INDIGENOUS TRADITIONAL KNOWLEDGE

Sanjeet Kumar

Indigenous Traditional Knowledge

Edited by,

Sanjeet Kumar

APRF PUBLISHERS

Title: Indigenous Traditional Knowledge *edited by Sanjeet Kumar*

Description: Includes bibliographical references
Subject: Medicinal Plants/ Ethnobotany/ Ethnopharmacology/ Plant Animal Interaction/ Biodiversity Conservation

Published by:
APRF Publishers
Ambika Prasad Research Foundation
5A/561, CDA, Sector 9, Cuttack, Odisha
PIN- 753014,Odisha,India
Email-Id:sanjeet.biotech@gmail.com
www.aprf.co.in

Indigenous Traditional Knowledge
First Edition: 2022
Photographs Front Page: Ramfal & A local of Uttarakhand having fodder plants
Back Page: Flowers of Mahua

Price: Rs. 1050/-

Designed by: APRF, Odisha

ISBN: 978-81-955847-0-3

DOI: 10.5281/zenodo.6663397

Author's Profile

Dr. Sanjeet Kumar, DELF

He is the founder and CEO of Ambika Prasad Research Foundation (APRF), Odisha & Institute of Biological Sciences (IBS), Odisha. He has work experience with many organizations & institutes like RPRC (Regional Plant Resource Centre), Odisha; RIE (Regional Institute of Education), Odisha; IBSD (Institute of Bioresources and Sustainable Development), Imphal, Manipur; NIT (National Institute of Technology), Odisha; Forest & Environment Department, Odisha etc. His research interests are plant taxonomy, medicinal plants, biodiversity and conservation, restoration of floral wealth, phytochemistry and microbiology. He has published about 120 research papers in the journals of national and international repute and 16 books (IntechOpen, Apple Academic Press, APRF, LAP Lambert Academic Publishing) and many book chapters along with popular articles. 03 PhD scholars are working under his guidance and 45 M. Sc students submitted their Project work under his able supervision.

Dr. Rajeev Kumar Singh, Botanist
Botanical Survey of India, MoEF & CC, Govt. of India
Industrial Section Indian Museum, Kolkata, West Bengal

MESSAGE

Human beings have been using plants and animals for food, shelter, clothing, medicines, etc. ever since he arrived on the earth. In tropical countries, people living in villages, biodiversity rich areas and forests have been using indigenous plants as medicines since ages. This traditional knowledge developed over centuries of experience, close observation of nature, trial of natural resources, inference and inheritance. The potential of human beings to utilize the natural resources for their welfare made them the most successful creatures on planet earth. Sustenace of human life on earth requires understanding the role of plants in past and current day cultures.

In simple words, 'Ethnobotany' is the systematic study of how people of a particular area or state or country make use of native plants for food, medicine, shelter, clothes, other daily needs and in ceremonial rituals. Aboriginal cultures are repositories of past knowledge and experiences and also form the backgrounds for future adaptations on the earth for mankind. The documentation of all types of traditional knowledge related to the use of the plants by the different cultures of the country is requisite for further research.

I am happy to know that Ambika Prasad Research Foundation is bringing a book entitled "Indigenous Traditional Knowledge" edited by Dr. Sanjeet Kumar. This book provides the ethnobotanical uses of plants by the indigenous peoples of the different parts of the country. I congratulate the editor and the authors wholeheartedly in their endeavour to bring out this valuable publication that would be of great interest to a wide range of readers.

Date: 12.04.2022

(Dr. Rajeev Kumar Singh)

CONTENTS

Traditional methods to remove the anti-nutritional factors from wild edible tuberous plants

Eswar Kumar[1], Kevileto Rote[2], Nidhi Mahendru[3*], Sundar S Mety[4], Chanchal Malhotra[5], Sugimani Marndi[6], Sanath Kumar N[7] and Sanjeet Kumar[6*]

[1]*Department of Botany, K.B.N College (Autonomous), Vijayawada, Andhra Pradesh, India*
[2]*Department of Soil & Water Conservation, Research Demonstration &Training Centre, Sechu Zubza, Kohima, Nagaland, India*
[3]*Department of Biotechnology, KMV, Punjab, India*
[4]*Department of Botany, Shri Gavisiddeshwasra Arts Science and Commerce Degree College,Koppal Karnataka, India*
[5]*Department of Botany, Baba Mastnath University, Rohtak, Haryana, India*
[6]*Biodiversity and Conservation Lab., Ambika Prasad Research Foundation, Odisha, India*
[7]*School of Applied Sciences, Centurion University of Technology and Management, Odisha, India*
*Email-Id: sanjeetaprf@gmail.com; nidhimahendru56@gmail.com
DOI:10.5281/zenodo.6384964

ABSTRACT

Due to ever increasing demand of food insufficiency, hunger management and malnutrition for increasing population, the indigenous information can play a key role in screening wild food plants particularly tuberous plants to use them as edible foods. Henceforth, there is crucial need to encourage knowledge about consumption such foods for fulfilling food requirements of the growing society. Also, documentation of the removal of the anti-nutritional factors from wild edible tuberous plants by tribal communities. A survey was made during 2019-2020 to document the traditional methods to remove anti-nutritional factors from tuberous plant in Odisha, India. 8 wild edible tuberous plants and the traditional ways to remove anti-nutritional factors are documented here along with their uses. The present study highlights the importance of Indigenous Traditional Knowledge (ITK) to develop future food from wild food plants.

Keywords: Tuberous plant, Tribal communities, Traditional methods, Anti-nutritional, Wild foods

INTRODUCTION

The increase in human population throughout the world has alarmingly increased the food scarcity problem. Due to post pandemic (Covid 19) conditions also, there is a worldwide spike in food prices. Thus, shifting the focus towards nutraceuticals and traditional practices for fulfillment of requirement of foods. The newer generation are not inclined towards agricultural practices and traditional farming is being lost at tribal & rural level. Although, advanced technologies are available for production of high yield, still world is facing food insufficiency and malnutrition. The 12 % of global population suffer from hunger management and secure food access of food as concluded by Magadoff and Tokar (2009). The food scarcity and decreased production of food is also due to global warming, urban sprawl and crop diversity loss. The most fundamental challenges faced by humanity ever is hunger management and malnutrition (Lomborg 2004). Every country have their own wild traditional foods. Many countries of the world are using very few crops and their derivatives as a food although there is vast exploration required for using biodiverse wild food plants. These are rich in several nutrients and are consumed by rural people frequently. The nutritional content of wild fruits was observed to be very high by Umaru et al, when compared with cultivated fruits, and also the antinutritional factors present had negative effects on human health. So, the main problem associated with the use of wild plants is the presence of antinutritional factors. The nutrients have positive effects, however, antinutrients are highly bioactive capable of causing deleterious effects as well as some beneficial health effects on human health, and vastly available in plant-based foods (Popova and Mihaylova 2019). The lack of knowledge and approach of modern society towards tribal practices is a major concern. The well documentation of the Indigenous Traditional Knowledge and various approaches by Tribal communities to remove

antinutritional factors from the wild food plants making them edible can improve and even solve the food insufficiency problems. Therefore, for all above mentioned aspects, the documentations on how to remove the anti-nutritional factors from the wild food is very important. Keeping this in view, an attempt has been made to protect, document, and conserve such traditional practices for removing anti-nutritional factors that will generate reference data to make horticultural plants from the wild one, thereby solving food scarcity and malnutrition problems globally.

METHODOLOGY

A survey was carried out in different tribal areas of Odisha state, India in the year 2019-2022. The information on tuberous plants and their uses after removal of anti-nutritional factors were collected from the participatory research random interview with local communities. The identification of plant species is done by Dr. Sanjeet Kumar, Biodiversity and Conservation Lab., Ambika Prasad Research Foundation, Odisha, India. With the help of documented literature the plant species is also identified (Haines 1925; Saxena and Brahman 1995).

RESULTS AND DISCUSSION

A total of 8 species distributed among 3 genera belonging to the 2 families were recorded from field surveys. Among the species, most of the species belonging to the family Dioscoreaceae (5 species) followed by Araceae (3 species) were documented. From ethnobotanical study, it was concluded that *Dioscorea* species is widely used. Most commonly tuber consumed are *Dioscorea puber, Dioscorea bulbifera, Dioscorea hispida, Dioscorea pentaphylla,* and *Dioscorea oppositifolia*.

Plate 1: Tuberous plant consumed by boiling by local people a) *Dioscorea oppositifolia*, b) *Dioscorea bulbifera*, c) Boiled tubers consumed by tribal people

From Araceae family, *Amorphophallus paeoniifolius, Amorphophallus bulbifer* and *Colocasia esculenta* are used as wild edible tuber crops. As per the information collected from the local communities, these tubers are not consumed directly due to antinutritional factors. Therefore, they do some traditional practices to remove such components from them. It was observed that mainly the tuber part is consumed by means of successive boiling, by roasting, putting overnight in water etc. *Dioscorea oppositifolia* were consumed by after successive boiling to remove the sour from the tuber (Plate1). *Dioscorea bulbifera* were consumed by tribal people by roasting the tuber (Plate 2; Plate 3). Another mode of consumption of *Dioscorea bulbifera* by successive boiling. Details are listed in the Table 1. These indigenous traditional knowledge will be extinct soon, if not documented in a scientific manner. Tribal people consumed them as a food and sell them to get financial help. In 2005, Bhandari and Kawabata reported about the bitterness in *Dioscorea* species and how it is removed by means of various techniques. *Dioscorea bulbifera* is bitter in taste and it can be removed by traditional ways (Bhandari and Kawabata 2005). In 2017, Kumar et al. reported that furanoid nor diterpenes and some other anti-nutritional factors are responsible for bitterness in *Dioscorea* species. In present study, it states that by various technique the bitterness is removed in *Dioscorea* species by boiling, steaming, baking over coal and by peeling the tuber. In 2018, Swardi et al. reported that *Dioscorea hispida* is consumed by successive boiling as a vegetable purpose. In 2014, Ramanathan et al. reported that *Colocasia esculenta* is cooked as vegetable but the mode of removing bitterness is not documented. In 2021, Buenavista states that in East Java, *Dioscorea hispida* were consumed in the form of chips. The scientific reason behind soaking and cooking of wild yams is to remove the hydrogen cyanide which makes it a toxic food.

Plate 2: *Dioscorea bulbifera* consumed by burning by tribal people a) Tuber of *Dioscorea bulbifera*, b) Burning of *Dioscorea bulbifera*, c) Cooked, d) Consumed after cooked

Plate 3: *Dioscorea bulbifera* by mode of successive boiling

Table1: Traditional methods to remove anti-nutritional from tuberous plants

Plant name	Part used	Mode of removal	Mode of consumption	Uses
Dioscorea puber	Tuber	Successive boiling	Boiled tuber consumed raw	Food value Economic value
Dioscorea puber	Tuber	Put overnight in running water	Cooked as a vegetable	Food value Economic value
Dioscorea puber	Tuber	Put overnight in water then boil	Consumed raw	Food value Economic value
Dioscorea bulbifera	Tuber	Successive boiling	Boiled tuber consumed raw and vegetable	Food value Economic value
Dioscorea bulibifera	Tuber	Put overnight in running water	Boiled tuber consumed raw	Food value Economic value
Dioscorea bulbifera	Tuber	Put overnight in water then boil	Consumed raw	Food value Economic value
Dioscorea bulbifera (Plate 3)	Tuber	Burn	Consumed in roasted form	Food value Economic value
Dioscorea hispida	Tuber	Successive boiling	Boiled tuber consumed raw and vegetable	Food value
Dioscorea pentaphylla	Tuber	Successive boiling	Boiled tuber consumed as a vegetable	Food value
Dioscorea oppositifolia	Tuber	Successive boiling	Boiled tuber consumed raw and vegetable	Food value Economic value
Amorphophallus paeoniifolius	Corm	Successive boiling	Boiled tuber consumed as a	Food value Economic value

			vegetable	
Amorphophallus paeoniifolius	Corm	Boiled with tamarind	Boiled tuber consumed as a vegetable	Food value Economic value
Amorphophallus bulbifer	Corm	Successive boiling	Boiled tuber consumed as a vegetable	Food value Economic value
Colocasia esculenta	Rhizome	Successive boiling	Boiled tuber consumed as a vegetable	Food value Economic value

CONCLUSION

By 2050, due to increased population worldwide there will be a huge demand for food. To solve this universal food shortage and malnutrition problems, the documentation of traditional food systems and their implementations are need of hour. Our recent study has focused on the Indigenous Traditional Knowledge of food plants which provides a base line data for screening wild food plants. The documentation and conservation of the traditional methods to remove antinutritional factors will help in developing future food. This documentation can also, play an integral part in the management of food insufficiency, combating malnutrition, low-cost food production and in generation of livelihood options for the tribal and rural populace of the world.

REFERENCES

Bhandari MR and Kawabata J. (2005). Bitterness and Toxicity in Wild Yam (*Dioscorea* spp.) Tubers of Nepal. Plant Foods for Human Nutrition. 60: 129-135.

Buenavista DP, Dinopol NMA, Mollee E and McDonald. (2021). From poison to food: On the molecular identity and indigenous peoples' utilisation of poisonous "Lab-o" (Wild Yam, Dioscoreaceae) in Bukidnon, Philippines. Cogent food and agriculture. 7:1-13.

Haines HH. (1994). The Botany of Bihar and Orissa. Adlard & Sons, London.

Kumar S, Das G, Shin HS and Patra JK. (2017). *Dioscorea* spp. (A wild edible tuber): A study on its ethnopharmacological potential and traditional use by the local people of Similipal Biosphere Reserve, India. Frontiers in Pharmacology. 8(52): 1-17

Lomborg B. (2004). Global Crises, Global Solutions. Cambridge University Press, Cambridge.

Magdoff F and Tokar B. (2009). Agriculture and Food in Crisis: An Overview. Monthly Review. 61(3):1-16.

Popova A and Mihaylova D. (2019). Antinutrients in Plant-based Foods: A Review. The Open Biotechnology Journal. 13:68-76.

RamanathanR, Bhuvaneswari R, Indhu M, Subramanian G and Dhandapani R. (2014). Survey of ethnobotanical observation on wild tuberous medicinal plants of Kollihills, Namakkal district, Tamil Nadu. Journal of medicinal plants studies. 2(4): 50-58.

Saxena HO and Brahmam M. (1995). The flora of Orissa. Orissa Forest Development Corporation & RRL, Bhubaneswar.

Suwardi AB, Indriaty and Navia ZI. (2018). Nutritional evaluation of some wild edible tuberous plants as an alternative food. Innovare Journal of Food Science. 6(2): 9(12).

Umaru HA, Adamu R, Dahiru D and Nadro MS. (2007). Levels of anti-nutritional factors in some wild edible fruits of Northern Nigeria. African Journal of Biotechnology. 6(16):1935-1938.

Medicinal ground orchids: source for value addition

Sundar S Mety[1], Suhas Choudhari[2], Suchetana Mukherjee[3], Rajbala Soni[4], Annapurna Dhal[5], Anuranjita Singh[6], Sanath Kumar N[7] and Sanjeet Kumar[6*]

[1]*Shri Gavisiddeshwar Arts Science and Commerce College, Koppal, Karnataka, India*
[2]*Dr. A. G. D. Bendale College, Jalgaon, Maharashtra, India*
[3]*Department of Botany, Sripat Singh College, Jiaganj, Murshdaabad, West Bengal, India*
[4]*Department of Environmental Sciences, Vaish College of Engineering, Rohtak, Haryana, India*
[5]*B. B. College, Baigaibadia, Mayurbhanj, Odisha, India*
[6]*Biodiversity and Conservation Lab., Ambika Prasad Research Foundation, Odisha, India*
[7]*School of Applied Sciences, Centurion University of Technology and Management, Odisha, India*
**Email-Id: sanjeetaprf@gmail.com*
DOI: 10.5281/zenodo.6392490

Abstract

Orchids are most diverse group among the angiosperms belonging to the family Orchidaceae. They are known for their unique habit, habitat, flowers and fragrance. They have aesthetic, economic and medico-food values. Less documentation is available on their medico-food values. Keeping this in view, an attempt has been made to document the medicinal uses of commonly available ground orchids in selected states of India. A survey was made during 2016-2022 with many project works and field visits along with literature survey. Results revealed that about 15 ground orchids commonly used for medico-food purposes belonging to 10 genus. The present works highlights the importance of ground orchids as a source of medicinal agents and to do value addition.

Keywords: Ground orchid, medicinal, phytochemical, value addition

INTRODUCTION

Orchids are the subject of interest from many sections of the society due to this alternative flowers, morphology, habitat, ornamental, food, medicinal and aesthetic values. About 1256 species of orchids are reported from India with 388 species being endemic or unique to India (Wildlife and biodiversity: Indian must conserve its orchid wealth by V. Sundararaju, Published by Downtoearth on 17 August 2020). The genus *Bulbophyllum* represent 137species shows the highest diversity. Among, the ground orchid, *Habenaria* represents 61 taxa. The diversity and distribution of Orchid species indicate that they could be the great source of medicinal agents. Most of Orchid species are unexplored and not evaluated their medicinal and pharmacological values. Among the orchid species, ground orchids are more alternative and easier to get. They are mostly tuberous and could be an agent for medicinal and pharmaceutical evaluation.

Whole world facing lack of adequate food and medicines for increasing population and on other hand, due to anthropogenic activities, climate change and deforestation, the biowealth is going to decline. The mal practices of drugs also created antimicrobial resistance (AMR) and drugs are going to fail (Kumar et al. 2013; Kumar and Jena 2014; Kumar 2017; Kumar and Jena 2017). All these above mentioned burning issues indicate at alarming rate towards finding new food and medicines from wild or unexplored habitats of the world. COID-19 pandemic highlights the importance of natural nutraceuticals as well as preventing agents. Therefore, an attempt has been made to gather the information on the medicinal ground orchids of India through field and literature survey. The present survey highlights the importance of ground orchids as a medicinal agent for pharmaceutical industries.

METHODOLOGY

Literature survey was made during Feb 2022 to March 2022 along with field surveys. The information gathered from the field during many projects works on floral wealth in Odisha, Jharkhand, Manipur, Sikkim and Kerala during the year 2015-2022 (Plate 1). The species was identified by Dr. Sanjeet Kumar, Ambika Prasad Research Foundation, Odisha, India.

Plate 1: Field survey for the collection of medicinal values of ground orchid species

RESULTS AND DISCUSSION

The field and literature surveys revealed that about 15 common ground orchids are used as medico-food agents belonging to 10 genera. The common enumerated medicinally important orchids are *Arundina graminifolia, Bletitla striata, Calanthe plantaginea, Calanthe triplicate, Cypripedium cordigerum, Goodyera discolor, Habenaria commelinifolia, Habenaria emarginata, Habenaria intermedia, Habenaria pectinata, Phaius tarikervilliae, Spiranthes sinensis,* and *Zeuxine strateumatica.* Details are listed in the Table 1 and Plate 2. Parts mostly used as root and rhizome for medicinal purposes. Orchid species cure many diseases like urine infection, dysentery, swelling and as tonic (Figure 1). It was observed that *Habenaria* is used often among the other enumerated ground orchids of India. Researchers also documented the medicinal values of Orchid species.

Table 1: Medicinally important ground orchids of India

Botanical name	Medicinal uses
Arundina graminifolia	Root juice is used as a tonic.
Bletitla striata	Tuber is used as tonic.
Calanthe plantaginea	Rhizome is used as tonic.
Calanthe triplicata	Root is used to cure dysentery.
Geodorum densiflorum	Root is used to cure skin infections.
Cypripedium cordigerum	Root is used as tonic.
Goodyera discolor	Root juice is used in urine infection.
Habenaria commelinifolia	Root used as tonic.
Habenaria plantaginea	Tuber paste juice is used in stomach pain.
Habenaria marginata	Root juice is used as a tonic.
Habenaria intermedia	Used in Astravarga (Singh & Duggal, 2009)

Habenaria pectinata	Tuber paste is used to reduce swellings.
Phaius tarikervilliae	Tuber is used as tonic.
Spiranthes sinensis	Root is used to reduce headache.
Zeuxine strateumatica	Tuber is used as tonic.

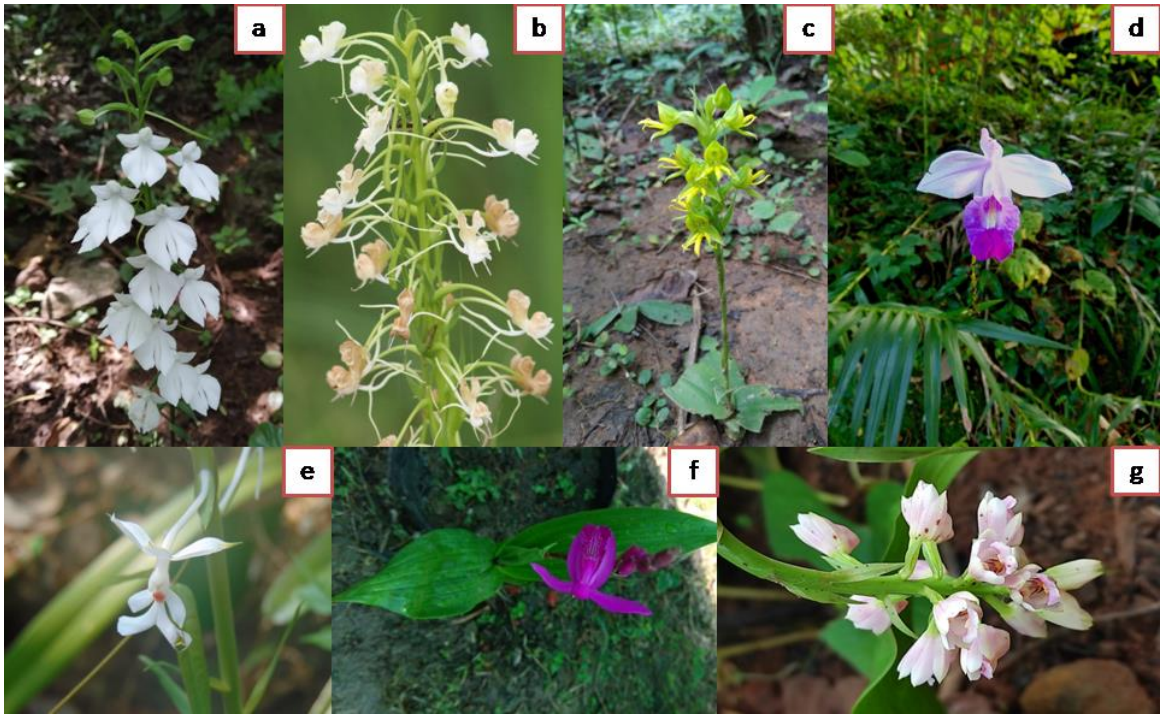

Plate 2: Some common medicinal ground orchids; a) *Habenaria plantaginea*; b) *Habenaria commelinifolia;* c) *Habenaria marginata*; d) *Arundina graminifolia*; e) *Calanthe triplicata*; f) *Bletitla striata;* g) *Geodorum densiflorum*

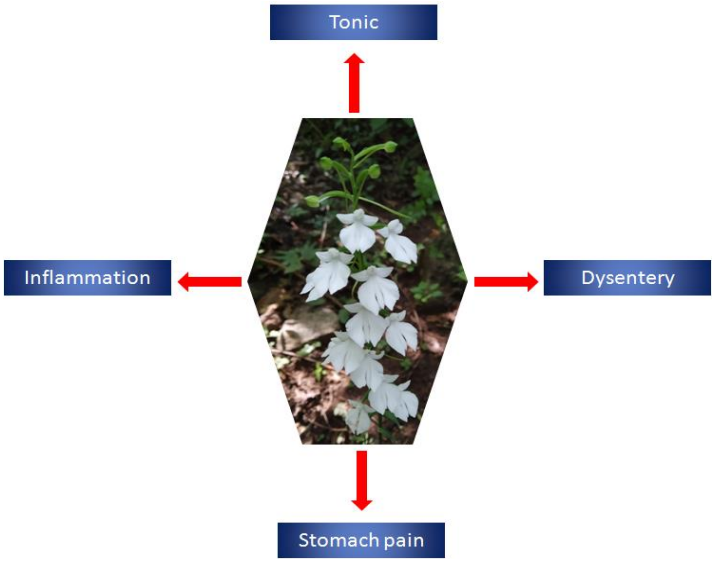

Figure 1: The recommendations on the uses of ground orchids for value addition as a herbal products

In 2012, Singh et al. states that *Bletitla striata* has specific compounds which can be used for medicinal purposes. Tezuka et al. (1990) states that *Spiranthes sinensis* has specific secondary metabolites which can be used to treat many diseases. In 2017, Tsering et al. states that *Habenaria intermedia* used as Astavavarga known as herb of immortality as it is a classical ingredient for ayurvedic formulations. In 2013, Pant states that *Arundina graminifolia* root is used to relieve body ache. *Calanthe plantaginea* rhizome dried powder is used as an aphrodisiac. In 2015, De et al. states that *Calanthe triplicata* root part is used to treat diarrhea with many ingredients in North East India. *Habenaria pectinata* tuber part is used to treat arthritis. Still more information and detailed work needed for documentation on orchids, specially ground orchids along with analyse the medicinal value (uses).

CONCLUSION

Orchids are specification or attractive for its flowering pattern but there is a lack of documentation on medicinal values and their validation. As orchid is a key indicator of non-pollution areas, it has some other uses that need a sound proof documentation scientifically. Many ground orchids are used as a tonic which could be a strong nutraceutical values. From this point of view, present work highlights the need of exploration works on ethnomedicinal values of ground orchids. Further need advanced work on their food, medicinal and pharmacological potential of ground orchids for value addition (Figure 1).

ACKNOWLEDGEMENT

Authors are thankful to the Forest officials and local communities of study areas. Authors are also thankful to the members of Ambika Prasad Research Foundation, Odisha, India.

REFERENCES

De LC, Rao AN, Rajeevan PK, Pathak P and Singh DR. (2015). Medicinal and aromatic orchids: an overview. International Journal of Current Research. 7(9): 19931-19935

Kumar S and Jena PK. (2014). Chromatographic, antibacterial and FT-IR analysis of *Dioscorea pentaphylla* L. tuber extracts. Plant Science Research. 36 (1&2): 83-90.

Kumar S and Jena PK. (2017). Tools from Biodiversity: Wild Nutraceutical Plants. Ed: James N Furze et al.: Identifying Frontier Research Integrating Mathematic Approaches to Diverse Systems / Sustainability. Springer, Swithzerland. DOI: 10.1007/978-3-319-43901-3-9.

Kumar S, Behera SP and Jena PK. (2013). Validation of tribal claims on *Dioscorea pentaphylla* through phytochemical screening and evaluation of antibacterial activity. Plant Science Research. 35: 55-61.

Kumar S. (2017). Yam (*Dioscorea* species): Future functional wild food of tribal Odisha, India. In Frontiers in bioactive compounds. Bentham Science Publishers Limited.

Pant B (2013). Medicinal orchids and their uses: Tissue culture a potential alternative for conservation. Africal Journal of Plant Science. 7(10): 448-467.

Singh A and Duggal S. (2009). Medicinal orchids: an overview. Ethnobotanical leaflets. 13: 357-363.

Tezuka Y, Li J, Hirano Hirano H. Ueda M, Nagashima K, Kikuchi T. (1990). Studies on the constituents of Orchidaceous plants IX. Constituents of *Spiranthes sinensis* (PERS.) AMES var. Amoena (M. Bieberson) HARA. Structures of spiranthesol, spiranthoquinone, spiranthol Cand spirasineol B, new isopentenyl dihydrophenantrenes. Chem. Pharm. Bull. 38: 629-635.

Tsering J, Tam N, Tag H, Gogoi J, Apang O. (2017). Medicinal orchids of Arunachal Pradesh: A Review. Bulletin of Arunachal Pradesh Forest Research. 32(1&2): 1-16.

Traditional country liquor and their medicinal uses

Guchhait KC[1], N. Anil Kumar[2], Snehalatha VR[3], Choudhary M[4], Shruti Rathore[5], Sanath Kumar N[6] and Sanjeet Kumar[7]

[1]*Department of Human Physiology, Vidyasagar University, Paschim Medinipur, West Bengal, India*
[2]*Department of Botany, SYTR Government Degree College, Madakasira, Anantapur, Andhra Pradesh, India*
[3]*Department of Botany, Govt. Victoria College, Palakkad, Kerala, India.*
[4]*Arid forest research institute, Jodhpur, India*
[5]*LCIT School of Pharmacy, Bilaspur, Chhatisgarh, India*
[6]*School of Applied Sciences, Centurion University of Technology and Management, Odisha, India*
[7]*Ambika Prasad Research Foundation, Odisha, India*
*Email Id: sanjeetaprf@gmail.com
DOI: 10.5281/zenodo.6392480

ABSTRACT

Country liquor is traditional beverage consumed by our ancestor since long. They make them using natural fermenting agent through traditional distillation methods. A survey was carried out in different place of Odisha & Jharkhand to collect the information on country liquor during 2018-2022. Results revealed that the local communities consumed them to rid from tiredness as well as a traditional beverage having food, socio-cultural and economic values. They also use the unfermented juice & fermented liquor against diseases and disorders. The chapter highlights the importance of five country liquors for value addition.

Keywords: Country liquor, medicinal values, tribal, economic values

INTRODUCTION

Country liquor is made from a variety of plant based raw materials and has different name in different countries. Country liquor is obtained from plant parts after the fermentation. It holds traditional values as well as shows medicinal properties, and for these reasons, people use it to cure many health problems. Making traditional country liquor is one of the oldest techniques is used by our forefathers. Earlier people consumed it for liquor and medicinal purposes too. Mostly the liquor is obtained from distillation process. Liquor is a fermented liquid of fruits, rice, flower *etc*. Liquor has several food, medicinal and economic values. Many of these liquors is found in tribal market areas for their livelihood purposes like handiya, a rice beer is very common. The handiya originates from the term 'handi', mean earthen pot in which handiya is fermented. Tribal people drink it in occasion and in their day-to-day life to get rid of tiredness. In occasion tribal people consumed in their festivals and offer to marangburu (Tribal deity). It is also a way of gathering of men and women. In market area, it is sold mostly by women. The recipe itself is a scientific method done by the traditional healers. Procedure for handiya mainly include rice which is boiled in water, and the ranu pills are mixed with that boiled rice to allow the fermentation. Then the country liquor is extracted by distillation method. Specific microbes help to take place the fermentation. It is believed by the Adivasi that consuming handiya is helpful to get relieve from daily tiredness from their daily wages and it may be some medicinal values as it is used against jaundice. The fermented rice is also used in Japan known as 'Sake' (Chameeva et al. 2009). Mahua is another country liquor made by the flowers of *Madhuca longifolia*, mostly consumed by rural

and tribal people (Mishra and Poonia 2019) and the raw flowers possess antioxidant activity (Singh et al. 2013). Another liquor found mostly in the rural & tribal areas made up by the stem juice of *Phoenix sylvestris*, locally known as "*Tadi*" (Torres et al. 2021; Kumar et al. 2022). According to literature it possesses antibacterial activity (Bokhari et al. 2012). *Caryota urens* is a palm tree and country liquor made up by the sap is locally known as solopa or salapa and it possesses antioxidant activity (Ranasinghe 2012). The fruits of *Baccaurea ramiflora* is used to make wine and consumed (Goyal et al. 2013) which also possesses antioxidant property. The above traditional practices to make country liquor and their medicinal values bring attention that there is a need to document them. During the floristic works, authors observed the traditional liquors in Odisha & Jharkhand states and 5 common country liquors are presented in this chapter.

METHODOLOGY

The study was carried out in the year 2018-2022 in selected districts of Odisha (Mayurbhanj, Keonjhar, Sundargarh, Gajapati, Ganjam, Kalahandi and Khordha) and Jharkhand (Giridih). Data was conducted through a series of questionnaire among the old people to young ones who do traditional practices on liquor in their daily life. The plant species was identified by Dr. Sanjeet Kumar, Ambika Prasad Research Foundation, Odisha.

RESULTS AND DISCUSSION

The survey works revealed that traditional country liquor like Handiya, Mahua, Solopa, Tadi and Latka are commonly used as country liquors and for medicinal purposes too (Table 1; Plate 1). The results revealed that 5 types of country liquor found in study areas. It was noticed that in Mayurbhanj areas, handiya and mahua are common. In other part of study areas, tadi, latka, solopa are commonly consumed. These are mostly made by the technique of traditional distillation and fermentation process by leaving them for 2-3 days to get fermented. The distillation process is mainly the separation of the components or substances from a liquid mixture by using selective temperature and condensation. In Plate 3 the handiya formulations has been shown. The procedure is boiling and cooking the rice and then water is rinsed. After rinsing, the rice is mixed to get cool and then added ranu. The ranu contains different type of plants like *Woodfordia fruticose*, *Tridax procumbens, Argyreia nervosa, Cissampelos pareira* etc (Plate 2; Table 2). The root part of these plants is mainly used. The roots are dried under sunlight for 24 hrs and pounded it together to make a round balls. The ball of different plant is get together with rice powder known as ranu. Then final step of it is the placing of rice in earthen pot and cover it with saal (*Shorea robusta*) leaves to get fermented for 2-3 days. Then water is added to it and filter the juice out of it, known as handiya. It has a strong foul odor. Mahua is also a country liquor and the flower of *Madhuca longifolia* is mainly used to make wine, has a strong and fetid odor (Plate 3).

Mahua is also sold in market. It is used as liquor which is consumed by tribal people to get relieve from tiredness after working. Tadi is a liquor made by the sap of *Phoenix sylvestris*, consumed mainly in Jharkhand and Sundargarh, Odisha. Solopa is made up by the sap of *Caryota urens* and usually observed in Ganjam, Gajapati and Kalahandi districts of Odisha state. Latka is made by the fruits of *Baccaurea ramiflora,* a less known country liquor. In 2013, Mishra reported that Mahua is used as country liquor and has medicinal values like possess antioxidant and anti-microbial properties. The flower of mahua contain essential minerals like Ca, P, Fe and K. (Saif et al. 2020; Kumar and Pradhan 2013). In 2021, Patel and Nema documented that *Caryota urens* known as solopa is used as liquor. The inflorescence of palm is tapped for its sweet phloem sap used to produce fermented beverage. It is locally known as solopa in many local areas. According to literature *Caryota urens* is used to make liquor but apart from that it has medicinal values possess antioxidant activity (Patel 2021). *Phoenix dactylifera* is locally known as tadi, is used as liquor and it is used to treat jaundice (Mallhi et al. 2014). Latka is a less known liquor used in tribal areas and has less documentation (Puthson et al. 2019). Furthermore documentation on the medicinal properties as well as the chemical constituents of the country liquor is needed.

Table 1: Traditional country liquor and their uses

Name of country liquor	Ingredient	Food	Medicine	Economic
Handiya	Roots of *Woodfordia fruticosa, Tridax procumbens, Argyreia nervosa, Cissampelos pareira* and boiled rice.	✓	✓	✓
Latka	Fruits of *Baccaurea ramiflora*	✓	✓	✓
Mahua	Flowers of *Madhuca longifolia* and Ranu pils	✓	✓	✓
Solopa	Stem juice of *Caryota urens*	✓	✓	✓
Tadi	Stem juice of *Phoenix sylvestris*	✓	✓	✓

Table 2: Common plants used to make Ranu pills

Botanical name	Family	Part used
Argyreia nervosa	Convolvulaceae	Root
Cissampelos pareira	Menispermaceae	Root
Tridax procumbens	Asteraceae	Root
Woodfordia fruticosa	Lythraceae	Root

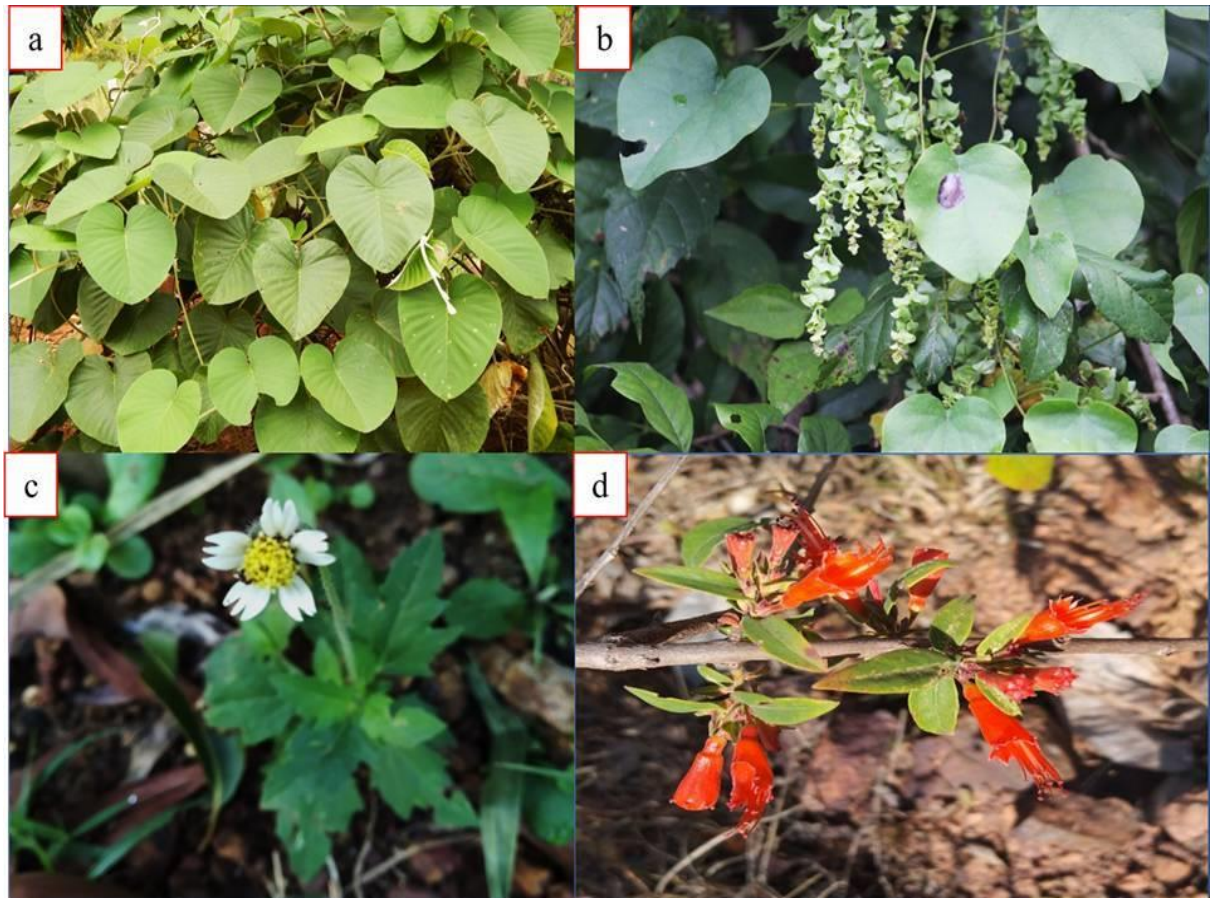

Plate 1: Plants used to make ranu pills a) *Argyreia nervosa,* b) *Cissampelos pareira,* c) *Tridax procumbens,* d) *Woodfordia fruticosa*

Plate 2: Traditional country liquor in many areas a) *Madhuca longifolia,* b) *Woodfordia fruticose,* c) *Caryota urens,* d) *Phoenix sylvestris*

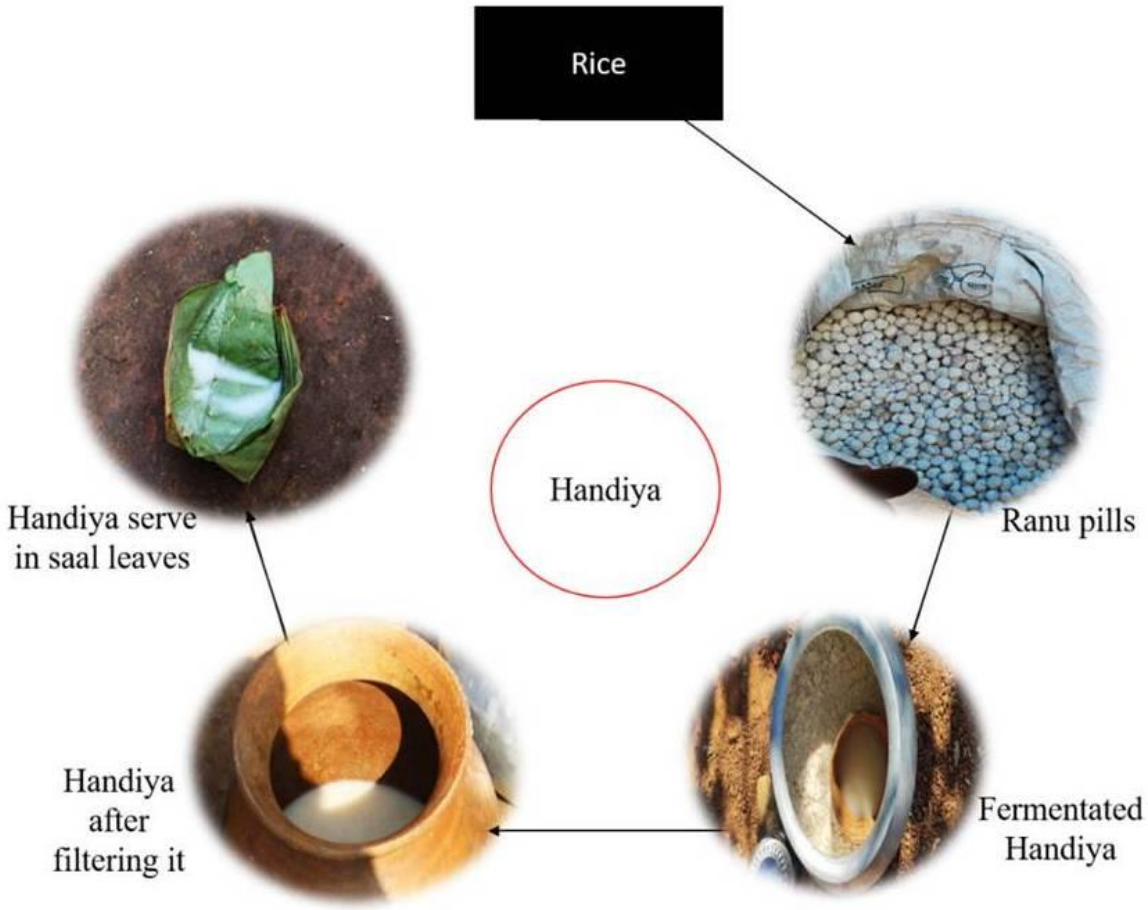

Plate 3: Making handia in traditional ways

CONCLUSION

Traditional Country liquor is staple and supplement food beverage of India. Local communities make them using locally available plan parts. The present study highlights the importance of five country liquors available in two states of India. Handia is a staple food beverage of many tribal groups in both states. The value addition and scientific validation on their food and medicinal values are needed.

REFERENCES

Bokhari NA and Perveen K. (2012). *In-vitro* inhibition potential of *Phoenix dactylifera* L. extracts on the growth of pathogenic fungi. Journal of Medicinal Plants Research. 6(6): 1083-1088.

Chameeva TB, Ninomiya M and Lida T. (2009). A Japanese sake brewery making decisions. An International Journal. 10(1): 108- 116.

Goyal AK, Mishra T and Sen A. (2013). Antioxidant profiling of Latkan (*Baccaurea ramiflora* Lour.*)* wine. Indian Journal of Biotechnology. 12: 137-139.

Kumar S and Pradhan S. (2013). *Madhuca Longifolia* (Sapotaceae): A Review of Its Traditional Uses and Nutritional Properties. International Journal of Humanities and Social Science Invention. 2(5): 30-36.

Kumar SN, Mishra S, Marndi S, Kondaji P, Choudhary R and Kumar S. (2022). Tadi: a country liquor of Bonai Forest Division, Odisha, India. Journal of Biodiversity and Conservation. 6(1): 461-463.

Mallhi TH, Qadir MI, Ali M, Ahmad B, Khan YH and Rehman AU. (2014). Ajwa Date (*Phoenix dactylifera*): An Emerging Plant in Pharmacological Research. Pakistan Journal of Pharm Sciences. 27(3): 607-616.

Mishra A and Poonia A. (2019). Mahua (*Madhuca longifolia*) flowers: review on processing and biological properties. Nutrition and Food Sciences. 49(6): 1153- 1163.

Patel C and Nema S. (2021). Sap collection, Production, Processing and Conservation of *Caryota urens* (Sulphi) in Bastar (Chhattisgarh). International Journal of Current Microbiology and Applied Sciences. 10(01): 1556-1567

Puthson P, Ardsamang T and Phichit SP. (2019). Pulp and Papermaking Properties of *Baccaurea ramiflora* Lour. Journal of Tropical Forest Research. 3 (1): 62-73

Ranasinghe P, Premakumaara GAS, Wijayarathna CD and Ratanasooriya WD. (2012). Antioxidant activity of *Caryota urens* L. (Kithul) sap. Faculty of Science University of Colombo, Colombo Sri Lanka. 23(2):117-125.

Saif M, Verma R, Kant R and Gupta RK. (2020). *Madhuca longifolia* (Mahua): A comprehensive ethno pharmacological review. International journal of chemical studies. 8(2): 172-175.

Singh R, Mishra BK, Shukla KB, Jain NK, Sharma KC, Kumar S, Kant K and Ranjan JK. (2013). Fermentation process for alcoholic beverage production from mahua (*Madhuca indica* J. F. Mel.) flowers. African Journal of Biotechnology. 12(39): 5771-5777

Torres RS, Salas BV and Plasencia SN. (2021). Date Palm: Source of Foods, Sweets and Beverages. 1-26.

Common wild edible foods in weekly tribal markets

BL Manjula[1], Asim Panda[2], Rita Shivlal Chudasama[3], Sanath Kumar N[4], Sugimani Marndi[5] and Sanjeet Kumar[5*]

[1]Department of Botany, Sri Jagadguru Renukacharya College of Science, Arts and Commerce, Bengaluru, Karnataka, India
[2]Department of Botany, Raidighi College, West Bengal, India
[3]Department of Botany, Government Science College, Gandhinagar, Gujarat, India
[4]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
[5]Ambika Prasad Research Foundation, Odisha, India
Email-Id: sanjeetaprf@gmail.com
DOI: 10.5281/zenodo.6395706

ABSTRACT

The urban population is facing shortage of food items and organic food materials. Therefore, researchers, entrepreneurs and food lovers are searching food from wild food plants. The tribal markets are the perfect platforms for screening wild food plants for future urban foods. Therefore, an attempt has been made to the survey of tribal markets of Bonai Forest Division, Odisha for enumerating commonly used wild foods. The survey results revealed that about 10 wild edible food species are commonly sold in most of tribal markets of study areas. They could be the future foods for the urban population.

Keywords: Wild, food value, medicinal value, economic value, tribal area, weekly market

INTRODUCTION

Food is the most essential requirement for sustenance of human life. Population of human beings are increasing very fast. Populace of the world is consuming limited number of agricultural crops and wild foods. Wild foods are usually consumed by the indigenous people throughout the world and they are mainly unexplored by the scientific community. The burning issue globally is to provide adequate amount of food for increasing population. In many countries, the malnutrition, food security and problems related to food are observed and organizations of national and international repute are working on them. To mitigate the problems, researchers are searching the wild food plants used by the ethnic community. Tribal markets are easy source(s) to get the tribal food or wild food plants. They collect from the near forested areas and consume them and as well as sell them to get very little amount of money for their livelihood. Therefore, keeping the importance of tribal haat (Weekly Tribal Market), an attempt has been made to enumerate the wild foods available in different tribal markets of Bonai Forest Division (BFD), Odisha. BFD is home of Bhuian, Munda, Oram, Kisan, Santhal etc. (Kumar et al. 2021; Kumar and Kumar 2021; Kumar et al. 2022). They have empirical knowledge about wild plants which can be used as food. The present paper highlights the importance of wild food plants to mitigate the food problems globally.

METHODOLOGY

The survey work was done in the year 2021-2022. Through a series of questionnaire, authors have collected the data from local weekly markets of Bonai Forest Division, Odisha, India (Plate 2). The local names were noted down and the plant species were identified by Dr. Sanjeet Kumar, Ambika Prasad Research Foundation, Odisha, India with the available books on Flora (Haines 1925; Saxena and Brahman 1995).

RESULTS AND DISCUSSION

Results revealed that 10 common wild edible foods like fruits of *Morus alba,* flowers of *Indigofera cassoides,* leaves of *Centella asiatica, Polygonum plebeium* & *Chenopodium album,* fruits of *Antidesma bunius,* tuber of *Dioscorea bulbifera* etc. Raanu pills etc are used as food. Raanu pills are natural fermenting agents made by the rice powder and roots of locally available medicinal plants. Plant

Plate 1: Wild edible foods in the tribal markets of Bonai Forest Division, Odisha, a) Fruits of *Morus alba,* b) Flowers of *Indigofera cassoides,* c) Leaves of *Polygonum plebeium,* d) Leaves powder of *Antidesma bunius,* e) Leaves of *Centella asiatica,* f) Leaves of *Chenopodium album*

parts like edible fruits, flowers and leaves are recorded. Details are listed in the Table 1. It was observed that season wise the weekly market products are changed but most common wild foods are the listed 10 species in Table 1 and Plate 1. It was noted that leaves are used more than other plant parts. Some other researchers have also documented the wild foods globally. Sinha and Lakra (2005) have reported 26 wild leafy vegetables, 30 types of wild fruits, 12 types of flowers, 11 types of seeds and 14 types of wild tuberous plants from Orissa. Kumar et al. (2012) reported 79 wild edible food plants including 11 species of *Dioscorea* from Similipal Biosphere Reserve Forest, Odisha, India. Singh and Kumar (2016) have reported 32 less known wild herbaceous plants consumed by the Munda tribe of district Khunti, Jhaarkhand, India. They have reported wild edible plants like *Butomopsis latifolia*, *Hygrophila auriculata*, *Limnophila aromatica*, *Limnophila repens*, *Limnophila rugosa*, *Marsilea minuta*, *Monochoria vaginalis*, *Rungia quinqueangularis* and *Sagittaria sagittifolia* etc. Bhatia et al. (2018) have reported 90 wild edible food plants from Jammu & Kashmir, India. Samal et al. (2019) have reported 160 species of wild edible plants from Keonjhar, Odisha, India. Kumar (2019) reported 103 species of wild edible plants from Bilaspur district, Himachal Pradesh, India. Saravanan et al. (2020) documented 85 wild food plants from Kuldiha Wildlife Sanctuary, Odisha, India. They also documented that *Leucas ciliata, Monochoria vaginalis, Alternanthera sessilis and Flemingia macrophylla* are consumed for medicinal purposes.

Plate 2: Survey works and tribal women are selling different wild edible foods in the tribal markets of Bonai Forest Division, Odisha, India

Table1: Wild edible foods available in the tribal markets of Bonai Forest Division, Odisha, India

Botanical Name	Local Name	Parts Used	Significance
Morus alba	Tut kuli	Fruit	Food value, Economic value, Medicinal value
Indigofera cassoides	Girli	Flower	Food value, Economic value, Medicinal value
Centella asiatica	Beng saag	Leaves	Food value, Economic value, Medicinal value
Chenopodium album	Bathua saag	Leaves	Food value, Economic value, Medicinal value
Antidesma bunius	Matha saag	Leaves	Food value, Economic value, Medicinal value
Polygonum plebeium	Pimpedi saag	Leaves	Food value, Economic value, Medicinal value
Dioscorea hispida	Korba aalu	Tuber	Food value, Economic value, Medicinal value
Dioscorea bulbifera	Pitalu	Tuber	Food value, Economic value, Medicinal value
Raanu pills	Raanu	Rice powder & roots of some locally available medicinal plants	Food value, Economic value, Medicinal value
Ficus spp.	Putkal saag	Leaves	Food value, Economic value, Medicinal value

CONCLUSION

Present study concluded that the tribal markets are the good source for collecting information about the wild edible food plants and their associated traditional practices for advanced scientific works in food chemistry, food biology and food problems. The most common 10 enumerated wild food plants revealed that they could be the future foods for urban food baskets.

ACKNOWLEDGEMENT

Authors are thankful to the Forest officials of Bonai Forest Division and local tribal communities of study areas and weekly markets.

REFERENCES

Bhatia H, Sharma YP, Manhas RK and Kumar K. (2018). Traditionally used wild edible plants of district Udhampur, J&K, India. Journal of Ethnobotany and Ethnomedicine. 14: 73.

Haines HH. (1994). The Botany of Bihar and Orissa. Adlard& Sons, London.

Kumar S, Jena PK and Tripathy PK. (2012). Study of wild edible plants among tribal groups of Similipal Biosphere Reserve Forest, Odisha, India; with special reference to *Dioscorea* species. International Journal of Biological Technology. 3(1): 11-19.

Kumar S. (2019). Wild edible plants consumed by rural communities in district Bilaspur, Himachal Pradesh, India. Journal of Biological and Chemical Chronicles. 5(2): 1-11.

Kumar SN and Kumar S. (2021). Taxonomic note on Luisia zeylanica (Orchidaceae) from Bonai Forest Division, Odisha, India. Richardiana. 5: 142-147.

Kumar SN, Mishra S and Kumar S. (2021). Documentation of Indigenous Traditional Knowledge (ITK) on commonly available plants in Koira range, Bonai Forest Division, Sndargarh, Odisha, India. Asian Plant Research Journal. 8(4): 83-95.

Kumar SN, Mishra S, Marndi S, Kondaji P, Choudhary R and Kumar S. (2022). Tadi: a country liquor of Bonai Forest Division, Odisha, India. Journal of Biodiversity and Conservation. 6(1): 461-463.

Samal D, Rout NC and Biswal AK. (2019). Contribution of wild edible plants to the food security, dietary diversity and livelihood of tribal people of Keonjhar district, Odisha. Plant Science Research. 41(1&2): 20-33.

Saravanan R, Kannan D, Panda SP and Datta S. (2020). Traditionally used wild edible plants of Kuldiha wildlife sanctuary (KWLS), Odisha, India. Journal of Pharmacognosy and Phytochemistry. SP6: 482-488.

Saxena HO and Brahmam M. (1995). The flora of Orissa. Orissa Forest Development Corporation & RRL, Bhubaneswar.

Singh G and Kumar J. (2016). Diversity and traditional knowledge on some less known edible wild herbaceous plant resources from district Khunti, Jharkhand, India. International Journal of Bioassays. 5(5): 4557-4562.

Sinha R and Lakra V. (2005). Wild tribal food plants of Orissa. Indian Journal of Traditional Knowledge. 4(3): 246-252.

Tribal ethnomedicine: a rich source for future drugs

Souradip Basu[1#], Sohini Gupta[2#], Kaustav Das[3], Subrata Sankar Bagchi[4] and Sayak Ganguli[5*]
[1#]Department of Anthropology, University of Calcutta, Kolkata, West Bengal, India
[2#]Department of Botany, Barasat Government College, Barasat 24 Pgs (N), West Bengal, India
[3] Department of Anthropology, Bangabasi College, Kolkata, West Bengal, India
[4]Dr. B.R. Ambedkar Chair, Department of Anthropology, University of Calcutta, Kolkata, West Bengal, India
[5]Department of Biotechnology, St. Xavier's College (Autonomous), Kolkata, West Bengal, India
#Equal Contribution
*Email-Id: sayakgan3@gmail.com
DOI: 10.5281/zenodo.6418656

ABSTRACT

The tribes are distributed across geographically different places with distinct environmental features, and many of these people still follow a traditional lifestyle with little or no contact with western diet. As a result, it can be predicted that their gut should be unadulterated. Traditional tribal knowledge of medicinal plants is an excellent resource for discovering bioactive compounds with therapeutic potential in phytochemical research. Not only do indigenous people use available flora for treating clinical conditions, they also consume those as pre and probiotics, which directly affect their gut microbiome. Tribes have established their own systems throughout the world. Tribals in India continue to utilise ancient traditional health care methods, including locally available plants. Traditional medical knowledge is vanishing as a result of urbanisation and migration. The forest is a rich resource of diversified ethno-botanical wealth, so that comprehensive research is required for proper documentation including ethnomedicinal knowledge of local tribes. Individuals were interviewed using pretested semi-structured questionnaires like the local name, scientific name, family, usable parts, and ethnomedicinal usage among others. Documentation of tribal people's local plant applications would aid in the long-term use of indigenous medicinal practices, and additional information will be useful for pharmacological research and the isolation of novel phytoconstituents. As a result, knowledge of illness and diseases would lead towards the requirement of local traditional or biomedical healing. Thus, there is a need to formulate a comprehensive database based on ethnomedicinal practices across healthy as well as diseased individuals in near future.

Keywords: Tribals, Medicinal Plants, Ethnomedicinal Practices, Bioactive Compounds

INTRODUCTION

Tribals constitute about 8.6 percent of India's total population. The absolute number of Scheduled Tribe population in India, according to 2011 census, was 104.3 million of which 94.1 million live in remote rural areas (Census of India 2011). In 2020, India's total and rural tribal populations are expected to be around 125 million and 112 million, respectively, based on current growth rates. Above 50 per cent of the tribal population live in forests (Government of India 2019), and derive their livelihoods from land and forest resources. Tribal population in West Bengal is rather significant and composed of 40 different tribes crisscrossing the state which has reached to 5.8 percent of the total population of the state. Amidst these 40 tribes, three (viz. Lodha, Birhor and Toto) are considered as Particularly Vulnerable Tribal Groups (PVTG). They have some specific features such as dependency on hunting, gathering for food, having pre-agriculture level of technology, zero or negative growth of population and extremely low level of literacy. In conjunction with the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Settlement Act, 2013 FRA protects the tribal population from eviction without rehabilitation and settlement (http://forestrights.nic.in/). The key

threat to indigenous people around the world is the gradual reduction of habitable land due to urbanisation and climate change. While urbanization affects direct land occupancy, the impact of climate change is much deeper rooted since agricultural lands become infertile and the deforestations lead to scarcity in natural produce. As a result, it is critical to protect tribal forest rights and livelihoods in order to preserve biodiversity. Maintaining traditional livelihood would likely to provide pristine gut towards the tribal population over time. More than 80% of the population in developing countries is still depending on herbal medication for health care till date (Farnsworth et al. 1985; WHO 2003). The use of medicinal plants for the treatment of a wide range of diseases has been documented in India from ancient times (Charak 1996), and the documentation of such ethnomedicine has contributed to the development of many current therapeutics (Cox and Ballick 1994; Fabricant and Farnsworth 2001). However, due to the impact of Western lifestyle (Khatun and Rahman 2019) and decreased interest in the utility of medicinal herbs found in their surroundings, the population carrying on traditional knowledge is diminishing day by day (Uniyal et al. 2006). Indigenous healing traditions have been culturally accepted throughout human history and the evolution of the environment. Traditional medicine is widely practiced, accounting for over 40% of all health care services provided (WHO 2013). Plants account for over 85% of traditional medicines (Farnsworth 1988). Medicinal plants have a long history in many indigenous groups and they are an important element of treating a variety of disorders, especially common ailments, and this practice of traditional medicine is based on hundreds of years of views and observations. Plants are used as medicine by almost every section of the Indian population, and around 7500 types of plants are used by various ethnic tribes. Tribal people, for example, collect and conserve locally available wild and cultivated plant species, and use herbal medicine to treat a wide range of ailments and disorders. India is one of the great emporia of ethnobotanical wealth (Kala 2005), with its massively diverse ethnic groupings and abundant biological resources. Forest environments, which have significant plant variety in a wide range of forest types supporting many medicinal plants both in hills and plains, are a major source of medicinal plants in West Bengal. The reserve forest covers 7,054 sq. km., or 54 percent of the entire forest area in the state, while protected forest covers 3,772 sq. km. or 30 percent of the total forest area (Anon 2015). Again, 34 percent of the entire protected forest area in the state has been designated as 'Protected Areas,' where habitat conservation is prioritised. Moreover, medicinal plant resources in conserved regions, residual reserve forests are effectively protected, despite the fact that the resource in remaining forest areas is under severe stress due to anthropogenic activities and other biotic factors (Biswas et al. 2017). Whereas, the ethnomedicinal plants are under threat due to deforestation, overgrazing and their reckless utilization. Therefore, it would indicate towards the urgent need of their conservation. Conservation of biological resources as well as their sustainable use is important in preservation of traditional knowledge (United Nations University Institute of Advanced Studies 2013). Thus, the study provided an insight to explore the traditional knowledge on medicinal plants complementing various previous ethnobotanical studies near surroundings.

METHODOLOGY

Initially, various government departments such as the Forest Department, the Department of Backward Classes, Panchayet Offices, and others were contacted for information on a checklist of forest villages with relevant demographic data and detailed information on the district's tribal population and tribal villages. Individuals were interviewed using pretested semi-structured questionnaires to document their knowledge about ethnomedicinal uses of native vegetation in their immediate environment. The survey

seemed responses like the local name, scientific name, family, usable parts, and ethnomedicinal usage among others. Plants were generally collected during the flowering stage, and the acquired plants were identified using relevant sources and standard herbarium techniques. On the basis of that information, a survey plan was developed (Datta et al. 2014, Mondal et al. 2020).

Case Reports: To provide a comprehensive narrative of the richness of the data sources and ethnomedicinal values which warrant conservation, we shall focus on two case reports, from two distinct geographical and phytogeographical zones of West Bengal highlighted in Figure 1.

Case Study 1: The name Santal is thought to be originated from a Bengali exonym. The word refers to people who live in Saont, which is now part of West Bengal's Midnapore region and is the Santals' historic homeland (Schulte 2018). Land, habitat, and area among the Santal of Central India are all influenced by ritual. Hor Hopon ("sons of mankind") is their ethnonym (Somers 1979). Due to the lack of significant archaeological records, the original homeland of the Santals is not known with certainty. The folklore of the Santals claims they came from Hihiri, which researchers have identified as Ahuri in Hazaribagh district. As per evidences, they were pushed onto Chota Nagpur, then to Jhalda, Patkum and finally Saont, where they settled for good (Sen 1997). Bankura district possess a geographical attribute of 23.2313°N, 87.0784°E along with rich resources. Santals cultivated their fields by plough. Bankura is famous for agriculture and huge production of mango and mustard. The livelihood of the Santals have revolved around the forests they live in.They obtain their basic needs from the forest's trees and vegetation. Besides that, people rely on hunting, fishing, and agriculture for their livelihood. Santals have a remarkable ability to make musical instruments, mats, and baskets out of plants. This talent is safely passed down through generations. Few plants have been reported in the table 1 along with their medicinal usage and significance across the area.

Table 1: Ethnomedicinal Usage across the Santal Tribes (Mondal et al., 2020)

Scientific name	Family	Local Distribution	Ethnomedical Uses
A. sativum	Amaryllidaceae	Herb	The juice made from bulb is used in treatment of ear problems.
Achyranthes aspera	Amaranthaceae	Herb	Leaf paste used to treat skin disease. Fresh root decoction is used for abortion.
Allium cepa	Amaryllidaceae	Herb	The paste of bulb is used in the treatment of joint pain.
Alstonia scholaris	Apocynaceae	Tree	The latex is massaged on the fractured bone.

Amaranthus viridis	Amaranthaceae	Herb	Crushed whole plant is applied to snake bite.
Andrographis paniculate	Acanthaceae	Herb	Leaf extract is taken orally for 3 days in stomach problems.
Annona squamosa	Annonaceae	Tree	Fruit is given for digestion.
Areca catechu	Arecaceae	Tree	Nuts are chewed to treat dysentery.
Asparagus racemosus	Asparagaceae	Climber	Dried root extract is used to treat dysentery and urine disorder.
Borassus flabellifer	Arecaceae	Palm	The juice of young leaves mixed with water is given in case of dysentery.
Calotropis gigantea	Apocynaceae	Shrub	Heated leaves with a layer of oil are used as heat treatment in fractured bone.
Catharanthus roseus	Apocynaceae	Herb	Leaf decoction is used in treatment of diabetes.
Celosia cristata	Amaranthaceae	Herb	The flower is used to treat dysentery.
Centella asiatica	Apiaceae	Herb	Leaf extract is mixed with a pinch of salt and taken orally to treat dysentery.
Cocos nucifera	Arecaceae	Palm	Copra of the dry fruit is crushed to extract oil which is used for ear pain.
Colocasia esculenta	Araceae	Herb	Leaf and tuber curry is taken with food to treat constipation.
Hygrophila auriculata	Acanthaceae	Herb	Freshly prepared leaf extract to treat anaemia.

Justicia adhatoda	Acanthaceae	Shrub	Leaf extract is given in an iron pot for purification and them taken orally to treat cough.
Mangifera indica	Anacardiaceae	Tree	Juice obtained from crushed bark is usually administered for diarrhoea.
Rauvolfia serpentina	Apocynaceae	Herb	Root paste is used to treat cuts and wounds and applied to snake bite. Decoction of root is also used to treat fever and hypertension.

Table 2: Ethnomedicinal Usage of reported tribes across Coochbehar (Datta et al. 2014)

Scientific Name	Family	Local Distribution	Ethnomedicinal Uses
Ageratum conyzoides	Asteraceae	Common wild	Leaves used to treat cut
Alstonia scholaris	Apocynaceae	Common wild	Bark extract used to treat intestinal worm; bark juice used to treat fever
Amaranthus spinosus	Amaranthaceae	Common wild	Leaves taken as vegetable to treat anemia; root paste applied on stomach to treat urinary disorder
Andrographis paniculata	Acanthaceae	Commonly cultivated	Leaf extract to treat jaundice; dried leaf extract to treat body pain
Azadirachta indica	Meliaceae	Common wild	Young twig used in cleaning teeth; leaf extract to treat liver ailment
Cajanus cajan	Fabaceae	Commonly cultivated	Leaf decoction for jaundice; leaf extract to treat dysentery
Calotropis gigantea	Asclepiadaceae	Common wild	Leaves used to treat rheumatism
Calotropis procera	Asclepiadaceae	Common wild	Leaves used to treat rheumatism and cuts; latex used in dog bite

Cassia occidentalis	Fabaceae	Common wild	Root extract applied to treat snake bite
Centella asiatica	Apiaceae (Umbelliferae)	Common wild	Leaf used to treat diarrhea and dysentery; leaf extract to treat eczema
Chenopodium album	Chenopodiaceae	Common wild and cultivated	Leaves used to treat intestinal worm
Cleome rutidosperma	Cleomaceae	Common wild	Seeds used in menstrual problems
Coccinia grandis	Cucurbitaceae	Common wild	Leaves used to treat hypertension
Croton bonplandianum	Euphorbiaceae	Common wild	Leaf extract used to treat cut and wounds
Curcuma longa	Zingiberaceae	Commonly cultivated	Rhizome paste applied in cuts and wounds
Cyperus rotundus	Cyperaceae	Common wild	Root extract used to treat cuts
Dalbergia sissoo	Fabaceae	Cultivated for timber	Leaf juice used to treat stomach disorder
Drymaria diandra	Caryophyllaceae	Common wild	Dried leaves smoked to treat cough
Eclipta prostrata	Asteraceae	Common wild	Leaf extract used to disinfect cut
Eupatorium odoratum	Asteraceae	Common wild	Fresh leaf juice externally applied to cuts and wouds to stop bleeding

Case Study 2: Coochbehar is a district in West Bengal's northwestern region, located near the foothills of the Eastern Himalaya. The name Cooch-Behar derives from the Koch tribe's name. Other tribes that live in this area include the Mech, Rava, Munda, Santhal, Garo, Oraon, and others, all of whom maintain the traditional culture in its original form. The district is recognised for its diverse floral composition and traditional culture, which is likely due to its location (26°36'20"-26°57'47" north; 89°54'35"-89°47'44" east) and climate. Recently, allopathic medicine has clearly outnumbered the use of medicinal herbs among tribals of Coochbehar district in the treatment of various ailments (Datta et al. 2014).

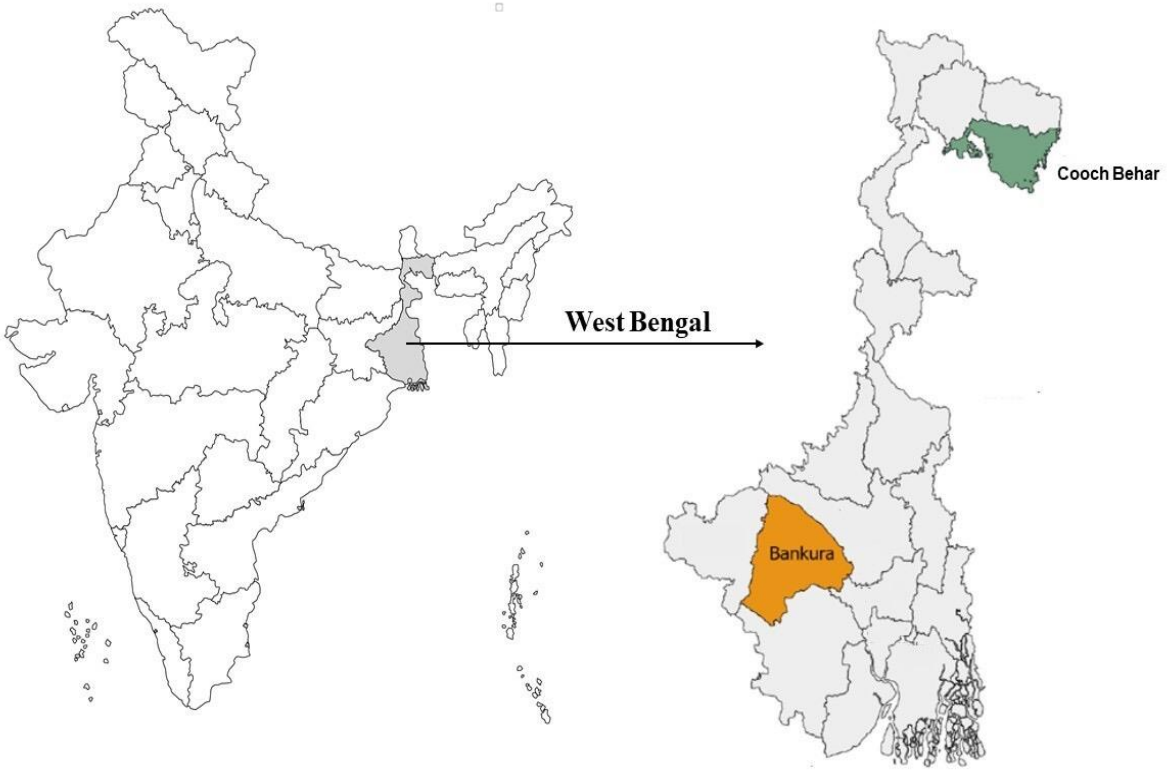

Figure 1. Location Map of India, West Bengal under study (Green Colour: Cooch Behar, Yellow Colour: Bankura) highlighted

However, their reliance on plants in their environment for relief from day to day diseases is unquestionable. All people who use plants as medicine, on the other hand, are concerned about the rapid disappearance of many therapeutic plants from their surroundings. The abundance of such plants in the area is likely to boost the use of plants as medicine. To attain the goal of sustainable development, the possibilities of propagation and cultivation of these plants in this area should be investigated. Few plants have been reported in the table 2 along with their medicinal usage and significance across the area.

CONCLUSION

Traditional medications, particularly herbal preparations, are increasingly being incorporated into local health care systems in underdeveloped countries, and many modern researchers are now active in exploring the enormous potential of ethnobotanical knowledge for treating many diseases. However, deforestation, overgrazing, and inappropriate use are putting ethnomedicinal plants at risk. As a result, it emphasises the critical importance of their preservation. Traditional knowledge preservation necessitates the conservation of biological resources as well as their long-term utilisation. However, information regarding the use of medicinal plants across the tribes documented to cure common physical issues such as minor injuries, stomach aches, and gastrointestinal disorders etc. need to be made accessible. Moreover, the scarcity of such plants in the immediate vicinity limits their use. Further research would provide insights towards the identification of novel bioactive compounds as well as open new horizons of sustainable conservation and management.

COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported here.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Dr. Subrata Sankar Bagchi and Dr. Sayak Ganguli for their constant support towards the work.

REFERENCES

Anon (2015). India State of Forest Report, Forest Survey of India, Ministry of Environment, Forests & Climate Change, Govt. of India, pp. 258-262

Biswas S, Shaw R, Bala S, and Mazumdar, A (2017). Inventorization of some ayurvedic plants and their ethnomedicinal use in Kakrajhore forest area of West Bengal. Journal of ethnopharmacology, 197, 231–241.

Census of India (2011). Office of the Registrar General and Census Commission. New Delhi: Government of India

Charak (1996). Charak Drdhbala. In: and others, editor. The Charak Samhita explained by K. Sastri and G.N. Chaturvedi. Varanasi. Chaukhamba Bharti Academy.

Cox PA and Ballick MJ. (1994). The ethnobotanical approach to drug discovery. Scientific American. 270(6):82–87.

Datta T, Patra AK, and Dastidar SG. (2014). Medicinal plants used by tribal population of Coochbehar district, West Bengal, India-an ethnobotanical survey. Asian Pacific journal of tropical biomedicine, 4(Suppl 1), S478–S482. https://doi.org/10.12980/APJTB.4.2014C1122

Fabricant DS and Farnsworth NR. (2001). The value of plants used in traditional medicine for drug discovery. Environmental Health Perspective. (Suppl 1). doi:10.1289/ehp.01109s169

Farnsworth NR. (1988). Screening plants for new medicines. In: Wilson EO, editor. Biodiversity. Washington DC: National Academy Press; p. 83-97

Farnsworth NR, Akerele O, Bingel AS, Soejarto DD and Guo Z. (1985). Medicinal plants in therapy. Bulletin of the World Health Organization.63(6):965–981

Government of India. (2019). TRIFED -A Brief Note on Scheme for Marketing of Minor Forest Produce through MSP and Value Chain Development. January

http://forestrights.nic.in/

Kala CP. (2005). Current status of medicinal plants used by traditional vaidyas in Uttaranchal State of India. Ethnobotany Research and Application 2005; 3: 267-278

Khatun MR and Rahman AHMM. (2019). Ethnomedicinal uses of plants by Santal Tribal peoples at Nawabganj upazila of Dinajpur district, Bangladesh. Bangladesh Journal of Plant Taxonomy. 26(1):117–126. Available from: https://dx.doi.org/10.3329/bjpt.v26i1.41926. doi:10.3329/bjpt.v26i1.41926

Lea Schulte- Droesch. (2018). Making place through ritual. Eds: Gustavo Benavides, Frank J. Korom

Mondal A, Adhikary T, Chakraborty D, Roy PK, Saha J, Barman A and Saha P. (2020). Ethnomedicinal uses of plants by Santal tribe of Alipurduar district, West Bengal, India. Indian journal of science and technology, 13, 2021-2029

Sen Suchibrata. (1997). The Santals, crises of identity and integration. RatnaPrakashan

Somers GE. (1979). The dynamics of Santal traditions in a peasant society. Schenkman Pub. Co.

United Nations University Institute of Advanced Studies (UNU-IAS) (2013). Payyappallimana U, Fadeeva Z, editors. Traditional knowledge andbiodiversity. Yokohama, Japan: UNU-IAS; p. 8-9

Uniyal SK, Singh KN, Jamwal P and Lal B. (2006). Traditional use of medicinal plants among the tribal communities of Chhota Bhangal, Western Himalaya. Journal of Ethnobiology and Ethnomedicine. 2(1):14–14. Available from: https://dx.doi.org/10.1186/1746-4269-2-14. doi:10.1186/1746-4269-2-14

WHO. (2003). Diet, nutrition and prevention of chronic diseases. Report of the Joint WHO/FAO Expert Consultation. Geneva, World Health Organisation (WHO)

World Health Organization (WHO). (2013). WHO traditional medicine strategy 2002-2005. Geneva: World Health Organization. [Online] Available from: http://www.who.int/medicines/publications/Traditional policy/en/index.htm. [Accessed on 27 October, 2013]

Ethnomedical, economical and medicinal importance of KAFAL (*Myrica esculenta* Buch. - Ham. ex D.Don), a local plant of Uttarakhand, India

Swati Josh[#*1] Aakriti Bhandar[#2] and Richa Badhan[#3]
[1]Uttarakhand State Health Department, Uttarakhand, India
[2]FRI Dehradun, Uttarakhand, India
[3]RCU PG College, Uttarkashi, Uttarakhand, India
#Equal Contribution
*Email-Id: swatijoshiap@gmail.com
DOI: 10.5281/zenodo.6662560

ABSTRACT

Myrica esculenta (KAFAL) is a well-known edible plant of Uttarakhand. Present book chapter is focused on its ethnomedicinal, medicinal and economical importance. Every part of the plant has its immense medicinal value. Fruit and various different parts of the plant have been used since ancient time for various purposes. Plant does not have medicinal value but also used by local people for various economic purposes. Various phytochemical obtained from the plant have a good potential of antioxidant properties, pharmacological properties and nutritious value. Over harvesting of the plant has made the species of the plant threat to extinction. There is still need a proper utilization and sustainable approach towards proper development of the plant, so that we can use it for future generation.

Keyword: KAFAL, *Myrica esculenta*, Edible fruit, Myricetin

INTRODUCTION

Indian Himalayan Region is a treasure house of many impeccable herbs and trees. Mostly the wild edible plants fetch eye over it. There are over 675 wild edible plants are found in Indian Himalayan Region and these are the prime source of timber, food, fodder and fuel for local people due to its high nutritive and medicinal properties (Samant and Dhar 1997). *Myrica esculenta* (Figure 1) is one of the highly nutritious and having tremendous medicinal value, which is commonly known as Kaphal, Boxberry. Plant is also known as 'hairy bayberry' and kataphala and with synonyms *Myrica sapida* and *Myrica farqharina*. In Sanskrit, plant is known as Katphal, in Urdu people called it Kaiphal, in Assam, it is known as Nagatenga, So-phi in Khasi, and in English Box myrtle'(Kabra et al. 2019). Plants have its economic importance and popularity for its delicious fruits and other processed products among local inhabitants (Bhatt et al. 2000). A proverb in the local people about this plant" *Kaphal pako m mi chakho*" is also popular. All parts of the plants have its medicinal values, as they are used in different Ayurvedic formulations (Makdoh et al. 2014). Syrup, Jam, pickle and refreshing drinks are made from the Fruit part of the plant. Bark, root and leaves of the plant have tremendous medicinal value and used in the treatment of various diseases (Kumar and Rana 2013).

There are so many bioactive compounds as alkaloids, flavonoids, glycosides, tannins, terpenoids, saponins, and volatile oils have been reported from the various extracts of the plants. Myricetin is the potential compound, which has been reported from the family of this plant, which is a key ingredients of various food products and have been reported for its antioxidant, anticancer, anti-diabetic and anti-inflammatory properties. Dye is also obtained from the bark of the plant (Jones et al. 2011; Semwal et al. 2016). Beside of its tremendous value, *M. esculenta* is in the state of danger of its extinction due to its excessive utilization as collection of plant and its parts totally dependent through the wild sources. Wild fruits are also gaining increased attention, as potential food supplement or cheaper

alternative of commercial fruits across the world. *M. esculenta* is a sub-temperate medium to large woody, evergreen, dioecious tree, is about 12 to 15 m in height. Both male and female trees are almost similar in appearance. The bark of the tree is light brown to black in color (Sood and Shri 2017). The leaves are narrowly elliptic-obovate or lanceolate-obovate to cuneate-obovate, ovate nearly entire or serrate and almost crowded towards the end of branches. The female flower is very small, sessile, solitary and bracteate with sepals and petals are either absent or not visible. The inflorescence is a catkin, axillary in position and bearing about 25 flowers in thread like style. The inflorescence of staminate flower is compound raceme. Each staminate flower has about 12 stamens, each with very short filament.

The fruits are succulent drupe with small ellipsoidal or ovoid to globose in shape, initially green and become reddish during ripening but due to its perishable nature it can't remain so long for 2-3 days. Flowering season starts from the month of October and remain till December and the fruit setting season starts from the month of November and ripened till April (Jeeva et al. 2011). *Myrica esculenta* belongs to family myrtaceae. Plants of this family grows in subtropical and temperate forests of pine, oak and rhododendron at the height of 900-2100m asl. Boxberry is dioecious, medium-sized, evergreen tree distributed over China, Taiwan, Japan, Western Highland of Cameroon, North America, South Africa, Australia, Brazil, Ethiopia, Nepal, and India. In Indian Himalaya from Ravi eastward to Assam, Khasi, Jaintia, Naga and Lushi hills and extends to Malaya, Singapore, China and Japan (Gusain and Khanduri 2016).

ETHNOBOTANICAL VALUES

Plant has various ethnomedicinal values (Table 1). The bark of the plant in the treatment of cough, asthma and ulcer (Table 1). Bark powder have potential for reducing headache through smelling (Gangwar et al. 2010; Kumari et al. 2011). Decoction of bark used as mouth freshener and in the treatment of tooth ache (Srivastava et al. 2016). Bark is also helpful in joint pain, paralysis, wound healing, head ache and cold (Arya et al. 2014). People of Orissa used bark of the plant in psychological treatments (Khan et al. 2008).

Meghalayan people used fruit juice of the plant in the treatment of diarrhoea, bark chewed for the toothache relieve and used for washing in throat infection (Jeeva et al. 2011). Khasi tribe of Meghalaya uses bark of the plant in poisoning fishes. Pulp of leave is used in the treatment of headache by the people of Uttarakhand (Bhatt and Negi 2006).

Table 1: List of ethno-medicinal uses of plants

Part of plant	Economical uses	Medicinal Uses	Sources
Bark	NIL	Toothache, rheumatism, ophthalmic, asthma, cough and cholera.	Nainwal and Kalra (2009); Jeeva et al. (2011).
Bark with stem	NIL	Asthma, diarrhoea, fever, chronic bronchitis, lung infections, dysentery and stomach problems.	Jeeva et al. (2011).
Flower	NIL	Oil of flowers is used for the treatment of ear ache, diarrhoea, paralysis and inflammations.	Jeeva et al. (2011).
Fruit	Juice, jam and pickle is used to sell in the markets	Unripe fruit is used as anthelmintic agent.	Nainwal and Kalra (2009).

Figure 1: Kafal (*Myrica esculenta*) tree in FRI Campus Dehradun

The bark of the tree is traditionally used as antiseptic, washing putrid sores, fish poisoning and external plaster in rheumatism. It is also used for tanning and dying yellow colored dye (Jeeva et al. 2011). The fruit of *M. esculenta* have high number of secondary metabolites such as flavonoid, phenolics, and natural anti-oxidants which lowers down the oxidative stress and may provide prevention from certain degenerative diseases and also procuring anti-microbial and anti-inflammatory properties.

The phenolic and flavonoid contents across populations of *M. esculenta* may varies due to morphological as well as biochemical characters of the fruits and can utilized for identification of best provenances for pro- motion under large scale plantation through horticulture and forestry interventions (Rawat et al. 2011). The regeneration potential of *M. esculenta* is very low in its natural habitats due to high anthropogenic activity and also having low rate of germination via seeds due to having impermeable seed coat. The seed germination method also yields a progeny of highly heterozygous plants (Bhatt and Dhar 2004).

Since ancient time various parts of the plants used in Ayurvedic formulations. "Chavyanprash" which is use for good digestion and improving immunity, "Katphaladi churna" used for fever, throat infection, respiratory disorder, and abdominal pain. "Pushyanuga churna" used for bleeding disorders, candidiasis, "Katphala taila" used for joint pain. "Arimedadi Taila" used in the treatment of tooth decay and breath problem. "Mahavisagarbha taila" used for vata imbalanced neuromuscular conditions. "Bala taila" used in vata disorder, respiratory tract infections, and weakness. "Khadiradi gutika" used in the treatment of dental, oral, throat and tonsillar infections. "Maha vatagajaknusa rasa" which is used to treat Rheumatoid arthritis, migraine, paralysis, cough, cold, asthma, "Brihat phala grhita" used to treat infertility (Kabra et al. 2019).

BIOACTIVE COMPOUNDS

A massive number of numerous phytochemicals has been reported from different extracts of *M. esculanta*. Leaves fruit and bark has been shown presence of myricetin, triterpenoids such as lupeol; oleanolic acid; trihydroxytaraxaranoic acid; dihydroxytaraxerane; dihydroxytaraxaranoic acid; tetrahydroxytaraxenoic aci; 3-epi-ursonic acid; arjunolic acid (Agnihotri et al. 2016; Dua et al. 2021). Whereas β-rosasterol; daucosterol; β-sitosterol-β-D-glucopyranoside, myresculoside (4-hydroxy-1,8-cineole 4-Oβ-dapiofuranosyl (1→6)-β-D-glucopyranoside (Wei et al. 2011).

Quercetin has been present in leaves (Bamola et al. 2009). Flavonoids also present in leaves. Taraxerol, stigmasterol, gallic acid and hydrolysable tannin has been reported in bark. Fruit extract showed the presence of catechin, gallic acid, chlorogenic acid and ρ-coumaric acids through Reverse phase HPLC (Rawat et al. 2011). Leaves has been shown presence of Ethyl-β-D-glucopyranoside, 3-hydroxybenzaldehyde; isovanillin; 4- (hydroxymethyl)-phenol; 4-methoxybenzoic acid. Gallic acid and ferulic acid has been reported in the fruit extract of *M.* esculanta through LC-MS analysis. Diaylheptanoids has been reported in leaves, root and bark. Myricanol and myricnone has been shown their presence in the bark. β-sitosterol has been reported in leaves and bark (Kabra et al. 2019).

Volatile compounds Present

Nerolidol; α-pinene; α-selinene; β-caryophyllene; β-selinen; α-caryophyllene; α-cadinol; linalool are the various volatile compounds which have been shown their presence in leaves. n-hexadecanol; eudesmol acetate and n-octadecanol are the compounds which have been reported in bark (Kabra et al. 2019).

Miscellaneous compounds

Fruits of *M. esculenta* has shown presence of amino acids; 1- ethyl-4-methylcyclohexane, myo-inositol, methyl-d-lyxofuranoside, 2-furancarboxyaldehyde, 2,5- furandionedihydro-3-methylene, furfural and oxirane (Kabra et al. 2019).

ANTIOXIDANT PROPERTIES

Natural antioxidants play important role in the treatment of depressive diseases and diseases generated through oxidative stress. Fruits of *M. esculanta* is a principal source of natural antioxidants. A good level of antioxidant properties through ABTS, DPPH and FRAP assays has been reported (ABTS-1.84 mM; DPPH—2.55 mM; FRAP—2.97 mM AAE/100 g fw) (Rawat et al. 2011). Antioxidant properties through DPPH assay has been reported previously through various researchers (Middha et al. 2016; Goyal et al. 2011, Goyal et al. 2013).

PHARMACOLOGICAL PROPERTIES

The bark of the stem contains proanthocyanidin, tannins, glycosides, gallic acid, myricanol, myricanone, epigallocatechin 3-O-gallate, two prodelphinidin dimers epigallocatechin - (4β → 8) – epigallocatechin 3-O-gallate and 3-O- galloylepigallocatechin- (4β → 8) - epigallocatechin 3-O-gallate and the hydrolysable tannin castalagin and myresculoside. The bark of the stem also has essential oil, which mainly consisted of n- hexadecanol (25.2%), eudesmol acetate (21.9%), palmitic acid (11.6%), cis β - caryophyllene (8.7%), n- pentadecanol (7.7%) and n-octadecanol (7.6%) and having potential antimicrobial activity (Agnihotri et al. 2012).

The leaves of the *Myrica esculenta* have two flavonoid glycosides identified as flavones 4'-hydroxy-3',5,5'-trimethoxy-7-O-β-D-glucopyranosy) (1→ 4)-α-L-rhamnopyranoside (1) and flavone 3',4'-dihydroxy-6-methoxy-7-O-α-L-rhamnopyranoside (2) with three known compounds â-sitosterol, â-sitosterol-β-D-glucopyranoside and quercetin (Bamola et al. 2009). The oil of the flower is a tonic useful in earache, diarrhea, inflammation and paralysis (Jeeva et al. 2011). The fruit of *M. esculenta* have high amount of phenolics, flavonoid and natural anti-oxidants which can play vital role in reducing the oxidative stress and preventing from certain degenerative diseases and possess anti-inflammatory and antimicrobial properties (Rawat et al. 2011).

Analgesic Properties

Plant has been used by local people for its analgesic and anti-inflammatory properties. Plant extract has been reported by researchers for its analgesic and anti-inflammatory properties (Middha et al. 2016).

Antiasthmatic Properties

Ethanolic extract of *M. sapida* has been reported for its broncho dilating properties. Hence useful for the treatment of asthma (Patel et al. 2008).

Anticancer

Acetone and acidic acetone extracts of fruit showed anticancer potential against C33A, SiHa and HeLa cell lines (Patel et al. 2011).

Anthelmintic

The methanolic/ethanolic extract of bark shows anthelmintic activity against earthworms (*Pheretima posthuma*) (Jain and Jain 2010).

Scavenging potential

Acetone extract of fruit pulp showed good scavenging potential (Seal 2011).

Anti-fungal

The methonolic/ethanolic extract of fruits of *M. esculenta* shows antifungal activity against *Candida albicans, Aspergillus flavus* and *Aspergillus parasiticus* (Chandra et al. 2012).

Antihypertensive

The methanolic extract of leaves shows potent ACE inhibition potential (Shrestha and Dhillion 2003).

Antidiabetic

The methanolic extract of leaves shows significant anti-dyslipidemic effect at 150 mg/kg and maintains blood glucose level (Rawat et al. 2013).

Anxiyolytic

Anxiyolytic activities have been reported in ethanolic extract of *Myrica nagi* (Khan et al. 2008: Syed et al. 2013).

Antidiarrheal

Ethanol leave extract of *Myrica esculenta* has been shown anti-diarrheal properties (Nayak et al. 2017).

Anti-inflammatory

Ethyl acetate, methanolic extract and aqueous extract *Myrica nagi* Linn. Bark has been reported for its anti-inflammatory effect (Patel et al. 2011).

Antimicrobial

Methanolic and chloroform extract of *Myrica Nagi* has been reported for showing antibacterial activity. (Suryavanshi et al. 2009). Hydro distilled oil acquired from bark extract of *Myrica esculenta* Buch. Ham has been reported for its antimicrobial activity against *Bacillus pumilus, Staphylococcus aureus, Staphylococcus epidermidis, Escherichia coli, Pseudomonas aeruginosa, Candida albicans, Aspergillus niger and Saccharomyces cerevisiae* (Agnihotri et al. 2012).

Antiulcer

Ethanolic extract of *Myrica esculenta* has been reported for its anti-ulcer potential (Swathi and Prasad 2015).

Wound healing

The bark extract possesses significant wound healing potential non-toxicity effects (Rawat et al. 2013).

CONCLUSION AND FUTURE PROSPECTUS

Since ancient time *Myrica esculenta* has been used for its healing and salutary properties. Beside various economical and ethnomedical uses plant has a good potential for its enormous medicinal value. Plants have been reported for its Analgesic, Anti-microbial, Anti-inflammatory, Anti-helminthic, Anti-asthmatic, Anticancer, Antipyretic, Antidiarrheal, Antimicrobial, Anti-ulcer, and wound healing properties. Plant has been reported for its high level of antioxidant properties. Various bioactive compounds have been reported from different extracts of the plants. But still there is mode of action of these compounds still needed to be required. A more emphasis on search of new compounds and new pharmacological properties such as neuroprotective, immunity booster, cardioprotective, still required. A sustainable approach is yet to be needed for saving this useful species from threat to extinction.

REFERENCES

Agnihotri S, Wakode S and Ali M (2016). Triterpenoids from the stem bark of *Myrica esculenta* Buch Ham. World Journal of Pharmacy and Pharmaceutical Sciences.5(4) :1319-1327.

Agnihotri S, Wakode S and Ali M. (2012). Essential oil of *Myrica esculenta* Buch. Ham: composition, antimicrobial and topical anti-inflammatory activities. Natural Product Research. 26(23):2266-2269.

Arya D, Khan AH and Adhikari M. (2014). Plant species used by locals as ethno-medicine in Kumaun region of Western Himalaya (India). International Journal of Pharmaceutical Sciences. 13(4) :3128-32.

Bamola A, Semwal DK, Semwal S and Rawat U. (2009). Flavonoid glycosides from *Myrica esculenta* leaves. Journal of Indian Chemical Society. 86(5): 535-536.

Bhatt ID and Dhar U. (2004). Factors controlling micropropagation of *Myrica esculenta* buch. – Ham. ex D. Don: a high value wild edible of Kumaun Himalaya. African Journal of Biotechnology. 3(10): 34-540.

Bhatt ID, Rawal RS and Dhar U. (2000). The availability, fruit yield and harvest of *Myrica esculenta* Buch. -Ham. ex.D. Don in Kumayun (West Himalaya) India. Mountain Research and Development. 20(2):146–153.

Bhatt UVP and Negi GCS. (2006). Ethnomedicinal plant resources of Jaunsari tribe of Garhwal Himalaya. Indian Journal of Traditional Knowledge. 5(3):331-335.

Chandra S, Saklani S, Mishra AP and Badoni PP. (2012). Nutritional evaluation, antimicrobial activity and phytochemical screening of wild edible fruit of *Myrica nagi* pulp. International Journal of pharmacy of Pharmaceutical Science. 4(3):407–411.

Dua TK, Joardar S, Chakraborty P, Bhowmick S, Saha A, Feo VD and Dewanjee S. (2021). Myricitrin, a Glycosyloxyflavone in *Myrica esculenta* Bark Ameliorates Diabetic Nephropathy via Improving Glycemic Status, Reducing Oxidative Stress, and Suppressing Inflammation. Molecules. 26(2):258-258.

Gangwar KK, Deepali and Gangwar RS. (2010). Ethnomedicinal plant diversity in Kumaun Himalaya of Uttarakhand, India. Nature and Science. 8(5):66-78.

Goyal AK, Middha SK and Sen A. (2011). Evaluation of the DPPH radical scavenging activity, total phenols and antioxidant activities in Indian wild *Bambusa vulgaris* "Vittata" methanolic leaf extract. Journal of Natural Pharmaceuticals. 5(1): 40–45.

Goyal AK, Mishra AT, and Sen A. (2013). Antioxidant profiling of Latkan (*Baccaurea ramiflora* Lour) wine. Indian Journal of Biotechnology. 12: 137-139.

Gusain YS and Khanduri VP. (2016). *Myrica esculenta* wild edible fruit of Indian Himalaya: need a sustainable approach for indigenous utilization. Ecology, Environment and Conservation. 22: 267-270

Jain VK and Jain B. (2010). Anthelmintic activity of ethanolic extract of bark of *Myrica esculenta*. International Journal of Pharmaceutical Science and Research.1:129–131.

Jeeva S, Lyndem FG, Sawian JT and Laloo RC. (2011). *Myrica esculenta* Buch. - Ham. ex D. Don. - a potential ethnomedicinal species in a subtropical forest of Meghalaya, northeast India. Asian Pacific Journal of Tropical Biomedicine. 1(2):174-177.

Jones JR, Lebar MD, Jinwal UK, Abisambra JF, Koren J, Laura BL, Leary JCO, Davey Z, Trotter J, Johnson AG, Weeber E, Eckman CB, Baker BJ and Dickey CA. (2011). The Diarylheptanoid (+)-aR,11S-Myricanol and two flavones from bayberry (Myrica cerifera) destabilize the microtubule-associated protein tau. Journal of Natural Product. 74(1):38-44.

Kabra A, Martins N, Sharma, Kabra R and Baghel US. (2019). *Myrica esculenta* Buch. -Ham. Ex D. Don: A natural source for Health Promotion and Disease Prevention. Plants. 8(6): 2-42.

Khan MDY, Sagrawat H, Upmanyu N and Siddique S. (2008). Anxiyolytic properties of *Myrica nagi* bark extract. Pharmaceutical Biology. 46(10-11):757-761.

Kumar A and Rana AC. (2013). Pharmacognostic and pharmacological profile of traditional medicinal plant: *Myrica nagi*. International Research Journal of Pharmacy. 3(12): 32–37.

Kumari, P, Joshi GC and Tewari LM. (2011). Diversity and status of ethnomedicinal trees of Almora district in Uttarakhand, India. International Journal of Biodiversity and Conservation. 3(7): 298–326.

Makdoh, Lynser MB and Pala KHM. (2014). Marketing of indigenous fruits: A Source of Income among Khasi women of Meghalaya, North East India. Journal of Agricultural Sciences. 5(1-2):1–9.

Middha SK, Kumar GA, Talambedu U, Babu D, Misra AK and Prakash L. (2016). Evaluation of antioxidative, analgesic and anti-inflammatory activities of methanolic extract of *Myrica nagi* leaves—An animal model approach. Symbiosis. 70(1-3):179-184.

Nainwal P and Kalra K. (2009). Study on the wound activity potential on the aqueous extract of the bark of *Myrica esculenta* Buch. &Ham. International Journal of Pharmaceutical and Clinical Research. 1(2): 85–87.

Nayak BK, Deka P and Eloziia N. (2017). Assessment of phytochemical & pharmacological activities of the ethanol leaves extracts of *Myrica esculenta* Buch. Ham. Journal of Pharmaceutical Research. 11: 444–449.

Patel KG, Bhalodia PN, Patel AD, Patel KV and Gandhi TR. (2008). Evaluation of bronchodilator and antianphylactic activity of Myrica sapida. Iranian Biomedicinal Journal.12 (3):191–196.

Patel T, Dudhpejiya A and Sheath N. (2011). Anti-inflammatory activity of *Myrica nagi* Linn. Bark. Ancient Science of Life. (2011).30(4):100–103.

Rawat S, Jugran A, Giri L, Bhatt ID and Rawal RS. (2011). Assessment of Antioxidant Properties in Fruits of *Myrica esculenta*: A popular wild edible species in Indian Himalayan Region. Evidence-Based complementary and alternative medicine. 2011: 8-8.

Rawat S, Kumar N and Kothiyal P. (2013). Evaluate the antidiabetic activity of *Myrica esculenta* leaves in streptozotocin induced diabetes in rat. International Journal of University and Pharmaceutical Biological Sciences. 2: 510–525.

Samant SS and Dhar U. (2009). Diversity, endemism and economic potential of wild edibles plants of Indian Himalaya. International Journal of Sustainable Development and World Ecology. 4(3):179–191.

Seal T. (2011). Antioxidant activity of some wild edible fruits of Meghalaya State in India. Advances in Biological Research. 5(3): 155–160.

Semwal DK, Semwal, Combrinck S and Viljoen A. (2016). Myricetin: A Dietary Molecule with Diverse Biological Activities. Nutrients. 8(2):1-31.

Shrestha PM, Dhillion SS. (2003). Medicinal plant diversity and use in the highlands of Dolakha district. Nepal. Journal of Ethnopharmacology. 86:81–96.

Sood P and Shri R. (2017). A Review on Ethnomedicinal, Phytochemical and Pharmacological aspects of *Myrica esculenta*. Indian Journal of Pharmaceutical Sciences. 80(1):2-13.

Srivastava B, Sharma VC, Pant P, Pandey NK and Jadhav AD. (2016). Evaluation for substitution of stem bark with small branches of *Myrica esculenta* for medicinal use-A comparative phytochemical study. Journal of Ayurveda and Integrative Medicine. 7(4): 1–6.

Suryavanshi JS, Karande KM and Udugade BV. (2009). Antibacterial activity of bark and fruits of *Myrica nagi*. Indian Journal of Natural Products. 25(3): 21–23.

Swathi D and Prasad KVSRG. (2015). Antioxidant and antiulcer potential of ethanolic extract of bark of *Myrica esculenta* in pyloric ligation ulcer model. International Journal of Pharmacy and Pharmaceutical Sciences. 7 (10): 195–198.

Syed S, Ahmad M, Fatima N, Mahjabeen and Jahan N. (2013). Neuropharmacological studies of *Myrica nagi* bark. International Journal of Biology and Biotechnology. 10(4): 553–558.

Wei Y, Chang-ming T, Xian L, Ya Z, Li W and Liang L. (2011). Study on the chemical constituents of *Myrica esculenta*. Journal of Yunnan University (Nat Sci). 33:453-457.

Medicinal Uses of Ginger and its Cultivation in North-East India

Bandaphira Lyngdoh Nongbri, Mamoni Teronpi and Vedant Vikrom Borah*
Department of Bio-Sciences, School of Life Sciences, Assam, Don Bosco University, Sonapur, Assam, India
*Email-Id: vedantvborah@gmail.com
DOI: 10.5281/zenodo.6506823

ABSTRACT

Ginger is a medicinal plant whose rhizome can be used for a variety of purposes. Even though ginger is grown throughout the country, North-East India produces most of the country's ginger. Because of its therapeutic properties, North-East India is a significant producer of ginger. The local varieties are unique to the region and a storehouse of novel phytochemicals. Ginger is used for treating various ailments ranging from nausea to digestive problems to menstrual disorders. This chapter concentrates on the use of ginger among the North-Eastern population and its importance as an antibiotic with pro nutritional value. Its cultivation and how it adds to total national production are discussed.

Keywords: Rhizome; Therapeutic properties; Ginger cultivation; North-East India

INTRODUCTION

Ginger, a monocotyledonous flowering plant, is native to Southeast Asia (Kikuzaki 1998). It is one of the world's healthiest and most delicious spices. It is a member of the Family Zingiberaceae, which comprises turmeric, cardamom, and galangal (Ivanovic et al. 2021). The underground stem, known as the rhizome, is a part of the plant established as a spice. It is also known as ginger root or ginger. Fresh, roasted, powdered, or as an oil or juice. Various uses of ginger include as an ingredient in cooking, cosmetics, and processed foods (Vernin and Parkanyi 2005; Kumar et al. 2013). Ginger contains carbohydrates, lipids, water, fibers, proteins, and minerals (Latona et al. 2012; Nutakor et al. 2020). Active compounds make up for the pungencies. These include volatile oil, shogoals, diarylheptanoids, gingerols, paradol, zerumbone, 1-dehydrogingerdione, terpenoids, and ginger flavonoids (Riaz et al. 2015; Yusof 2016). It includes three compounds that make it a spice: zingerone, gingerol, and shogaol (Jesudoss et al. 2017). Zingerone and shogaol come from gingerol, a phenol present in raw, uncooked ginger. Dried ginger is spicier than fresh ginger due to its heat level. With dried ginger, the heat level doubles, while old ginger is spicier than the young ones (Bag 2018). Depending on the variety, the flesh of the rhizome may be black, white, or red. Harvesting mature or young ginger impacts the thickness of the ginger skin (Bhatt et al. 2013). There are different varieties of ginger- *Zingiber officinale Roscoe*, *Z. zerumbet*, *Z. montanum*, *Z. americanus*, *Z. argenteum*, *Z. spectabile*, *Curcuma amada* (Mango ginger), *Alpinia purputa* (Red ginger), *Hedychium flavescens* (Yellow ginger), *Z. aromaticum Val*, *Z. rubens* (Bengal ginger). Ginger plants, 3-4 feet tall, are tropical and subtropical, herbaceous, perennial plants with sympodial branching. They like soil that is both fertile and damp and acidic. The leaf blades are long and thin, ranging from 15 to 30cm in length. They emerge differently from the sheaths that cover the thick stems. Flowers are in clusters, spiral and cone-like, and grow 4-5 feet in diameter, blooming in July-August. Ginger is grown in Karnataka, Orissa, Assam, Meghalaya, Arunachal Pradesh, and Gujarat, among other states in India.

GINGER AND ITS CULTIVATION IN NORTHEAST INDIA

Northeast India is a ginger-growing area; states like Meghalaya, Arunachal Pradesh, Mizoram, and Sikkim are the leading ginger-producing states (Yadav et al. 2004; Vijayan et al. 2020). Northeast India, with its diverse ethnic population and traditional knowledge, is an important repository of rich flora. Since the accessible Zingiberous plant species in NE India have medical potential, the *Zingiberaceae* family is medicinal. This region could be the treasure house of ginger germplasm (Yadav et al. 2004). Ginger is a cash crop in Meghalaya, and it plays an essential role in the farmer's economy. In the North-eastern region, Meghalaya is the second-largest ginger producer, and the Ri-Bhoi district is the third-largest producer of ginger (Yadav et al. 2004). Other than that, ginger-producing districts are East Garo Hills, West Garo Hills, East Khasi Hills, South-West Khasi Hills, and West Jaintia Hills. Varieties such as Nadia, Khasi local, Sying met, Syingmakhir, Ing bah, Syingshmoh, Moran, and Rio de Janeiro are grown here (Kharjana et al. 2017). These varieties produce more rhizomes with high fiber content. Several cultivated types of ginger are named after the places they are grown. Moran and Jorhat local types are two indigenous Assamese ginger varieties that produce an equal number of rhizomes (Hazarika and Kakoti 2013). Dry ginger recovery of these varieties is much better than exotic Rio-de-Janeiro. Basar Local is very popular in Arunachal Pradesh because of its high yield and adaptability to the local environment (Yadav et al. 2004; Rymbai et al. 2018). *Hedychium mechukanum* and *Amomum arunachalense*, both found in Arunachal Pradesh, are two new ginger species discovered in Northeast India (The Hindu, 2020). Thingpui and Thinglaidon local types are grown in Mizoram (Yadav et al. 2004). Black ginger rhizomes with a bluish-black tinge have therapeutic properties and they are cultivated for that purpose by Mizoram inhabitants (Yadav et al. 2004; Rahman et al. 2009; Jha et al. 2017). It is also sold at a very high price, owing to its medicinal value. Manipur prefers Thingpui in the hills. The tribals in Nagaland usually grow a variety having high pungency but are smaller in size. In Nagaland, there is another kind of ginger with a pinkish tinge within the rhizome (Rahman et al. 2009). Because of their high yield and large rhizomes, the local varieties 'Bhainse' and 'Gorubathan' are grown commercially in Sikkim. Because of its low fiber content, the cultivar Nadia is popular in Meghalaya and the Northeastern region (Yadav et al. 2004). Among the members of the Zingiberaceae family, Arunachal Pradesh is florally rich among the states of the Northeast (88%). *Zingiber officinale* Rosc. and *Curcuma longa* L. plants are found in all seven sister states that have a wide geographic range (Tushar et al. 2010). Ginger grows best in a wet, humid climate with well-drained soil such as sandy or clay loam, red loam, or laterite loam. In the Northeast, ginger is grown as a rainfed crop, but it is also grown in other regions of the world as a rainfed and irrigated crop. Since it is an exhausting crop by nature, it is not cultivated in the same field year after year (Vijayan et al. 2020). The prevalence of jhum cultivation in large parts of the NE region's agriculture is one of the region's most significant features. Ginger is grown on raised beds (called bun) in the jhum fields in the region's hills. Under this, large tracts of hills are demarcated, and the forest is cleared by burning. Thus, the land available is then cultivated. Along the slope, buns about one-meter width once built and filled with farm waste, dried leaves, and other materials that are burnt before the sowing of seed rhizomes. Land burning reduces weed growth and soft rot disease while also increasing the supply of some plant nutrients. After 3-4 years, this jhum land is abandoned, and a new piece of land is cleared in the same way. This has been a tradition in the region for centuries and the lifestyle of several tribes is associated with this cultivation (Yadav et al. 2004). But, when the population was lower, there was less strain on the forest. As a result, the land had ample time to recuperate after abandonment (10-15 years). With the population increase, the demand for land has increased, and the cycle has shortened (3-5 years). After harvest, the seed rhizomes are stored in the pit

under soil cover in the field. When the rhizomes sprout in March-April, they are removed and planted in the field. Earthing up, and ridge and furrow planting systems are seen in ginger fields in Assam and Tripura (Yadav et al. 2004).

MEDICINAL PROPERTIES OF GINGER

Ginger has therapeutic properties such as antimicrobial (Karuppiah and Rajaram 2012; Teles et al. 2019), anti-parasitic (El-Sayed and El-Saka, 2015; Phan et al. 2021), antioxidant, anti-inflammatory (Bode and Dong 2011; Mashhadi et al. 2013), analgesic (Wilson 2015), anticancer (Park et al. 2014; Akimoto et al. 2015; Pal et al. 2016), hepatoprotective (Huang 2019), cardiovascular system impact (Nicoll and Henein 2009), and gastrointestinal relief (Nutakor et al. 2020). Ginger is one of the first recognized spices for its pungency and scent. Indian Ayurvedic and Chinese medicine have used ginger since ancient times due to its beneficial qualities. Chinese medicine uses it for quick transportation of body fluids. This accelerates blood supply in the entire body. It has a stimulatory effect on the heart muscles and a strong capacity to dilute the blood (Bag 2018). Furthermore, in Chinese medicine, ginger leaves have been used to flavor food since ancient times (Shahrajabian et al. 2019). The Chinese use ginger to warm the body and treat intense colds. Furthermore, it stimulates a weak and slow heartbeat, treats light skin, and protects the body after blood loss (Sugimoto et al. 2018). Ginger relieves fatigue, cold-induced disease, colic, asthma, cough, heart palpitation, swellings, dyspepsia, lack of appetite, and rheumatism (Sugimoto et al. 2018; Shahrajabian et al. 2019). Ginger may be eaten fresh or dry and used in teas, soft drinks, and bread (White 2007). Ginger is used in making oil, paste, spice, tea, syrup, bread, and wine, among other things (Bag 2018). Beer is a popular beverage in many countries, due to its flavor and aroma. Ginger beer has organoleptic and physicochemical properties with a longer expiry date. Antioxidants from plant material added to beer, help lower the oxidative and damaging effects of alcohol on the human body (Zheplinska et al. 2019). Essential oils are extracted from various plant sections, including *Curcuma angustifolia* Roxb., *Curcuma caesia* Roxb., which had antifungal activity (Borah et al. 2019), *Alpinia malaccensis* Rosc., *Costus spiralis* Rosc., and *Zingiber cassumunar* Roxb., which have antimicrobial and antioxidant properties (Habsah et al. 2000; Sahoo et al. 2014). Essential oils are a significant source of scent besides offering the intended medical function. The practitioner employed plants alone or with other plant species to treat human ailments. Eighty-four percent of herbal preparations use a single plant as a therapy for an ailment, while sixteen percent use a mixture of plants. The remedies that need a single plant may be useful to produce new medicines. This is because identifying therapeutically active components from a single plant may be easier (Ekor 2014). *Costus speciosus* and *Elettaria cardamomum* Maton were the most successful against a range of diseases. Rhizome powder from plants, such as *Amomum subulatum* Roxb., *Curcuma aromatica* Salisb., *Elettaria cardamomum*, and *Hedychium spicatum* Sm. is used to treat snake and insect bites. The rhizome is most often used in medicine as a whole or as a paste (Tushar et al. 2010b; Kumar et al. 2013). In certain cases, a combination of herbs and, sometimes molasses, is used to prepare the medicine (Bode and Dong 2011; Mashhadi et al. 2013). Other plants, such as *Alpinia galanga* L. and *Euphorbia neriifolia* L., combined with Zingiberaceae members are used to treat skin allergies (Anand et al. 2022). *Curcuma caesia* with *Andrographis paniculata* are anti-asthmatic and anti-inflammatory herbs used to treat insects and snakebites (Tushar et al. 2010a). *Globbaclarkei* Baker along with *Adhatodavasica* for treating cough, *Zingiber officinale* along with *Nigella sativa* L. as an anti-inflammatory, and *Zingiber montanum* along with *Kaempferia galanga* L. (Khasi- syingshmoh, Assamese- chandramula) and *Zingiber officinale* for treating diarrhea, headache, menstrual pain, and is also effective for dandruff or scabs on the head (Rahnama et al. 2012; Shahzad et al. 2017; DeFilipps

and Krupnick 2018). It is important to note that most of the plants found in all sister states of the North-East area served the same purpose and resembled those found in other parts of India. There have even been examples when a certain ethnic community in one location utilized a specific plant species to cure a specific condition, while a different ethnic community in another area used the same plant species to treat a completely different ailment. For example, the Khampit community in Arunachal Pradesh uses *Alpinia galanga* as an anti-inflammatory agent while the Barak valley ethnic community in Assam uses the same species as an abortifacient (Tushar et al. 2010). The use of *Amomum sulbatum* species as an analgesic and antiseptic was recorded earlier but its use against rheumatic joints is new (Bisht et al. 2011). The communities of Borok, crush fried rhizomes and apply them to relieve joint pain (Tushar et al. 2010). The use of *A. linguiforme* against diabetes is recorded and is also used against high blood pressure by the Nyishi community of Arunachal Pradesh (Tushar et al. 2010). The property of *Costus variagata* L. has been known for generations and is used in the treatment of piles (Tushar et al. 2010). The crushed rhizome of *Alpinia bracteate* Rosc. is used to treat abnormal menstruation (Ye et al. 2021). The action of *Zingiber purpureum* Rosc. , which is used to treat paralysis, is defined as a neural or muscular stimulant (Tushar et al. 2010).

GINGER AS AN ALTERNATIVE TO ANTIBIOTICS IN ANIMALS

Growth promoters or feed additives are molecules that are added at a low rate to animal feeds without changing their composition (Mohammed and Yusuf 2011). They hasten animal growth and, as a result, increase the size and weight of the animals. Antibiotics are the most used growth promoters, but their use is declining and could be phased out. Growth promoters are categorized as pronutrients since they improve the physiology and microbiology of animals. Pronutrients are micro-ingredients utilized in animal feed formulations that have physiological and microbiological effects that are unique from those of other nutrients. They are micro-ingredients included in the composition of animal feeds unique from any other nutrients and they are classed as chemicals that may have the same impact as antibiotic feed additives. Many plants' active ingredients are pro nutrients and they have recently been tested in animal feeds. Pronutrients are also sometimes referred to as phytogenic feed additives (Mohammed and Yusuf 2011). Phytogenic feed additives are plant-derived materials that are fed to animals to help them perform better. This type of feed additive has recently received a lot of attention, particularly in the swine and poultry industries (Windisch et al. 2008). This seems to be motivated by the European Union's 2006 ban on the use of most antibiotic feed additives (Anadon 2006). Antimicrobials have been used in the poultry industry for growth promotion, disease prevention, and treatment of infections for many years (Mohammed and Yusuf 2011). But there is evidence that antibiotic-resistant bacteria transmit from animals to humans (Kuehn 2007). This situation has placed a lot of pressure on the poultry industry to stop using antibiotics in animal feeds or reduce their use and find viable alternatives. Because of the current understanding of the risks of drug-resistant microbes resulting from the use of antibiotics as feed additives and the current ban on antibiotic use in some countries, finding suitable substitutes in animal feeds, particularly with phytogenics would be critical. Furthermore, since the emergence of contemporary organic agriculture, the use of inorganic feed additives in animal feeds has been discouraged. The broad range of active ingredients in, *Zingiber officinale* can function as a pro-nutrient. It contains volatile oils such as borneol, camphene, citral, eucalyptol, linalool, phellandrene, zingiberene, zingiberol (gingerol, zingerone, and shogaol), and resin. The compounds that give ginger its flavor, the most noteworthy of which are gingerol and shogaol, contain some of its therapeutic benefits (Semwal et al. 2015). Ginger includes a protein-digesting enzyme called Zingibain, which assists in digestion and kills parasites and their eggs (Mohammed and Yusuf 2011). It also has antibacterial and

anti-inflammatory properties, and helps other antibacterials, such as antibiotics, by up to 50% (Mohammed and Yusuf 2011). The goal is to maintain a low mortality rate, and a good level of animal yield while preserving the environment and consumer health (Abd El-Hack et al., 2020). There are some benefits to ginger and its derivatives in poultry nutrition. These include the inhibition of pathogenic microorganisms in the intestine. Broiler chickens gain more weight because of improved digestion and stimulation of digestive enzymes. Improved hepatic enzymes, antioxidant enzymes, lipid, and protein profiles in the blood and serum. Increased number of times you reproduce and the size of reproductive organ muscles. Increased egg-laying rate, egg weight, mass, laying performance, and egg yolk antioxidant. Ginger extract as a feed supplement promotes the production of low cholesterol eggs. Consumers and customers prefer low-cholesterol eggs to maintain heart health. In broilers, improve carcass characteristics and reduce belly fat (Abd El-Hack et al., 2020).

CONCLUSION

As a medicinal spice, ginger and its related varieties have shown promise. It is one of the most valuable crops grown in North-East India. As a result, the cultivators' livelihoods improve. Surprisingly, this spice may be grown organically in kitchen gardens. The cultivable crop area is expanding over time and ensures that ginger is available for the local population. For small farmers, it is a significant source of income and employment. With more people becoming aware of Ayurveda and the nutritional needs of animals, ginger production should skyrocket in the near future. Its oils and phytochemicals, as well as the variation among local varieties, should pique the interest of young researchers looking to develop cultivation methods, extraction, and herbal technology, as well as developing newer packaging and preservation methods, and perhaps even offering solutions to threats like antibiotic resistance and chronic infections using in silico applications.

REFERENCES

Abd El-Hack, M. E., El-Saadony, M. T., Shafi, M. E., Qattan, S. Y. A., Batiha, G. E., Khafaga, A. F., Abdel-Moneim, A. M. E., & Alagawany, M. (2020). Probiotics in poultry feed: A comprehensive review. *Journal of Animal Physiology and Animal Nutrition, 104*(6), 1835–1850. https://doi.org/10.1111/jpn.13454

Akimoto, M., Iizuka, M., Kanematsu, R., Yoshida, M., & Takenaga, K. (2015). Anticancer Effect of Ginger Extract against Pancreatic Cancer Cells Mainly through Reactive Oxygen Species-Mediated Autotic Cell Death. *PLOS ONE, 10*(5), e0126605. https://doi.org/10.1371/journal.pone.0126605

Anadon, A. (2006). The EU ban of antibiotics as feed additives (2006): alternatives and consumer safety. *Journal of Veterinary Pharmacology and Therapeutics, 29*(s1), 41–44. https://doi.org/10.1111/J.1365-2885.2006.00775_2.X

Anand, U., Tudu, C. K., Nandy, S., Sunita, K., Tripathi, V., Loake, G. J., Dey, A., & Proćków, J. (2022). Ethnodermatological use of medicinal plants in India: From ayurvedic formulations to clinical perspectives – A review. *Journal of Ethnopharmacology, 284*, 114744, 1-28. https://doi.org/10.1016/j.jep.2021.114744

Bag, B. B. (2018). Ginger Processing in India (*Zingiber officinale*): A Review. *International Journal of Current Microbiology and Applied Sciences, 7*(4), 1639–1651. https://doi.org/10.20546/ijcmas.2018.704.185

Bhatt, N., Waly, M. I., Musthafa, M. E., & Ali, A. (2013). Ginger: A functional herb. In: Food as Medicine. Nova Science Publishers, Inc., pp. 51–71.

Bisht, V. K., Negi, J. S., Bhandari, A. K., & Sundriyal, R. C. (2011). *Amomum subulatum* Roxb: Traditional, phytochemical and biological activities-An overview. *African Journal of Agricultural Research, 6*(24), 5386–5390. https://doi.org/10.5897/AJAR11.745

Bode, A. M., & Dong, Z. (2011). The Amazing and Mighty Ginger. In: Benzie IFF & Wachtel-Galor S, editors. Herbal Medicine: Biomolecular and Clinical Aspects: Second Edition, Boca Raton (FL): CRC Press/Taylor & Francis, p. 131–156.

Borah, A., Paw, M., Gogoi, R., Loying, R., Sarma, N., Munda, S., Kumar Pandey, S., & Lal, M. (2019). Chemical composition, antioxidant, anti-inflammatory, anti-microbial and in-vitro cytotoxic efficacy of essential oil

of *Curcuma caesia* Roxb. leaves: An endangered medicinal plant of North East India. *Industrial Crops and Products, 129*, 448–454. https://doi.org/10.1016/j.indcrop.2018.12.035

DeFilipps, R. A., & Krupnick, G. A. (2018). The medicinal plants of Myanmar. *PhytoKeys, 102*(102), 1-341. https://doi.org/10.3897/phytokeys.102.24380

Ekor, M. (2014). The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. *Frontiers in Pharmacology, 4*(177), 1-10. https://doi.org/10.3389/FPHAR.2013.00177

El-Sayed, N. M., & El-Saka, M. M. (2015). Anti-Parasitic Activity of *Zingiber officinale* (Ginger): A Brief Review. *Aperito Journal of Bacteriology, Virology and Parasitology, 2*(112), 1-7. https://doi.org/10.14437/2378-7864-2-112

Habsah, M., Amran, M., Mackeen, M. M., Lajis, N. H., Kikuzaki, H., Nakatani, N., Rahman, A. A., Ghafar, & Ali, A. M. (2000). Screening of Zingiberaceae extracts for antimicrobial and antioxidant activities. *Journal of Ethnopharmacology, 72*(3), 403–410. https://doi.org/10.1016/S0378-8741(00)00223-3

Hazarika, D. J., & Kakoti, M. (2013). Study on the Indigenous Varieties of Ginger of Golaghat District (Assam), and its Economic Viability as Aroma Ingredients. *Journal of Natural Product and Plant Resources, 3*(1), 24–29.

Huang, Y. S. (2019). The hepatoprotective effect of ginger. *Journal of the Chinese Medical Association, 82*(11), 805–806. https://doi.org/10.1097/jcma.0000000000000174

Ivanović, M., Makoter, K., &Razboršek, M. I. (2021). Comparative Study of Chemical Composition and Antioxidant Activity of Essential Oils and Crude Extracts of Four Characteristic Zingiberaceae Herbs. *Plants, 10*(3), 501, 1-18. https://doi.org/10.3390/plants10030501

Jesudoss, V. A. S., Santiago, S. V. A., Venkatachalam, K., & Subramanian, P. (2017). Zingerone (Ginger Extract): Antioxidant Potential for Efficacy in Gastrointestinal and Liver Disease. In: J Gracia-Sancho & J Salvadó, Editors. Gastrointestinal Tissue: Oxidative Stress and Dietary Antioxidants, Academic Press; p. 289–297. https://doi.org/10.1016/B978-0-12-805377-5.00021-7

Jha, A. K., Verma, V. K., Deshmukh, N. A., Rymbai, H., Assumi, S. R., Devi, M. B., &Talang, H. D. (2017). Spices for Income Enhancement in NE Region: Needs and Focus. In *Entrepreneurship and Skill Development on Market Driven Production and Processing of High Value Crops of NEH Region*. ICAR Research Complex for NEH Region.

Karuppiah, P., & Rajaram, S. (2012). Antibacterial effect of *Allium sativum* cloves and *Zingiber officinale* rhizomes against multiple-drug resistant clinical pathogens. *Asian Pacific Journal of Tropical Biomedicine, 2*(8), 597-601. https://doi.org/10.1016/S2221-1691(12)60104-X

Kharjana, N. V, Bordoloi, N., & Sharma, S. (2017). A study on the extent of adoption of improved ginger cultivation practices by the farmers in Ri-Bhoi district of Meghalaya. *International Journal of Agricultural Science and Research (IJASR) , 7*(4):383–390.

Kikuzaki, H. (1998). Ginger for drug and spice purposes. In: Mazza, G & Oomah BD, Editors. Herbs, Botanicals and Teas. First edition. CRC Press, p. 75–99.

Kuehn, B. M. (2007). Antibiotic-Resistant "Superbugs" may be transmitted from animals to humans. *JAMA, 298*(18), 2125–2126. https://doi.org/10.1001/JAMA.298.18.2125

Kumar, K. M., Asish, G., Sabu, M., & Balachandran, I. (2013). Significance of gingers (Zingiberaceae) in Indian System of Medicine - Ayurveda: An overview. *Ancient Science of Life, 32*(4), 253-261. https://doi.org/10.4103/0257-7941.131989

Kumar, S. R., Ray, R. C., & Kumar Paul, P. (2013). Development and Storage Studies of Therapeutic Ready to Serve (RTS) Made from Blend of Aloe vera, Aonla and Ginger Juice. *Journal of Food Processing and Technology, 4*, 1-5. https://doi.org/10.4172/2157-7110.1000232

Latona, D. F., Oyeleke, G. O., &Olayiwola, O. A. (2012). Chemical Analysis of Ginger Root. *IOSR Journal of Applied Chemistry, 1*(1), 47–49. https://doi.org/10.9790/5736-0114749

Mashhadi, N. S., Ghiasvand, R., Askari, G., Hariri, M., Darvishi, L., &Mofid, M. R. (2013). Anti-Oxidative and Anti-Inflammatory Effects of Ginger in Health and Physical Activity: Review of Current Evidence. *International Journal of Preventive Medicine, Supplement 1*, S36-42.

Mohammed, A. A., & Yusuf, M. (2011). Evaluation of ginger (*Zingiber officinale*) as a feed additive in broiler diets. *Livestock Research for Rural Development, 23*(9), 202.

Nicoll, R., & Henein, M. Y. (2009). Ginger (*Zingiber officinale* Roscoe): a hot remedy for cardiovascular disease? *International Journal of Cardiology, 131*(3), 408–409. https://doi.org/10.1016/j.ijcard.2007.07.107

Nutakor, C., Essiedu, J. A., Adadi, P., &Kanwugu, O. N. (2020). Ginger Beer: An Overview of Health Benefits and Recent Developments. *Fermentation, 6*(4), 102. https://doi.org/10.3390/fermentation6040102

Pal Kaur, I., Kaur Deol, P., Kiran Kondepudi, K., & Bishnoi, M. (2016). Anticancer Potential of Ginger: Mechanistic and Pharmaceutical Aspects. *Current Pharmaceutical Design*, *22*(27), 4160–4172. https://doi.org/10.2174/1381612822666160608115350

Park, G. H., Park, J. H., Song, H. M., Eo, H. J., Kim, M. K., Lee, J. W., Lee, M. H., Cho, K.H., Lee, J. R., Cho, H. J., & Jeong, J. B. (2014). Anti-cancer activity of Ginger (*Zingiber officinale*) leaf through the expression of activating transcription factor 3 in human colorectal cancer cells. *BMC Complementary Medicine and Therapies, 14*(408), 1-8. https://doi.org/10.1186/1472-6882-14-408

Phan VAN, Q., Harmansa YILMAZ, B., &Yavuzcan YILDIZ, H. (2021). *In vitro* Antiparasitic Activity of Ginger (*Zingiber officinale*) Bulb and Pomegranate (*Punica granatum*) Peel Against Monogenean Fish Parasite., *Dactylogyrus*sp. *Acta Aquatica Turcica*, *17*(1), 56–63. https://doi.org/10.22392/actaquatr.751913

Rahman, H., Karuppaiyan, R., Kishore, K., &Denzongpa, & R. (2009). Traditional practices of ginger cultivation in Northeast India. *Indian Journal of Traditional Knowledge*, *8*(1), 23–28.

Rahnama, P., Montazeri, A., Huseini, H. F., Kianbakht, S., &Naseri, M. (2012). Effect of *Zingiber officinale* R. rhizomes (ginger) on pain relief in primary dysmenorrhea: a placebo randomized trial. *BMC Complementary and Alternative Medicine*, *12*, 92. https://doi.org/10.1186/1472-6882-12-92

Riaz, H., Begum, A., Raza, S. A., Mohy-Ud-Din Khan, Z., Yousaf, H., & Tariq, A. (2015). Antimicrobial property and phytochemical study of ginger found in the local area of Punjab, Pakistan. *International Current Pharmaceutical Journal, 4*(7), 405-409. https://doi.org/10.3329/icpj.v4i7.23591

Rymbai, H., Jha, A. K., Talang, H. D., Deshmukh, N. A., Verma, V. K., Baiswar, P., Firake, D. M., Laha, R., Sinha, P. K., Devi, M. B., Deka, B. C., & Prakash, N. (2018). Organic Ginger Cultivation in North Eastern Region. Published by Director, ICAR Research Complex for NEH Region, Umiam-793103, Meghalaya. pp. 35.

Sahoo, S., Singh, S., & Nayak, S. (2014). Chemical Composition, Antioxidant And Antimicrobial Activity Of Essential Oil And Extract Of *Alpinia Malaccensis* Roscoe (Zingiberaceae). *International Journal of Pharmacy and Pharmaceutical Sciences*, *6*(7), 183–188.

Semwal, R. B., Semwal, D. K., Combrinck, S., & Viljoen, A. M. (2015). Gingerols and shogaols: Important nutraceutical principles from ginger. *Phytochemistry*, *117*, 554–568. https://doi.org/10.1016/j.phytochem.2015.07.012

Shahrajabian, M. H., Sun, W., & Cheng, Q. (2019). Clinical aspects and health benefits of ginger (*Zingiber officinale*) in both traditional Chinese medicine and modern industry, *69*(6), 546–556. https://doi.org/10.1080/09064710.2019.1606930

Shahzad Aslam, M., & Syarhabil Ahmad, M. (2017). Ethnobotanical Uses of *Globba* Species: A brief review. *BAOJ Pharmaceutical Sciences*, *3*(2), 35.

Sugimoto, K., Takeuchi, H., Nakagawa, K., & Matsuoka, Y. (2018). Hyperthermic Effect of Ginger (*Zingiber officinale*) Extract-Containing Beverage on Peripheral Skin Surface Temperature in Women. *Evidence-Based Complementary and Alternative Medicine*, *2018*(2018), 1-8. https://doi.org/10.1155/2018/3207623

Teles, A. M., Araújo, B., Santos, C. G., Ferreira, N., Mouchreck, K., Da, S., Calabrese, A., Lucia, A.-S., & Almeida-Souza, F. (2019). Ginger (*Zingiber officinale*) Antimicrobial Potential: A Review. In: Wang H, Editor. *Ginger Cultivation and Its Antimicrobial and Pharmacological Potentials*, IntechOpen, p. 1-13. https://doi.org/10.5772/intechopen.89780

The Hindu. (2020) Two new species of ginger found from northeast. Available from: https://www.thehindu.com/news/national/kerala/two-new-species-of-ginger-found-from-northeast/article33443098.ece [Accessed on 12 October, 2021]

Tushar, Basak, S., Sarma, G. C., &Rangan, L. (2010). Ethnomedical uses of Zingiberaceous plants of Northeast India. *Journal of Ethnopharmacology*, *132*(1), 286–296. https://doi.org/10.1016/j.jep.2010.08.032

Vernin, G., &Parkanyi, C. (2005). Chemistry of Ginger. In: Ravindran PN & Babu KN, Editors, *Ginger: The Genus Zingiber*, First edition, CRC Press, pp. 87–180.

Vijayan, A. K., Gudade, B. A., Gautam, A., Deka, T. N., Bora, S. S., Dhanapal, K., &Remashree, A. B. (2020). Cultivation of Ginger in Sikkim under an Organic System. In: Wang H, Editor. *Ginger Cultivation and Its Antimicrobial and Pharmacological Potentials*, IntechOpen, pp. 1-11. https://doi.org/10.5772/intechopen.87049

White, B. (2007). Ginger: An Overview. *American Family Physician*, *75*(11), 1689–1691.

Wilson, P. B. (2015). Ginger (*Zingiber officinale*) as an analgesic and ergogenic aid in sport: A systemic review. *Journal of Strength and Conditioning Research*, *29*(10), 2980–2995. https://doi.org/10.1519/JSC.0000000000001098

Windisch, W., Schedle, K., Plitzner, C., &Kroismayr, A. (2008). Use of phytogenic products as feed additives for swine and poultry. *Journal of Animal Science*, *86*(14), E140–E148. https://doi.org/10.2527/JAS.2007-0459

Yadav, R. K., Yadav, D. S., Rai, N., Sanwal, S. K., &Sarma, P. (2004). Commercial Prospects Of Ginger Cultivation In North-Eastern Region. *ENVIS Bulletin*, *12*(2), 1-5.

Ye, H., Li, C., Ye, W., Zeng, F., Liu, F., Liu, Y., Wang, F., Ye, Y., Fu, L., & Li, J. (2021). Medicinal Angiosperms of Zingiberaceae, Cannaceae, and Marantaceae. In: Ye, H., Li, C., Ye, W., Zeng, F. (eds), *Common Chinese Materia Medica*, Springer, Singapore, pp. 67–208. https://doi.org/10.1007/978-981-16-5920-1_2

Yusof, Y. A. M. (2016). Gingerol and its role in chronic diseases. *Advances in Experimental Medicine and Biology, 929*, 177–207. https://doi.org/10.1007/978-3-319-41342-6_8

Zheplinska, M., Mushtruk, M., Vasyliv, V., &Deviatko, O. (2019). Investigation of the process of production of crafted beer with spicy and aromatic raw materials. *Potravinarstvo Slovak Journal of Food Sciences*, *13*(1), 806–814. https://doi.org/10.5219/1183

Tribal Medicine of India: Natural Remedies for Good Health

Ashish Kumar[1*] and Jnanesha AC[2]
[1]Crop Production & Protection and publication division, CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, India
[2]CSIR-Central Institute of Medicinal and Aromatic Plants, Research Centre, Boduppal, Hyderabad-500092, Telangana, India
*Email-id: devashish121@gmail.com
DOI: 10.5281/zenodo.6615686

ABSTRACT

This chapter elucidates the use of some medicinal plants by tribes. They have a wealth of knowledge regarding using numerous plants or plant components as medicine. According to the World Health Organization (WHO), as much as 80% of the world's population now relies on traditional medicine for their primary healthcare requirements. The tribal people found the therapeutic properties and medical efficacy of wild herbs and treated various ailments, discomforts, and diseases. Herbal medicine has been declining in popularity recently, which could mean that valuable information on medicinal plants is being lost. This chapter encompasses some important plants used as a medicine in tribal areas of India viz., Dioscorea bulbifera (Aerial Yam), Saraca asoca (Ashoka), Achyranthes aspera (Chaff-flower), Cissus quadrangularis (Devil's backbone), Butea monosperma (Flame of the Forest), Tinospora cordifolia (Giloy or Guduchi or Amrita), Abrus precatorius (Indian liquorice), Centella asiatica (Indian pennywort), Solanum Indicum (Indian Solanum), Hemidesmus indicus (Indian Sarsaparilla), Andrographis paniculata (Kalmegh), Boerhavia diffusa (Punarnava) and Mucuna pruriens (Velvet bean) and their bioactive compounds and therapeutic value.

Keywords: Tribal medicine, Medicinal plants, bioactive compounds, Curative properties

INTRODUCTION

Traditional medicine is "the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, used in maintaining health and preventing, diagnosing, improving or treating physical and mental illness" (World Health Organization http://www.who.int/topics/traditional_medicine/en/). There are many different traditional medicine systems, and the environment of the prevailing condition influences the philosophy and practices of each geographic area within which it first evolved (WHO 2005). However, a common philosophy is a holistic approach to life, equilibrium of the mind, body, and the environment, emphasizing health rather than disease. Generally, the focus is on the individual's overall condition rather than on the particular ailment or illness the patient suffers. The use of herbs is a core part of all traditional medicine systems (Rajeswara 2015).

Over the past 100 years, the development and mass production of chemically synthesized drugs have revolutionized health care in most parts of the world. However, large sections of the population in developing countries still rely on traditional practitioners and herbal medicines for their primary care (Kumar and Jnanaesha 2017b). In Africa, up to 90% and in India, 70% of the population depend on traditional medicine to help meet their health care needs. Traditional medicine accounts for around 40% of all health care delivered, and more than 90% of general hospitals in China have units for traditional medicine (WHO 2005). However, the use of traditional medicine is not limited to

developing countries. During the past two decades, public interest in natural therapies has significantly increased in industrialized countries, with expanding use of ethnobotanicals (Rajeswara 2015).

RESEARCH NEEDS ON HERBAL MEDICINE

Research needs in the field of herbal medicines are enormous but are balanced by the potential health benefits and the considerable size of the market. Research into the quality, safety, molecular effects, and clinical efficacy of the numerous herbs in common usage is needed. Newly emerging scientific techniques and approaches, many of which are mentioned in this book, provide the required testing platform. Genomic testing and chemical fingerprinting techniques using hyphenated testing platforms are now available for definitive authentication and quality control of herbal products. They should be regulated to safeguard consumers, but questions of efficacy will remain unless and until adequate amounts of scientific evidence are accumulated from experimental and controlled human trials (Giordano et al. 2005; Evans 2008; Tilburt and Kaptchuk 2008). Evidence for the potential protective effects of selected herbs is generally based on experiments demonstrating a biological activity in a relevant in vitro bioassay or experiments using animal models. In some cases, this is supported by both epidemiological studies and a limited number of intervention experiments in humans (WHO 2001). In general, international research on traditional herbal medicines should be subject to the same ethical requirements as all research related to human subjects, with the information shared between different countries. This should include collaborative partnership, social value, scientific validity, fair subject selection, favorable risk-benefit ratio, independent review, informed consent, and respect for the subjects (Giordano et al. 2005; Tiburt and Kaptchuk 2008). However, the logistics, time, and cost of performing extensive, controlled human studies on the clinical effectiveness of an herb are prohibitive, especially if the focus is on health promotion. Therefore, there is an urgent need to develop new biomarkers that more clearly relate to health (and disease) outcomes. Predictor biomarkers and subtle but detectable signs of early cellular change that are mapped to the onset of specific conditions are needed (Giordano et al. 2005).

Research is also needed to meet the challenges of identifying the active compounds in the plants, and there should be research-based evidence on whether whole herbs or extracted compounds are better. The issue of herb–herb and herb-drug interactions are also important and requires increased awareness and study, as polypharmacy and polyherbacy are common (Canter and Ernst 2004; Cohen and Ernst 2010; Loya et al. 2009; Qato et al. 2008). The use of new technologies, such as nanotechnology and novel emulsification methods, in the formulation of herbal products will likely affect bioavailability and the efficacy of herbal components, and this also needs study. Advances in rapid genetic sequencing, coupled with the manipulation of biosynthetic pathways, may provide a vast resource for the future discovery of pharmaceutical agents (Li and Vederas 2009).

MPs USED AS A TRIBAL MEDICINE

Humans have always relied on nature and its remedies to relieve themselves of bodily and mental discomforts. The primary source of all-natural drugs is traced to medicinal plants and a few microorganisms. From time immemorial, various traditional and folk forms of medicine have appreciated the medicinal plants for their miraculous therapeutic properties that have attracted the interest of modern medicine and industries. Upon extensive studies on the medicinal plants, it has been observed that the presence of low molecular weight compounds of wide structural diversity found in

almost all medicinal plants is responsible for the expression of medicinal properties. These compounds are termed as secondary metabolites, and these compounds are vital for the survival and protection of the plant. The combinations are secreted in small amounts compared to other compounds which are involved in the metabolic and physiological pathways. Still, their involvement in the protection aspect is of utmost importance (Jnanesha and Kumar 2019).

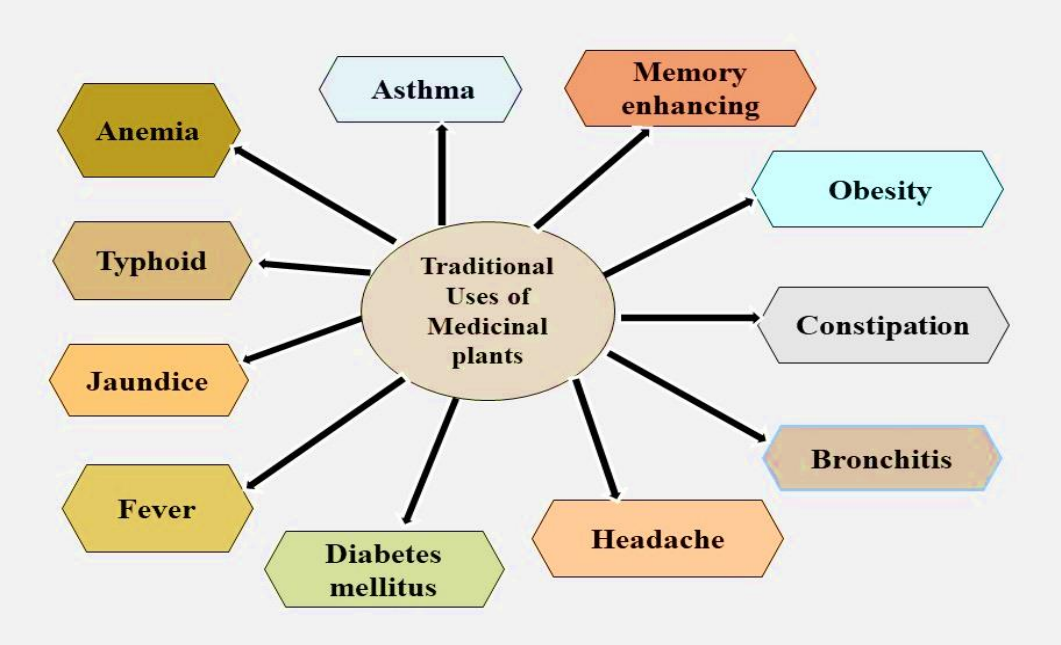

Figure 1: Traditional Uses of Medicinal Plants

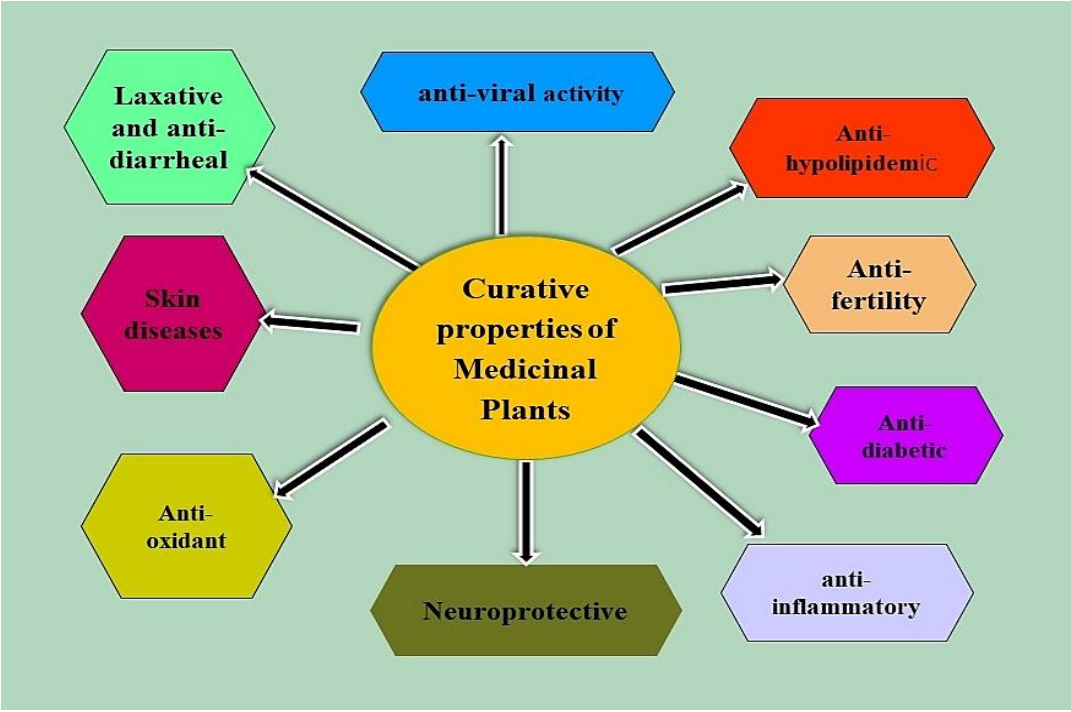

Figure 2: Curative properties of Medicinal Plants

These compounds are involved in many pathways like cellular signalling pathways, either directly or indirectly involved in processes like pollination, repelling insects, or harmful organisms. The names, families, and used parts of the traditional plants aresummarized in Table 1. Some important plants used as a medicine in tribal areas of India are *Dioscorea bulbifera* (Aerial Yam), *Saraca asoca* (Ashoka), *Achyranthes aspera* (Chaff-flower), *Cissus quadrangularis* (Devil's backbone), *Butea monosperma* (Flame of the Forest), *Tinospora cordifolia* (Giloy or Guduchi or Amrita), *Abrus precatorius* (Indian liquorice), *Centella asiatica* (Indian pennywort), *Solanum Indicum* (Indian Solanum), *Hemidesmus indicus* (Indian Sarsaparilla), *Andrographis paniculata* (Kalmegh), *Boerhavia diffusa* (Punarnava) and *Mucuna pruriens* (Velvet bean) are effective in tribal human health care (Figure 1-3).

Aerial Yam

The species develops very long vines and produces tubers underground, but the bulbils (aerial tubers) that grow at the base of its leaves are the more important food products. This yam is popular in household gardens mainly because it produces a crop after only 4 months of growth and continues producing for the life of the vine as long as 2 years. Moreover, the bulbils can be easily harvested for eating after boiling at any time. A subtropical or sub-temperate and humid climate with distinct two to three months of cold winters is ideal for the growth of the plant. Sandy loam soil is most suitable for its cultivation and better yield of corm (Kundu et al. 2021).

Botanical Name: *Dioscorea bulbifera* L.

Family: Dioscoreaceae

Indian Name: Ratalu, Pahadi Alu, Ban alu (Hindi); Air Potato, Aerial Yam, Potato yam (English); Varahikanda (Sanskrit); Varahi, Dukarkand (Marathi); Bon Alu 9Assamese); Pit Alu (Oriya); Ban Alu (Bengali); Goch-aloo/ Bon-aloo Gosh Alu (Assamese); AmbaliGenasu, Kuntagenasu, Negilugonne (Kannada); Pannukkizhangu, Kaattu-k-kaay-Valli (Tamil); Adavi Dumpa (Telugu) (Kundu et al. 2021).

Origin and Distribution

The species is distributed throughout tropical and subtropical areas, up to 1000 m altitude. It is a shade-loving species but grows well in open areas too. About 50 species of Dioscorea are found in India (Kundu et al. 2021). A large number among them occur in the wild state. *Dioscorea* species are distributed nearly throughout India except in the dry north-western regions. They are found growing at elevations of 8000-15000 ft. in the Himalayas. In its wild state, it is extremely bitter. Under cultivation, the plant loses its bitterness and is grown for the tubers, roasted and eaten. The tuber is used by the tribal population of central India as a food, particularly in Madhya Pradesh, Chhattisgarh, Jharkhand, and Orissa (Byarugaba et al. 2007).

Traditional Uses

It is also reported to have remedial potential against conjunctivitis, leucoderma, dyspepsia, urinary discharges, jaundice, diabetes, asthma, bronchitis, strangay and Vata biliousness. They are also used against tumour. Bulbils are boiled and used to treat sexual vigour Paste of the leaves is used to cure skin related infections. Tribes in the Indian state of Telangana use dried tubers cut into pieces early in the morning to cure piles (Byarugaba et al. 2007).

Bioactive compounds

The tuber contains steroidal saponins, diosgenin, bitter and non-bitter terpenes, nonditerpene glucosides, diosbulbinoside D & F, a large number of diosbulbins, diterpene, lactones, phenanthrenes, dihyrophenanthrene, furanoid non-diterpenes, and d-sorbitol. Bulbils also contain diosgenin (Adesanya et al. 1989; Bhandari and Kawabata 2004)

Curative properties

It is used in haemoptysis, epistaxis; pharyngitis; goitre; pyogenic infections, scrofula; orchitis; sprains, and injuries. *Dioscorea* is a famous for Indian non-vegetarian Ayurvedic medicine. *Dioscorea* is used in treatment of Vata disorders like loss of strength and hemiplegia etc. Dried *Dioscorea* is known to dissolve toxins, cures carbuncles, scrofula and purulent infections (Bhandari and Kawabata 2004; Azeem et al. 2013).

Ashoka

Asoka is a medium-sized, evergreen tree with beautiful fragrant flowers. Leaves are alternate, paripinnate, copper-red when young, green when mature, and 30–60 cm long. Bark on old stems is dark green in colour, often marked by bluish and an ash white patch of lichens. Ashoka tree has been mentioned in some of the oldest Indian text apart from Ayurveda. Across India, the Ashoka tree is believed to be sacred and apart from Ramayana, the Ashoka tree is mentioned in Buddhism and Jainism. Charaka Samhita, which is believed to have been composed in 1000 BC, describes Ashoka tree and its medicinal benefits (Yadav et al. 2013; Ahmad et al. 2016).

Botanical Name: *Saraca asoca* (Roxb.) de Wilde

Family: Caesalpiniaceae

Indian Name: Kankeli (Sanskrit); Ashoka (Assamese); Ashoka (Bengali); Ashoka (Gujrati); Ashoka (Hindi); Ashokadamara (Kannada); Ashok (Kashmiri); Asokam (Malayalam); Ashok (Marathi); Ashoka (Oriya); Ashok (Punjabi); Asogam (Tamil); Ashokapatta (Telugu) (Devan et al. 2021).

Origin and Distribution

Asoka is distributed throughout India, naturally frequent in South India, Sri Lanka, Orissa, and Assam. The species also occurs in central and eastern Himalayas up to 750 m altitude. It is grown as an avenue tree due to its foliage and fragrant flowers. The tree is found mainly throughout India, especially in West Bengal, Assam, Odisha, Tamil Nadu, Karnataka, Kerala, Andhra Pradesh, Meghalaya and Maharashtra. It is also widely distributed across the Western Ghats (both South and Central), the Sahyadri region, and the Himalayas (Devan et al. 2021).

Traditional Uses

The bark of this plant is used in the Ayurvedic and modern herbal medicine systems with a profound application for curing complex gynaecological diseases. It is found throughout India (Ahmad et al. 2015), especially in Konkan, Deccan, Karnataka, Maharashtra, central and north India, and eastern Himalayas up to an altitude of 750 m (Devan et al. 2021; Pradhan et al. 2009). Stem bark of Asoka tree is strongly astringent and a uterine sedative, uterine tonic, and styptic, having a stimulating effect on endometrial and ovarian tissue. The bark is also useful in dyspepsia, fever, and burning sensation. It is also used to treat menorrhagia, leucorrhoea, internal bleeding, haemorrhoids, and hemorrhagic dysentery. Many tribal Women of Chhattisgarh, consumes Ashoka bark after boiling into cow milk to prevent gynecological disturbances (Pradhan et al. 2009; Devan et al. 2021).

Bioactive compounds

The Phytochemical take a look at shows the presence of numerous chemical ingredients of Saracaindica plant. Bark carries catechol, sterol, tannins, flavonoids, glycosides, leucopetargonidin and leucocyanidin. The stem includes quercetin, amyrine, ceryl alcohol and beta sterol (Pradhan et al. 2009; Devan et al. 2021). The bark and stem discovered to comprise quercetin, quercetin-3-O-α-lrhamnoside, kaempferol three-O-α lhamnoside, amyrine, ceryl alcohol and β-sitosterol (Yadav et al. 2013). Flower carries oleic, linoleic, palmitic and stearic acids, P-sitosterol, quercetin, kaempferol-3-O-P-D-glucoside, apigenin-7-O-p-D-glucoside, Pelargonidin-three, five- diglucoside, cyanidin-three, leucocyanidin and gallic acid (Yadav et al. 2013). Four anthocyanin pigments are remoted from plant life; beta and alpha sitosterol are remoted from fixed oil of vegetation (Rastogi and Mehrotra 1999). Seed and Pod incorporate oleic, linoleic, palmitic and stearic acids catechol, (-) epicatechin and leucocyanidin (Yadav et al. 2013).

Curative properties

It is extensively used in the pharmaceutical preparations like asokarishta and asokagirtha. Most of these plant parts like stem, bark, flowers, leaves and fruits are used in Ayurveda for their medicinal properties. The barks are used for the treatment of menorrhagia, uterine infections, rheumatic arthritis, hemorrhoids, dysmenorrhoea and bacterial infections (Pradhan et al. 2009; Misra 2013). During 100 A.D. the name of Ashoka plant was mentioned in Charka Samhita as anodynes in gynecological disorders. All parts of this plant such as Ashoka flower, barks, leaves, roots, and seeds have medicinal value and have been used widely in anticancer, antimicrobial, anti-inflammatory, anti-arthritic, medication (Pradhan et al. 2009; Misra 2013).

Chaff-flower

Chaff-flower is an important perennial medicinal herb found as an herbal weed throughout India. This plant is 0.2-2.0 m high. The base is woody, angular or ribbed, simple or branched; nodes are bulged, often tinged with pink color (Raj et al. 2011).

Botanical Name: *Achyranthes aspera* var. *indica* L.

Family: Amaranthaceae

Indian Name: Prickly Chaff flower, Rough chaff tree, Red chaff tree (English); Aghata (Sanskrit); Latjira, Chirchira (Hindi); Safad Aghedo (Gujarati); Shiru-kadaladi (Tamil); Uttaraene (Telugu); Kadaladi (Malayalam); Kutri (Punjabi) (Raj et al. 2011; Kumar 2019).

Origin and Distribution

Chaff-flower is found on field boundaries, roadsides, wild areas, forests, and waste places as a weed throughout India up to an altitude of 2100 m and in South Andaman Islands. It is most common in the northern plains of India. It is most commonly found to be a medicinal herb in Shivbari sacred groves Indian state of Himachal Pradesh. It is also a weed herb of district Lalitpur, Jhansi, Lucknow, Barabanki, Prayagraj of Uttar Pradesh, India (Neelesh et al. 2019).

Traditional Uses

In the traditional system of medicines, seeds, roots, and shoots are the most important parts which are used for their medicinal properties. In traditional medicines, whole plant ash is used in gaseous distention, gastritis, cough, asthma, and urinary bladder stones; the ash with honey is also used to relieve cough (Luseba et al. 2007; Raj et al. 2011). The herb is mainly prescribed in amenorrhea due to hemostasis, dysmenorrhoea, and irregular menstruation, injuries due to impact, fractures, contusions

and strains, hematemesis, epistaxis, hematuria due to gonorrhoea, gingivitis, laryngitis, and carbuncle. In folk medicine, it is one of the plants used for contraception, and the leaves are traditionally used to treat wounds (Raj et al. 2011). The decoction of leaves and roots is used as a diuretic, and the plant sap is useful in dissipating the corneal opacity.

Bioactive compounds

It contains carbohydrates, alkaloids, proteins, glycosides, flavonoids, saponins, and tannins. Other chemical constituents such as achyranthine, 6-pentatriacontanone, betaine, pentatriaontane, hexatriacontane, and tritriacontane are also present (Luseba et al. 2007; Raj et al. 2011).

Curative properties

This plant has different Curative properties in various plant parts like Antiviral and Anticarcinogenic, Spermicidal, Hepatoprotective, Nephroprotective, Antidiabetic, Antiinflammatory, Immunostimulates, Antimicrobial, Antiparasitic, Anti-allergic, Wound Healing, Antioxidant and Hypolipidemic properties of Chaff-flower which are instrumental in making it potent against infections (Luseba et al. 2007; Raj et al. 2011).

Devil's backbone

Devil's backbone an important medicinal perennial plant is both easy to grow and fast-growing. It is a fleshy, cactus-like liana widely used as a common food item in India. Veldt Grape is a succulent shrubby climber with 4 winged internodes and a tendril at the nodes and reaches a height of 1.5 m approximately. Stem jointed at nodes, internodes are 8 to 10 cm long and 1.2 to 1.5 cm wide (Kumar 2019). Flowering is rare, and flowers are small, greenish-white, bisexual, tetramerous, and opposite the leaves. Fruit globose/obovoid fleshy berries. *Cissus quadrangularis* is propagated by seeds and stem cuttings. It is vegetatively propagated mainly in the month of May to July. It requires warm tropical climate (Kumar 2019; Piyush et al. 2021).

Botanical Name: *Cissus quadrangularis* Linn.

Family: Vitaceae

Indian Name: Veldt grape, Devil's backbone, Adamant creeper (English); Hadasinkuda (Oriya); Harjora (Assamese); Harbhanga, Harjora (Bengali); Hadjod, Hadjora, Jangli-angoor (Hindi); Asthisamhaara, Mangaravalli (Kannada); Cannalamparanta (Malayalam); Chaudhari, Hharsankar, Kandavela (Marathi); Asthisamhari, Asthisamhrta (Sanskrit); Perandai (Tamil); Gudametige, Kokkitaya-ralu (Telugu) (Piyush et al. 2021).

Origin and Distribution

The plant is native to several hotter regions of India alongside hedges, neighboring countries like Bangladesh, Pakistan, Srilanka, and Malaysia (Kumar 2019; Piyush et al. 2021).

Traditional Uses

The roots and stems are most useful for healing fractures of the bones. The C. *quadrangularis* has been documented in Ayurveda and Siddha systems of medicine to treat various ailments like syphilis, gouts, piles, leucorrhoea, venereal diseases, diarrhea, and dysentery (Kumar 2019; Piyush et al. 2021).

Bioactive compounds

The plant contains calcium oxalate, β-carotene, ascorbic acid, β-sitosterol, and 3-ketosteroids, also flavonoids such as quercetin, and kaempferol. The stem comprises two unsymmetrical tetracyclic triterpenoids, onocer-7-ene-3α, 21β-diol and onocer- 7-ene-3β, 21 α –diol, two steroidal principles I and II, δ-amyrin, δ-anyone (Periyasamy 2001).

Curative properties

The plants have medicinal properties like bone healing, antimicrobial, anti-diabetic, anti-inflammatory, anti-obesity, anti-oxidant, bone turnover (Chiesa et al. 2018), cardiovascular, and hepatoprotective activities. The stem juice of the plant is used to treat scurvy, menstrual disorders, otorrhoea, and epistaxis (Ampai et al. 2007).

Flame of the Forest

The Butea is initially grown in all regions of India, thriving in the dry season being a deciduous tree. It grows up to a height of 15 meters, being short and sprouting at a slow pace. The dark green leaves are in pinnate shape, arranged as three leaflets arising from the stems. The flowers of Palash are vibrant orange in color, with many wide petals, aligned in a cluster or raceme form, and are edible, being very bitter. The fruit is a small pod with a sharp, biting taste upon budding (Geeta et al. 2011; Divya and Rao 2015).

Botanical Name: *Butea monosperma* (Lam.) Taub.

Family: Fabaceae

Indian Name: Flame of the forest (English); Kinaka, palas, paras, polashi (Bengali); kakria, kesudo, khakara, khakharo, palasso, phullas (Gujarati); chinchra, dhak, palas, paras (Hindi); brahmavriksha, mathuga, mutthugada mara, muttuga, palasa, plashu, thoras (Kannada); brahmavriksham, mukkappuyam, palas, palasinsamatha (Malayalam); palas, paras, phulas (Marathi); kinjuko, palasa, polas, porasu (Oriya); chachra, dhak, palas (Punjabi); kinsuka, palasa, palasha (Sanskrit); murukkan, palasu, punamuruku, purasu (Tamil); modhugu, moduga, palasamu (Telegu); palash, palashpapra (Urdu) (Divya and Rao 2015).

Origin and Distribution

The plant is commonly called a Palash tree in India. It grows throughout India as well as the South Asian peninsula. Butea tree gets up to 50 ft in height, with stunning flower bunches. The leaves of trees lose with the flowers develop, in the month of January - March. This tree grows in open plains in its natural habitat and is highly drought-resistant and reproduced by seeds and suckers. Natural reproduction starts early in the rainy season. Generally, it grows gregariously on open grasslands and is scattered in mixed forests. Plantations can be raised both on irrigated and drylands (Reddy et al. 2014; Divya and Rao 2015).

Traditional Uses

In the traditional system of medicines, it is used in abdominal enlargement, ascites; biliousness, eye diseases, skin, itch, piles, tumors, ulcers, splenomegaly, and wounds. The Juice from the plant as well as the oil is antiseptic. In tribal medicine of India, the seeds are used for keratitis; piles; urinary discharges, skin ailments, and diseases of the brain, eye, headache, and skin. The powdered seeds are used as a

febrifuge and tonic in bronchitis and whooping cough (Sehrawat and Sultana 2006; Divya and Rao 2015).

Bioactive compounds

The plant also contains palasitrin and major glycosides as Butrin, butolic acid, cyanidin, histidine, lupenone, lupeol, (-)-medicarpin, miroestrol, palasimide and shellolic acid. The leaves of Butea contains Glucoside, Kino-oil containing oleic and linoleic acid, palmitic and lignoceric acid, barks contains Kino-tannic acid, Gallic acid, pyrocatechol, stem contains Stigma sterol-e-D-glucopyranoside and nonacosanoic acid, 3-Z-hydroxyeuph-25-ene and 2, 14-dihydroxy- 11, 12- dimethyl-8-oxo-octadec-11 enylcyclohexane, flower contains monospermoside (butein 3-e-d-glucoside) and isomonospermoside, chalkiness', aureoles, flavonoids (palasitrin, prunetin) and steroids, triterpene, butein, butin, isobutrin, coreopsis, isocoreopsin (butin 7-glucoside), sulphurein, Gum contains tannins, mucilaginous material, pyrocatechin, seed contains A nitrogenous acidic compound, along with palasonin is present in seeds (Sehrawat and Sultana 2006; Divya and Rao 2015). It also contains monospermoside (butein 3-e-d-glucoside) and so monospermoside, oil (yellow, tasteless), proteolytic and lipolytic enzymes, plant proteinase and polypeptidase, Resin contains from seed coat allophanic acid, Z- Amyrin, e-sitosterone its glucoside and sucrose; lactone-nheneicosanoic acid-delta-lactone, jalaric esters i, ii and laccijalaric esters iii, IV. and Sap contains colourless isomeric flavanone and its glucosides, butrin, chalcones, butein, butin (Sehrawat and Sultana 2006; Reddy et al. 2014; Divya and Rao 2015).

Curative properties

Butea plant has different Curative properties in various plant parts like anti-diarrheal, anti-stress, anthelmintic, antidiabetic, hepatoprotective, aphrodisiac, antifungal, astringent, anti-inflammatory, laxative, and antioxidant qualities. The butea plant flowers and leaves are diuretic, astringent, aphrodisiac, and increase the flow of blood in the pelvic region. The seeds of the tree have purgative, diuretic to stimulate the production of urine and anthelmintic i.e., anti-parasitic properties. The seed powder is used in the case of intestinal parasites. Palash tree bark yields a gum known as kino, which houses astringent properties to treat haemorrhoids (Madhav et al. 1967; Sehrawat and Sultana 2006; Reddy et al. 2014; Divya and Rao 2015).

Giloy or Guduchi or Amrita

Giloy, commonly known as "Amrita" or" Guduchi" a climbing shrub found throughout India. In other words, the fountain of life force is an apt title for this medicinal plant. The stems and roots are an integral constituent of several compound preparations (Khan et al. 2016). The species is endemic to India and is common throughout tropical and subtropical zones at an altitude of 600 m. The plant is found normally deciduous and dry forests. The plant is a large, deciduous plant that grows to 1-meter height and 0.5 meters wide extensively spreading climbing shrub with several elongated twining branches (Kumar et al. 2019b). *T. cordifolia* can be propagated by seeds and also vegetative cuttings. Stem cuttings are the best planting material for raising commercial crop. The cuttings can be obtained from mother plants in May to July (Kumar and Jnanesha, 2017a). The cuttings of the small finger thickness with 6 to 8-inch length long stem having 2 or 3 nodes are used. The healthy plants stem cuttings are sown directly in the ready field. The stem is harvested during autumn when it develops to a diameter of more than 2.5 cm and basal part is left for further growth (Singh et al. 2003).

Botanical Name: *Tinospora cordifolia* (Willd.) Miers.

Family: Menispermaceae

Figure 3: Plants uses as a Tribal Medicine; 1) *Dioscorea bulbifera,* 2) *Saraca asoca*, 3) *Achyranthes aspera*, 4) *Cissus quadrangularis*, 5) *Butea monosperma*, 6) *Tinospora cordifolia*, 7) *Abrus precatorius*, 8) *Centella asiatica*, 9) *Solanum Indicum*, 10) *Hemidesmus indicus*, 10) *Andrographis paniculata*, 12) *Boerhavia diffusa*, 13) *Mucuna pruriens*

Indian Name: Giloy (English); Giloe, Gurcha (Hindi); Guluchi (Oriya); Gulancha (Bengali); Galac, Garo (Gujrati); Amrutaballi (Kannada); Chittamrutu (Malayalam); Gulvel (Marathi); Agnisikha, Amrta, Amrtavallari, Amrtavalli, Guduchi, Jivantika, Vatsahani (Sanskrit); Gilo (Punjabi); Seendal, Seendilkodi (Tamil); Thippateega (Telugu); Gilau, Gulunch, Gurch, Jivantika, Vajra (Urdu) (Saha et al. 2012).

Origin and Distribution

The plant is distributed throughout the tropical region of India up to 1,200 m above sea level from Kumaon to Assam. It is common to grow throughout India, especially tropical areas, mainly in India such as Arunachal Pradesh, Assam, Bihar, Delhi, Gujarat, Goa, Karnataka, Kerala, Maharashtra, Odisha, Sikkim, Tamil Nadu, Uttar Pradesh, and West Bengal (Hartmann et al. 1997). It is indigenous to India, Myanmar, Sri Lanka, China, Thailand, Philippines, Indonesia, Malaysia, Borneo, Vietnam, Bangladesh, North Africa, and South Africa. It is typically grown in deciduous and dry forests at elevations up to 1000 feet (Kumar et al. 2019).

Traditional Uses

There are over 400 different tribal and other ethnic groups in India and used giloy in ages for the treatment of fever, jaundice, chronic diarrhea, cancer, dysentery, bone fracture, pain, asthma, skin disease, poisonous insect, snake bite, eye disorders (Singh et al. 2003). The stem is bitter, stomachic, diuretic stimulates bile secretion, causes constipation, allays thirst, burning sensation, vomiting, enriches the blood, and cures jaundice. The root and stem of giloy are prescribed in combination with other drugs as an antidote to snakebite and scorpion sting. Leaves are used in Juice or decoction of leaves is administered orally with honey in fever (Khan et al. 2016).

Bioactive compounds

T. cordifolia contains high fibre (15.9%), sufficient protein (4.5%-11.2%), sufficient carbohydrate (61.66%), and low fat (3.1%). Its nutritive value is 292.54 calories per 100 g. It has high potassium (0.845%), high chromium (0.006%), sufficient iron (0.28%) and sufficient calcium (0.131%) (Hartmann et al. 1997).

Curative properties

This plant has great potential for developing useful drugs. The leaves extract has shown anti-HIV 1 activity. A dry bark of *T. cordifolia* has anti-spasmodic, antipyretic, anti-allergic, anti-inflammatory and anti-leprotic properties (Hartmann et al. 1997). The plant also bears antioxidant, anti-inflammatory, anti-tuberculosis; wound healing, immunomodulatory and immunoprotective, hepatoprotective, anti-osteoporotic, anti-cancer, anti-tumor, anti– malaria, cardioprotective nature and many more properties that make them a topic of great importance and interest (Sonkamble et al. 2015; Khan et al. 2016; Salkar et al. 2017).

Indian liquorice

Indian liquorice has seen growing wild throughout all tropical forests and is propagated through seeds: a woody-stemmed, dextrorse twining herb or climbing herb. The fruit is a legume (pea-shaped pod) about 3 cm long containing hard ovoid seeds (shiny, scarlet, and black in color) about 1 cm long. The seeds are red, with a black spot covering one end. Traditionally, leaves, roots, and seeds are used in tribal medicine (Narendra and Bapoda 2014).

Botanical Name: *Abrus precatorius* L.

Family: Fabaceae

Indian Name: Gunchi, Ganchi, Rati (Hindi); Runji, Gunja (Oriya); Kunni, Guruginia, Guruvenda (Telugu); Gunj (Marathi); Chunhali, Kunch (Bengali); Chanothi, Gunja (Gujarati); Ganji, Gul-Ganju, Guluganji, Madhuka (Karnataka); Liluwani, Raturmani (Assam); Kunnikuru (Malayalam); Chanoti, Gunchi, Gunja (Marathi); Gundumani, Kuntumani (Tamil); Labrigunchi, Ratak (Punjab) (Narendra and Bapoda 2014).

Origin and Distribution

Indian liquorice is a plant that originates from Southeast Asia and is native to India. It grows at altitudes up to 1200 m on the outer Himalayas. It is a common plant in Nigeria. Its plant is found in all the regions of India, from the Himalayas to southern India and Ceylon (Narendra and Bapoda 2014).

Traditional Uses

The parts of the Indian liquorice plant used medicinally in the tribal areas are the root, leaves, and seeds. Indian liquorice is traditionally used to treat tetanus and to prevent rabies. The plant is used in traditional medicine to treat scratches, sores, and wounds caused by dogs, cats, and mice. The herb's leaves are used to cough, cold and cure fever. The roots are used to treat hemoglobinuria bile and jaundice. Paste of roots is used to cure abdominal pains, tumors, and abortion. The root is chewed as a snake bite remedy. Dry seeds of Indian liquoriceare used to cure worm infection (Kinjo et al. 1991; Narendra and Bapoda 2014)

Bioactive compounds

Indian liquorice is rich in various bioactive compounds. The leaves of Indian liquoric contains like abrine, trigonelline,abrusoside A, abrusoside B, abrusoside C, abrusoside D, glycyrrhizin and root of contains abrol, abrasive, precasine and precool, quinones-abruquinones A, B, C, D, E, F. Seeds are rich in several essential amino acids like serine, Abrusin, Abrusin-2′-0-apioside, hederagenin, kaikasaponin III, sophoradiol, sophoradiol-22-0-acetate, tryptophan, trimethyl, alanine, amyrin, alpha, ursolic acid, valine and methyl ester (Ali and Malek 1966; Georgewill 2009; Narendra and Bapoda 2014)

Curative properties

This plant is having different Curative properties in various plant parts like neuroprotective, anti-diabetic, anti-oxidative, anti-viral, memory enhancing, anti-convulsant, anti-epileptic, anti-depression, anti-helminthic, anti-serotonin, neuromuscular, immune-modulating, abortifacient, anti-implantation, anti-inflammatory, anti-arthritic, diuretic, anti-microbial anti-yeast and analgesic, anti-cancer, anti-fertility, anti-spermatogenic, antiestrogenic, anti-malarial, anti-allergic, anti-asthmatics, anti-cataract, anti-insecticide, anti-toxicity activity (Kinjo et al. 1991; Narendra and Bapoda 2014)

Indian pennywort

Indian pennywort is a prostrate, stoloniferous, perennial, creeper herb growing up to an average length of 15 cm. Its stem is glabrous, striated, rooting at the nodes, and the plant is propagating vegetatively by runners (stolons). Indian pennywort is one of the chief herbs for treating skin problems, healing wounds, and revitalizing the nerves and brain cells, hence primarily known as a "food for the brain" (Prasad et al. 2019)

Botanical Name: *Centella asiatica* (L.) Urban

Family: Apiaceae

Indian Name: Bemgsag, Brahma-Manduki, Gotukola, Khulakhudi, Mandookaparni (Hindi); Hingotukola (Oriya); Bhekaparni, Bheki, Brahmamanduki, Darduchhada, Divya, Mahaushadhi, Mandukaprnika, Manduki, Mutthil, Supriya, Tvasthi (Sanskrit); Kodagam, Kodangal, Kutakm, Kutannal, Muthal, Muttil, Muyalchevi Kanarese Brahmisoppu, Urage, Vandelagaillikiwigidda, Vondelaga (Malayalam); Bekaparnamu, Bokkudu, Saraswataku, Mandukbrahmmi, Saraswati (Telugu); Karinga, Karivana (Marathi); Babassa, Vallarai (Tamil); Thankuni, Thunimankuni (Tripura); Thankuni, Tholkuri (Bengal); Manimuni Deccan Vallarai (Assam); Chokiora Meghalaya Bat-maina (Bihar) (Kumar and Gupta 2002).

Origin and Distribution

The plant is native to Southeast Asia. It is a tropical climate plant found in India, Sri Lanka, China, Indonesia, Pakistan, China, Japan, Malaysia, Tropical America, South Africa, and Pacific islands. It is commonly found as a weed in crop fields and other waste places throughout India up to more than 600 m altitudes. In north-eastern hills, it is found up to 2500 m (Prasad 2019).

Traditional Uses

Indian pennywort is a common herbal medicine in India for different ailments like elephantiasis, leprosy, gastric catarrh, kidney troubles, ulcers, urethritis and leucorrhoea. Indian pennyworthas also been used extensively as a traditional remedy for a wide spectrum ofailments such as leprosy, psoriasis, eczema, dermatitis, ulcerous skin, wound burn, scar management, and adaptogenic and cardiotonic agents. Indian pennywort is also a good source of several micronutrients, iron, phosphorus, sodium, vitamin C, vitamin A, carotene, and dietary fiber (Prasad 2019).

Bioactive compounds

Asiaticoside, indocentelloside, thankuniside are the major glycosides responsible for the medicinal properties. The whole plants of *C. asiatica* contained several triterpene acids, saponine and sapogenins viz. brahmic acid, isobrahmic acid, brahmocides and brahminocide, thankuniside, tankunic acid, asiaticoside, Asiatic acid and madecassic acid, isothankuniside and isothankunic acid, madasiatic acid, asiaticosides A and B. The plant has been reported to contain alkaloids, glycosides, sterols, tannins, sugars and inorganic salts. It is said to improve memory and understanding and to cure leprosy, Jaundice and gonorrhea, and fever. Chakradatta directed the fresh Juice of the leaves to be given with milk and liquorice powder as an alternative tonic (Prasad 2019; Sakshi et al. 2010; Zainol et al. 2003)

Curative properties

It's potential antioxidant, anti-inflammatory, antipsoriatic, antiulcer, hepatoprotective, anticonvulsant, sedative, immunostimulant, cardioprotective, antidiabetic, cytotoxic and antitumor, antiviral, antibacterial, insecticidal, antifungal, neuroprotective, antioxidant. For lepra, other activities have been widely claimed in many reports and is very much related to its properties and mechanism of action of the plant's bioactive constituents, namely the triterpenic acid (asiatic acid made cassoside acid), triterpenic saponin (made cassoside and asiaticoside), flavonoids, and other phenolic compounds (Prasad 2019; Suguna et al. 1996; Kumar and Gupta 2002).

Indian Solanum

Indian Solanumis a commonly growing perennial herb, very prickly, diffuses bright green perennial weed with bright green leaves and zigzag stem, and is mostly found in the arid region. The berries are green and white strips when young but yellow when matured. The flowers are purple in colour and bloom in Oct-March of the year. The berries are yellow with many seeds (Varshney and Khan 1971). The plant is xeric in nature and can grow well in shady places and in areas that receive low rainfall. This species may also be inter-cropped in tree plantation sites.

Botanical Name: *Solanum Indicum* Linn.

Family: Solanaceae

Indian Name: Vanabharata, Badikateri (Hindi); Putirichunda (Malyalam); TellaMulaka (Telugu); Kandiarivaddi (Punjab); Kateli (Urdu); Kirugullia, Heggulla, (Kannad); Cheru Vazhuthina (Khare 2007).

Origin and Distribution

The species is commonly found throughout the tropical and subtropical India. Indian Solanum grows as a wild plant in many parts of India, particularly in arid regions where annual rainfall ranges from 750 mm to 1500 mm like Odisha, Andhra Pradesh, Telangana, Karnataka, Uttar Pradesh, Bihar, Madhya Pradesh, Manipur, Assam, West Bengal (Parmar et al. 2010).

Traditional Uses

Roots of Yellow berried nightshade are one of the important constituents of Ayurvedic preparation dashmularishta, used as a tonic for lactating mothers (Kumar et al. 2011). Kondh tribes of Dhenkanal district of Orissa, India is, using the hot aqueous extract of the matured fruits as a traditional medicine for the treatment of diabetes mellitus (Parmar et al. 2010). Fruits are used as a folk medicine to treat inflammatory problems as well as throat infections by the local people of Manipur, India. An entire plant is used for treating leprosy, dropsy, and cough by the folklore (Madhavi et al. 2014). Mukunda tribes of Rajasthan, India used the root paste for the treatment of hernia (Pandey et al. 2018). Root poultice used to treat the piles is practiced as a traditional medicine in many villages of South India. Seeds, along with mustard oil fumigation, are used as an excellent remedy for treating dental caries, teeth pain, pus formation, and associated swelling of gums (Panday et al. 2018). Stem, flowers, and fruits are used for relief in burning sensation in feet. Seeds are also used as a remedy for cough and asthma (Rahman et al. 2003).

Bioactive compounds

Plant Contains alkaloids, sterol, saponins, flavonoids and their glycosides, carbohydrates, fatty acids, amino acids, etc. The fruits are found to contain several steroidal alkaloids like solanacarpine and solamargine (Rahman et al. 2003).

Curative properties

This plant has different parts like roots, stem, leaves, fruits, and seeds pharmacological activities include hepatoprotective, cardioprotective, anti-asthmatic and mosquito repellents properties. Fruits are edible and used by the local people as folk medicines in treating throat infections and other inflammatory problems. A decoction of the fruits of the plant is used by tribal and rural people of Orissa, India for the treatment of diabetes (Rahman et al. 2003).

Indian Sarsaparilla

Indian Sarsaparillahas long been used as a folk medicine and found to be an important ingredient in ayurvedic and Unani preparations (Anonymous 1997). It is perennial, diffusely twinning or prostrate semi-erect shrub, a woody rootstock having numerous slender wiry lactiferous branches with purplish-brown bark. This plant is found throughout India growing under mesophytic to semi dry conditions in the plains and up to an altitude of 600 m. It is quite common in open scrub jungles, hedges, and uncultivated soil. It is found in India, Sri Lanka, Pakistan, Iran, Bangladesh, and Moluccas. it's a climbing vine plant found in the Upper Gangetic plain, eastwards to Bengal and Sundarbans and from Central provinces to Travancore and South India (Anonymous 2005). It having wider distribution in the Indian sub-continent, and the supply, mostly from the wild, would have been sufficient to meet the domestic demand for Ayurveda and folk medicine and for preparation of popular beverages like "nannari sherbet" in South India (Jnanesha et al. 2021).

Botanical Name: *Hemidesmus indicus* L. R. Br.

Family: Asclepiadaceae

Indian Name: Anantmool, Sugandhipala (Telugu); Magrabu (Hindi); Ananta (Sanskrit); Nannari (Tamil, Malayalam); Syama (Sanskrit); Namdaberu (Kannada); Sogadaberu (Kannada); sarsaparilla (English) (Aadhan and Anand 2018).

Origin and Distribution

Indian Sarsaparillais widespread in the Indian Plains and the coast and in the mountains up to a height of 600 m, further beyond not exceeding 1000m. Globally the species is distributed in India, South East Asia, Sri Lanka, Pakistan, Iran, Bangladesh, Afghanistan and Malaysia. In India, it is found in mainly Southern India and Northern India, Sikkim and Peninsular India. This species is globally distributed in Indo-Malaysia. Within India, it is found in moist deciduous forests, scrub jungles, hedges and degraded sites from Upper Gangetic plains of North India to Assam and Peninsular India (Aadhan and Anand 2018).

Traditional Uses

Use of this plant against leucorrhoea at Bargarh district in Orissa and Sattordem Village of Goa has been reported (Sen and Behera 2000; Kamat 2001). Antipyretic use of this plant has also been reported (Singh and Kumar 1999). Siddique et al. (2004) have reported the use of H. indicus among the local people and herbal practitioners of Barind Tract of Bangladesh against diarrhea, rheumatism, fever, headache, asthma, eye disease, and wounds. Rajasab and Isaq (2004) have reported the use of H. indicus among the tribes of north Karnataka. Ayyanar and Ignacimuthu (2005) have reported traditional uses of Indian Sarsaparilla among the Kani tribals in Kouthalai of Tirunelveli hills, Tamil Nadu. Uses of Indian Sarsaparilla among the Korku tribe of Amravati district of Maharashtra have been reported by Jagtap et al. (2006). The Juice or drink prepared from Indian Sarsaparillaroot is locally called as nannari or sugandhapala. The drink is medicinal, which cools the system, gives good appetite and acts as a blood purifier and it is also called as poor man's drink and roots are used for preparation of chutneys and pickles. It is a medicine for food indigestion, constipation and gas troubles. The drink nannari is served especially during special occasions to the people in the Deccan plateau region, and the roots are sold in important pilgrim centres and local shanties at throw-away prices. Decoction of leaves of Indian Sarsaparilla was prescribed by Charaka in a shallow complexion, loss of voice, cough, menstrual disorders and dysentery, whereas entire plant is prescribed for treating asthma, cough, abdominal swelling and aching limbs (Khare 2007)

Bioactive compounds

The roots of Indian Sarsaparillacontain hexatriacontane, lupeol, its octacosanoate, α-amyrin, β-amyrin, its acetate and sitosterol. It also contains new coumarino-lignoid-hemidesminine, hemidesmin I and hemidesmin II, six pentacyclic triterpenes including two oleanenes, and three ursenes. The stem contains calogenin acetylcalogenin-3-0-β-D-digitoxopyrannosyl-0-β-D-digitoxopyronsyl-0-β-D-digitoxopyranoside. It also afforded 3-keto-lup-12-en-21 28-olide along with lupanone, 4-methoxy-3-methoxybenzalaldehyde, lupeol-3-β-acetate, hexadecanoic acid, and 3-methoxy-4-5methoxybenzalaldehydglycosides-indicine and hemidine. The leaves contain tannins, flavonoids, hyperoside, rutin and coumarin. Leucodermalignoids such as hemidesminine, hemidesmin I and hemidesmin II are rare group of naturally occurring compounds present in leaves (Sethi et al. 2006).

Curative properties

The pharmacological activities includes antioxidant, analgesic activity, anti-arthritic activity, anti-cancerous activity, antipyretic activity, hepatoprotective activity, anti-diabetes activity, antimicrobial activity, antileprotic activity, antiacne activity, antithrombotic activity, antihyperlipidaemic activity, antinociceptive activity, wound healing activity, larvicidal activity, anticonvulsant activity, renoprotective activity, anti-ulcer activity, anti-psychotic activity, nootropic activity, antigenotoxic effect and anti-angiogenic activity. Due to the effective usage of this herb in biomedical science, it is essential to optimize the standard protocols for its propagation and enhancement of bioactive molecules (Sethi et al. 2006).

King of Bitters/Kalmegh

Kalmegh is used in traditional Siddha and Ayurvedic systems of medicine as well as in tribal herbal medicine in India and some other countries for multiple clinical applications. It grows erect to a height of 30-110 cm in moist shady places with glabrous leaves and white flowers with rose-purple spots on the petals (Kumar and Jnanesha 2021).

Botanical Name: *Andrographis paniculata* (Burm. f.) Wall. ex Nees

Family: Acanthaceae

Indian Name: Chirayata, Kalmegh (Hindi); King of Bitters (English); Kariyatu (Gujarathi); Nelaberu (Kannada); Kiriyattu (Malayalam); Olenkiryata (Marathi); Bhuinimba (Oriya); Kalmegh, Mahatita (Bengali); Nilavembu (Tamil); Kalmegha, Bhunimba (Sanskrit); Nilavembu (Telugu) (Farooqui and Khan 1993).

Origin and Distribution

Kalmegh is native to Southeast Asian countries, *i.e.*, India, China, Taiwan and Sri Lanka. The species is cultivated in many parts of India, China, Thailand, the East and West Indies, and Mauritius (Subramanian et al. 2012). It is grown throughout the plains and hills in India, from Uttar Pradesh to Assam, especially in West Bengal and Mizoram. It is also cultivated in the southern part of India and naturally grown in wastelands, and road-sides. It is usually propagated from seeds during the rainy phase of the summer season (Kharif) crop in India (Kumar and Jnanesha 2021).

Traditional Uses

The leaves are bitter in taste, and it is also called as king of bitter. The chemical components present in it are andrographolide, neoandrographolite, and deoxyandrographlide. Normally, leaves and roots are

used for medicinal purposes. The Plant possesses febrifuge, tonic alterative, stomachic, constipation, cholera, diabetes, general debility, hookworm infestation, piles and stomach disorder. It is also used as a cure for torpid liver and jaundice (Kumar et al. 1993, Farooqui and Khan 1993).

Bioactive compounds

The root contains flavonoids-andrographin, panicolin, apigenin-4' 7-dimethyl ether, mono-O-methyl wightin and 5-hydroxy 7, 8, 2, 3-tetra methoxy flavones and leaves contain β-sitosterol, diterpenoid and sesquiterpenoid-paniculides ABC and andrographolides, neo-andrographolide and 13-labbadien-16, 15 olidel (Farooqui and Khan 1993; Singh et al. 1999).

Curative properties

Andrographolide has been identified as a major antihepatotoxic principle; clinical studies carried out indicate that this may be a beneficial drug in preventing and treating arterial thrombotic disease and it is also having antidiarrhoeal activity against *E-coli* and it also exhibit strong choleretic action. Flavones extracted from the root prevent the formation of thrombi and the development of myocardial infarction (Farooqui and Khan 1993; Zhao and Fang 1991; Singh 1983).

Punarnava

Punarnava is an annual or perennial, erect, ascending, creeping or climbing herb with club-shaped or stalked glands and glandular hairs while its root is spindle-shaped and often woody. The leaves are ovate-lance-shaped, white beneath but sometimes with red marginal glands. The flowers are arranged 1-12 together in cymose panicles. It is widely dispersed, occurring throughout India, the Pacific, and southern United States (Nayak et al. 2016).

Botanical Name: *Boerhavia diffusa* Linn.

Family: Nyctaginaceae

Indian Name: Ranga Punarnabha (Asamese); Hog weed (English); Motosatodo (Gujrati); Gadapurna (Hindi); Sanadika (Kannada); VanjulaPunarnava (Kashmiri); Kahtilla, Sophaghni, Sothaghni (Sanskrit); RaktaPunarnabha (Bengali); XhuvanaTazhtawa (Malayalam); Ghetuli (Marathi); Lalapuiruni (Oriya); khattan Punjabi); Mukurattai (Tamil); Erragalijeru (Telegu) (Nayak et al. 2016).

Origin and Distribution

Punarnava is originated throughout the warmer parts of the country up to an altitude of 2000 metres in the Himalayan region. It is perennial, spreading hogweed, commonly grown abundantly in waste places, ditches and marshy places throughout rains. It grows in dry open localities, pastures, along railroads, wastelands, waysides, on rocks and sand, and in secondary forests (Nandi et al. 1974; Nayak et al. 2016).

Traditional Uses

Among all the parts of the plant, the root part of Punarnava is widely used in the traditional system of medicine. It has been used in the Ayurveda system of medicine for thousands of years. It is used to treat gastrointestinal disorders, and leaves are used to treat dyspepsia, enlarged spleen, and general abdominal disorders. The leaves of Punarnava are often used as green vegetable in many parts of India. It is believed to improve and protect eyesight. It has diuretic properties and is used by diabetics to lower blood sugar. The whole plant is used in the treatment of Biliousness, Jaundice, Internal Inflammation, Constipation, Asthma and Congestion. It has been used as a blood purifier, cardiotonic and a treatment

for Anaemia, Leucorrhoea, Mascara, and as an antidote to snake venom. It has a generally warming effect on the body (Nandi et al. 1974; Nayak et al. 2016).

Bioactive compounds

Bioactive contains found in Punarnava roots diverse class of chemical compounds including phenolic glycoside, terpenoids, organic acids, boeravinones A-J (a group of rotenoids), flavone, isoflavone, flavonol, flavonoid glycoside, xanthone, Lignin, purine nucleoside, sterol, sterol ester, Punarnavine, sitosterol, Boeravinone, palmitic acid, steroids (ecdysteroid), fatty acid, hydrocarbons (Nandi et al. 1974; Nayak et al. 2016).

Curative properties

The plant in whole has a numerous medicinal property like anti-stress, hepatoprotective, anti-oxidant, Antidiabetic, anticonsulvant, Anticarcinogenic, antimicrobial, anti-inflammatory, Antibacterial, Antifibrinolytic, Diuretic, Genoprotective, hypoglycaemic, Immunomodulator etc (Nandi et al. 1974; Nayak et al. 2016).

Velvet bean

Since some 50 years ago, farmers in some regions of Latin America have developed and disseminated the use of "Velvetbean" as rotation or associated crop to make a continuous. Mucuna is a popular Kharif crop in India (Rajeshwar et al. 2005). Mucuna thrives well in subtropical, tropical, and semiarid areas receiving 50–75 cm annual rainfall with plenty of sunshine. Mucuna grows better in warm, humid climates, with annual precipitation from 3.8 to 31.5 dm and temperatures between 18.7 and 30 °C; night temperatures of 21 °C promote flowering. The plants are sensitive to frost during the growing season, drought tolerant once established but do not tolerate excess moisture. They grow on various soil types, with pH between 4.5 and 7.7 (Hussian and Manyam 1997).

Botanical Name: *Mucuna pruriens* (L.) DC.

Family: Fabaceae

Indian Name: Cowhage, Kiwanch or Konch (Hindi); Velvet bean or Cowitch (English); Atmagupta or Kapikacchu (Sanskrit); Poonaikkaali (Tamil), Alkushi (Bengali); Khaajkuiri (Marathi) (Hussian and Manyam 1997).

Origin and Distribution

In India, the mature seeds of Mucuna bean are traditionally consumed by a South Indian hill tribe, the Kanikkars, after repeated boiling to remove anti-nutritional factors. It is widespread over most of the subcontinent and is found in bushes, hedges, and dry-deciduous, low forests throughout the plains of India. In India, 14 species are found in the foothills of the Himalayas, the plains of West Bengal, Madhya Pradesh, Karnataka, Kerala, Andhra Pradesh, Uttar Pradesh, the Andaman & Nicobar Islands, and Srilanka (Rajeshwar et al. 2005)

Traditional Uses

Mucuna pruriens is a good aphrodisiac and also a nervine tonic. It is used to treat spermatorrhea and diseases of the genitourinary system. It is considered a viable source of dietary proteins due to its high protein concentration (23–35%) and its digestibility, which is comparable to that of other pulses such as

soybean, rice bean, and lima bean. It is therefore regarded as a good source of food (Vermal et al. 2014).

Bioactive compounds

The velvet bean seeds are high in protein, carbohydrates, lipids, fibre, and minerals. The seeds of all *Mucuna* species contain a high concentration of L-dopa; velvet bean seeds contain 7-10% L-dopa. The main plant chemicals found in velvet bean include (Vermal et al. 2014): alkaloids, alkylamines, arachidic acid, behenic acid, beta-carboline, beta-sitosterol, bufotenine, cystine, dopamine, fatty acids, flavones, galactose d, gallic acid, genistein, glutamic acid, glutathione, glycine, histidine, hydroxygenistein, 5-hydroxytryptamine, isoleucine, l-dopa (Hussian and Manyam 1997), linoleic acid, linolenic acid, lysine, mannose d, methionine, 6-methoxyharman, mucunadine, mucunain, mucunine, myristic acid (Majekodunmi et al. 1997), niacin, nicotine, oleic acid, palmitic acid, palmitoleic acid, phenylalanine, prurienidine, prurienine, riboflavin, saponins, serine, serotonin, stearic acid, stizolamine, threonine, trypsin, tryptamine, tyrosine, valine, and vernolic acid (Tripathi and Upadhyay 2001).

Curative properties

Mucuna pruriens principal constituents are L-DOPA and the bioactive alkaloids mucunine, mucunadine, mucuadinine, prurienine and nicotine, as well as beta-sitosterol, glutathione, lecithin, oils, venolic and gallic acids. L-DOPA is a neurotransmitter precursor (Hussian and Manyam 1997), an effective drug for relief in Parkinson's disease (Majekodunmi et al. 1997). The seed is a prophylactic against oligospermia and is useful in increasing sperm count, ovulation in women (Verma et al. 2014).

FUTURE ASPECTS

Since ancient times, plants have been used as a source of medicine. Tribal people mostly use plants to treat a variety of ailments and infections. These medications are both safe and non-harmful to the environment. However, tribal communities and their legacy are being eroded due to urbanisation, deforestation, and industrialization. This chapter highlights the importance of a wide variety of plants in tribal medicine, which could be of great interest for research and drug development and the discovery of new bioactive substances that require further investigation. Medicinal plant knowledge gained from tribals would be useful for pharmacognosists and pharmacologists. Hence, more studies and research must be carried out to find out the ethnobotanical knowledge among the tribal groups.

The tribal people mainly rely on plants to cure many diseases and infections. But, nowadays, the tribal communities and their heritage are started to diminish due to urbanization, deforestation, and industrialization. The tribes employ the different parts of plants such as stem, fruits, leaves, bark, latex, root, rhizome, etc. for healing the diseases. The lifestyle of tribes has proven that plants are the potential source for treating many diseases and also for the maintenance of good health. So, the documentation of medicinal plants used by tribal communities will lead the way to acquire knowledge as well as for the development of novel drugs against various life-threatening diseases. Hence, more studies and researches must be carried out to find out the ethnobotanical knowledge among the tribal groups.

ACKNOWLEDGMENT

The authors are thanks to the Director, CSIR-Central Institute of medicinal and Aromatic Plants (CSIR-CIMAP), Lucknow, for facilities and sincere thanks to Dr. B. R. Rajeswara Rao Retired Chief Scientist from CSIR-CIMAP, Lucknow for availing some useful information.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this chapter.

REFERENCES

Aadhan K & Anand, SP. (2018). Ethnomedicinal plants utilized by Pallyars tribe in Sadhuragiri hills, Southern Western Ghats, Tamil Nadu, India. International Journal of Biological Research. 3 (1):7-15.

Adesanya SA, Ogundana, SK & Roberts MF. (1989). Dihydrostilbene phytoalexins from *Dioscorea bulbifera* and *D. dumentorum*. Phytochemistry. 28(3): 4–5.

Agrawal R, Sethiya NK & Mishra SH. (2013). Antidiabetic activity of alkaloids of *Aerva lanata* roots on streptozotocin-nicotinamide induced type-II diabetes in rats. Pharmaceutical Biology. 51(5): 635-642.

Ahmad F, Misra L, Tewari R, Gupta P, Mishra P & Shukla R. (2015). Anti-inflammatory flavonol glycosides from *Saraca asoca* bark. Nat. Prod. Res. 23: 1–4.

Ali E & Malek A. (1966). Chemical investigation on *Abrus precatorius* Linn. (Beng. Kunch). Science Research. 3:141-145.

Amalraj A & Gopi S. (2007). Medicinal properties of *Terminalia arjuna* (Roxb.) Wight & Arn.: A review. Journal of Traditional and Complementary Medicine. 7(1): 65-78.

Ampai P, Wanicha S, Duangta K, Tawat T & Vichai R. (2007). Analgesic, anti-inflammatory and vagotonic effects of *Cissus quadrangularis*. Journal of Ethno pharmacology. 110 (2): 264-270.

Anil T, Pawar & Neeraj S.V. (2017). Phytopharmacology of *Abelmoschus moschatus* Medik.: A review. International Journal of Green Pharmacy.11 (4). S648-53.

Anonymous. (1997). The Wealth of India. Raw materials, Vol. III, V and X, CSIR, New Delhi, India.

Anonymous. (2005). Quality standards of Indian Medicinal Plants, ICMR, New Delhi. 2:119-128.

Ayyanar M and Ignacimuthu S. (2005). Traditional knowledge of Kani tribals in Kouthalai of Tirunelveli hills, Tamil Nadu. Indian Journal of Ethnopharmacology. 102: 246-255.

Azeem AK, Arun R, Dilip C, Rasheed SP & Prasanth NV. (2013). Pharmacognostical studies of *Dioscorea bulbifera* Linn tubers. Am. J. Pharm. Tech. Res. 3 (2), 311–318.

Banerjee S, Banerjee S, Jha GK & Bose S. (2020). *Barleria prionitis* L.: An Illustrative Traditional, Phytochemical and Pharmacological Review, The Natural Products Journal. 10:1-17.

Bhandari MR & Kawabata J. (2004). Assessment of antinutritional factors and bioavailability of calcium and zinc in wild yam (*Dioscorea spp.*) tubers of Nepal. Food Chem. 85: 281–287.

Byarugaba D, Ndemere P & Midgley J. (2007). The vulnerability and resilience of *Dioscorea species* in utilized and nonutilized zones of Bwindi impenetrable national park. African Journal of Ecology. 45(3): 258–264.

Canter PH & Ernst E. (2004). Anthocyanosides of *Vaccinium myrtillus* (bilberry) for night vision-a Systematic review of placebo-controlled trials. Surv Ophthalmo. 149:38–50.

Chatterjee A & Pakrashi SC. (2002). The Treatise on Indian Medicinal Plants. Vol II. New Delhi: NISCIR: 51-53.

Chiesa LM, Nobile M, Panseri S & Arioli F. (2018). Suitability of feathers as control matrix for antimicrobial treatments detection compared to muscle and liver of broilers. Food Control. https://doi.org/ 10.1016/j. foodcont.2018.04.02.

Devan AS & Warrier RR. (2021). *Saraca asoca*- morphology and diversity across its natural distribution in India. Int. Journal of Complement Alt Med. 14 (6):317–323.

Devasagayam TP & Sainis KB. (2002). Immune system and antioxidants, especially those derived from Indian medicinal plants. Indian J Exp Biol. 40: 639-655.

Dindaa B, Niranjan D, Dindac S, Dindad M & Sarma SI. (2015). The genus *Sida* L. – A traditional medicine: Its ethnopharmacological, phytochemical and pharmacological data for commercial exploitation in herbal drugs industry. Journal of Ethnopharmacology. 176:135-176.

Divyafageria & Rao DV. (2015). A Review on *Butea monosperma* (Lam.) Kuntze: A Great Therapeutic Valuable Leguminous Plant. International Journal of Scientific and Research Publications. 5 (6): 01-09.

Evans S. (2008). Changing the knowledge base in Western herbal medicine. Soc Sci Med. 67 (20): 98-106.

FarahIram S, Alam Khan & Asif Husain. (2017). Phytochemistry and potential therapeutic actions of Boswellic acids: A mini-review. Asian Pacific Journal of Tropical Biomedicine. 7 (6): 513-523.

Farooqui AA & Khan MM. (1993). Production Technology of Medicinal and Aromatic Crops. Indian Herbs Research and Supply Co, Bangalore.

Geeta R & Prakash R. (2011). *Butea monosperma* (LAM.) Kuntze: A Review. Int Res J of Pharma. 2 (7): 98- 108.

Georgewill OA & Georgewill UO. (2009). Evaluation of the anti-inflammatory activity of extract of *Abrus precatorious*. Eastern J Med. 14:23-25.

Giordano J, Engebretson J & Garcia MK. (2005). Challenges to complementary and alternative medical research: Focal issues influencing integration into a cancer care model. Integr Cancer Ther. 4 (2): 8-10.

Gulati K, Pankaj Verma, NishantRai & Arunabha Ray. (2021). Role of nutraceuticals in respiratory and allied diseases, Nutraceuticals (Second Edition) Efficacy, Safety and Toxicity. Pages 101-115

Harshavardhini KR, Jananipriya S, Pavithra S & Kannan KP. (2021). A Revitalizer, Cytotoxicity - New Insights into Toxic Assessment, Sonia Soloneski and Marcelo L. Larramendy, Intech Open, DOI: 10.5772/intechopen.96119.

Hartmann HT, Kester DE, Davies FT & Geneve RL. (1997). Plant propagation principles and practices. 6th ed. Prentice-Hall of India Pvt. Ltd., New Delhi. pp. 276-238.

Hullatti KK & Bhattacharjee P. (2011). Pharmacognostical Evaluation of Different Parts of *Coleus amboinicus* Lour., Lamiaceae. Pharmacognosy Journal. 3 (24): 39-44.

Husain A. (1993). Medicinal Plants and their Cultivation. CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow.

Hussain G & Manyam BV. (1997). *Mucuna pruriens* proves more effective than L DOPA in parkinsons' disease animal model. Phytotherapy Research. 11(6):419-423.

Jagtap A & Sing NP. (1999). Fascicles of Flora of India. Botanical Survey of India, Government of India, India.

Jnanesha AC & Ashish Kumar. (2019). Agro-technology and Bio-prospecting in Important Medicinal Plants. In. Medicinal, Aromatic & Spice Plants. Eds. Akhil Baruah. Eastern Book House Publication, Guwahati, India. 01: 327-347.

Jnanesha AC, Ashish Kumar & Manoj Kumar Singh. (2021). Indian Sarsaparilla, Hemidesmus indicus, an Endangered Medicinal Plant of India. In Plants for Novel Drug Molecules: Ethnobotany to Ethnopharmacology. Eds. Bikarma Singh and Yash Pal Sharma. New India Publishing Agency, New Delhi, India, 483-494.

Jokarab A, Fatemeh M, Omid S, Mohsen NT and Shokouhsadat H. (2016). Potential therapeutic applications for *Terminalia chebula* in Iranian traditional medicine. Journal of Traditional Chinese Medicine. 36 (2): 250-254.

Kamat SV. (2001). Folk medicines of Sattordem Village of Goa. A note on Ethnobotany, USA.

Khan MM, Dul Haque MS & Chowdhury MS. (2016). Medicinal use of the unique plant *Tinospora cordifolia*: evidence from the traditional medicine and recent research. Asian J Med Biol Res. 2: 508-512.

Khare CP. (2007). Indian Medicinal Plants–An Illustrated Dictionary. First Indian Reprint, Springer (India) Pvt. Ltd. New Delhi.

Kinjo J, Matsumoto K, Inoue M, T Takeshita T & Nohara T. (1991). A new sapogenol and other constituents in abrin semen, the seeds of *Abrus precatorius* L. Chem Pharm Bull, 39 (1): 116-119.

Kumar A & Jnanesha AC, Siddiqui S & Siddiqui H. (2021). Medicinal plants used against diabetes: Medico-Biowealth of India Voll. II. Eds. Rajkumari Supriya Devi, Sanjeet Kumar, Rim Samir Hamdy and Agatha Sylvia Khalkho. APRF Publishers, Odisha, India. pp. 01-22.

Kumar A & Jnanesha AC. (2016). Medicinal and Aromatic Plants Biodiversity in India and Their Future Prospects: A review. Ind. J. Unani Med. 4 (1): 6-13.

Kumar A & Jnanesha AC. (2017a). Cultivation, Utilization and Role of Medicinal Plants in Tradition Medicine in Deccan Eco-climate. Int J. on Agric Sci. 8 (1): 98-103.

Kumar A & Jnanesha AC. (2017b). Medicinal and Aromatic plants agro technologies developed by CSIR-Central institute of medicinal and aromatic plants. J. Pharmacognosy and Phytochem. 6 (3): 173-175.

Kumar A and Jnanesha AC. (2017). Genetic diversity and conservation of medicinal plants in Deccan plateau region in India. Journal of Medicinal Plants Studies. 5 (3): 27-30.

Kumar A, Jnanesha AC, Venugopal & Nagaraju S. (2019). Post-harvest and value addition of important medicinal crops. In. Research Trends in Medicinal Plant Sciences. Eds. Manzoor Hussain. AkiNik Publications, Delhi, India. Vol. 04: 51-75.

Kumar A. (2019). *Cissus quadrangularis* Linn: A useful Indian medicinal plants. Agriculture & Food: e-Newsletter. 01 (09): 212-213.

Kumar MHV and Gupta YK. (2002). Effect of different extracts of *Centella asiatica* on cognition and markers of oxidative stress in rats: Journal of Ethnopharmacology. 79: 253-260p.

Kumar N, Jai Gopal Sharma, Samar Pal Singh, Amarjeet Singh, Hari Krishna V & Rina Chakrabarti. (2019). Validation of growth-enhancing, immunostimulatory and disease resistance properties of *Achyranthes aspera* in *Labeo rohita* fry in pond conditions. Heliyon. 5: e01246.

Kundu BB, Karan V, Ayesha F, Jha P, Pandey DK & Kumar V. (2021). *Dioscorea bulbifera* L. (Dioscoreaceae): A review of its ethnobotany, pharmacology and conservation needs. South African Journal of Botany. 140: 365-374.

Li JWH & Vederas JC. (2009). Drug discovery and natural products: End of an era or an endless. Frontier Science. 325:161–5.

Loya AM, Gonzalez Stuart A & Rivera JO. (2009). Prevalence of polypharmacy, polypharmacy, nutritional supplement use and potential product interactions among older adults living on the United States-Mexico border: A descriptive, questionnaire-based study. Drugs Aging. 26:423–36.

Luseba, D, Elgorashi EE, Ntloedibe DT &Van Staden J. (2007). Antibacterial, anti-inflammatory and mutagenic effects of some medicinal plants used in South Africa for treatment of wounds and retained placenta in livestock. S. Afr. J. Bot. 73: 378–383.

Madhav R Seshadri TR & Subramanian GBV. (1967). Structural investigations of lac resin: I. Chemical studies on hard resin. Indian. J. Chem. Sec. B. 5: 132.

Majekodunmi SO, Adegoke OA & Odeku OA. (2008). Formulation of the extract of the stem bark of Alstoniaboonei as tablet dosage form. Trop J Pharm Res. 7 (2): 987-994.

Nandi RP & SK Chatterjee. (1974). Occurrence of punarnavines in *Boerhaavia repens* Linn. Indian J. Exp. Biol. 12: 509-511.

Narendra Garaniya & Atul Bapodra. (2014). Ethnobotanical and Phytophrmacological potential of *Abrus precatorius* L.: A review. Asian Pacific Journal of Tropical Biomedicine. 4 (1): S27-S34.

Nayak P & Thirunavoukkarasu M. (2016). A review of the plant *Boerhaavia diffusa*: its chemistry, pharmacology and therapeutical potential. The Journal of Phytopharmacology. 5 (2): 83-92.

Nohr A, Rasmussenb B & Straandc J. (2009). Resin from the mukul myrrh tree, guggul, can it be used for treating hypercholesterolemia: A randomized, controlled study. Comp Therapies Med. 17:16–22.

Ojha KS, Nandave M, Arora S, Mehra DR, Joshi S, Narang R & Arya DS. (2008). Effect of *Commiphoramukul* extract on cardiac dysfunction in isoproterenol induced myocardial infraction. Indian J Exp Biol. 46:646–652.

Pandey RV, Shukla SS, Jain A, Jain A, Gupta VB & Deb L. (2018). Evaluation of Comparative Immunomodulatory Potential of *Solanum xanthocarpum* Root and Fruits on Experimental Animal. Indian Journal Pharm. Educ. Res. 52: S237- S245.

Periyasamy A, Rajkumar & Mahalingam K. (2001). Phytochemical screening and antimicrobial activity from five Indian medicinal plants against human pathogens. Middle-East Journal of Scientific Research. 5(6): 477-482.

Piyush S, Bafnaa PH, Patil, Saurabh KM & Rakesh EM. (2021). *Cissus quadrangularis* L: A comprehensive multidisciplinary review. Journal of Ethnopharmacology. 279: 114-355.

Prajapathi ND & Kumar U. (2003). Dictionary of Medicinal Plants, Agrobios, Jodhpur. 294

Prasad A, Mathur AK & Mathur A. (2019). Advances and emerging research trends for modulation of centelloside biosynthesis in *Centella asiatica* (L.) Urban- A review. Industrial Crops and Products. 141: 111768.

Qato DM, Alexander GC, Conti RM, Johnson M, Schumm P & Lindau ST. (2008). Use of prescription and over-the-counter medications and dietary supplements among older adults in the United States. JAMA. 300:2867–78.

Rahman MA, Alam, MS, Ahmad QN, Khan MAI & Abdullah-Al-Mahbub. (2003). Genetic Analysis on Yield and its Component Traits of Tomato (*Lycopersicon esculentum* Mill.). The Agriculturists. 1: 21-26.

Raj Neeta S, Jyoti B, Anjuvan, S & Prabhjot K. (2011). Antibacterial potential of *Achyranthus aspera* Linn Procured from Himachal Pradesh, Punjab and Haryana, India. Res. J. Chem. Sci. 1: 80–82.

Rajasekaran S, Ravi K, Sivagnanam K & Subramanian S. (2006). Beneficial effects of *Aloe vera* leaf gel extract on lipid profile status in rats with streptozotocin diabetes. Clin Exp Pharmacol Physiol. 33:232–37.

Rajeshwar Y, Gupta M & Mzumder UK. (2005). *In-vitro* lipid per oxidation and antimicrobial activity of *Mucuna pruriens* seeds. Iranian Journal of Pharmacology and Therapeutics. 4(1):32-5.

Rajeswara Rao BR. (2016). Springer International Publishing Switzerland, M.R. Abuja and S.M. Jain (eds.), Genetic Diversity and erosion in plants; Sustainable Development and Biodiversity. 8: 357-407.

Rane M, Neha Sahu, Sainin and Ajgoankar, Nikhil Teli & Deepa Verma. (2014). A Holistic Approach Review of Solanum virginianum L. Research and Reviews: Journal of Pharmacy and Pharmaceutical Sciences. 3 (3): 1-4.

Rastogi, RP & Mehrotra BN. (1999). Compendium of Indian Medicinal Plants. Vol. II, Central Drug Research Institute, Lucknow & National Institute of Science Communication & Information Resources, New Delhi, 611-612.

Reddy CS, Murthy EN, Reddy KN & Raju V. (2014). *Butea monosperma* (Lam.) var. *lutea* (Witt.): A Little-Known Taxon of India Needs Immediate conservation. 12: 292-294.

Saha S & Ghosh S. (2012). *Tinospora cordifolia*: One plant, many roles. Anc Sci Life. 31(4): 151–159.

Salkar K, Chotalia C & Salvi R. (2017). *Tinospora cordifolia*: an antimicrobial and immunity enhancer plant. Int. J. Sci. Res. 6: 1603-1607.

Sehrawat A & Sultana S. (2006). Chemoprevention by *Butea monosperma* of hepatic carcinogenesis and oxidative damage in male wistar rats. Asian Pacific Journal of Cancer Prev. 7(1):140-148.

Sen SK & Behera LM. (2000). Ethno medicinal plants used against leucorrhoea at Bargarh district in Orissa (India*)*. Neo Botanica. 8:19-22.

Sethi A, Srivastav SS & Srivastav S. (2006). Pregnane glycoside from *Hemidesmus indicus*. Indian Journalof Heterocyclic Chemistry. 16:191-192.

Siddique NA, Bari MA, Naderuzzaman ATM, Khatun N, Rahman MH, Sultana RS, Matin MN, Shahnewaz S & Rahman MM. (2004). Collection of indigenous knowledge and identification of endangered medicinal plants by questionnaire survey in Barind. Tract of Bangladesh. Journal Biological Sciences. 4: 72-80.

Sing Sandhya, Preetipandey & Kumar S. (2000). Traditional Knowledge on the Medicinal Plants of Ayurveda. Central Institute of Medicinal and Aromatic Plants, Lucknow.

Singh AK, Mishra HO & Singh KS. (1999). Kalmegh (*Andrographis paniculata*) cultivation in India. Farm Bulletin No. 10. Central Institute of Medicinal and Aromatic Plants, Lucknow.

Singh KK & Kumar K. (1999). Ethno therapeutics of some medicinal plants are used as antipyretic agents among the tribals of India. Journal of Economic and Taxonomic Botany. 23: 135-141.

Singh S, Asmita G, Abhimanyu S and Batra A. (2010). *Centella asiatica* (L.): A Sabyasachi Plant with Immense Medicinal Potential but Threatened. 4(2): 9-17.

Sonkamble VV & Kamble LH. (2015). Antidiabetic potential and identification of phytochemicals from *Tinospora cordifolia* Am. J. Phytomed. Clin. Ther. 3: 97-110.

Sophy R, Fleming AT, Ronald BSM, Shankar KG, Vidhya R, Rajagopalan V, Sheeba A & Durgalakshmi R. (2015). Antimicrobial Activity of Extracts of *Adenanthera pavonina* and *Mussaenda philippica* Against Isolated Bacteria and Fungi. International journal of pharmacy science and life research. 5(4):21-26.

Subramanian R, ZainiAsmawi M & Sadikun A. (2012). A bitter plant with a sweet future: A comprehensive review of an oriental medicinal plant: *Andrographis paniculata*. Phytochemistry Rev. 11:39-75.

Suguna L, Sivakumar P & Chandrakasan G. (1996). Effect of *Centella asiatica* extract on dermal wound healing in rats: Indian Journal of Experimental Biology. 34: 1208-1211.

Sundaran J, Raleena begum, Muthu Vasanthi, ManjalamKamalapathy, Giridharan Bupesh & Uttam Kumar Sahoo. (2020). A short review on pharmacological activity of *Cissus quadrangularis*. Bio Information. 16(8): 579–585.

Tandon, VR & Gupta RK. (2006). *Vitex negundo* Linn (VN) leaf extract as an adjuvant therapy to standard anti-inflammatory drugs. Indian Journal of Medicinal Research. 124(4):447-450.

Tilburt JC & Kaptchuk TJ. (2008). Herbal medicine research and global health: An ethical analysis. Bull World Health Organ. 86 (8):594–9.

Tiwari P, Jena S & Sahu PK. (2019). *Butea monosperma*: Phytochemistry and Pharmacology. Acta Scientific Pharmaceutical Science. 3(4): 19-26.

Tripathi YB & Upadhyay AK. (2001). The antioxidant property of *Mucuna pruriens* L. Current Science. 80: 1-11.

Varshney IP & Khan AA. (1971). Chemical examination of fruits and stems of *Solanum indicum*. Indian Journal of Pharmacy. 33 (3):49-50.

Verma S, Jain A & Gupta VB. (2010). Synergistic and sustained anti-inflammatory activity of guggul with the Ibuprofen: a preliminary study. Int J Pharma Biol Sci. 1:1–7.

Vermal SC, Vashishth E, Singh R, Pant P & Padhi MM. (2014). A Review on Phytochemistry and Pharmacological Activity of Parts of *Mucuna Pruriens*: Used as an Ayurvedic Medicine. World Journal of Pharmaceutical Research. 3(5):138-58.

World Health Organization (WHO). (2005). National Policy on Traditional Medicine and Regulation of Herbal Medicines. Report of WHO global survey. Geneva.

World Health Organization http://www.who.int/topics/traditional_medicine/en/.

Yadav G, Garg VK, Thakur N & Khare P. (2013). Locomotor Activity of methanolic extract of *Saraca indica* bark. Adv. Biol. Res.7: 1–3.

Zainol MK, Abd-Hamid A, Yusof S & Muse R. (2003). Anti-oxidant activity and total phenolic compounds of leaf, root and petiole of four accessions of *Centella asiatica* (L.) Urban. Food Chemistry. 81:575-581.

Table1: List of Indian medicinal Plants used as a medicine by Tribal communities

Indian name	Scientific name	Family	Part (s) used	Traditional Uses	Curative properties	References
Aloe	*Aloe vera*	Liliaceae	Leaves	Liver complaints, vomiting, bronchitis, asthma, jaundice and ulcers. Relieves constipation, maintains a good gastric pH, helps in inflammatory bowel diseses, non-ulcer dyspepsis, gastric and duodenal ulcer	Anti-inflammatory, antifungal, antibacterial, anticancer, antioxidant, cytoprotective, antidiabetic and immunomodulatory activities	Rajasekaran et al. (2006)
Asthma Weed	*Euphorbia hirta*	Euphorbiaceae	Whole plant	female disorders, respiratorym ailments (cough, coryza,mbronchitis, and asthma), and worm infestations in children, Dysentery, Jaundice, Pimples, Gonorrhoea, Digestive problems, and Tumors	Antibacterial, Antimalarial, Anti-inflammatory, Galactogenic, Antiasthmatic, Antidiarrheal, Antioxidant, Antifertility, Antiamoebic, Antifungal	Kumar et al. (2010)
Arjun	*Terminalia arjuna*	Combretaceae	Bark	Cardiovascular diseases (CVD), ulcers, diabetes, cough, excessive perspiration, asthma, tumor, inflammation and skin disorders	Cooling, aphrodisiac, urinary astringent, fractures, cirrhosis of liver, hypertension	Amalraj and Gopi (2007); Singh et. al. (1999)
Bala	*Sida Cordifolia*	Malvaceae	Bark; Seeds, Roots	Diarrhea, dysentery, gastrointestinal and urinary infections, malarial and other fevers, childbirth and miscarriage problems, skin ailments, cardiac and neural problems	Antimicrobial, anti-inflammatory and analgesic, hepatoprotective, cytotoxic, cardioprotective, antitubercular, antioxidant, antidiabetic and antiobesity	Dindaa et al. (2015)
Babul	*Acacia arabica*	Legumes	Leaves; bark; flowers; pods:	Diarrhoea, dysentery, diabetes, astringent, anthelmintic, in	Anti-Microbial, Anti-bacterial, Anti-fungal, Anti - diarrheal, Anti-viral,	Chatterjee and Pakrashi (2002)

			gum	skin diseases, cough and bleeding piles; gonorrhoea and as an antiasthmatic, diuretic, leprosy, leucoderma, bronchitis, seminal weakness, utero-vesical disorders	Anti-inflammatory, Antibiotic, Anti-oxidant, Antispasmodial	
Black pepper, white pepper, green pepper	*Piper nigrum*	Piperaceae	Fruit	Used in food products, like syrups, jams, preserves, pickles, snacks, biscuits, and candies, treat chronic bronchitis, asthma, constipation, gonorrhea, paralysis of the tongue, diarrhea, cholera, viral hepatitis, respiratory infections, stomachache, bronchitis, cough and tumors	Antimicrobial, antioxidant, antihypertensive, antidiabetic, anticonvulsive, antifungal, antiviral, hypolipidemic, anticarcinogenic, chemoprotective, and prebiotic activities	Kumar et al. (2011)
Chebulic Myrobalan	*Terminalia chebula*	Combretaceae	Dried immature fruits	Useful in opthalmia, hemorrhoids, dental caries, bleeding gums, ulcered oral cavity	Antioxidant, laxative, astringent, anti-bilious and antidysentery	Jokarab et al. (2016)
Elephant Creeper	*Argyreia nervosa*	Convolvulaceae	Whole plant	Treatment of gonorrhoea, strangury and chronic ulcers. A preparation "Fortege" made from this plant along with several other ingredients is used to cure sexual disorders in males.	Antiulcer, antitumour, antidiabetic, antifilarial, antiviral, antibacterial, antifungal, antifertility, antimicrobial and root useful in digestive, aperient, purgative, carminative and nervine	Anonymous (1995); Sing et al. (2000)
Five-leaved chaste tree	*Vitex negundo*	Lamiaceae	Leaves; seeds; roots	Chronic bronchitis, Nirgundi decoction is used for steambath for arthritis, joint pains and sciatica. The dried leaves when	Astringent, febrifuge, sedative, tonic and vermifuge, inflammatory swelling of the joints formed due	Tandon and Gupta (2006); Khan (1993)

				smoked are said to relieve headache. Decoction of leaves is an effective gargle in stomatitis and sorethroat.	to rheumatism, hydrocele and splenic enlargement	
Gorakhbuti	*Aerva lanata*	Amaranthaceae	Whole plant	cure and prevention for Scurvy, Diarrhoea and Dysentery, strengthens stomach tissues and good for digestion	Anti-oxidant properties, nephroprotective values, hepatoprotective properties anti lithiatic activities (increased urinary excretion of calcium, oxalate and uric acid crystals), anti-diabetic/hypoglyc-aemic activities, and anti-cancer properties	Agrawal et al. (2013); Husain (1993)
Guggul	*Commiphora wightii*	Burseraceae	Resin	Cholesterol lowering effect, used to treat cardiac disorders	Hypolipidemic activity, anti-Inflammatory, antifertility, antioxidant activity, cardioprotective and antiarthritic Activity	Verma et al. (2010); Nohr et al. (2009); Ojha et al. (2008); Sing et al. (2000)
Indian madder	*Rubia cordifolia*	Rubiaceae	Roots	Arthritis, cephalalgia, cough, diabetes, discolouration of the skin, dysmenorrhoea, emmenagogue, general debility, hemorrhoids, hepatopathy, intermittent fevers, jaundice, leucorrhoea, neuralgia, pectoral diseases	Antiseptic, styptic, anodyne, depurative, urino-genital disorders	Prajapathi and Kumar (2003)
Indian borage	*Coleus amboinicus*	Lamiaceae	Leaves	Leaves of used in fever, hepatopathy, renal and vesicle calculi, cough, chronic asthma, hiccough, bronchitis, anthelmintic, colic	Antimicrobial, Antibacterial, Respiratory Disorders, Antiepileptic, Antitumorigenic, Anti-Inflammatory and Wound	Hullatti and Bhattacharjee (2011)

				and convulsions	Healing Activities	
Musk okra	*Abelmoschus moschatus*	Malvaceae	Whole plant	Useful in ophthalmopathy, cardiac debility, hyperdipsia, burning sensation, nausea, dyspepsia, ptyalism, vomiting, flatulent colic, diarrhea, strangury, asthma, bronchitis, calculi, halitosis, pectoral diseases leukoderma and general debility	antihysteric, baked products, stimulating and antispasmodic properties	Pawar and Vyawahare; (2017); Husain (1993)
Red lucky seed	*Adenanthera pavonina*	Fabaceae	Leaves	Asthma, boil, diarrhoea, gout, inflammations, rheumatism, tumour and ulcers, and as a tonic, blood disorders, arthritis, rheumatism, cholera, paralysis, epilepsy, convulsion, spasm and indigestion	Antidiabetic, antibacterial, antifungal, cytotoxicity, antioxidant, analgesic, anticonvulsant, depressant, and anti-inflammatory activity	Sophy et al. (2015); Sing et al. (2000)
Salai guggul	*Boswellia serrata*	Burseraceae	Gum; Resin	Chronic inflammatory diseases including chronic ulcerative colitis, rheumatoid arthritis, crohn's disease, and bronchial asthma; in addition to its anti-depressive and beneficial effects in brain tumor patients	Anti-inflammatory, anti-arthritic, anti-rheumatic, anti-diarrheal, anti-asthmatic, anti-microbial anti-fungal, anti-complementary	Shah et al. (2017)
Vasaka	*Adhatoda vasica*	Acanthaceae	Leaves; seed	Cough, colds, asthma, to liquefy sputum, as a bronchodilator, bronchial catarrh, bronchitis, and tuberculosis. A number of parts of	Antibacterial, antifungal, hepatoprotective, antimutagenic, antitussive, anti-inflammatory and antiulcer,	Gulati et al. (2021)

				the plant are commonly used in the forms of decoctions or powders. The juice from the leaves is also frequently used.		
Vajradanti	*Barleria prionitis*	Acanthaceae	Leaves; roots	Pacifies vitiated vata, pitta, gingivitis, stomatitis, burns, dental caries, inflammations ascites, edema, wounds, nocturnal ejaculation and cracking heel	Antimicrobial activity, anthelmintic activity, antidiarrheal activity, antioxidant activity, antifertility activity, anti-diabetic activity, anti-inflammatory and antinociceptive activity	Banerjee et al. (2020); Husain (1993)
Vishnukantha	*Evolvulu salsinoides*	Convolvulaceae	Whole plant	Neurodegenerative diseases as brain tonic, amnesia and asthma, epilepsy and as a hepatoprotective	Antimicrobial, Antimicrobial, Antimicrobial, Antimicrobial, Antioxidant	Harshavardhini et al. (2021)

Ethno-botanical Study of Medicinal Plants of Fingeshwar area of Gariyaband District, Chhattisgarh, India

Prerna Soni
Department of Biotechnology, SPCAS PG College Nawapara, Rajim, Raipur, Chhattisgarh, India
Email- prernasn@yahoo.com
DOI: 10.5281/zenodo.6662984

Abstract

Medicinal Plants have been used by tribals and local people for cure of various diseases due to their rich capacity to treat specific disorders. They are remarkable diverse group of plants and usually used as traditional medicine by rural and tribal people. Man has been utilizing plants as medicinal purpose since long ago. Because of significant importance and for commercial value the sustainable utility and their conservation is necessary. During the present investigation Fingeshwar area of Gariyaband district in Chhattisgarh was selected for medicinal studies of herbal plants. This area is also marked for rich biodiversity. For the above process 40 tribals were selected and through random interview data were collected. Medicinal plants their local name, botanical name, family name, plant parts which has the medicinal properties and its crude preparation method for using certain health disorders were recorded in their local language. Gariyaband tribals had a great similarity regarding the use of plants as a source of medicines for life style diseases like diabetes, arthritis, hypertension, respiratory problem, digestive problem, skin diseases etc. 17 cultivated medicinal plant species were collected from Fingeshwar areas of Gariyaband district and are used by local peoples of village in their day-to-day life to cure various ailments have been documented along with their uses. A total of 17 plant species belonging to 17 genera and 14 families were reported for different therapeutic uses. The plants are used for medicine is enumerated alphabetically and the local name, family names, plant part used and curing diseases has documented for Gariyaband district. Fabaceae was the dominant family and Leaves were reported to be the most frequently use part of plants for the treatment of various diseases followed by other plant parts namely stem, root, seed, bark, fruit and flowers.

Keywords: Medicinal plants, Health disorders, Local tribals, Gariyaband, Fingeshwar

INTRODUCTION

Ethno-botany accounts for the study of relationship between people and plants for their use as medicines, food, shelter, clothing, fuel, fodder and other household purposes (Balick 1996). Schultes (1962) defined ethnobotany as "the study of the relationship which exists between people of primitive societies and their plant environment".

The traditional uses of some medicinal plants are handed over from generation to generation. Medicinal plants are remarkable diverse group of plants and usually used as traditional medicine by rural and tribal people. Man has been utilizing plants as medicinal purpose since long ago. Because of significant importance and for commercial value the sustainable utility and their conservation is necessary.

Medicinal Plants have been used by tribals and local people for cure of various diseases. As most of the diseases of modern society are life style disease and the use of herbal medicines can overcome such problems (Kumar 2010). Medicinal plants have huge significance in providing health care to about 80% of the population in India. Primarily the plants are the key part of folk medicines. Gradually the folk medicines led to the increase of traditional system of medicine like Ayurveda in India.

Chhattisgarh state is rich in the natural resources of herb and medicinal plants, which traditionally being used to treat various diseases. Hence, it is essential to conserve, protect and document the important plant species. During the present investigation, Fingeshwar area of Gariyaband district in Chhattisgarh was selected for medicinal studies of herbal plants.

METHODOLOGY

The plants were collected from Fingeshwar areas of Gariyaband district of Chhattisgarh. Geographically Gariyaband located at 20.2571° N, Latitude and 82.3018° E longitude. It is situated in the south eastern part of the Chhattisgarh. The detailed information pertaining their botanical names, local names, family name, and plant parts which has medicinal properties. All information regarding the uses of plants for treating various ailments and diseases was collected by directly interviewing elderly learned and experienced person of rural people of the villages.

Several visits also have done with these resource persons who helped us to identify the plants with their local/tribal names and their medicinal uses. All plants and their uses were confirmed through many resource people as far as possible in other localities of the state. During the investigation the all information about plant parts used and mode of administration, etc were recorded. The identification of plants was also done using the references of Flora of British India by Hooker (1875) and Herbaceous flora of Dehradun by CR Babu (1977).

RESULTS AND DISCUSSION

17 cultivated medicinal plant species were collected from Fingeshwar areas of Gariyaband district and are used by local peoples of village in their day-to-day life to cure various ailments have been documented along with their uses (Table 1; Figure 1-2; Plate 1). A total of 17 plant species belonging to 17 genera and 14 families were reported for different therapeutic uses. The plants are used for medicine is enumerated alphabetically and the local name, family names, plant part used and curing diseases has documented for Gariyaband district.

Table1: List of Ethno medicinal plant species used in the treatment of various ailments in Fingeshwar area of Gariyaband district

Botanical Name	Common Name	Family	Plant Parts Used	Disease cured
Acacia nilotica	Babul	Fabaceae	Leaves, stem and bark	Stomach problems, liver tonic, hair fall, fever, gonorrhoea, diarrhoea, diabetes, eye-watering, dysentery, excessive bleeding, blood clotting and leucorrhoea.
Amorphophallus paeoniifolius	Jimikand	Araceae	Corm	Rheumatism, inflammation, arthritis, heart disease and liver disease
Artabotrys hexapetalus	Hari champa	Annonaceae	Fruit and bark	Fever, diarrhoea, dysentery, sprain, inflammation, gout, leprosy, skin disease, wounds, tumours,

				cough, asthma, bronchitis and constipation.
Asparagus racemosus	Satavari	Asparagaceae	Root, stem and leaves	Gastric ulcers, cough, diarrhoea and diuretic.
Butea monosperma	Palash	Fabaceae	Seed, flower, root and fruits	Dysentery, diarrhoea, skin ulcers, cataract, relieves boils, pimples, skin ulcers, swelling and bleeding piles.
Carissa caranda	Karonda	Apocynaceae	Fruit leaves and root	Fevers, earache and syphilitic pain, diabetic ulcer, urine disorder, skin disease, anaemia, stomach pain and wound.
Cassia tora	Charota	Caesalpiniaceae	Leaves seeds and stem	Snake bite, allergy and joint problems.
Delonix regia	Gulmohar	Fabaceae	Flower	In constipation.
Ipomoea batatas	Shakarkand	Convolvulaceae	Root and leaves	Diarrhoea, diabetes, toothache, melanoma, wound and nausea.
Lawsonia inermis	Heena	Lythraceae	Seed and leaves	Wound and stomach ulcer.
Lantana camara	Lantana	Verbenaceae	Leaves	Chicken pox, measles, asthma and ulcers.
Madhuca longifolia	Mahua	Sapotaceae	Seeds, flowers, fruit and leaves	Acute and chronic tonsillitis, gout, heart disease and eye disease.
Mimosa pudica	Chuimui	Fabaceae	Leaves, stem and root	Urinogenital disorders, piles, dysentery, sinus, and also applied on wounds.
Phyllanthus emblica	Amla	Phyllanthaceae	Whole plant	Diabetes, haemorrhage and leucorrhoea.
Shorea robusta	Sal	Dipterocarpaceae	Leaves, Seed, bark and fruit	Excessive salivation, epilepsy, and chlorosis, ulcers and leprosy.
Solanum virginianum	Bhaskatiya	Solanaceae	Root and fruit	Cough asthma and ear problem.
Tinospora cordifolia	Giloy	Menispermaceae	Whole plant	Liver disease and urinary tract infections.

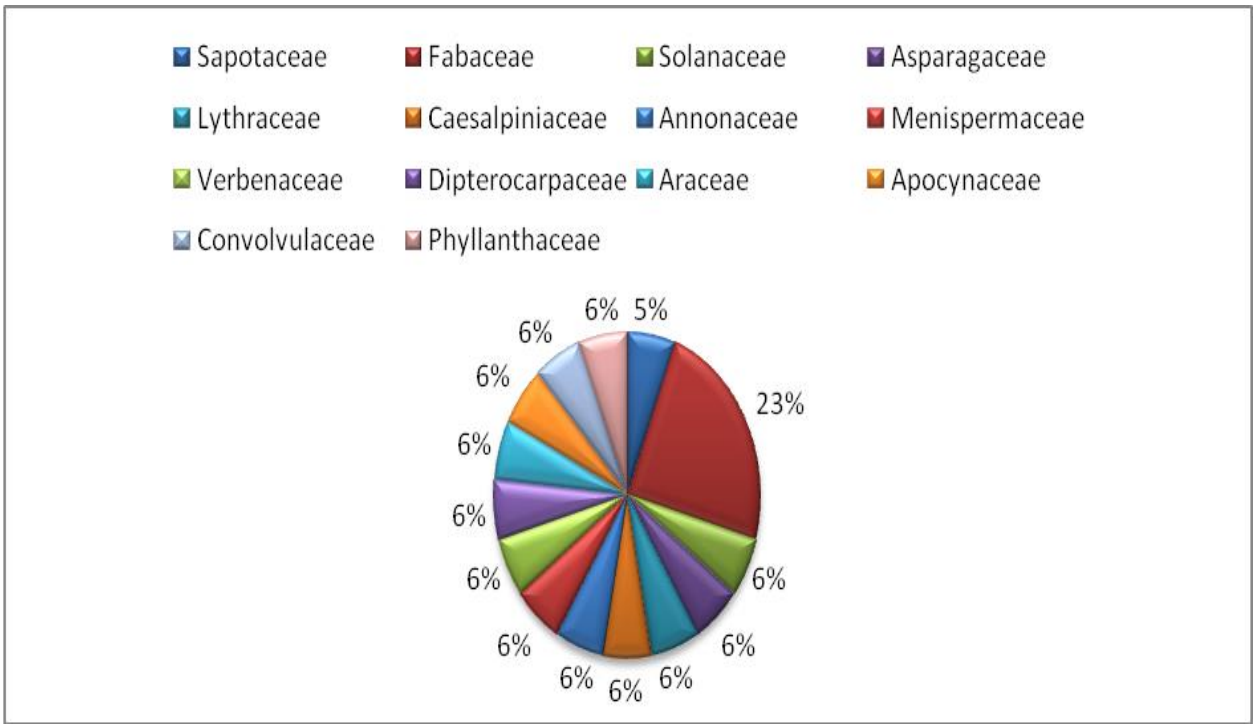

Figure1: Distribution of Plant Families

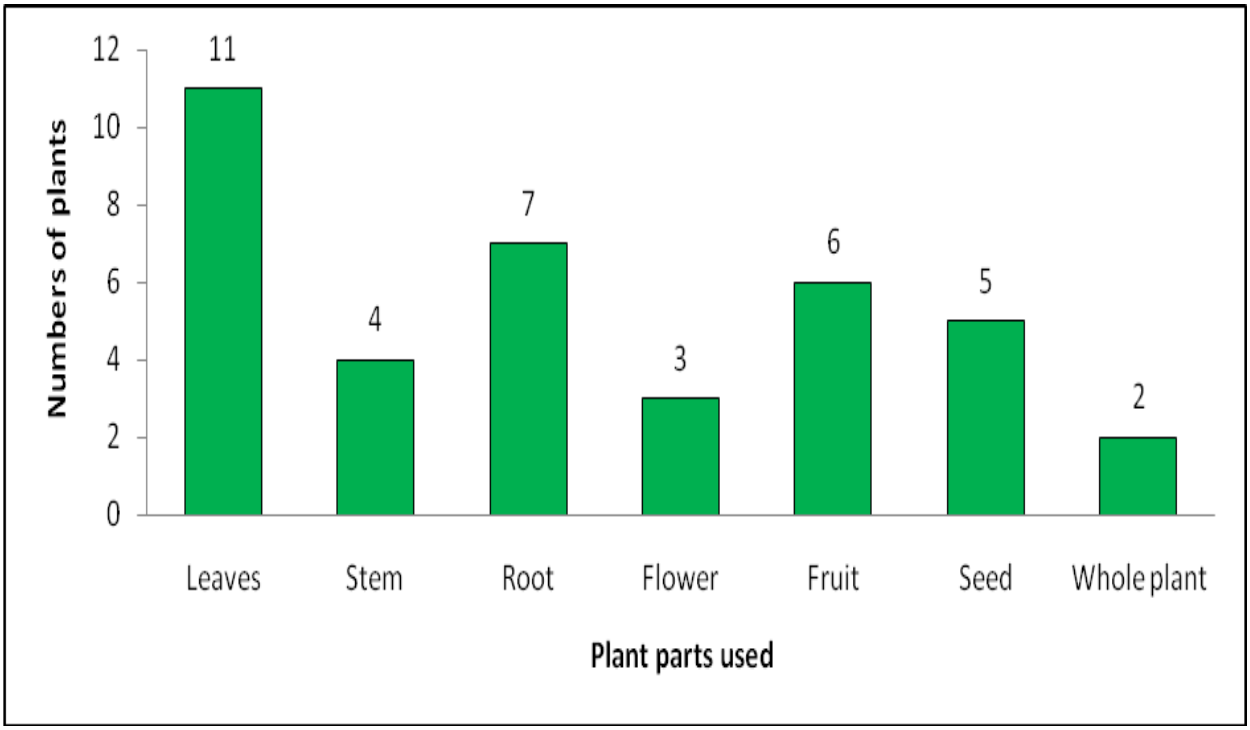

Figure 2: Uses of plant parts

Heena

Jimikand

Lantana

Mahua

Bhaskatiya

Satavari

Gulmohar

Hari Champa

Giloy

Sal

Karonda

Babul

Chumui

Charota

ShakarKand

Plate 1: Ethno-medicinal plants used in the different diseases and disorders in Gariyaband district

Fabaceae was the dominant family with 4 species followed by Phyllanthaceae, Caesalpiniaceae, Menispermaceae, Annonaceae, Araceae, Apocynaceae, Verbenaceae, Lythraceae, Asparagaceae, Dipterocarpaceae, Convolvulaceae, Solanaceae and Sapotaceae. Leaves were reported to be the most frequently use part of plants for the treatment of various diseases followed by other plant parts namely stem, root, seed, bark, fruit and flowers.

Although a review of literature reveals that considerable research work has been done on ethno-medicinal plants in India (Alagesaboopathi 2013; Murthy 2012; Kumar et al. 2010; Jain and Vairale 2007; Jain et al. 2006; Mishra 2011; Shukla et al. 2010), many significant information and native knowledge base have already been lost as information hold with older generation could not be transmitted to younger generations and remains unrecorded and still there are some core areas which need to be surveyed intensively like Gariyaband district for probing new traditional medicines.

CONCLUSION

The present study highlights the importance of local medicinal plants and their uses for curing many health care problems. The study indicates that need more exploration works followed by the evaluation of pharmacological works for developing future drugs to fight against various diseases and disorders.

ACKNOWLEDGEMENT

Author is thankful to elderly local people of the Fingeshwar of Gariyaband for their valuable information shared regarding the ethno medicine and healing practices. This work was supported by the Department of Biotechnology, Seth Phool Chand Agrawal Smriti PG College Nawapara, Raipur (CG).

REFERENCES

Alagesaboopathi C. (2013). Ethnomedicinal plants used for the treatment of snake bites by Malayali tribals and rural people in Salem districts, Tamil Nādu, India. Int. J. Biosci. 3(2): 42 53.

Babu CR. (1977). Herbaceous Flora of Dehradun, Publication and Information Directorate, CSIR Hillside road, New Delhi.

Balick MJ. (1996). Transforming ethnobotany for the new millennium. Ann. Mo Bot Gard. 83: 58 66.

Hooker JD. (1875). Flora of British India, London and Becelers: William Clowers and sons Ltd., London.

Jain AK and Vairale MG. (2007). Some threatened angiospermic taxa of Chambal Eco-region. Phytotaxonomy. 07: 107 110.

Jain JB, Kumane SC and Bhattacharya S. (2006). Medicinal flora of Madhya Pradesh and Chhattisgarh: A review. Indian Journal of Traditional Knowledge. 5(2): 237-242.

Kumar V, Sachan P, Nigam G and Singh PK. (2010). Some ethno-medicinal plant of Chitrakoot district (U.P.). Biozone Int. J. Life Sci. 2(1&2): 270-283.

Mishra M. (2011). Wild harvesting and management of some medicinal plants in the natural forest of central India, Ind. Jour. of fund and Appl. Life Science. 1(2): 90-97.

Murthy EN. (2012). Ethno medicinal plants used by Gonds of Adilabad district, Andhra Pradesh, India. Int. J. Pharm. Life Sci. 3(10): 2034 2043.

Schultes RE. (1962). The role of ethanobotanist in search for new medicinal plants. Lloydia. 25 (4): 257-266.

Shukla AN, Shrivastava S and Rawat AKS. (2010). An ethnobotanical survey of medicinal plants of Rewa district, Madhya Pradesh. Indian Journal of Traditional Knowledge. 9(1): 191-202.

APRF PUBLISHERS

5F/561, SECTOR-9, CDA

CUTTACK- 753014

9 788195 584703