidant compounds in the plant extract. The extract also demonstrated anticancer activity by increasing the percentage of cell death and decreasing the percentage of live cells. As the concentration of **Bauhinia purpurea** leaf extract and optical density increased, the percentage of cell death also rose, confirming its anticancer potential.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 43 - 56 |

Cancer Vaccines: A Comprehensive Review

[1] Vrushali M Murari

[2] Supriya S Shete

[1]Bachelor of Pharmacy Student at Dr. Shivajirao Kadam College of Pharmacy, Kasabe Digraj, Sangli, Maharashtra, India 416305

Email: murarivrushali@gmail.com

[2]Assistant professor (Department of Pharmaceutics) at Ashokrao Mane College of Pharmacy Peth Vadgaon. Maharashtra, India 416112

Email: gourishete2000@gmail.com

Article DOI Link: https://doi.org/10.5281/zenodo.13906109

DOI 10.5281/zenodo.13906109.

Abstract

There are over 277 different types of tumors, which makes it among of the most prevalent causes deaths worldwide. The cornerstone of treatment has included the use of traditional cancer therapies such as chemotherapy, radiation, and surgery. However, by using the immune system of the human body to target and eliminate cancer cells, advances in immunotherapy have entirely altered the way that cancer is treated. One potential area of immunotherapy is the development of cancer vaccines, which recognize and target antigens associated with tumors to elicit long-lasting anticancer immune system reactions. Particular attention is paid to vaccines against lung, brain, and prostate cancers, for which recent clinical studies have produced positive outcomes. The potential of vaccines to reduce tumor burden and prevent recurrence is still being highlighted by current research, despite issues with vaccination efficacy across various kinds of cancer. In order to optimize clinical advantages, vaccines against cancer of the future must improve immune system regulation and overcome delivery-related obstacles.

***Keywords*:** Cancer vaccines, Immunotherapy, Tumor, cancer relapse, cancer reappreciation.

Introduction

One among the most prevalent causes for mortality in this nation is cancer. [1,2,3]. With the most general sense, the word "cancer relates to about 277 various kinds of cancer that are malignant. [4]. Carcinoma is a hereditary disease [5]. Tumors may develop if

genetic material—in the present instance, viral DNA—is produced by healthy cells [6].

Radiation therapy, chemotherapy, and surgery are common chemotherapy for cancer choices. A relatively recent addition to this toolkit is biological therapy, also known as immunotherapy, which is biomedical treatment, and biological reaction modification treatment. [7]. Immunotherapy has taken place increasingly in the fight for cancer. A plethora of innovative immunotherapies, which including immune check point inhibitors (ICIs), oncolytic infectious agents, and therapies involving recombinant antigens receptor-T cells, have recently been licensed for use in clinical trials. [8,9,10,11]. The most recent improvements in our understanding of the endogenous immune system have contributed to the exploration and development of immunotherapy, an additional therapeutic paradigm with enormous potential for future important advances. [12]. The standard of life or survival rates for patients have greatly increased with tumor immunotherapy as contrasted with previous medical procedures (which include radiation, chemotherapy, & operation).[13]. One promising area that offers options for treating cancer is immunology [14,15]. In the future, cancer vaccines could play a bigger part in both the avoidance and cure of the disease as they represent a new therapeutic and preventive approach [16]. An increasingly popular approach is small-molecule the immunotherapy procedure, which targets several signaling pathways linked to the immune response [17]. The potential answers to the major technical challenges faced in cancer vaccinations & treatment can be found in systems for drug delivery that utilize nanoparticles with particular physical, chemical, or biological characteristics. [18]. The production of highly specific tumor antigen-expressing "oncolytic immunizations" has been made possible by the emergence of novel technologies that can recognize antigens from tumors including immunological epitopes that across a variety of different cancer types. This is a potential approach to targeting tumors. [19]. Medical, in vitro, along with in vivo studies have all demonstrated the effectiveness of chemotherapy for cancer [20]. Compared to conventional medicines, many alternative remedies have been authorized with fewer adverse effects. Therapeutic developments, such as nanoparticulate administration technology, may lead to enhanced therapeutic outcomes. [21]. In the year 1900, Paul Erlich (1906) advocated the use of antibodies for directing harmful substances to cells with cancer within the context of tumor therapy. As we'll see, Erlich's theory has been updated thanks to the production of extremely specific monoclonal antibody molecules (MoAbs) using Kohier & Milstein's the hybridoma technique (1975) [22]. These vaccines have a little chance of recurrent tumors or metastasis and can aid in the removal of cancerous cells through a variety of tissues and systems of cells within the human organism. [23]. Recent breakthroughs have focused on the molecular processes that allow the body to identify and fight dangerous or cancerous tumors, including the use of specific markers such as peptide-based anticancer vaccines that target tumor-associated antigens. [24] According the

concept of cancer vaccination theory, cancerous cells are going to be specifically destroyed by the immune system of the patient.[25].

Vaccines:

What exactly are vaccines?

Vaccinations generally help to maintain our health. They are made from less potent or benign strains of the disease they are meant to protect against. This suggests that they are not the source of the illness. The body's immune response creates antibodies that recognize and neutralize the disease's benign variants. The body is going to be able to recognize the disease if it recurs after producing these antibodies. You thus have protection against it.

What do cancer vaccines rely of?

Vaccinations are being studied as a possible treatment for cancer. Vaccination works similarly to immunity against diseases in that they are made to recognize specific amino acids on cells that are cancerous. Cancer vaccines aim to elicit immune system responses that target specific cells in the tumor, specifically targeting lethal CD8 + T cells which recognize tumor antigen. [26]. An antigen, or antigen, is a substance that triggers an undesirable immunological response. Both malignant and healthy cells have antigens on them. Tumor related antigen are proteins found in malignant cells. Normal cells either lack these antigens or contain them in much smaller amounts when they do.

Immunotherapy:

One kind of treatment for cancer called immunotherapy works by strengthening a person's immune response. Immunotherapy can alter or enhance the immune system's ability to recognize and destroy cancerous cells. Immunology, which uses the immune system of the human body to combat cancer, has received a lot more attention and is now a common cancer therapy technique. Anticancer immunotherapy has a significant advantage over standard cancer treatments in that it not only eliminates the primary tumors but also addresses metastases or recurrence. [27]. Numerous immunotherapeutic strategies, including inhibitors of checkpoints, CAR T-cell therapy, TIL treatment, and vaccines for cancer, immune checkpoint inhibition combo therapy, potential bispecific immunoglobulins, have had their mechanisms of action or clinical application comprehensively studied. Significant advancements in the field, accompanied by empirical evidence and case studies, confirm immunotherapy's remarkable effectiveness in treating a diverse range of cancer types. [28]. Moreover, CAR-T therapy physically modifies the immune system of a person to search for specific proteins on cancerous cells, effectively destroying the cells that are malignant. For patients battling cancer, immunotherapy has shown impressive gains in treating some types of the disease. [29].

How Cancer Is Treated Using Immunotherapy:

Immunology is a medical procedure that fights illnesses like malignancy by focusing on particular immunological proteins. Here are two approaches you can take to this:

- Strengthening or bolstering your immune system's built-in defenses to improve its ability to detect and eliminate cancer cells.
- The method of creating elements of the immune system in a laboratory

and employing these in order to enhance or recover the system's capacity to detect and eradicate malignant cells. Via a series of steps described to constitute the cancer-immunity cycle, CD8-positive cytotoxic T lymphocytes are the main agents of the immune response against cells from tumors. [30,31]. This process encompasses: (1) The procedure via which cells in tumors produce antibodies, while antigen-presenting cell types (APCs), like cells called dendritic cells (DCs), analyze released antigen; (2) In order to help in T cell identification, the major compatibility complex, either MHC, category I or the second-grade components release antigens from tumors onto the outermost protective layer of APCs. (3) the lymph nodes' T lymphocytes' primed & stimulation after recognizing a tumor antigen; (4) The blood vessel-based movement of stimulated T lymphocytes towards the tumor site; (5) T cell invasion throughout and surrounding the tumor; (6) The procedure through which T cells detect antigen-presenting malignancies by binding components of the class I MHC found on cancer cells to T cell receptors, or the receptors for T cells upon T cell membranes; and (7) More antigens from the tumor are released as the outcome of T cells destroying tumor cells, strengthening the immune response. Every stage of this procedure has been shown to be either enhanced or inhibited by a variety of receptors and ligands that they contain. [32].

Vaccines in prostate cancer:

Among among the most common cancers nowadays that seriously endangers the livelihoods and health of older men is cancer of the prostate. [33,34,35]. 345,000 people die from prostate cancer each year, underscoring the pressing requirement for the best possible care. [36,37].

Although it begins as testosterone-dependent, it eventually advances to castration-resistant cancer of the prostate (CRPC), which is irreversible despite the availability of modern chemotherapeutic and pharmaceutical therapies that concentrate on the androgen receptor communication pathway. [38]. This method is transforming cancer treatment and has the potential to make a substantial influence on the development of prostate cancer. [39,40].

For most tumor types, immunology has greatly improved disease treatment; yet, its applicability in curing prostate cancer is still limited. [41].

Recently, immunotherapy has become a cutting-edge field of study for the management of cancer of the prostate. It works by stimulating cancer-fighting immune system cells in the host to produce tumor-killing actions. [42].

Antibodies against cancer of the prostate, that have been demonstrated for a number of years to elicit immune system reactions, are starting to demonstrate significant treatment promise. [43].

Phase two investigations with therapeutic immunizations such as DCVAC/PCa or PROSTVAC, demonstrated encouraging outcomes for curing cancer of the prostate; phase 3 studies are now being conducted.[44]. McNeel et al. produced the most

thoroughly investigated DNA vaccine towards the management of prostate cancer. In 2006 and 2009, two preliminary trials comprising a vaccine including the PAP gene demonstrated safety. [45,46]. These participants are the same people who were enrolled in the Ad5-PSA vaccination's first phase trial of the ongoing Phase II trial. Six injections, consisting of GM-CSF plus the plasmid preparation containing the DNA vaccine, were administered to all patients at intervals of 14 days. although a few patients displayed immune responses against PAP as evidenced by proliferation of T cells or IFN-γ production. Anti-PAP antibodies, however, were not discovered. Clinically, over the course of the 8.5–12-month observation period, the patients' PSADT increased somewhat. 2010 saw the publication of a second analysis of immune responses. [47]. Further studies with vaccines made from DNA have been carried out with several antigens associated with cancer of the prostate. [48,49,50].

Lastly, prognosis and predicting indications for clinical gain must be found for the purpose to improve both patient outcomes and vaccine potency. These clues can then be used to inform the choice of therapeutic interventions for those individuals who would be most likely to experience profit [51].

Vaccines for Brain tumor:

Tumors that are malignant are still one of the main causes of death for people. [52]. Tumors of the brain are caused by unchecked and fast cell proliferation. [53]. The most frequent primary brain tumor, also known as malignant glioma, has a dismal prognosis despite a variety of therapeutic options like radiation, chemotherapy, or surgery. [54-60]. Amino or dendritic cell vaccines enhance the way the immune system reacts to antigens from tumor in order to combat brain tumors. By triggering humoral immunity through the production of antibodies and cytotoxic T cells, vaccines create an overall immune system reaction that enables the human body to fight brain tumors and cross the barrier between the blood and the brain. [61]. Tumor-associated antigens (TAAs) or antigens specific to the tumor (TSAs) are two distinct types of antigens made up of peptides generated from malignancies that have been demonstrated to stimulate positive immune system reactions. [62]. Future clinical trials involving DC vaccination treatments for malignant gliomas are expected to build upon the foundation established by recent experiments. It's encouraging that the trials are moving on to Phase II. In a multi-center Phase II study, Dr. Linda Liau and Northwest Biological therapies, Inc. (Seattle, WA) is looking for GBM patients to test the efficiency of its homologous DC-based vaccination, DCVax®-Brain (The Northwest Biotherapeutics 2007). The trial intends to include 141 people with recent diagnoses.

Patients will have concomitant radiation therapy, chemotherapy, and surgery.

In order to treat malignant gliomas, novel treatments are essential. However, six months of free of progression will probably be the main objective for clinical investigations until we can connect individual immune reactions with clinical outcomes. These immunizations are expected to emerge as a feasible option for individuals undergoing difficult therapies when

barriers that hinder their efficacy are addressed and vaccine uniformity progresses. [63].

Vaccines for lung cancer:

Immunotherapy is widely acknowledged as a major anticancer accomplishment, especially with regard to the creation of cancer-fighting vaccines. These vaccines aim to use the immune system of the human body to target and eliminate malignant cells, with a focus on antigens associated with malignancies. [64,65,66]. Although lung cancers were not generally thought to be good candidates for vaccine treatment, and new approaches have shown promise in eliciting active immune reactions against particular tumor antigens, which has resulted in research studies suggesting better survival. [65,66].

On the other hand, past attempts at cancer of the lung vaccination have not yielded great results. However, an important change has occurred over the last ten years as a result of improvements in immunoadjuvants and their administration systems, as well as a deeper comprehension of the immune response and tumour antigens. [66]. In addition, the high number of mutations in tumors in non-small cell lung carcinoma, or NSCLC, suggests that the illness may react to the immunotherapy procedure, such as immunizations. [67]. It was additionally suggested that immune checkpoint blockers (ICI) and cancer vaccines for treatment be combined to maximize therapeutic results. [68].

In summary, the advancement of vaccines and immunotherapy has changed the face of the treatment of lung cancer. Current research studies that target particular antigens of tumors and the utilization of cutting-edge platforms like mRNA vaccines have showed positive outcomes despite past disappointments. [66,69]. It is possible that cancer chemotherapy therapy throughout the future will combine conventional treatments with novel immunological regimens, such as cancer therapy vaccines. [68,70]. These tactics will be further refined and their role in the normal course of care for patients with cancer of the lungs will be determined by the continuing clinical trials and research.

Vaccines used in other types of cancers:

A wide range of cancers of the bloodstream, including leukemia, are caused by the aberrant proliferation of leukocytes throughout development. [71]. The significance of the immune system's reaction in the therapy of blood cancers has been extensively studied in an assortment of settings. Continuing periods of remission having DLIs, utilizing allogeneic rather than autologous transplants, plus removing immunosuppression form those suffering from posttransplant lymphoproliferative syndromes all demonstrate how important the body's defense system is in these conditions. [72].

Tumors that grow in the airways or the tissue of the lungs are referred to as lung cancer, or bronchogenic malignancy. Since 1987, HPV has been responsible for greater numbers of women's fatalities than cancer of the breast, making it one of the primary causes of cancer-related fatalities in the US. Around 225,000 additional instances of cancer of the lung are identified in the US each year, while 160,000 individuals pass away from the disease. [73].

Vaccination efforts versus lung cancer have not been successful in the past. [66]. Injections administered subcutaneously, intramuscularly, and intradermally were used in breast cancer vaccine trials. Clinical investigations have demonstrated the futility of these endeavors. The creation of a vaccination against breast cancer may have been impeded by a number of circumstances.

Future Prospectives:

Oncology's promising new frontier of cancer vaccinations holds great promise for future developments. The effectiveness of cancer vaccines has significantly increased due to recent advancements in biotechnology and nanotechnology, suggesting promising futures for tumor immunotherapy [74]. Target selection, vaccine development, and strategies for bypassing the immunosuppressive processes used by cancers have all seen significant advancements in the field [75].

Notably, since the 1950s, there have been difficulties in the creation of cancer vaccines, despite the fact that they have good sensitivity, mild toxicity, and the ability to maintain immunologic memory for the rest of one's life [76]. But the recent success of mRNA vaccines against SARS-CoV-2 has spurred a wave of research into cancer vaccines, emphasizing their benefits, which include low side effects, effective development of protective immune responses, and lower acquisition costs [77].

Personalized strategies that target tumor-specific neoantigens may hold the key to developing cancer vaccines in the future and improve therapeutic efficacy [78]. Clinical trial efficiency is expected to increase with advancements in delivery technologies, such as nanoparticles and cell-penetrating peptides [79]. Future development priorities also include combination medicines combining new molecular entities with standard of care, enhanced clinical trial designs, and biomarkers for response prediction and patient selection [80]. These advancements point to a bright future for cancer vaccines as an essential part of immunotherapy methods in oncology, together with further research into novel antigens and adjuvants.

Conclusion:

A new age in oncology has begun with the creation of cancer vaccines, which have an opportunity to improve patient results and the level of life. Immunotherapy, especially cancer vaccines, offers a promising substitute that can target cancer cells specifically while limiting harm to healthy tissues, even though conventional treatments are still necessary. Recent developments, including the application of oncolytic vaccinations, have demonstrated great promise in the treatment of malignancies such as brain, lung, and prostate cancers. There are still issues to be resolved, such as the requirement to improve vaccine potency and create trustworthy biomarkers for gauging therapeutic outcomes. Cancer vaccinations are expected to become more and more important in tailored chemotherapy for cancer as research into them progresses, providing optimism for better outcomes and a lower likelihood of a cancer relapse. Despite previous challenges, recent advances in mRNA vaccines and targeted techniques targeting tumor-specific neoantigens offer substantial promise. Cancer vaccinations are expected to become a vital part of

immunology due to their numerous benefits, including minimal side effects, fast immune response growth and development, and lower costs. The identification of biomarkers that are combination therapies, and enhanced clinical study design are priority priorities for continuing research that will increase the effectiveness of therapy and perhaps save many lives through enhanced cancer treatment.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 57 - 60 |

Phytosociology

Dr. Sameera Khwaja Ahrar Ahmad

Associate Professor, Dept. Of Botany, N.T.V. S's G.T.Patil Arts, Commerce and Science College, Nandurbar -425412 (Maharashtra State), India

Article DOI Link: https://doi.org/10.5281/zenodo.13906233

DOI 10.5281/zenodo.13906233

Abstract

Ecological communities possess distinct structural attributes that help differentiate various ecosystems, with both plant and animal communities playing integral roles. Plant ecologists focus on the structural classification of plant communities, while animal ecologists emphasize functional interrelationships. However, the structure of animal communities is largely dependent on plant communities. Phytosociology, the study of plant community structures and interrelationships, has evolved significantly due to the contributions of the Zurich-Montpellier school. Despite critiques and modifications, the fundamental concepts of the school remain influential.

Phytosociology investigates the structural attributes of plant communities, which are divided into analytical and synthetic characters. Analytical characters, observed in the field, can be qualitative or quantitative. Qualitative attributes include physiognomy (the external appearance of vegetation), periodicity (seasonal processes), aspection (seasonal appearance), phenology (life cycle phases), and stratification (vertical layering of plants). Quantitative characters include density (individuals per unit area), frequency (distribution uniformity), and abundance (number of individuals in a given area).

Raunkiaer's Law of Frequency divides species frequency into five classes, offering insights into species distribution within a community. Homogeneous communities typically follow a J-shaped frequency curve, while heterogeneous ones show a greater presence of species in higher frequency classes.

Sampling techniques such as quadrat and point methods help in assessing species distribution, abundance, and density. These methods provide valuable data on community structure and are vital tools in ecological research to understand the diversity and dynamics of plant communities

Keywords: Ecological communities, Phytosociology, Plant communities, Structural attributes, Zurich-Montpellier school, Analytical characters, Synthetic characters, Physiognomy, Periodicity, Aspection, Phenology, Stratification, Density, Frequency,

Abundance, Raunkiaer's Law of Frequency, Quadrat method, Point method, Species distribution, Community structure.

Introduction

Communities, particularly in ecological studies, have structural characteristics that allow researchers to distinguish between various ecosystems. Both plant and animal communities are integral parts of these ecosystems, but the approach to studying them differs between ecologists. Plant ecologists focus primarily on the structural aspects of plant communities, including classification and nomenclature, while animal ecologists emphasize the functional relationships among organisms. However, it is essential to recognize that the structure and organization of animal communities are deeply intertwined with those of plant communities.

The field of phytosociology, or the study of plant communities, owes much of its current understanding to the contributions of the Zurich-Montpellier school. Despite numerous critiques, modifications, and advancements from prominent figures like Hanson (1950), Curtis and McIntosh (1950), Becking (1957), Dansereran (1951), and Poore (1955, 1956), the core principles of the Zurich-Montpellier school have remained largely intact.

Definitions:

Phytosociology refers to the study of the structure of plant communities and the relationships between different plants within these communities. The structural attributes of a plant community are generally categorized as either **analytical** or **synthetic.**

- **Analytical attributes** are directly observed in the field.
- **Synthetic attributes** are derived from data collected through the study of analytical characteristics.

Analytical attributes are further divided into **qualitative** and **quantitative characters.**

Qualitative Characters:

- **Physiognomy**

Physiognomy describes the external appearance of a community, based on dominant plants, plant height, density, color, etc. It focuses on the life forms of predominant plants without emphasizing individual species. For instance, ecosystems like forests, grasslands, and savannahs are distinguished by their physiognomy. Cain and Castro (1959) defined physiognomy as the form and structure of vegetation.

- **Periodicity**

The form and appearance of a plant change as it progresses through different life stages. Periodicity refers to the regular seasonal occurrence of processes such as leaf formation, flowering, and seed shedding.

- **Aspection**

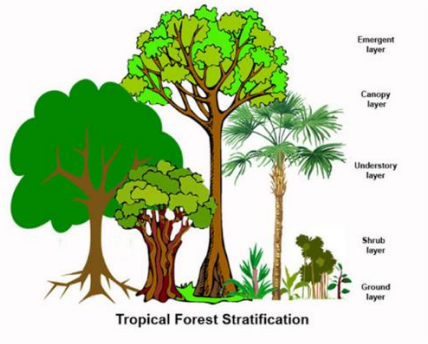
Aspection refers to the changing appearance of a plant community throughout different seasons, such as during rainy, summer, or winter seasons.

- **Phenology**

Phenology examines life cycle phases and the specific times of year they occur. Each stage in a plant's life cycle, referred to as a phenophase, reflects phenological patterns that vary seasonally.

Stratification: Stratification describes how plants are distributed vertically

within a community. This layering allows plants to utilize available resources—such as sunlight and space—more efficiently. In a forest, for example, taller trees, smaller trees, shrubs, herbs, and grasses form distinct vertical layers. Similarly, below-ground root structures exhibit stratification, with roots accessing different layers of soil for nutrients.



Tropical Forest Stratification

Quantitative Characters

Density

Density is the number of individuals of a particular species per unit area or volume. It provides insight into how densely a species populates a given space within a community.

Frequency

Frequency indicates how uniformly individuals of a species are distributed within the community. It is expressed as a percentage based on the number of observations. Sampling unit size can affect how frequency is calculated, as small sampling units may underestimate widely spaced species.

Abundance

Abundance refers to the number of individuals of a species per unit area. It is calculated by dividing the total number of individuals of a species in all quadrants by the number of quadrants where the species is present. This measurement, however, does not provide a complete picture of a species' overall presence in an area.

Formula:

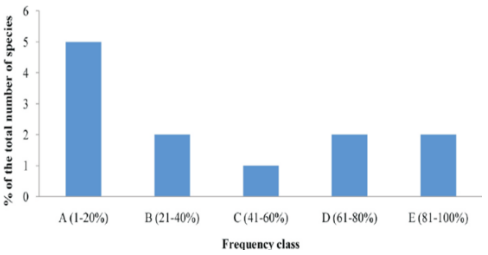
$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrants}}{\text{Total number of quadrants in which the species occurred}}$$

Raunkiaer's Law of Frequency and Frequency Diagram

Raunkiaer (1934) categorized species frequency into five classes:

- A = 0-20%
- B = 21-40%
- C = 41-60%
- D = 61-80%
- E = 81-100%

According to Raunkiaer's Law, the percentage of species in a plant community should follow the order: A > B > C > D > E. In homogeneously distributed vegetation, these percentages are approximately 53%, 14%, 9%, 8%, and 16%, respectively. This results in a **J-shaped frequency diagram.** Communities that have a greater number of species in frequency class E and fewer in class A are considered heterogenous.



Sampling Techniques of Population

1. **Quadrat Method**

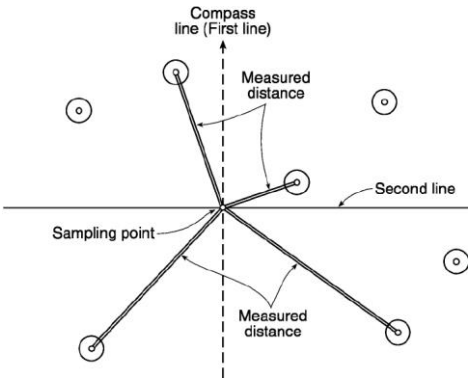
- **List Quadrat:** Used to document species occurrence in a sampling area.

- **List Count Quadrat:** Involves numerical counts of individuals for abundance and density studies.
- **Chart Quadrat:** Records species distribution in space, typically using graph paper, allowing for long-term monitoring of community structure changes.

2. Point Method

This technique samples species at various points within a study site. It includes:

- **Point Frame Method:** Developed by Levy and Madden (1933), this method uses a frame with 10 holes and records the species touched by nails.
- **Point Center Quarter Method:** Introduced by Cottom and Curtis (1956), this method involves fixing a needle at random points and recording species at those points.



Dieter Mueller-Dombois et.al 2008 Vegetation January 2008 In book: Bioiversity Assessment of Tropical Island Ecosystems Chapter: 3: Vegetation. This structured approach helps ecologists better understand and compare the diversity, structure, and function of plant communities in different ecosystems.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 61 - 68 |

Ethnobotany Past and Present

Dr. Kulbhushan W. Pawar,

Sanket P. Gawali

Department of Botany and Research Centre, Rayat Shikshan Sanstha's, R. B. Narayanrao Borawake College, Shrirampur Dist. Ahmednagar- 414105 Affilated Savitribai Phule Pune University Pune.

Email: sanketgawali0672@gmail.co

Article DOI Link: https://doi.org/10.5281/zenodo.13906245

DOI 10.5281/zenodo.13906245.

Introduction to Ethnobotany:

Exploring the Past, Embracing the Present Ethnobotany, the study of the relationship between humans and plants, has been an integral part of human culture and tradition for thousands of years. This interdisciplinary field combines botany, anthropology, and ecology to understand the complex interactions between people and plants. From ancient civilizations to modern societies, ethnobotany has played a vital role in shaping human health, culture, and environment.

Past: The Roots of Ethnobotany

In ancient times, plants were the cornerstone of medicine, food, shelter, and spiritual practices. Indigenous cultures developed sophisticated knowledge systems to classify, utilize, and conserve plant resources. Ethnobotanical knowledge was passed down through generations, often through oral traditions and cultural rituals. The contributions of ancient civilizations, such as the Egyptians, Greeks, Chinese, and Indigenous Americans, have laid the foundation for modern ethnobotany.

Present: The Significance of Ethnobotany Today

In the present day, ethnobotany continues to evolve, addressing pressing global challenges:

1. **Conservation and Sustainability:** Ethnobotany informs strategies for preserving biodiversity and promoting sustainable resource management.
2. **Health and Wellness:** Ethnobotanical research discovers new medicines and validates traditional remedies.
3. **Climate Change:** Understanding traditional plant use helps mitigate climate change impacts on local communities.
4. **Cultural Preservation:** Ethnobotany supports the preservation of

indigenous knowledge and cultural heritage.

Modern Applications and Future Directions

Ethnobotany has expanded into various fields, including:

1. **Pharmacognosy:** Developing new medicines from plant-based compounds.
2. **Ecological Restoration:** Using traditional knowledge to restore degraded ecosystems.
3. **Agroecology:** Promoting sustainable agriculture practices.
4. **Biocultural Diversity:** Preserving cultural and biological diversity. As we move forward, ethnobotany will continue to bridge traditional knowledge with modern science, fostering innovative solutions for a more sustainable and equitable future.

Traditional Medicine in Ancient Cultures

Traditional medicine has its roots in ancient cultures, where plants played a vital role in treating various ailments. These cultures relied on observational knowledge, experimentation, and spiritual beliefs to develop medicinal practices. Here are some examples:

Ancient Civilizations and Their Medicinal Plants

1. Egyptian Medicine (circa 1550 BCE): Egyptians used willow bark (Salix alba) for pain relief, containing salicylic acid, similar to aspirin. Other plants used include: Papyrus (Cyperus papyrus) for digestive issues, Senna (Cassia angustifolia) for constipation, Mandrake (Mandragora officinarum) for anxiety and insomnia.
2. Ayurvedic Medicine (India, circa 400 CE): Ayurvedic practitioners used: Turmeric (Curcuma longa) for inflammation and wound healing, Neem (Azadirachta indica) for skin conditions and fever, Ginger (Zingiber officinale) for digestive issues.
3. Traditional Chinese Medicine (TCM, circa 2000 BCE): TCM practitioners used: Ginseng (Panax ginseng) for vitality and energy, Ephedra (Ephedra sinica) for respiratory issues, Licorice root (Glycyrrhiza glabra) for digestive and respiratory problems.
4. Greek and Roman Medicine: Hippocrates (460-370 BCE) and Galen (129-216 CE) used: Foxglove (Digitalis purpurea) for heart conditions, Opium poppy (Papaver somniferum) for pain relief, Rosemary (Rosmarinus officinalis) for cognitive function.

Methods of Preparation and Administration

Ancient cultures employed various methods to prepare and administer medicinal plants, including: Infusions (teas) Decoctions (boiling) Tinctures (alcoholic extracts) Ointments and salves (topical applications) Powders and pills

Legacy and Impact

Traditional medicine has contributed significantly to modern healthcare:

1. Discovery of New Medicines: Many modern medicines originate from traditional plantbased remedies.
2. Understanding Pharmacology: Studying traditional medicine has helped understand pharmacological principles.

3. Cultural Exchange and Preservation: Traditional medicine has facilitated cultural exchange and preservation of ancient knowledge.

Food and Cuisine: The Role of Plants in Traditional Cuisines

Plants have been the foundation of human cuisine for thousands of years, providing essential nutrients, flavour, and texture to traditional dishes. In ancient Mesoamerican cultures, maize (corn) was a staple crop, used in various forms and preparations.

Maize in Ancient Mesoamerica

Maize was domesticated around 7,000 years ago in Mesoamerica and became a central component of the diet:

Tortillas and Tamales: Maize was ground into flour for tortillas and tamales, staple foods in Mesoamerican cuisine. Atol and Pozole: Maize was used to make atol (a warm drink) and pozole (a hearty soup). Nixtamalization: Mesoamericans developed nixtamalization, a process of soaking maize in limewater to increase nutritional value and flavor.

Other Plants in Traditional Cuisines

Beans and Squash: These "Three Sisters" were planted together, providing protein, fiber, and nutrients. Chilies and Herbs: Chilies added flavor and heat, while herbs like epazote and cilantro added freshness. Cacao and Vanilla: These luxury items were used in sacred rituals and as flavorings.

Food Preparation and Cultural Significance

Traditional cuisine was often prepared using ancient techniques: Grinding and Milling: Maize was ground into flour using metates (stone tools). Roasting and Toasting: Plants were roasted or toasted to enhance flavor and texture. Steaming and Boiling: Plants were cooked using steam pits or boiling water.

Food played a significant role in cultural and spiritual practices:

Rituals and Ceremonies: Food was used in rituals for fertility, harvests, and spiritual growth.

Community and Sharing: Food was shared among community members, fostering social bonds.

Traditional Knowledge: Recipes and preparation methods were passed down through generations.

Legacy and Impact

The use of plants in traditional cuisine has had a lasting impact:

Modern Cuisine: Many modern dishes, like tacos and tamales, originated from ancient Mesoamerican cuisine.

Food Security: Traditional crops like maize and beans continue to provide food security for local communities.

Cultural Preservation: Traditional cuisine helps preserve cultural heritage and identity.

Ancient Trade and Exchange: The Silk Road and Beyond

The exchange of plants and plant products has been a vital component of human civilization, facilitating the transfer of goods, ideas, and cultures across ancient trade routes. The Silk Road, a network of routes connecting China with the Mediterranean, exemplifies the significance of plant-based trade in ancient times.

The Silk Road: A Plant-Based Trade Network

Chinese Silk and Spices: Chinese silk, tea, and spices like cinnamon and pepper

were highly prized in the West. Indian Textiles and Herbs: Indian textiles, indigo, and herbs like turmeric and ginger were traded extensively. Middle Eastern Dates and Frankincense: Dates, frankincense, and myrrh from the Middle East were coveted for their flavor, aroma, and medicinal properties. Mediterranean Grains and Olives: Grains, olives, and olive oil from the Mediterranean region were traded for their nutritional and culinary value.

Other Ancient Trade Routes

The Road: Connected the Mediterranean to Arabia, facilitating the trade of frankincense and myrrh. The Spice Route: Linked India to the Mediterranean, enabling the exchange of spices like pepper, cinnamon, and cardamom.

The Tea-Horse Road: Connected China to Tibet, facilitating the trade of tea, horses, and other goods.

Plant-Based Commodities

Spices: Pepper, cinnamon, ginger, and turmeric were highly valued for flavouring and preservative properties. Textiles: Cotton, silk, and wool were traded for clothing and other textiles. Dyes: Indigo, madder, and pomegranate were used as natural dyes. Medicinals: Herbs like ginseng, rhubarb, and myrrh were traded for their medicinal properties.

Impact of Ancient Trade and Exchange

Cultural Exchange: The transfer of plants, ideas, and cultures facilitated cultural exchange and understanding.

Economic Growth: Trade stimulated economic growth, urbanization, and specialization.

Plant Diversity: The exchange of plants led to the introduction of new species, promoting biodiversity.

Legacy of Ancient Trade and Exchange

1. Modern Trade Routes: Contemporary trade routes, like the Belt and Road Initiative, draw inspiration from ancient networks.
2. Globalization: Ancient trade and exchange laid the groundwork for modern globalization.
3. Plant Conservation: The study of ancient trade and exchange informs modern plant conservation efforts.

Present Ethnobotany: Modern Applications and Future Directions

Ethnobotany continues to evolve, incorporating new technologies, interdisciplinary approaches, and contemporary issues. Here are some aspects of present ethnobotany

Conservation and Sustainability: The Vital Role of Ethnobotanical Knowledge

Ethnobotanical knowledge is crucial in modern conservation efforts and sustainable practices, offering valuable insights into the complex relationships between humans and the natural environment.

Importance of Ethnobotanical Knowledge:

Biodiversity Conservation: Ethnobotanical knowledge helps identify and prioritize plant species for conservation, ensuring the preservation of culturally significant and ecologically valuable species. Sustainable Resource Management: Ethnobotanical research informs sustainable harvesting practices, reducing the risk of over-exploitation and promoting ecological balance.

Ecological Restoration: Ethnobotanical knowledge guides ecological restoration efforts, using traditional practices to revitalize degraded ecosystems.
Climate Change Mitigation and Adaptation: Ethnobotany helps communities adapt to climate change by documenting traditional climate-resilient practices and identifying plant species with potential for carbon sequestration.

Applications in Conservation and Sustainability:
Protected Areas Management in Ethnobotanical knowledge informs the management of protected areas, ensuring the inclusion of culturally significant plant species.
In Sustainable Agriculture: Ethnobotany promotes sustainable agriculture practices, such as agroforestry and permaculture, inspired by traditional farming systems. Non-Timber Forest Products (NTFPs) Management: Ethnobotanical research guides sustainable NTFP harvesting, ensuring the long-term viability of forest ecosystems.
Community-Based Conservation: Ethnobotany supports community-based conservation initiatives, empowering local communities to manage their natural resources.

Benefits of Integrating Ethnobotanical Knowledge:
Cultural Preservation in the Ethnobotanical knowledge helps preserve cultural heritage and traditional practices. Community Engagement Ethnobotany fosters community engagement and participation in conservation efforts. Effective Conservation Strategies Ethnobotanical knowledge informs effective conservation strategies, tailored to local contexts. Sustainable Livelihoods Ethnobotany promotes sustainable livelihoods, supporting local economies and human well-being.

Challenges and Future Directions:
Knowledge Integration Integrating ethnobotanical knowledge into mainstream conservation and sustainability practices. Community Capacity Building Building capacity within local communities to manage and conserve their natural resources. Policy Support Developing policies that recognize and support the importance of ethnobotanical knowledge in conservation and sustainability efforts above mention the challenges and direction is imporatnt to conservation and sustainability in ethnobotany.

Drug Discovery and Development: Ethnobotany's Role in Uncovering New Medicines
Ethnobotany has played a significant role in the discovery of new medicines, with many traditional plant remedies serving as leads for modern drug development. The Madagascar periwinkle (Catharanthus roseus) is a prime example, with its use in cancer treatment showcasing the potential of ethnobotanical knowledge.
Contributions to Drug Discovery:
Lead Compound Identification Ethnobotanical research identifies plant species with medicinal properties, providing leads for drug development. Traditional Knowledge Indigenous knowledge of plant use informs the discovery of new medicines, reducing the risk of rediscovering known compounds. Diversity of Plant Species

Ethnobotany explores the vast diversity of plant species, increasing the likelihood of discovering novel compounds.

Examples of Ethnobotany-Inspired Medicines:

1. Madagascar Periwinkle (Catharanthus roseus): The rosy periwinkle's traditional use in Madagascar led to the discovery of vinblastine and vincristine, used in cancer treatment.
2. Pacific Yew (Taxus brevifolia): The Pacific yew's bark contains taxol, used in cancer treatment, which was discovered through ethnobotanical research.
3. Willow Bark (Salix alba): Willow bark's traditional use led to the discovery of salicylic acid, the active compound in aspirin.

Process of Ethnobotany-Inspired Drug Development:

Ethnobotanical Research: Identify plant species with medicinal properties through ethnobotanical research.

Phytochemical Analysis: Analyze plant extracts to identify bioactive compounds.

Bioassays and Screening: Conduct bioassays and screening to evaluate the biological activity of isolated compounds.

Clinical Trials: Conduct clinical trials to evaluate the safety and efficacy of new medicines.

Challenges and Future Directions:

1. Intellectual Property Rights: Address concerns around ownership and benefit-sharing related to traditional knowledge.

2. Conservation and Sustainability: Ensure sustainable harvesting practices and conservation of plant species.

3. Interdisciplinary Collaboration: Foster collaboration between ethnobotanists, pharmacologists, and clinicians to accelerate drug development.

Climate Change and Ethnobotany: Impacts on Traditional Plant Use and Knowledge

Climate change is altering ecosystems, affecting plant distribution, and impacting traditional plant use and ethnobotanical knowledge. Rising temperatures, changing precipitation patterns, and increased frequency of extreme weather events are disrupting the delicate relationships between humans and plants.

Impacts on Traditional Plant Use:

1. Changes in Plant Availability: Shifts in plant distribution and abundance affect the availability of traditional medicines, food, and other plant resources.
2. Loss of Plant Diversity: Climate-driven extinctions and reduced plant diversity erode the foundation of traditional knowledge and practices.
3. Disrupted Plant-Human Interactions: Changes in plant phenology and distribution disrupt traditional interactions, such as timing of harvests and ceremonial activities.

Impacts on Ethnobotanical Knowledge:

1. Erosion of Traditional Knowledge: Climate change accelerates the loss of traditional knowledge as older generations pass away, and younger generations adapt to new environmental conditions.
2. Changes in Plant Identification and Classification: Climate-driven changes in plant morphology and

distribution challenge traditional plant identification and classification systems.
3. Shifts in Cultural Significance and Meaning: Climate change alters the cultural significance and meaning of plants, as traditional uses and practices become less relevant.

Case Studies:
1. Andean Communities and Potato Diversity: Climate change threatens potato diversity, impacting traditional food security and cultural practices.
2. Indigenous Australian Communities and Bushfood: Changes in bushfood availability and quality affect traditional food systems and cultural practices.
3. Amazonian Communities and Medicinal Plants: Climate-driven changes in plant distribution and abundance impact traditional medicine and health practices.

Adaptation and Mitigation Strategies:
1. Documenting Traditional Knowledge: Record and preserve traditional knowledge and practices before they are lost.
2. Community-Based Conservation: Support community-led conservation initiatives to protect and restore plant diversity.
3. Climate-Smart Agriculture: Develop and implement climate-resilient agricultural practices that incorporate traditional knowledge.

Intellectual Property Rights and Benefit-Sharing in Ethnobotanical Research

Ethnobotanical research often involves the use of traditional knowledge and biological resources, raising complex issues related to intellectual property rights and benefit-sharing.

Challenges:
1. Ownership and Control: Who owns traditional knowledge and biological resources?
2. Informed Consent: Are communities adequately informed and consenting to research and commercialization?
3. Equitable Benefit-Sharing: How are benefits shared fairly among stakeholders?
4. Cultural Appropriation: Is traditional knowledge being used respectfully and with proper attribution?

Opportunities:
1. Community Engagement: Collaborative research models involving communities in decision-making.
2. Access and Benefit-Sharing Agreements: Formal agreements ensuring fair distribution of benefits.
3. Traditional Knowledge Documentation: Recording and preserving traditional knowledge for future generations.
4. Sustainable Development: Ethnobotanical research contributing to local economic development and conservation.

Future Directions:

Strengthening Community Engagement Empowering communities in research and decisionmaking. Developing Innovative Benefit-Sharing Models Exploring new approaches to equitable benefit-sharing. Enhancing Traditional Knowledge Protection Strengthening international frameworks and national laws.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 69 - 74 |

Ethnomedicinal And Pharmacognostical Investigations on Roots of *Clerodendrum Serratum* (L.) Moon.

[1]Patil Arun Vishnu

[2]Jadhav Varsha Dilip

[1] Assistant Professor, Department of Botany, Yashwantrao Chavan College, Halkarni Tal. Chandgad, Dist. Kolhapur, (M.S.) India.

[2]Department of Botany, Shivaji University, Kolhapur (M.S.), India

Email: arunpatil545@gmail.com

Article DOI Link: https://doi.org/10.5281/zenodo.13906307

DOI: 10.5281/zenodo.13906307

Abstract

The present paper deals with ethnomedicinal and pharmacognostical studies on roots of *Clerodendrum serratum* (L.) Moon. It belongs to family Verbenaceae It is a small shrub distributed in the deciduous forests of the Western Ghats of India. In Indian system of medicine, the plant is well known as Bharangi. The present investigation deals with Ethnomedicinal information, macroscopic and microscopic characters, analysis of ash, dry matter, moisture content, powder behavior, fluorescence analysis and phytochemical analysis of roots of Clerodendrum serratum (L.) Moon. Ethnomedicinal information was collected from local rural people (Vaidus) in villages of Kolhapur district of Maharashtra, India. Locally roots of C. serratum are used for the treatment of snake bite, rheumatic pains, skin diseases and asthma and bronchitis. The roots were extracted with different solvents and screened for their phytochemical constituents. Phytochemical tests revealed the presence of phenols, flavones, tannins, coumarins, alkaloids reducing sugars, xanthoproteins and glycosides. Macro and microscopic character will be helpful for correct botanical identification of the crude drug. In addition, ash value, moisture content, dry matter, results of powder behavior, fluorescence analysis and phytochemical data will be helpful for the standardization and quality control of precious indigenous drug. The adulterants if any in the crude drug can also easily identified by these studies. The study scientifically validates the use of plant in traditional medicine.

Keywords: Ethnomedicinal; Pharmacognostical; Clerodendrum serratum; Roots; Traditional; Medicine.

Introduction:

Clerodendrum serratum belonging to family Verbenaceae commonly called as Bharangi is a small shrub distributed in the deciduous forests of the Western Ghats of India. It is widely distributed in tropical and subtropical regions of the world. As per the traditional claims roots are the potential source of drugs for various ailments such as asthma, body ache, bronchitis, rheumatism, snake bite and ulcers. It is one of the few drugs that block histamine response1. The ancient knowledge of herbal medicine is a great source of information for scientific community, researchers and medical practitioners. Medicinal plants form a large group of economically important plants that provide the basic raw material for pharmaceuticals. Ethanobotanical studies of Kolhapur District reveals that roots of Clerodendrum serratum were used to treat snake bite, rheumatic pains, skin diseases and asthma and bronchitis. However, there are no reports on the pharmacognostical features of the plant. Hence, the present investigation is an attempt in this direction and includes morphological and anatomical evaluation, determination of physico-chemical constants and preliminary Phytochemical screening of different extracts of C. serratum.

Material and Methods

Ethnomedicinal information was collected through interview with traditional rural practitioners (Vaidus) as suggested by Jain, 19872. Fresh plant material was collected from Kolhapur district of Maharashtra (India). Plant was identified with the help of Flora of Kolhapur District3. For microscopic studies uniform, thin, free hand sections of stem bark were taken and stained as per the procedure of Johansen, 19404. Macro and microscopic character were studid as described by Trease and Evans, 20025. Ash value, dray matter and moisture content of the material were determined by following the method of AOAC, 19906. Bark material was dried in shade so as to prevent decomposition of active principles and made into fine powder for the studies of power behavior, fluorescence study and phytochemical tests as per given in Indian Pharmacopeia. Fluorescence analysis of the powered was examined under U.V light according to the method suggested by Chase and Pratt, 19497 and Kokoski et al., 19588.

Results

Macroscopic characters

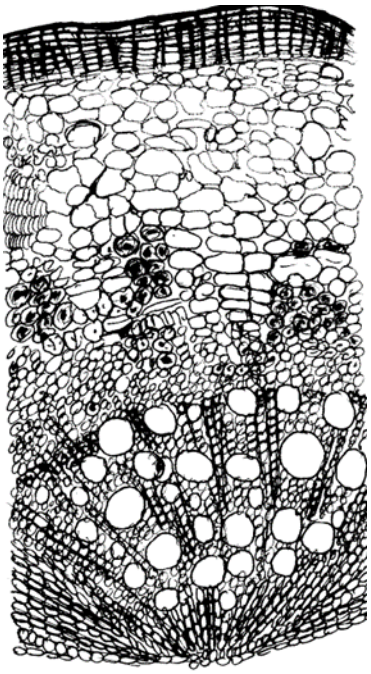
Clerodendrum serratum belonging to family Verbenaceae is a slightly woody shrub with bluntly quadrangular stem and branches and 3 - 8 ft. in height (Fig. 1). Roots cylindrical, mature roots hard, 1-1.5cm thick, external surface pale brown having elongated lenticels, internally yellowish brown, younger roots are smooth, older roots are somewhat rough, longitudinally furrowed at places exfoliated exposing the inner wood. Leaves usually three at a node, sometimes apposite, oblong or elliptic with serrate margin. Flowers in lax villous panicles with bractiform leaves at the base of cymes, calyx cup like, minutely five toothed pubescent, corolla bluish purple. Fruits drupaceous, four lobed.

Microscopic Characters

T.S. of root

T. S. of root of Clerodendrum serratum was circular in outline. It shows central porous wood occupying the major portion of the root surrounded by a narrow ring of bark (Fig. 2). Externally it was covered with multilayered tangentially elongated, radially arranged cork cells. Following the cork, is the phelloderm which is composed by 4 - 5 layers of rectangular parenchyma. Phelloderm consists of acicular crystals of calcium oxalate. Inner to phelloderm, there was many layers of secondary phloem transversed with isolated or groups of stone cells containing prismatic crystals of calcium oxalate. Cambium was distinct. Secondary xylem was composed of vessels and xylem parenchyma. The medullary rays were uniseriate to multiseriate.

Ash value: 3.7%,
Dry matter: 41.3%,
Moisture content: 58.65%.



T.S. of root

Flowering twig

Powder study:

Root powder of Clerodendrum serratum was buff brown in colour and coarse in texture. It shows acicular and prismatic crystals of calcium oxalate, stone cells, starch grains, fragments of cork, xylem fibres and xylem vessels.

Behavior of root powder with different chemical reagents

Root powder with different chemical reagent indicates presence of alkaloids, flavonoids, cystein, steroids, xanthoproteins, glycosides, proteins and oils. Tests for starch and tannins were negative (Table- 1).

Fluorescence character of root powder under visible and UV light

The root powder of C. serratum treated with different chemical reagents produces different fluorescence. When it was treated with conc. H_2SO_4 produces black fluorescence under visible and

366nm and green fluorescence under 254nm UV light (Table - 2).

Phytochemical screening

Root extracts show positive tests for phenols, flavones, tannins, coumarins, alkaloids reducing sugars, xanthoproteins and glycosides. The tests were negative for saponins and anthraquinones (Table - 3).

Table 1: Behavior of powdered drug with different chemical reagents

SN	Treatment / Reagent	Behaviour	Inference
1	Powder as such	Buff brown	--
2	Powder + 1 N NaOH	Brown	Flavonoid
3	Powder + 5% Iodine	Grey	--
4	Powder + 40% NaOH + Lead acetate	Yellow	cystein
5	Powder + Conc.H_2SO_4	Dark brown	Steroid
6	Powder + Conc. HNO_3 + Ammonia	Brown	Xanthoprotein
7	Powder + 5% $FeCl_3$	Buff brown	--
8	Powder + 5% KOH	Brown	Glycoside
9	Powder + 1% $AgNO_3$	Grey	Protein
10	Powder + Sudan III	Red brown	Oil
11	Powder + Glacial acetic acid	Buff brown	--
12	Powder + Picric acid	Green yellow	Alkaloid

Table 2: Fluorescence characters of powdered drug under Visible and U.V. light

SN	Treatment / Reagent	Visible	254nm	366nm
1	Powder as such	Buff brown	Bistachio green	Brown
2	Powder + NaOH in water	Dark brown	Asparagus green	Brown
3	Powder + NaOH in Alcohol	Brown	Dark olive green	Black
4	Powder + Conc. HCl	Buff yellow	Yellow green	Brown
5	Powder + Conc. H_2SO_4	Black	Forest green	Black
6	Powder + Conc. HNO_3	Orange yellow	Black	Black
7	Powder + 10% HCl	Olive	Yellow green	Black
8	Powder + Acetone	Buff brown	Lawn green	Black

9	Powder + 5% KOH	Brown	Green yellow	Black
10	Powder + Iodine	Black	Dark olive green	Black
11	Powder + $FeCl_3$	Camel brown	Brown	Black
12	Powder + D.W.	Lion brown	Yellow green	Black

Table 3: Phytochemical tests

Chem. constituents	**Solvents**					
	Methanol	**P. ether**	**Acetone**	**Chloroform**	**Ethanol**	**Aqueous**
Phenols	+ + +	–	+ + +	+	+ + +	+ + +
Anthraquinones	–	–	–	–	–	–
Flavones	+	–	–	–	+	+
Tannins	+ +	–	–	–	+	+
Coumarins	–	+	+ + +	+	–	–
Saponins	–	–	–	–	–	–
Alkaloids	+ + +	+	+ +	+	+	–
Reducing sugars	–	–	–	–	–	+ +
Xanthoproteins	+ +	–	–	–	–	+
Glycosides	–	–	–	–	–	+ +

(+= Low, ++= Medium, +++= High, □= Absent)

Conclusion

The present study on ethnomedicinal, pharmacognostical and phytochemical evaluation on roots of Clerodendrum serratum (L.) Moon provide useful information for its identification. Macroscopic and microscopic characters, behavior of bark powder analysis, fluorescence characters of root powder and phytochemical tests can be used as a diagnostic tool in the correct identification of plant. Phytochemical tests revealed the presence of phenols, flavones, tannins, coumarins, alkaloids, reducing sugars, xanthoproteins and glycosides. The adulterants if any in the plant material can also easily identified by these studies. The study scientifically validates the use of plant in traditional medicine.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 75 - 81 |

Heritage and Healing: Insights into Ethnogynaecology

Mrs. Ruchika Yadav

Assistant Professor, Dept. of Botany

SIES College of Arts, Science and Commerce (Empowered Autonomous), Sion (W)

Email: daniruchika2@gmail.com

Article DOI Link https://doi.org/10.5281/zenodo.13906333

DOI: 10.5281/zenodo.13906333

Abstract

This study explores the ethnogynaecological practices of medicinal plants used for women's health in Khyber Pakhtunkhwa, Pakistan, and Jajpur district, Odisha, India. A comprehensive examination identified various plant species utilized for addressing various gynaecological issues, including menstrual disorders, pregnancy-related complications, and menopause symptoms. The findings highlight the significant reliance on traditional knowledge and local resources among indigenous communities, emphasizing the therapeutic potential of these plants. However, the research also identifies a concerning decline in interest among younger generations in learning these practices, which threatens the preservation of this cultural heritage. The study advocates for the documentation and integration of traditional knowledge with modern healthcare approaches, underscoring the need for collaboration between ethnobotanists and local healers. By revitalizing these practices, we can enhance women's health outcomes and ensure the sustainability of valuable ethnobotanical knowledge for future generations.

Keywords: ethnogynaecological, menstrual disorders, menopause, ethnobotanists, indigenous

Introduction:

Plants have historically fulfilled essential human needs, providing shelter, clothing, food, flavours, fragrances, and medicinal resources. They form the foundation of sophisticated traditional medicine systems, including Ayurveda, Unani, and Chinese medicine. Medicinal plants play a crucial role in healthcare, particularly as concerns grow regarding the cost, side effects, and toxicity of synthetic pharmaceuticals. The contemporary search for new therapeutic compounds increasingly relies on the disciplines of ethnobotany and ethnopharmacognosy, which guide

researchers in exploring diverse sources and classes of bioactive compounds.

Women possess extensive traditional knowledge regarding the medicinal use of plants, which is vital for treating various ailments. However, this knowledge is diminishing as younger generations show decreasing interest in these valuable practices and healing techniques. Ethno medicinal studies are crucial for discovering new crude drugs from indigenous medicinal plants, as they have historically led to the identification of key modern pharmaceuticals.

Gynaecology, the branch of medicine focused on the female reproductive system, is now complemented by ethno-gynaecology, which addresses the health issues of tribal women, including conditions such as abortion, menstrual disorders, menopause syndrome, morning sickness, leucorrhoea, fertility issues, and complications during childbirth. Ethno-gynaecology reflects the traditional practices of indigenous communities in managing female health concerns. While allopathic medicine, surgery, and non-steroidal anti-inflammatory drugs are commonly used to treat gynaecological disorders, these interventions can lead to significant side effects, including nausea, vomiting, sexual dysfunction post-hysterectomy, skin rashes, and gastrointestinal issues. More severe complications, such as liver, kidney, and cardiovascular impairments, can arise from prolonged use of certain medications. Additionally, there is a risk of foetal harm from specific drugs during pregnancy, highlighting the importance of integrating traditional knowledge into modern medical practices.

Study area:

This paper examines various ethnogynaecological studies conducted in six remote regions of Khyber Pakhtunkhwa (KPK) Province, Pakistan: Bannu, Kohat, Karak, Malakand, Mansehra, and Chitral. These areas, characterized by diverse topography and a predominantly Pashtun population, rely heavily on medicinal plants and forest resources for healthcare and livelihoods. Bannu, located in southern KPK, covers 877 km² and has a population of approximately 19,593. Karak spans 600 km² and is also situated in the south, while Kohat is at an elevation of 489 m above sea level. Malakand is found in northern KPK, and Chitral, the largest district, encompasses 14,850 km² and is home to about 320,000 residents.

Insights from the Jajpur district in Odisha, India, are also included, which spans 2,887.69 km² and is rich in minerals. This district has a tribal population of 125,989, with various communities, including the Mundas, who have long utilized local flora for medicinal purposes. Additionally, research from three districts in southern West Bengal—Paschim Medinipur, Purba Medinipur, and Murshidabad—was reviewed for their agro-climatic diversity and local medicinal practices. The findings underscore the significance of documenting indigenous knowledge to support the conservation and sustainable use of bio-resources.

Overall, this analysis highlights the importance of further exploration of ethnogynaecological practices in these regions, aiming to enhance understanding of traditional medicinal knowledge and its potential applications in modern healthcare.

Common Name	Botanical Name	Family	Plant Part Used	Vernacular Name	Use of the Plant
Aloe Vera	*Aloe barbadense*	Asphodelaceae (Liliaceae)	Leaf	Ghrit Kumari	Leaf juice used in menstrual disorders
Ashoka Tree	*Saraca asoca*	Fabaceae	Bark	Ashok	Bark juice used in menstrual disorders and to relieve menopause
Betel Leaf	*Piper betle*	Piperaceae	Leaf	Paan	Leaf juice used for menstrual regulation
Bitter Gourd	*Momordica charantia*	Cucurbitaceae	Fruit	Karela	Fruits used for menstrual regulation and in fertility issues
Bitter Orange	*Citrus aurantium*	Rutaceae	Fruit	N/A	Fruits used to enhance menstrual health
Black Cohosh	*Actaea racemosa*	Ranunculaceae	Root	N/A	Roots used to treat menopausal symptoms and to regulate menstrual cycles
Cabbage	*Brassica oleracea*	Brassicaceae	Leaves	N/A	Leaves alleviate menstrual pain
Cardamom	*Elettaria cardamomum*	Zingiberaceae	Seeds	Elaichi	Seeds used to ease menstrual discomfort
Catnip	*Nepeta cataria*	Lamiaceae	Aerial parts	N/A	Aerial parts are used to calm nervousness, aids in sleep
Cinnamon	*Cinnamomum verum*	Lauraceae	Bark	Dalchini	Bark used to treat menstrual pain, enhances circulation
Clove	*Syzygium aromaticum*	Myrtaceae	Buds	Laung	Buds ease pain and iflammation during menstruation
Coriander	*Coriandrum sativum*	Apiaceae	Leaves/Seeds	Dhania	Leaves and seeds alleviate morning sickness, digestive issues
Cumin	*Cuminum cyminum*	Apiaceae	Seeds	Jeera	Seeds act as a digestive aid, may help with menstrual discomfort
Dandelion	*Taraxacum officinale*	Asteraceae	Leaves	Dandi	Leaves are used to improve menstrual health

Dill	*Anethum graveolens*	Apiaceae	Leaves/Seeds	Suva	Leaves and seeds relieve digestive Issues and helps to regulate menstruation
Dong Quai	*Angelica sinensis*	Apiaceae	Root	N/A	Root juice enhances female reproductive health
Evening Primrose	*Oenothera biennis*	Onagraceae	Oil from seeds	N/A	Oil from the seeds alleviate PMS symptoms and skin health
Fennel	*Foeniculum vulgare*	Apiaceae	Seeds	Saunf	Seeds relieve menstrual discomfort, enhances lactation
Fenugreek	*Trigonella foenum-graecum*	Fabaceae	Seeds	Methi	Seeds improve lactation, alleviates menstrual pain
Ginger	*Zingiber officinale*	Zingiberaceae	Rhizome	Adrak	Rhizome juice used to ease nausea, improves digestion
Ginger Lily	*Hedychium coronarium*	Zingiberaceae	Rhizome	N/A	Rhizome is anti-inflammatory, aids digestion
Hawthorn	*Crataegus monogyna*	Rosaceae	Berries	N/A	Berries support heart health, may alleviate menopause symptoms
Jackfruit	*Artocarpus heterophyllus*	Moraceae	Fruit	Kathal	Fruits are nutrient-rich, may improve reproductive health
Marigold	*Tagetes erecta*	Asteraceae	Flowers	Genda	Flowers are anti-inflammatory, used for skin conditions
Marshmallow	*Althaea officinalis*	Malvaceae	Root/Leaves	N/A	Roots and leaves sooth irritation
Moringa	*Moringa oleifera*	Moringaceae	Leaves	Sahjan	Leaves are nutrient-rich, supports overall health
Motherwort	*Leonurus cardiaca*	Lamiaceae	Aerial parts	N/A	Aerial parts ease anxiety and menstrual discomfort
Nettle	*Urtica dioica*	Urticaceae	Leaves	Bichu	Leaves alleviate menstrual cramps, improve circulation
Olive Leaf	*Olea europaea*	Oleaceae	Leaves	N/A	Leaves improve circulation, may help with fertility
Peppermint	*Mentha piperita*	Lamiaceae	Leaves	N/A	Leaves relieve nausea, aids digestion
Pineapple	*Ananas comosus*	Bromeliaceae	Fruit	N/A	Fruits act as digestive aid, may promote fertility
Plantain	*Plantago major*	Plantaginaceae	Leaves	N/A	Leaves sooth irritation, digestive aid

Pomegranate	*Punica granatum*	Punicaceae	Fruit	Anar	Fruits used to treat menstrual irregularities, promotes fertility
Raspberry	*Rubus idaeus*	Rosaceae	Leaves	N/A	Leaves help to regulate menstrual cycles
Red Clover	*Trifolium pratense*	Fabaceae	Flowers	N/A	Flowers support reproductive health, eases PMS
Saffron	*Crocus sativus*	Iridaceae	Stigma	N/A	Dried stigma used to enhance mood, regulates menstrual cycles
Sweet Potato	*Ipomoea batatas*	Convolvulaceae	Root	Ratalu	Root is nutrient-rich and supports reproductive health
Thyme	*Thymus vulgaris*	Lamiaceae	Aerial parts	Ajwain	Seeds are anti-spasmodic, used in menstruation
Turmeric	*Curcuma longa*	Zingiberaceae	Rhizome	Haldi	Rhizome is anti-inflammatory, aids menstrual health
Wild Garlic	*Allium vineale*	Amaryllidaceae	Bulb	Lasan	Bulbs used to alleviate menstrual cramps
Willow Bark	*Salix alba*	Salicaceae	Bark	N/A	Bark juice is anti-inflammatory and relieves pain during menstruation

Result and discussion

The investigation into ethnogynaecological practices across Khyber Pakhtunkhwa, Pakistan, and Jajpur district in Odisha, India, reveals a rich tapestry of traditional knowledge surrounding the use of medicinal plants for women's health. Various plants were identified, showcasing their diverse applications in addressing gynecological issues such as menstrual disorders, pregnancy-related ailments, and menopause symptoms. The use of plants like Aloe vera, Ashoka, and Fenugreek highlights the reliance on locally available resources by indigenous communities, reflecting a deep-rooted understanding of herbal medicine passed down through generations. This traditional knowledge is particularly

significant in rural areas where access to modern healthcare may be limited.

However, the declining interest among younger generations in learning these traditional practices poses a risk to this invaluable knowledge. As urbanization and modern medical practices gain prominence, there is an urgent need for documentation and preservation of this ethnobotanical wisdom. Ethnogynaecological studies not only emphasize the importance of these plants in female health care but also stress the need for integrating traditional knowledge with scientific research to explore potential pharmacological benefits. By fostering collaboration between ethnobotanists and local healers, we can ensure the sustainability and revitalization of these traditional practices, contributing to improved health outcomes for women in these regions.

Conclusion

The exploration of ethnogynaecological practices in Khyber Pakhtunkhwa, Pakistan, and Jajpur district, Odisha, India, underscores the critical role of medicinal plants in addressing women's health issues. The identification of 50 key plant species used traditionally for gynecological ailments highlights the rich cultural heritage and deep ecological knowledge embedded within these communities. However, the decline in interest among younger generations poses a significant threat to the preservation of this invaluable knowledge. Therefore, it is essential to document and promote these traditional practices, ensuring their integration into contemporary health care. By fostering collaboration between local communities, ethnobotanists, and healthcare professionals, we can enhance the understanding and application of these plants, ultimately supporting women's health and well-being while safeguarding cultural heritage for future generations.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2 | Year: 2024 | pp: 82 - 90 |

Comparative account on Bioactive potential of *Cajanus cajan* (L.) Millsp. and *Cajanus scarabaeoides* (L.) Thouars.

Siddharth Krushnat Katkole

Varsha D. Jadhav (Rathod)

Department of Botany, Shivaji University Kolhapur.

Email: sidkatkole@gmail.com and vdj_botany@unishivaji.ac.in

Article DOI Link: https://doi.org/10.5281/zenodo.13910494

DOI 10.5281/zenodo.13910494.

Abstract

The nutraceutical, phytochemical, and bioactive properties of *Cajanus cajan* and *Cajanus scarabaeoides* were compared in a study. While *C. scarabaeoides* has the ability to produce bioactive substances, *C. cajan* is commonly grown for its nutritional and medicinal qualities. Both species are resilient to harsh environments. Both herbs have been used traditionally to cure a variety of illnesses. In Nigeria, *C. cajan* is used to treat cancer. Pigeon pea is rich in protein, fats, carbohydrates, and ash, making it a valuable food source in India. During malting, protein to *C. cajan* (21 mg/g) and fat content increase, while ash content decreases. Processing methods like de-hulling can lead to nutrient losses. Pigeon pea has potential to mitigate protein deficiency, with varying nutritional content per 100 grams.

C. scarabaeoides was higher in total free amino acids (7.18 mg/g) than *C. cajan* (5.59 mg/g). *C. scarabaeoides* also has more soluble sugars (8.34 mg/g) than C. cajan (6.67 mg/g), but not significantly. However, *C. cajan* contains more soluble phenols (1.29 mg/g) than *C. scarabaeoides* (0.97 mg/g). *C. scarabaeoides* has higher protein content (28.26 mg/g) compared PPI hydrolysates shows antioxidant capacities, indicating potential as bioactive peptides for functional food ingredients. *C. scarabaeoides* and *C. cajan* exhibit significant antioxidant properties, with potential applications in health foods. *C. cajan* also shows higher nitrate reductase activity compared to *C. scarabaeoides*. Additionally, methanolic and methanol extracts of C. cajan demonstrate antidiabetic effects, suggesting a role in diabetes management.

Keywords: nutraceutical, phytochemical, *Cajanus scarabaeoides*, *Cajanus cajan*, bioactive compound

Introduction:

Cajanus is a genus in the Fabaceae family with approximately 37 species found throughout the tropical and subtropical areas (Gargi et al., 2022). *C. cajan* (pigeon pea) is the most widely farmed and important species due to its high nutritional value, providing essential proteins and elements, as well as its therapeutic properties.

On the other hand, *C. scarabaeoides* (wild pigeon pea), though less well-known and underutilized, holds significant potential due to its bioactive compounds and notable pharmacological and genetic properties. Both species are valued for their ability to withstand extreme conditions, including drought. (Dey and Sinha 2015; Dinore et al., 2024)

Traditional Uses:

An ethnobotanical analysis of *Cajanus scarabaeoides* revealed that, thanks to a variety of chemical components, including secondary metabolites with therapeutic value, it can be used as a remedy for a variety of ailments. Microscopically examining the leaves and stems revealed unique anatomical traits, which helped distinguish between different plant components. Important pharmacogenetic and physicochemical characteristics were also found for use in subsequent study. Notably, *C. scarabaeoides* alcoholic stem extract demonstrated potent parasite-killing properties, suggesting that it may be useful in the treatment of filarial infections. Furthermore, the plant's nutritional advantages and therapeutic properties contribute to its significance as a significant resource for the production of food and feed. (Wanjari et al., 2023).

Ahisdi reported the utilization of *C. cajan* for treating cancer in South-western Nigeria in a separate study. Referred to as Arhar or Tuvar, the plant's leaves have flavonoids, tannins, resins, and terpenoids, and a paste from the leaves is commonly used to heal mouth sores and swelling (Upadhyay 2010). The Leaf extract of *C. scarabaeoides* (L.) Thouars is used as traditional treatment of jaundice, diabetic also used as antidote against food poisoning, gingivitis, stomatitis, and constipation (Upadhyay 2010). The root paste of *C. scarabaeoides* applied with coconut oil to check falling hairs to cure baldness (Sharma M and Kumar 2013)

Nutraceuticals

1. **Proximate analysis:** Pigeon pea, a nutritious vegetable, has an impressive nutritional profile. The moisture level of the leaf powder is 9.20%, whereas the stem powder is 8.6%. Ash data show that total ash content is 12.80% for leaves and 6.90% for stems, with water-soluble ash at 2.9% (leaf) and 1.3% (stem), and acid-insoluble ash at 2.2% (leaf) and 1.4% (stem) (Kolhe and Patil 2021).
2. **Nutrient value:** Pigeon pea is a crucial source of high-quality protein (Talari and Shakappa 2018), providing approximately 20-22% protein, 1.2% fat, 65% carbohydrates, and 3.8% ash. This nutritional profile is particularly significant for the vegetarian population in India, where pigeonpea contributes to dietary protein intake (Sarkar et al., 2020)

Pigeon pea, shows significant changes in protein content and fat content during malting. The moisture content decreases with germination time, while protein content increases. Ash content decreases, potentially affecting nutritional value. Crude fiber decreases, potentially reducing disease risk. Fat content is lower in malted samples, indicating a leaner food option. These changes in protein, ash, and fat content contribute to the overall nutritional profile of pigeon pea. (Nwosu and Nwosu 2013)

This Pigeon pea is abundant in starch, protein, calcium, manganese, crude fiber, fat, trace elements, and minerals, underscoring its significance as a dietary staple. However, processing methods such as de-hulling can lead to nutrient losses that adversely affect its nutritional profile (Saxena, Kumar, and Sultana 2010)

The *C. cajan* shows the nutritional and therapeutic advantages of pigeonpea, emphasizing its potential to mitigate protein deficiency in developing economies. With a protein content ranging from 21-26%, pigeonpea serves as an excellent dietary option for individuals who cannot afford meat. (Rama Karri and Nalluri 2017). Per 100 grams, the nutritional profile of *Cajanus cajan* includes carbohydrates ranging from 19.5 to 23.9 grams, serving as an energy source. Protein content varies between 7.2 and 21.0 grams, making it significant for vegetarian diets, while fat is low, ranging from 0.9 to 2.3 grams. Crude fiber, which supports digestive health, is present in amounts from 2.3 to 8.2 grams, and ash content, indicating mineral content, ranges from 1.4 to 1.6 grams. The vitamins include Vitamin C, an antioxidant, ranging from 4.80 to 569.2 mg, and Vitamin A (β-Carotene), supporting vision, from 0.05 to 0.36 mg. Key minerals include potassium (552 to 1392 mg) for heart health, phosphorus (127 to 367 mg) for bone health, and calcium (16.3 to 200.9 mg) for bone strength. Additionally, essential amino acids per 100 grams include leucine (0.2 g), lysine (0.3 g), valine (0.2 g), and isoleucine (0.2 g). (Wu et al., 2024).

C. scarabaeoides shows Crude protein ranges from 28 % to 36 % in green foliage of pigeon pea (Phatak et al. 1993). Although C. scarabaeoides is not more explored by Dey conducted comparative study between two species results show below

Total Free Amino Acids: *C. scarabaeoides* exhibits a higher total free amino acid content (7.18 mg/g) compared to *C. cajan* (5.59 mg/g) (t-value: 3.31, $p < 0.05$). (Dey et al., 2017)

Soluble Sugar Content: *C. scarabaeoides* has elevated soluble sugar levels (8.34 mg/g) in comparison to C. cajan (6.67 mg/g), though this difference is not statistically significant (t-value: 1.99). (Dey et al., 2017)

Soluble Phenol Content: *C. cajan* (1.29 mg/g) contains significantly more phenol than *C. scarabaeoides* (0.97 mg/g) (t-value: 4.96, $p < 0.05$). (Dey et al., 2017)

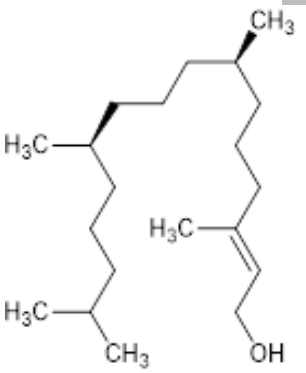
Soluble Protein Content: *C. scarabaeoides* presents a higher protein content (28.26 mg/g) than *C. cajan* (21 mg/g), yet the difference is not statistically significant (t-value: 0.06) (Dey et al.,2017). Pigeon pea seeds typically contain about 20-22% protein and notable amounts of essential amino acids and minerals, rendering them a valuable nutritional resource for both humans and animals (Abebe 2022).

Phytochemical Composition:

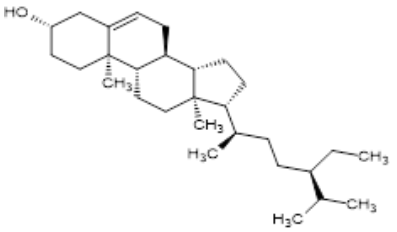
The phytochemical analysis of *Cajanus scarabaeoides* and *Cajanus cajan* revealed a rich profile containing coumarins, cardiac glycosides, tannins, phenols, and flavonoids. Quantitative assessments showed that the methanol extract had the highest levels of total phenolic, tannin, and flavonoid content.

- A total of 21 unsaponifiable compounds were identified in the hexane extract, including notable compounds such as phytol, beta-sitosterol, stigmasterol, and campesterol. Additionally, 12 fatty acids were detected, with 9,12-octadecadienoic acid and palmitic acid being the most prominent (Hassan et al., 2016).
- Quercetin-3-O-beta-D-glucopyranoside was isolated from *Cajanus cajan* for the first time, along with other flavonoids such as orientin, vitexin, quercetin, luteolin, apigenin, and isorhamnetin (Hassan et al., 2016).
- Specific compounds identified include hexadecanoic acid methyl ester, α-amyrin, β-sitosterol, pinostrobin, longistylin A, and longistylin C (Ashidi et al., 2010)

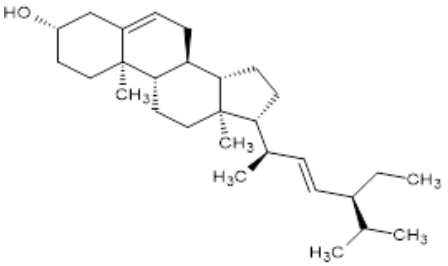
The phytochemical analysis of *Cajanus scarabaeoides* seed extracts revealed a rich profile containing coumarins, alkaloids, cardiac glycosides, tannins, phenols, and flavonoids. Quantitative assessments showed that the methanol extract had the highest levels of total phenolic, tannin, and flavonoid content (Gargi et al., 2022; Pattanayak et al., 2010; Rokkam et al., 2024).



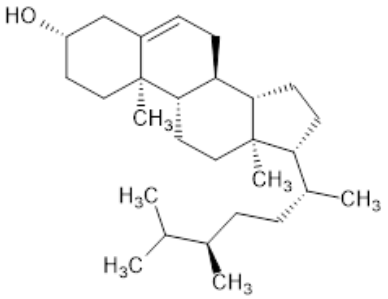
Phytol



beta-sitosterol



Stigmasterol



campesterol

Fig 1: Compounds identified in phytochemical analysis.

Bioactive potential

1. Anti-diarrheal activity:

The study on Cajanus scarabaeoides revealed its antidiarrhoeal properties through phytochemical analysis. The methanol extract, which yielded 8.94%, showed significant antidiarrhoeal activity in various experimental models. In the castor oil-induced diarrhoea model, the methanol extract significantly reduced feces and diarrheic feces, while loperamide showed a higher inhibition. The methanol extract also delayed intestinal transit, indicating its potential to treat diarrhoea. The results suggest the methanol extract's traditional use in herbal medicine for treating diarrhoea. Further studies are recommended to isolate active constituents. (Pattanayak et al., 2010)

2. Antioxidant Activity:

PPI hydrolysates are shown in the study to have antioxidant properties indicating that it is useful source of bioactive peptides. These peptides may find application as functional dietary additives in the fight against hypertension and oxidative stress. Peptide sequences from PPI digests were analysed for their bioactivities using the BIOPEP database, which revealed ACE inhibition and antioxidant characteristics. Free radical scavenging and metal chelation in food formulations are two of PPI's functional uses (Tapal et al., 2019).

Cajanus scarabaeoides exhibits significant antioxidant inhibition, with 45.54% activity ((Dey and Sinha 2015) Additionally, the butanol fraction of *C. cajan* seeds displayed antioxidant properties through DPPH radical scavenging activity, with an IC50 value of 9.07 mg/ml (Hassan et al. 2016) Various extracts (aqueous, ethanol, ethyl acetate, n-butanol, petroleum ether) from *C. cajan* leaves were also tested for antioxidant potential using the DPPH radical-scavenging assay and the β-carotene-linoleic acid test. The findings showed that these extracts, along with compounds such as cajaninstilbene acid, pinostrobin, vitexin, and orientin, possess valuable antioxidant properties, indicating potential applications in medicine and health foods (Pal et al., 2011).

3. Nitrate Reductase Activity:

Cajanus cajan (3.4 μmoles NO_2 $h^{-1}g^{-1}$) shows significantly higher activity compared to *C. scarabaeoides* (1.59 μmoles NO_2 $h^{-1}g^{-1}$) (t-value: 7.45, $p < 0.05$) (Dey et al., 2017).

4. Antidiabetic Effects:

In alloxan-induced diabetic rats, the methanolic extract significantly lowered fasting blood sugar levels; the greatest impact was shown 4-6 hours after injection. This suggests that C. cajans may have a role in the treatment of diabetes (Pal et al., 2011). In streptozotocin-induced diabetic mice, the methanol component of red gram markedly lowered blood glucose levels; a significant reduction was seen at the 10-hour post-administration ($p<0.01$) (Habib et al., 2010). The aqueous extract raised normal rats' fasting blood glucose levels when tested on streptozocin-induced Type 2 diabetic rats. This draws attention to a complicated interplay that might help manage hypoglycemia brought on by too much insulin or hypoglycemic drugs. (Pal et al., 2011).

5. Hypocholesterolemic Effects

A stilbene-containing extract from *C. cajan* was found to reduce the atherogenic properties of dietary cholesterol in mice. This effect was associated with increased expression of hepatic Low-Density Lipoprotein receptors and enhanced bile acid synthesis, suggesting a role in cholesterol management (Pal et al. 2011).

6. Microbial Activity:

The extracts exhibited significant inhibitory effects against microbial strains, including Staphylococcus aureus and Escherichia coli. In vivo studies further demonstrated the antimicrobial potential of *C. cajan* (Pal et al. 2011).

7. Antifilarial activity

The study explores the antifilarial activity of *Cajanus scarabaeoides* (EECs) extract, which has shown significant effectiveness against the filarial nematode Setaria cervi. The extract, enriched with bioactive polyphenols like resveratrol and ferulic acid, was found to be selectively toxic to filarial parasites while nontoxic to mammalian cells and tissues. The extract's mechanism of action involves oxidative stress, leading to a redox imbalance, activating the nematode's CED pathway, ultimately causing the parasite's death. The extract's simple, cost-effective preparation method makes it a viable option for further development. (Ray et al. 2018).

8. Anti-Inflammatory Activity:

Cajanus cajan hexane extract revealed a considerable ability to prevent carrageenan-induced inflammation. The treatment reduced inflammation by 85% and 95% at dosages of 200 mg/kg and 400 mg/kg, respectively, three hours after the carrageenan challenge. The extract also significantly reduced serum levels of inflammatory indicators, such as tumor necrosis factor-alpha (TNF-a) and interleukin-6 (IL-6), by 11% and 20%, respectively. (Pal et al., 2011)

9. Immunomodulatory Effects:

The hexane extracts significantly reduced immunoglobulin G (IgG) serum levels in rats with carrageenan-induced inflammation, indicating possible immunomodulatory actions.
(Pal et al., 2011)

10. Antinociceptive Activity:

The study evaluated the antinociceptive effects of the hexane extract using the writhing test in mice. The results showed that the extract reduced the number of writhings by 61% and 83% at doses of 200 mg/kg and 400 mg/kg, respectively (Hassan et al., 2016)

11. Cytoxicity Activity:

The methanol extract of Cajanus cajan exhibited the highest cytotoxicity among all tested extracts, with an IC50 value between 5-10 µg/mL (Ashidi et al., 2010)

Hypocholesterolemic Effects:

The stilbenes-containing extract-fraction from *Cajanus cajan* (SECC) reduces atherogenic properties of dietary cholesterol by enhancing hepatic LDL-receptor and cholesterol-7-alpha-hydroxylase expression, improving bile acid synthesis, and lowering LDL cholesterol in mice. A methanol extract of *C. cajan* seeds significantly reduced lipid levels in streptozotocin-induced mice. An isolated compound (CCA1) from *C. cajan* also showed strong hypolipidemic activity. Additionally, a *C. cajan* diet improved cholesterol levels

in hypercholesterolemic hamsters by boosting CPT-1, LDL-receptor, and antioxidant enzyme activities. In diabetic rats, *C. cajan* beverages reduced cholesterol levels by 19.78%. (Gupta Rakesh Kumar 2021).

Toxicity:

The exposure to *C. cajan* leaf extracts led to significant weight changes in female rat kidneys and male rats, with no significant differences observed after a 2-week recovery period. Behavioral observations showed reduced motility, abdominal distention, and poor grooming in rats treated with high-dose ethanol extract. Body weight gains were consistent and positive during both exposure and recovery periods, with no significant differences compared to controls. Acute toxicity tests showed no deaths and consistent weight gains. (Tang et al., 2017)

Conclusion:

To put it briefly, the pigeon pea (*Cajanus cajan*) and its wild relative, *Cajanus scarabaeoides*, have the potential to be significant sources of nutrients and have medicinal qualities. It is a possible source of lean protein because studies have revealed that important nutrient values have been altered by processing procedures like malting, including an increase in protein and a decrease in fat content. Its rich Phytochemicals variety, which includes a multitude of secondary metabolites, also makes it safe to use medicinally in the treatment of a wide range of illness, from filarial infections to diarrhea. Because of its antibacterial, antidiabetic, anti-inflammatory, and antioxidant qualities, pigeon pea has emerged as a functional meal that can help developing countries fight chronic illnesses and hunger. Growing interest in pigeon pea's bioactive peptides, natural antioxidants, and pharmaceutical uses necessitates more study into isolating bioactive chemicals and streamlining extraction techniques. These results are critical to improving food security, advancing sustainable agriculture, and bringing this underutilised crop into the mainstream globally.

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RESEARCH AND REVIEW IN ETHNOBOTANY AND PHARMACOGNOSY

ISBN: 978-81-970663-8-2| Year: 2024 | pp: 91 - 97 |

Ethnopharmacology

[1]Neha B. Patil.

[2]Tasmeem T. Shaikh.

[3]Rahul S. Adnaik.

[1,2]M- Pharmacy (Pharmacology), Anandi Pharmacy College kalambe tarf kale, Kolhapur)

[3]Associate professor, Anandi Pharmacy College kalambe tarf kale, Kolhapur

Email: nehapatil882001@gmail.com, tasmeemshaikh441@gmail.com

Article DOI Link: https://doi.org/10.5281/zenodo.13910530

DOI 10.5281/zenodo.13910530.

Abstract

Although ethnopharmacological knowledge is prevalent and crucial in tribal communities, a large portion of it is, at most, subjective and has not been verified by science. Even though plant resources are widely used in conventional drugs, only few plant species have had bioassay analyses done to look into their medicinal qualities and confirm the safety and effectiveness of conventional treatments.[1]

This paper examines the current role of ethnopharmacological research in drug discovery (particularly in relation to the American and European markets) and the advancement of these phytotherapeutical resources for local use in their countries of origin. It also discusses some examples of ethnopharmacological studies carried out in the past 200 years.[2]

Keywords: Ethnopharmacology, Thymus Satureioides Coss, Aloe-vera, Drug discovery.

Introduction

According to Kunwar et al. (2006), medicinal plants are extensively used for commerce, home cures, and survival. They also aid in reducing human suffering. According to estimates, 70–80% of people worldwide get their main medical care from traditional herbal medicine (Farnsworth &Soejarto 1991). An age-old conventional medical practice called ayurveda offers cures for both health issues and condition mitigation. The application of organic or plant-based traditional pharmaceuticals are a significant component of Ayurvedic therapies, which are becoming more and more popular. The past ten years have seen a

resurgence in interest in phytomedicine, and numerous species of medicinal plants are being investigated for their potential medicinal properties.[1] Humans have utilized a variety of natural materials to treat ailments and enhance their health throughout human history. Materials were obtained from plants, animals, and minerals found both nearby and farther away from humans. Experts have drawn attention in recent years to the dearth of data regarding the relative significance of a medical plant (or other useful plant) inside a culture and the necessity of comparing plant uses across cultural boundaries. These ethnobotanical investigations identify the species that we believe have the highest likelihood of containing bioactive compounds and should be researched phytochemically, which has significant implications for research on natural products. Indigenous individuals preserve their health by using a wide variety of plants as remedies. The development of novel drugs using conventional biological applications holds up a lot of potential.[3]

Objectives

- Finding new substances made from plants and animals that can be incorporated into traditional medical systems is the primary objective of ethnopharmacology. Pharmaceutical companies can utilize this expertise to design new medications.
- To create a medication to cure patients and, in the end, to substantiate the custom of using medicinal plants.
- The goal of ethnopharmacology is to catalog and characterize the plants and animals that are utilized by different societies. After then, research is done on these plants and their formulations in order to pinpoint, separate, and describe the active ingredients that provide the plants their therapeutic effects on humans.
- The objectives of ethnopharmacological research are to identify and comprehend the therapeutic properties of plants that have historically been used to treat certain medical conditions.

Several instances of ethnopharmacology in the nineteenth century:

The contemporary definition of ethnopharmacology was only made feasible by scientific advances in the ability to examine the effects of drugs and extracts on model systems. Consequently, one of the pioneers of this tradition must be regarded as being Claude Bernard (1813–1878), who carried out thorough investigations on the pharmacological effects of curare. Bernard states that using experimental methods to analyze the data provided by field researchers is a crucial objective.

The United States arrow toxins curare has an effect on the nervous motoric element, which we were able to identify in our biological research. We were also able to determine a mechanism that leads to death, which is an inert ability of this poisoned substance. However, do we have to stop here, or have we crossed the line that our current [19th century] science allows us to reach? Nothing in my opinion. To stop the event of curare, it is necessary to extract the active ingredient from the foreign substances it is combined with and investigate the physical and chemical alterations the hazardous material leaves on the organic

element (the body). These objectives are not all that unlike from those of contemporary ethnopharmacological researchers, as we shall see later. “Some wild tribes in South America used cureare to poison their arrows.” Bernard, 1966. Numerous early travelers and explorers recorded this use. The German natural scientist Alexander Von Humboldt is particularly well-known for his extremely thorough accounts of the methods used to produce poisoned arrows in the village of Esmeralda on the Orinoco River around 1800.[2]

Ethnopharmacology in twentieth century:

The field continued to be a well-established and essential component of the biological and pharmaceutical sciences during the first half of the century. The field didn’t begin to lose significance until the mid-20th century, when antibiotics were developed and pharmaceutical research was redirected.

As such, it thrived in secluded places such as Harvard University’s Botanical Museum, where R. E. Schultes established a school dedicated to botany-oriented study. Research by journalist and bank manager R. Gordon Wasson (22.9.1898–23.12.1986), who was lured to the field of ethnopharmacology by one of Schultes’s previous contributions, brought the field unexpectedly back into the public eye. Hallucinogenic fungus captivated Wasson and his wife Valentina PavlovnaGuercken. They spent a lot of time studying R. G. Wasson and his group, who were the first “aliens” to engage in the Huautla de Jimenez Mexican community’s nightly “velada” (ritual). The team was first introduced to the use of “Our Little ones,” or as they are now well called, the Sacred mushrooms (Psilocybe spp.), in Velada by the healer Maria Sabina.[2]

Ethnopharmacology in twenty-first century:

An international forum for bioscientific and clinical research on food and medicinal plants, as well as other natural compounds utilized globally, is called Frontiers in Ethnopharmacology. It is open access. The utilization of these resources in the medications of the future is contingent upon this multidisciplinary approach. Neglected illnesses are nevertheless frequently treated with medications, especially common ones like diarrhea that are carried by vectors. The use of plants to treat or manage HIV/AIDS and other urgent illnesses is expanding. All diseases require innovative therapeutic approaches, and herbal medicines from these traditions have drawn special attention recently for the management (prevention or therapy) of chronic conditions like diabetes, brain problems, and many cancer types. Significant gaps exist in our understanding of these medications’ potential for interactions as well as their general safety. The scientific study of the complex compounds developed from such traditions is a central problem in the field of pharmacology. Because they are multicomponent mixtures of active, partially active, and inactive chemicals, extracts made from plants, fungi, or animals present some special issues because the activity is frequently not focused on one objective in mind. Owing to this intricacy, isolates frequently differ, making it difficult to consistently replicate the effects of pharmacology. They also present special chances.[4]

Ethnopharmacology:

The discipline of ethnopharmacology as a recognized area of study is very new. The phrase was originally used in the title of a psychedelic book in 1967. A truly interdisciplinary topic of research that is crucial to the study of traditional medicine is the observation, identification, description, and experimental analysis of the constituents and the effects of such indigenous remedies. "The interdisciplinary scientific exploration of biologically active agents traditionally employed or observed by man" is the definition of ethnopharmacology. This description does not specifically address the problem of finding new pharmaceuticals, but it does highlight the bioscientific examination of locally produced drugs. Many indigenous medical systems around the world rely heavily on medicinal herbs, which are typically thought of as a component of a culture's traditional knowledge.[3]

Examples of Ethnopharmacological Studies:

An investigation of the physiological effects of the arrow poison curare, its botanical origin, and the component responsible for these effects offers an intriguing example of an early ethnopharmacological approach. Many early explorations recorded the employment of cure as a means of poisoning arrows by some untamed tribes in South America. Another example is drowning from ethnobotanical study with Turkmen in the northeastern Iranian region of the Sahra. Salvia viridis L. (Lamiaceae) seeds are used by Turkmens to treat inflammation eye conditions and clean their eyes of dusty and reeds.[3]

Ethnopharmacology of medicinal plant:

❖ **Thymus satureioidesCoss**

Satureioides Thymus Coss. Is a perennial shrub that ranges in height from 10 to 60 cm and is a member of the genus Thymus and family Lamiaceae. The native name for T. satureioides, an endemic medicinal plant of Morocco, is "Azkuni" or "Zaitra." The arid and semiarid environments of the Moroccan High Atlas and Anti-Atlas are home to a large population of this species. In folk medicine, T. satureioides has been widely used to treat a wide range of illnesses, including as metabolic disorders, gastrointestinal issues, immunological and dermatological conditions, diabetes, colds, and fevers. T. satureioides is used to treat bronchitis, skin conditions, sense of smell, circulatory disorders, urogenital issues, neurological and visual conditions, cooling, pharyngitis, cough, influenza, and as an antispasmodic agent, according to ethnopharmacological research.

Fig. 1: Thymus satureioides at flowering stage

Compounds	Part Used
Apigenin	Leaves
Luteolin	Leaves, Aerial parts
Eriodictyol	Leaves
Oymonin	Leaves
Quercetin	Aerial parts
Hesperetin	Aerial parts
Hyperoside	Aerial parts
Bicyclogermacrene	Flowering top, aerial parts
A-Ferulene	Aerial parts
A-Humulene	Aerial parts, flowering top

Table 1: Chemical compounds from T. satureioides

T. satureioides, particularly its Eos, has been shown in a number of pharmacological reports based on in vitro and in vivo studies to exhibit a variety of biological activities, including insecticidal, anti-microbial, antioxidant, fungicide, diabetic medications, cancer-preventing, and hypolipedemic impacts.[5]

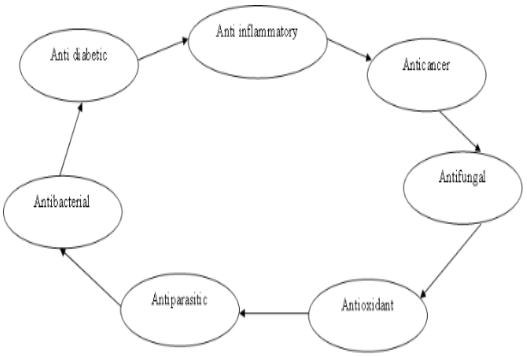

***Fig. 2: Pharmacological properties of T. satureioides*.**

❖ **Aloe Vera L.**

Aloe vera L., also known as ghritokumari in the local language, is a highly significant perennial medicinal herb that grows virtually everywhere in Bangladesh. It is a member of the Xanthorrhoeaceae family. It is a drought-resistant, stemless succulent belonging to the lily group. Because it is xerophyte, it can grow when it receives rain even in arid environments. It comes from hot regions naturally, and for more than 5000 years, Egyptian, Indian, Chinese, and European cultures have utilized it medicinally to treat everything from malignancy to eczema. Over 75 physiologically active compounds, including vitamins, minerals, enzymes, polysaccharides, phenolic compounds, and organic acids, have been found in the solid material of A. vera leaves. These substances have been reported to have anti-inflammatory, antioxidant, immune-boosting, anticancer, anti-aging, sunburn-relieving, and antidiabetic qualities. Numerous investigations showed that A. vera gel has antitumor effectiveness in terms of decreased tumor burden, tumor shrinkage, tumor necrosis, and extended survival rates. A. Vera gel was also demonstrated to exhibit antigenotoxic and chemopreventative effects on benzo (α) pyrene-DNA adducts in addition to these effects. One possible mechanism of action for the anticancer effects of aloe polysaccharides is stimulating of the immunity.[6]

Constituent	Chemicals
Amino acid	Phenylalanine, Tyrosine, Aspartic acid And histidine
Hormone	Auxins and gibberllins
Minerals	Calcium, Chromium
Sterol	Cholesterol, Campesterol,

Sugar	Monosaccharide
Vitamin	Vitamin A, C, E, B,choline and folic acid.

Table 2: Chemical constituents of A. vera leaf

Disease/Effects	**Plant part and Method**	**Tested organism**
Cardiovascular	Leaf	Male Calotes Versicolor Daudin
Hypolipidaemic effect	Leaf gel extract	Rat
Blood pressure	Plant extract	Rat
Hypertension	Leaf	Male Calotes Versicolor Daudin
Inflammation	Leaf extract	Normoglycemic rats

Table 3: Pharmacological activities of A. Vera

Discussion & Conclusion

In order to further advance the application of this local knowledge, we limited the usage of the word "ethnopharmacology" in this review to the assessment of indigenous uses and the growth of our body of knowledge regarding medicinal plants. Thus, useful adjunct to bioprospecting, which employs a methodology less centered on the usage of native plants.[2]

T. satureioides is an endemic Moroccan medicinal plant whose chemical profile, pharmacological characteristics, and ethnomedicinal usage are described in this scientific review. Moroccan traditional medicine makes extensive use of this plant to treat a variety of conditions, including bronchitis, diabetes, hypertension, and skin conditions.[5] The research makes clear that A. vera is a highly significant plant because of its many therapeutic qualities and its chemical constituents, which include enzymes, hormones, sterols, vitamins, amino acids, and anthraquinones.[6] Plants have a variety of medicinal applications, and the various mixtures that may be made from them are essential components of nearly all established medical systems. Numerous currently used drugs as well as numerous pharmacological principles and targets currently used for drug discovery were discovered as a result of extensive efforts to properly understand and rationalize the most appropriate therapeutic uses of many traditionally known medicinal and/or poisonous plants.[7]

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ABOUT THE EDITOR'S

Dr. Poonam Panaskar

She is currently working as an Assistant Professor at Dapoli Urban Bank Senior Science College, Dapoli. She completed her Ph.D. in Botany from the Department of Botany, Shivaji University, Kolhapur, in 2017. Her research interests include Ethnobotany, Pharmacognosy, and Nutraceutical studies. She has published 14 research papers in various national and international journals, as well as two book chapters. She has attended several national and international conferences, workshops, and seminars. She has registered three patents. She has also served as a member of the Board of Studies (BoS) at Mahaveer Mahavidyalaya, Kolhapur, affiliated to Shivaji University, Kolhapur, Maharashtra.

Dr. Kamlakar Patil

He is currently working as an Assistant Professor at Rayat Shikshan Sanstha's Sadguru Gadage Maharaj College, Karad. He received his Ph.D. in 2019 from the Government of Maharashtra's Rajaram College, Kolhapur, affiliated with Shivaji University, Kolhapur. He has published seven research papers in various national and international journals. He has attended several national and international conferences, workshops, and seminars. He holds life membership in the Mangrove Society of India. He has three patents registered in his name and has served as a resource person in more than five workshops. He has also completed a minor research project funded by RUSA.

Dr. Swati Kharade

She is currently working as an Assistant Professor at AIJ Degree College of Science, Murud-Janjira, since 2019. She completed her Ph.D. in Botany from the Department of Botany, Shivaji University, Kolhapur, in 2015. She has published 14 research papers in various national and international journals and has attended several national and international conferences, workshops, and seminars.

Dr. Ahilya V.Waghmode

She is currently working as an Assistant Professor in Botany and Co-Ordinator of Food Science at Rayat Shikshan Sanstha's Sadguru Gadage Maharaj College, Karad. She completed her Ph.D. in Botany from the Department of Botany, Shivaji University, Kolhapur. She has published 27 research papers in various national and international journals and completed one major research project funded by DST-SERB and two minor research project funded by RUSA and Shivaji University, Kolhapur respectively. She holds life membership of Seaweed Research and Utilization Association, Parangipettai, Tamil Nadu, Mangrove Society of India (MSI), C/o National Institute of Oceanography, Dona Paula, Goa, International Women scientist association (IWSA) Mumbai, Microbiologist Society India, Osmanabad, Eurasian Academy of Environmental Sciences and Young Phycological Society. She is an review board member of American Journal of Plant Biology, International Journal of Science Info (IJSI) and Journal Referee of Egyptian Journal of Aquatic Biology and Fisheries, Indian Journal of Geo-Marine Sciences, Journal of Pharmaceutical Research International, Regional studies in Marine Science. She published four books and five Book. She has three patents registered in her name. She was

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ISBN: 978-81-970663-8-2

Price- 750/-

Nature- 29