J. Biodivers. Conservation 9(1): 01-29 ISSN: 2457-0761 (online)
2025 http://www.aprfjournal.in

Research Article

Evaluation of quantitative ethnobotanical uses in Mayurbhanj district, Odisha, India

Nibedita Jena, Subhalakshmi Rout, Sweta Mishra and Sanjeet Kumar*

Ambika Prasad Research Foundation, Odisha, India

*Email-Id: sanjeetaprf@gmail.com; ORCID: https://orcid.org/0000-0001-9538-397X

DOI: https://doi.org/10.5281/zenodo.14674405

Article Details: Received: 2024-08-20 | Accepted: 2025-01-16 | Available online: 2025-01-17

Abstract: The indigenous communities of Mayurbhanj district in Odisha, India, have long relied on traditional plant-based remedies to address various health ailments and daily needs. This ethnobotanical study aimed to document and analyze the traditional uses of plants among the local communities, with a focus on their medicinal, culinary, and other applications. A comprehensive survey was conducted among 55 informants from 20 villages in Mayurbhanj district, using semi-structured interviews and participant observation. The study recorded the use of 10 plant species, belonging to 09 families, for various purposes. Most of these plants were used for medicinal purposes, including the treatment of dental problems, skin infections, eye problems, gastrointestinal disorders, and other ailments. The study employed various quantitative indices, including the Relative Frequency of Citation (RFC), Informant Consensus Factor (ICF), Fidelity Level (FL%), and Use Value (UV) to evaluate the consistency and significance of the reported plant uses. The results showed a high level of consensus among informants regarding the medicinal uses of these plants, with ICF values ranging from 0.71 to 1.0. The FL% values indicated that certain plants, such as *Jatropha gossypiifolia* and *Vitex negundo*, were widely recognized and utilized for specific health conditions. The study's findings highlight the significance of traditional plant-based knowledge in addressing the healthcare needs of local communities. The documented plant uses also demonstrate their potential for new drug discoveries and their importance in conserving biodiversity. However, the study also underscores the need for further research to validate the efficacy and safety of these traditional remedies, as well as to address the challenges of cultural and intellectual property rights related to traditional knowledge. This research contributes to the growing body of literature on ethnobotany and traditional medicine, emphasizing the importance of preserving and promoting indigenous knowledge systems. The study's outcomes are expected to inform policy and conservation efforts, while also providing a foundation for future research on the medicinal properties and applications of these traditional plant species.

Keywords: Ethnobotany, Traditional medicine, Medicinal plants, Indigenous communities

Introduction

The world's biodiversity hotspots are facing unprecedented threats, including habitat destruction, climate change, and overexploitation of natural resources (Willis et al., 2007; Shivanna, 2022). These threats not only imperil the survival of countless plant and animal species but also jeopardize the livelihoods and cultural heritage of indigenous communities that have long relied on these ecosystems for their sustenance and well-being (Estrada et al., 2022). In this context, it is essential to document and preserve the traditional knowledge systems of these communities, which are rapidly disappearing due to urbanization, modernization, and other factors. India, with its rich cultural and biological diversity, is home to numerous indigenous communities that have developed unique traditional knowledge systems over centuries (Gomez-Baggethun et al., 2013; Arjona-Garcia et al., 2021). These systems encompass a broad range of practices, including traditional medicine, agriculture, and natural resource management. In the state of Odisha, for example, various tribal communities have long relied on traditional plant-based remedies to address their healthcare needs (Kumar et al., 2012; Aradhana et al., 2022; Devi et al., 2023). These remedies are often derived from locally available plant species, which are used in various forms, including decoctions, infusions, and powders (Das et al., 2020; Kumar et al., 2021; Das et al., 2022; Devi et al., 2022; Mishra et al., 2022; Saha et al., 2022; Agarwal et al., 2023; Nayak and Kumar, 2023; Devi et al., 2024; Sahu et al., 2024). Despite their significance, these traditional knowledge systems are facing numerous challenges, including the erosion of cultural heritage, the loss of biodiversity, and the lack of recognition and protection under Indian law. In recent years, there has been a growing recognition of the importance of preserving traditional knowledge systems, not only for their cultural significance but also for their potential contributions to modern medicine, agriculture, and conservation (Das et al., 2024; Sinha et al., 2024a; Mukherjee et al., 2024; Singh and Kumar, 2024; Sharma et al., 2024; Sinha et al., 2024b; Basole et al., 2024; Joshi et al., 2024; Jaiswal et al., 2024). However, much remains to be done to document, validate, and promote these systems, particularly in the context of India's diverse and rapidly changing ecosystems. The district of Mayurbhanj in Odisha is a biodiversity hotspot, with a rich array of plant and animal species. The district is also home to numerous indigenous communities, including the Santhal, Kolha, and Munda tribes, which have developed unique traditional knowledge systems over centuries (Kumar and Jena, 2017). This study aims to document and analyse the traditional plant uses among the indigenous communities of Mayurbhanj district, with a focus on their medicinal, culinary, and other applications using quantitative methods of ethnobotany. The study employs a quantitative ethnobotanical approach, combining semi-structured interviews and participant observation to gather data on the traditional plant uses of local communities. The present study highlights the importance of traditional knowledge of Mayurbhanj district of Odisha state, India.

Methodology

Study area: The present study was carried out in the villages of Badampahar Range located in the Rairangpur Forest Division, Mayurbhanj, Odisha, India. Mayurbhanj is the largest district of Odisha covering an area of about 10, 400 km^2 (Sahoo et al., 2024). The district shares borders with Medinipur district of West Bengal to the north-east, Singhbhum district of Jharkhand to the north-west, while

Balasore and Keonjhar districts of Odisha to the south-east and south-west, respectively (Mohanty, 2020). It is Odisha's 3rd most populous district after Ganjam and Cuttack, with the highest percentage of tribal communities forming about 60% of the total population (Behera, 2015). The major tribes of the study area include Santhal, Ho, Bhumij, Munda, Bathudi, Bhuiyan, Kisan, Gond, Sounti, and Kharia (Parida and Mishra, 2023). The district has the Chottanagpur plateau with rich biodiversity, several mineral resources like iron ore, magnetite, China clay, galena, asbestos, quartzite, etc. of which the major iron-ore deposits are found in Badampahar and Suleipat, along with many river basins (Karan, 1953). The Budhabalanga River is the main river of Mayurbhanj with minor rivers like Deo, Sone, Gangahar, and Salandi (Sethi et al., 2022). It is an agro-climatic region experiencing a sub-tropical climate with a hot and humid summer, and chilling winter with good precipitation (Ray and Patro, 2016). The average annual rainfall ranges from 150-164 cm in this area (Ray et al., 2016). The district is the home to the Similipal Biosphere Reserve, which has a microclimate with extreme summers and winters, receiving moderate to heavy rainfall and consisting of rich vegetation and biodiversity. It is endowed with lush green vegetation comprising of moist deciduous Sal forests, semi-evergreen forests, deciduous hill forests, dry deciduous Sal forests, plain Sal forests, grassland, and savannah (Das and Behera, 2012).

Data collection of informants: The study consisted of 55 individuals, 29 of whom were female and 26 males, residing in different locations of the study area. The informants mainly belonged to five tribal groups namely Kolha, Santhal, Munda, Kharia, and Kudmi, and other groups like Gopal and Bindhani from 20 villages of Mayurbhanj, Odisha. The highest number of informants belonged to the Kolha group whereas the lowest to the Bindhani group. The interviewees in the present study were mainly farmers, housewives, traditional healers, and forest watchers whose ages ranged from 35 to 73 years. The informants were interviewed through semi-structured questionnaires and group discussions with their consent and confidentiality about their personal details was maintained. The questionnaire consisted of the individual and socio-economic particulars of the informants like name, age, gender, occupation, tribe, etc. A simple random sampling technique was used for the interviews (N'do et al., 2024). The personal data of the informants were collected to acknowledge the age group and gender from whom the information on the selected medicinal plants and their uses were gathered. It emphasizes the value of people belonging to higher age groups and traditional healers who have a lot of information on traditional knowledge and healing practices thereby increasing the reliability of the collected ethnobotanical data (Espinosa et al., 2013; Plate 1).

Data collection about the location: The study was conducted in 20 villages of the Mayurbhanj district of Odisha state viz. Ambatola, Badajodi, Bhadusahi, Bhandan, Bhogabandi, Bhuyanbasa, Chaturisahi, Chauradibadam, Dudhijharan, Gandarbahar, Jamukeswar, Kantasala, Maharajpur, Purunapani, Ramjali, Sargada, Sarjomgada, Siltia, Suleipat, and Tetulsahi. The diverse tribal population played a significant role in selecting some of the study areas highlighting the cultural aspects and gain of traditional knowledge (Jana et al., 2023). The geographical and ecological features, climatic conditions, and plant distributions also played a major role in the selection process of study areas. Another criterion for choosing the study areas was the sighting of the selected medicinal plants near the residences of

selected villages. GPS points were collected in the chosen villages using the Garmin GPS Etrex 10 GPS navigator.

Data collection on ethnobotanical uses: Ethnobotanical surveys were carried out in the selected study areas of Mayurbhanj, Odisha from 2020 to 2024. The data were collected from the informants through semi-structured interviews, group discussions, note-making, and open-ended conversations (Anadka and Gulimane, 2024; Plate 1).

Plate 1: Field survey in study areas for collection of ethnomedicinal uses

For the survey, 10 medicinal plants namely *Celastrus paniculatus*, *Cleistanthus collinus*, *Cryptolepis buchananii*, *Holarrhena pubescens*, *Jatropha gossypiifolia*, *Mimosa pudica*, *Morinda pubescens*, *Schleichera oleosa*, *Terminalia chebula*, and *Vitex negundo* were selected. Most of the information collected from the interviewees was related to the personal details of the informants, uses, and treatment methods of the selected medicinal plants to cure different health ailments, along with the origin of knowledge for traditional remedies (Gervaise et al., 2024).

Herbarium preparation: The plant specimens of the selected medicinal plants were collected during field surveys for easy identification (Madani et al., 2017). The specimens were pressed, dried, and poisoned properly before pasting them on the herbarium sheets. The voucher specimens of each plant species were deposited in the Herbarium unit of Biodiversity and Conservation Lab, APRF, Cuttack, Odisha with voucher numbers APRFH-122, APRFH-120, APRFH-127, APRFH-119, APRFH-126, APRFH-124, APRFH-125, APRFH-106, APRFH-121, and APRFH-123 (Plate 2).

Calculation of Relative Frequency of Citation (RFC): Relative Frequency Citation (RFC) is an ethnobotanical quantitative analytical technique that emphasizes the importance of a specific plant species for the treatment of any health ailments in a particular study area (EI-Ghazouani et al., 2024). It can be calculated as the ratio of the informants mentioning the use of a plant species to the total number of informants, where the higher RFC value indicates the higher use of the plant species within a community (Acharya et al., 2024).

$$RFC = \frac{FC}{N}$$

where, FC =Informants mentioning the use of plant species

N =Total informants

Calculation of Use Value (UV): Use Value (UV) accesses the relative importance of local plant species within a community, taking into consideration the medicinal, culinary, festive, and other uses of a particular plant species (Radi et al., 2024).

$$UV = \frac{\sum U}{N}$$

where, U =Number of uses mentioned by each informant for a given plant species

N =Total informants interviewed for a particular plant

Calculation of Fidelity Level (FL%): Fidelity Level (FL%) demonstrates the use of a single plant species in the treatment of a single disease (Mechaala et al., 2022).

$$FL\% = \frac{NP}{N} \times 100$$

where, NP =Number of informants mentioning the use of a plant species in the treatment of a particular disease

N =Total informants interviewed

Calculation of Informant Consensus Factor (ICF): Informant Consensus Factor (ICF) is the value that shows the degree of agreement among participants on the medicinal uses of the plant species for a particular health ailment (Anas et al., 2024).

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

where, Nur =Number of times an ailment was mentioned

Nt =Number of plants mentioned to treat that ailment

Results and discussion

Ethnobotanical information is the base of many life stuffs among the human beings and modern societies. In the analysis of field survey, Table 1 presents demographic information about 55 informants who participated in a study on traditional plant uses in Mayurbhanj district, Odisha, India. The informants belong to various indigenous communities, including Santhal, Munda, Kolha, and Kudmi. The table provides details on each informant's name, location, ethnic affiliation, gender, age, and occupation. The informants' ages range from 35 to 73 years, with the majority being farmers. The table offers a snapshot of the socio-cultural profile of the informants, highlighting the importance of traditional knowledge in rural communities. The predominance of farmers among the informants suggests a strong connection between the community's livelihood and their traditional knowledge of plants. The presence of traditional healers and homemakers among the informants also underscores the significance of plant-based remedies in local healthcare practices. Overall, the table provides a foundation for understanding the cultural context and traditional knowledge systems of the communities involved in the study. Table 2 presents information on 23 collection sites in Mayurbhanj district, Odisha, India, from where ethnobotanical data was gathered. The table provides details on the geographical location of each site, including GPS coordinates and elevation, as well as the number of informants at each location. This information helps to contextualize the traditional knowledge systems of the region, highlighting the diversity of plant uses and the importance of geographical location in shaping these systems. The collection sites are spread across various villages and hamlets, with elevations ranging from 324m to 458m. The number of informants at each site varies, with some locations having only one informant and others having up to six. This suggests that traditional knowledge is not uniformly distributed, and certain locations may have more knowledgeable individuals or communities. The information presented in Table 2 provides a foundation for understanding the complex relationships between geographical location, traditional knowledge, and plant use in Mayurbhanj district. Table 3 presents a comprehensive list of 10 ethnomedicinal plants used by local communities in Mayurbhanj district, Odisha, India belonging to 9 families. The table provides detailed information on the local names, parts used, and

traditional uses of each plant, highlighting the significance of these plants in traditional medicine. The plants are used to treat a wide range of ailments, including skin infections, muscle pain, stomach problems, dental issues, eye problems, headache, wound inflammation, and rheumatic pain. The table reveals the versatility of these plants, with multiple uses reported for each species. For example, *Celastrus paniculatus* is used to treat skin infections and muscle pain, while *Holarrhena pubescens* is used to treat stomach problems, diarrhoea, and skin issues. Similarly, *Jatropha gossypiifolia* is used to treat dental problems, stomach issues, eye problems, and skin infections. This highlights the importance of these plants in traditional medicine and their potential for future drug development. The documentation of these traditional uses is crucial for the conservation of medicinal plants and the preservation of traditional knowledge. The table serves as a valuable resource for researchers, policymakers, and local communities, providing a foundation for further studies on the medicinal properties of these plants. By recognizing the significance of these plants in traditional medicine, we can work towards their sustainable use and conservation, ultimately contributing to the well-being of local communities and the preservation of biodiversity. Table 4 presents the Relative Frequency of Citation (RFC) for each of the 10 ethnomedicinal plants listed. The RFC is calculated by dividing the number of informants who mentioned a particular plant species by the total number of informants (55). The table reveals that *Jatropha gossypiifolia* and *Celastrus paniculatus* have the highest RFC values (0.32 and 0.31 respectively), indicating that these plants are widely recognized and used by the local communities. The RFC values range from 0.12 (*Morinda pubescens*) to 0.32 (*Jatropha gossypiifolia*), suggesting varying levels of recognition and usage among the local communities. The table provides valuable insights into the cultural significance and traditional uses of these plant species, highlighting their importance in local healthcare practices. Table 5 presents the calculation of Use Values (UV) for each of the 10 ethnomedicinal plants listed. The UV is calculated by dividing the number of uses reported for a particular plant species by the total number of informants. The table reveals that *Jatropha gossypiifolia*, *Celastrus paniculatus*, *Terminalia chebula* and *Schleichera oleosa* have the highest UV values (0.3, 0.3, 0.3 and 0.63 respectively), indicating that these plants have the most diverse range of uses. The UV values range from 0.13 (*Mimosa pudica*) to 0.63 (*Schleichera oleosa*), suggesting varying levels of versatility and importance among the plant species. The table provides valuable insights into the traditional uses of these plant species, highlighting their significance in local healthcare practices and daily life. By quantifying the use values, the table helps to identify the most valuable and versatile plant species, which can inform conservation and sustainable use efforts. Table 6 presents the calculation of Fidelity Level (FL%) for each plant species used against specific diseases or ailments. The FL% is calculated by dividing the number of informants mentioning the use of a plant species for a particular disease by the total number of informants mentioning the plant for any use. The table reveals that *Vitex negundo* has the highest FL% (23.63%) for its use as an insect-repellent, indicating high consensus among informants about its effectiveness. The table provides valuable insights into the traditional uses of these plant species and their perceived effectiveness. For example, *Jatropha gossypiifolia* is used against multiple ailments, including dental problems, skin infections, and eye problems, with varying levels of fidelity. Similarly, *Holarrhena pubescens* is used to treat gastrointestinal disorders, diarrhoea, and dysentery, with a high FL% for gastrointestinal disorders (12.72%). This

information can inform the development of new drugs and conservation efforts. Table 7 presents the calculation of Informant Consensus Factor (ICF) for various diseases or ailments treated by the local communities. The ICF is a measure of the agreement among informants about the use of a particular plant species for a specific disease. An ICF value of 1 indicates complete agreement among informants, while a value closer to 0 indicates less agreement. The table reveals that there is complete agreement among informants about the use of certain plant species for diseases such as dental problems, mouth ulcer, cough, crack heels, and insect repellent (ICF = 1). High ICF values are also observed for eye problems (0.85) and muscle pain (0.86), indicating a high level of consensus among informants about the effectiveness of these plant species. In contrast, lower ICF values are observed for gastrointestinal disorders (0.71) and skin infections (0.75), suggesting less agreement among informants about the use of plant species for these conditions.

Table 1: Details of informants of present study

Name/Location	Race	Gender	Age	Occupation
Asha Mahakud/Suleipat	Gopal	F	53	Farmer
Bagun Sirka/Ambatola	Kolha	M	47	Farmer
Baha Besra/Sargada	Santhal	M	70	Traditional healer
Balma Naik/Chauradi	Kolha	F	59	Farmer
Basanta Kumar Mohanta/Kantasala	Kudmi	M	53	Farmer
Basanti Ho/Chauradi	Kolha	F	37	Farmer
Bhima Naik/Chaturi sahi	Kolha	M	48	Farmer
Bilanti Ho/Maharajpur	Kolha	F	37	Farmer
Birang Janko/Ambatola	Munda	F	37	Farmer
Bisu Sirka/Sarjomgada	Kolha	M	62	Farmer
Biswanath Sirka/Sarjomgada	Kolha	M	61	Farmer
Bodni Naik/ Bhuyanbasa	Kolha	F	38	Farmer
Chandmuni Tiria/Bhuyanbasa	Kolha	F	54	Traditional healer
Chandra Pingua/Sarjomgada	Kolha	M	48	Farmer
Chandramuni Hansdah/Bada Jodi	Santhal	F	38	Housewife
Chare Pingua/Sarjomgada	Kolha	M	61	Farmer
Chipri Gagrai/Ramjali	Kolha	F	73	Farmer

Daka Kuda/Siltia	Kolha	M	65	Farmer
Dasrath hemram/Gandarbahar	Kolha	M	55	Farmer
Dayanidhi Naik/Ramjali	Kolha	M	53	Farmer
Deepak Hemram/Gandarbahar	Kolha	M	51	Farmer
Devraaj Mohanta/Jamukeswar	Kudmi	M	43	Farmer
Duka Ho/Jamukeswar	Kolha	M	72	Farmer
Fudan Majhi/Ramjali	Santhal	M	44	Farmer
Ganga Ho/Maharajpur	Kolha	M	38	Farmer
Gopinath Hemrum/ Bhadusahi	Santhal	M	62	Farmer
Jayashree Tiria/Bhuyanbasa	Kolha	F	35	Farmer
Jora Ram naik/Bhagabandi	Kolha	M	38	Farmer
Khageswar Konakle/Chiltia	Kolha	M	46	Farmer
Kujia Naik/Purunapani	Munda	F	66	Farmer
Laxmi Naik/Bhuyanbasa	Kolha	F	39	Farmer
Madhusudan Gagrai/Ramjali	Kolha	M	43	Farmer
Maendi Murmu/Bhagabandi	Santhal	F	41	Farmer
Mana Hemram/Gandarbahar	Kolha	M	68	Farmer
Mangi Sirka/Ambatola	Munda	F	39	Farmer
Panchami Sing/Ramjali	Kolha	F	36	Housewife
Phulamani Hansdah/Bada Jodi	Santhal	F	36	Farmer
Pinki Murmu/Sargada	Santhal	F	37	Farmer
Puja Lohar/Kantasola	Bindhani/Lohar	F	39	Homemaker
Purnima Mahakud/Suleipat	Gopal	F	46	Farmer
Putkun Pingua/Sarjomgada	Kolha	F	43	Farmer

Raimuni Sing/Chaturi sahi	Kolha	F	39	Farmer
Ram Sing Gagrai/Ramjali	Kolha	M	43	Farmer
Rupa Ho/Badam chauradi	Kolha	F	68	Farmer
Salho Soren/Bada Jodi	Santhal	F	48	Homemaker
Salma Hemram/Bada Jodi	Santhal	F	39	Farmer
Salma Marandi/Bhandan	Santhal	F	35	Farmer
Samayu Murmu/Bhandan	Santhal	M	60	Farmer
Saunri Majhi/Bhadusahi	Santhal	F	39	Farmer
Siba Dehuri/Suleipat	Kharia	M	36	Farmer
Simaal Naik/Bhuyanbasa	Kolha	M	68	Farmer/Traditional healer
Sita Murmu/Dudhijharan	Santhal	F	43	Farmer
Somra Naik/Chaturi sahi	Kolha	M	37	Forest watcher
Sula Dehuri/Tetulsahi	Kharia	F	70	Farmer
Sumi Hansdah/Bada Jodi	Santhal	F	58	Farmer

Table 2: Information on collection sites of ethnobotanical uses in present study

Location	GPS	Sample information
Ambatola	N 22°01.741’ E 086°07.138’ Elevation 450m	3 informants
Badajodi	N 22°06.714’ E 86°13.015’ Elevation 333m	5 informants
Bhadusahi	N 22°05.444’ E 086°07.341’ Elevation384m	2 informants

Bhandan	N 22°06.098’ E 086°09.159’ Elevation 346m	2 informants
Bhogabandi 1	N 22°06.955’ E 086°09.838’ Elevation 331m	1 informant
Bhogabandi 2	N 22°06.599’ E 86°09.755’ Elevation 344m	1 informant
Bhuyanbasa 1	N 22°06.991’ E 086°11.090’ Elevation 372m	3 informants
Bhuyanbasa 2	N 22°06.582’ E 86°10.746’ Elevation 364m	2 informants
Chaturi Sahi	N 20°05.793’ E 086°11.650’ Elevation 358m	3 informants
Chauradi Badam 1	N 22°05.738’ E 086°08.991’ Elevation 372m	2 informants
Chauradi Badam 2	N 22°05.739’ E 086°08.993’ Elevation 374m	1 informant
Chiltia	N 22°03.437’ E 086°04.715’ Elevation 342m	2 informants
Dudhijharan	N 22°06.955’ E 086°09.838’ Elevation 331m	1 informant
Gandarbahar	N 22°02.042’ E 086°05.970’ Elevation 445m	3 informants
Jamukeswar	N 22°00.668’ E 086°06.552’ Elevation 449m	2 informants
Kantasala	N 22°05.734’ E 086°09.842’ Elevation 374m	2 informants
Maharajpur	N 22°01.683’	2 informants

	E 086°08.558' Elevation 458m	
Purunapani	N22°07.821' E 086°11.568' Elevation 345m	1 informant
Ramjali	N 22°06.637' E086°07.260' Elevation 349m	6 informants
Sargada	N 22°05.815' E 086°12.441' Elevation 346m	2 informants
Sarjomgada	N 22°03.436' E 086°04.715' Elevation 339m	5 informants
Suleipat	N 22°08.421' E 086°13.957' Elevation 324m	3 informants
Tetulsahi	N 22°05.743' E 086°08.587' Elevation 364m	1 informant

Table 3: Enumeration of ethnomedicinal plants and their uses

Plant Name	Local Name(s)	Parts used	Uses
Celastrus paniculatus Willd.	Kujuri, Pengu	Seed	Seed oil is used to cure skin infections. Seed oil is also used to massage to reduce muscle pain
		Leaf	Used as leafy vegetable (By frying with oil, onion, tomato and garlic)

Cleistanthus collinus (Roxb.) Benth. ex Hook.f.	Pasu, Karada	Whole plant	Used as insect repellent
		Seed	Seed oil is used again cracked feet or skin problems
Cryptolepis buchananii R.Br. ex Roem. & Schult.	Dudhinai, Dudhilata	Root	The decoction is used to cure stomachache.
		Stem	Used in making rope
Holarrhena pubescens Wall. ex G. Don	Haata, Paba, Lajkudia, Kurei, Kutkunein, Kuruchi	Leaf	Leaf decoction is taken to cure stomach problems
		Bark	1 teaspoon of bark decoction is taken orally to cure stomachache and diarrhoea
		Root	1 spoon of root decoction is taken in empty stomachache twice a day to treat diarrhoea.
Jatropha gossypiifolia L.	Nali bendrii, Tutka, Jada, Potam Jada, Papae, Poktambindi	Stem	Used as toothbrush to cure dental problems (3/4 days)

		Latex	Stomach problems (1 time/day) Eye ache and swelling (2 drops of latex used to cure eye problems) Used to cure crack heels Used against skin infections
Mimosa pudica L.	Japith	Root	1 tablespoon of root decoction is taken to cure headache
Morinda pubescens Sm.	Aachu	Leaf	Tender leaves are consumed as leafy vegetable The leaf paste is used to treat wound and inflammation
		Fruit	The fruit powder is taken orally for boosting immunity
Schleichera oleosa (Lour.) Oken	Kusum, Baru	Seed	Seed oil is used to reduce rheumatic and menstrual pain Seed paste is used to treat animal wound

Terminalia chebula Retz.	Harida, Rola, Lupung	Fruit	The fruit juice is used to cure diarrhoea and cough The fruit is eaten by chewing to cure mouth ulcer The fruit is used in making a polyherbal medicine named as “Triphala” to cure diabetes
Vitex negundo L.	Begna, Sinduari	Leaf	Inhaling the smoke from the leaves can treat cough
		Whole plant	The whole plant is used as an insect repellent

Table 4: Calculation of Relative Frequency of Citation

Plant Name	Informants Name	Number of Informants for a particular plant species	Total informants	RFC (Relative Frequency of Citation)
Celastrus paniculatus Willd.	1. Salma Marandi 2. Samayu Murmu 3. Laxmi Naik 4. Simaal Naik 5. Champa Tiria 6. Debraj Mohanta 7. Ganga Ho 8. Bilanti Ho	17	55	0.31

	9. Duka Ho 10. Balma Naik 11. Putkun Pingua 12. Daka Kuda 13. Chandmuni Tiria 14. Jaishree Tiria 15. Bhima Naik 16. Somra Naik 17. Salho Soren			
Cleistanthus collinus (Roxb.) Benth. ex Hook.f.	1. Samayu Murmu 2. Salma Marandi 3. Laxmi Naik 4. Seemal Naik 5. Dugi Naik 6. Maendi Murmu 7. Ramsing Murmu 8. Putkun Pingua 9. Chandra Pingua 10. Mangi Sirka 11. Raimuni Sing 12. Bhima Naik 13. Panchami Sing	13	55	0.23
Cryptolepis buchananii R.Br. ex Roem. & Schult.	1. Salma Marandi 2. Samayu Murmu 3. Laxmi Naik 4. Seemal Naik 5. Debraj Mohanta	12	55	0.21

	6. Maendi Murmu 7. Dayanidhi Naik 8. Putkun Pingua 9. Chandra Pingua 10. Chandmuni Tiria 11. Jaishree Tiria 12. Raimuni Sing			
Holarrhena pubescens Wall. ex G. Don	1. Seemal Naik 2. Mana Hemram 3. Khageswar Konakle 4. Sula Dehuri 5. Saunri Majhi 6. Maendi Murmu 7. Rupa Ho 8. Basanti Ho 9. Balma Naik 10. Putkun Pingua 11. Chandmuni Tiria 12. Jaishree Tiria 13. Fudan Majhi	13	55	0.23
Jatropha gossypiifolia L.	1. Gopinath Hemram 2. Salma Marandi 3. Samayu Murmu 4. Bodni Naik 5. Laxmi Naik 6. Bilanti Ho 7. Duka Ho	18	55	0.32

	8. Dasrath Hemram 9. Saunri Majhi 10. Jora ram Naik 11. Maendi Murmu 12. Basanta Kumar Mohanta 13. Rupa Ho 14. Balma Naik 15. Putkun Pingua 16. Chandmuni Tiria 17. Raimuni Sing 18. Jaishree Tiria			
Mimosa pudica L.	1. Dugi Naik 2. Champa Tiria 3. Dasrath Hemram 4. Deepak Hemram 5. Sula Dehuri 6. Saunri Majhi 7. Maendi Murmu 8. Chipri Gagrai 9. Chandra Pingua 10. Putkun Pingua 11. Chandmuni Tiria 12. Jaishree Tiria 13. Raimuni Sing 14. Bhima Naik 15. Madhusudan Gagrai	15	55	0.27

Morinda pubescens Sm.	1. Dugi Naik 2. Champa Tiria 3. Laxmi Naik 4. Seemal Naik 5. Putkun Pingua 6. Chandra Pingua 7. Chare Pingua	7	55	0.12
Schleichera oleosa (Lour.) Oken	1. Gopinath Hemram 2. Mana Hemram 3. Dasrath Hemram 4. Jora Ram Naik 5. Bisu Sirka 6. Daka Kuda 7. Salho Soren 8. Biswanath Sirka	8	55	0.14
Terminalia chebula Retz.	1. Salma Marandi 2. Samayu Murmu 3. Seemal Naik 4. Dasrath Hemram 5. Sita Murmu 6. Rupa Ho 7. Basanti Ho 8. Putkun Pingua 9. Daka Kuda 10. Raimuni Sing	10	55	0.18
Vitex negundo L.	1. Salma Marandi 2. Samayu Murmu	15	55	0.27

	3. Bodni Naik 4. Laxmi Naik 5. Seemal Naik 6. Mana Hemram 7. Deepak Hemram 8. Sita Murmu 9. Jora Ram Naik 10. Rupa Ho 11. Basanti Ho 12. Balma Naik 13. Daka Kuda 14. Baha Besra 15. Pinki Murmu			

Table 5**:** Calculation of Use Value(s)

Plant species	Uses	Total informants	Use Value (UV)
Celastrus paniculatus Willd.	1. Dental problems 2. Skin infections 3. Eye problems 4. Stomachache 5. Crack heels 6. Swelling cheeks	18	0.3
Cleistanthus collinus (Roxb.) Benth. ex Hook.f.	1. Insect repellent in crop field 2. Seed oil is used against skin problems	13	0.15
Cryptolepis buchananii R.Br. ex Roem. & Schult.	1. Stomachache 2. Making rope	12	0.16

Holarrhena pubescens Wall. ex G. Don	1. Antidiarrhea 2. Antidysentery 3. Stomach problems	13	0.23
Jatropha gossypiifolia L.	1. Dental problems 2. Skin infections 3. Eye problems 4. Stomachache 5. Crack heels 6. Swelling cheeks	18	0.3
Mimosa pudica L.	1. Folk use- Deep sleep 2. Used against stomach problems and headache	15	0.13
Morinda pubescens Sm.	1. Used as leafy vegetable 2. Fruit powder is used for boosting immunity	7	0.28
Schleichera oleosa (Lour.) Oken	1. Edible fruit 2. Seed oil is used against skin infections 3. Seed paste is externally applied to treat animal wounds 4. Seed oil is used to reduce rheumatic pain 5. Seed oil is also used to reduce menstrual pain	8	0.63

Terminalia chebula Retz.	1. Treat mouth ulcer 2. Antidiarrhea 3. Stomach problems	10	0.3
Vitex negundo L.	1. Eye inflammation 2. Waist pain 3. Treat cough 4. Insect repellent	15	0.26

Table 6: Calculation of Fidelity Level (%)

Disease	Plants used against the disease	No. of informants mentioning the use of a plant species for a particular disease	FL% (Fidelity Level)
Dental problems	*Jatropha gossypiifolia*	12	21.81
Skin infections	*Jatropha gossypiifolia*	1	1.81
	Celastrus paniculatus	5	9.09
	Cleistanthus collinus	4	7.27
	Schleichera oleosa	3	5.45
Eye problems	*Jatropha gossypiifolia*	6	10.9
	Vitex negundo	2	3.63
Gastrointestinal disorder	*Cryptolepis buchananii*	2	3.63
	Jatropha gossypiifolia	1	1.81
	Holarrhena pubescens	7	12.72
	Morinda pubescens	1	1.81
	Terminalia chebula	4	7.27
Diarrhoea	*Holarrhena pubescens*	4	7.27
	Terminalia chebula	2	3.63

Dysentery	*Holarrhena pubescens*	1	1.81
Mouth ulcer	*Terminalia chebula*	2	3.63
Cough	*Terminalia chebula*	3	5.45
Crack heels	*Jatropha gossypiifolia*	2	3.63
Muscle pain	*Celastrus paniculatus*	8	14.54
	Cryptolepis buchananii	5	9.09
	Vitex negundo	3	5.45
Insect-repellent	*Vitex negundo*	13	23.63

Table 7**:** Calculation of Informant Consensus Factor

Diseases	No. of times an ailment was mentioned	No. of plants mentioned to treat that ailment	ICF (Informant Consensus Factor)
Dental problems	12	1	1
Skin infections	13	4	0.75
Eye problems	8	2	0.85
Gastrointestinal disorder	15	5	0.71
Diarrhoea	6	2	0.8
Dysentery	1	1	0
Mouth ulcer	2	1	1
Cough	3	1	1
Crack heels	2	1	1
Muscle pain	16	3	0.86
Insect repellent	13	1	1

Some other researchers have also documented the ethnomedicinal plants of Mayurbhanj district. Mohanta et al., (2006) documented the ethnomedicinal plant resources of Similipal Biosphere Reserve whereas Rout and Panda, (2010) documented 77 ethnomedicinal plants from Mayurbhanj district, Odisha, India. Panda (2014) also documented 187 plants from Similipal Biosphere Reserve, Mayurbhanj, Odisha having ethnomedicinal uses. Dikshit et al., (2016) documented 49 ethnomedicinal plants from Similipal Biosphere Reserve. Sinha et al., (2021) reported 35 ethnomedicinal plants from the weekly market of Karanjia, Mayurbhanj, Odisha while Aradhana et al., (2022) documented 13 ethnomedicinal plants used to cure diabetes in Mayurbhanj, Odisha, India. Jena and Devi, (2024) documented the ethnomedicinal plants of Odisha including Mayurbhanj district. The above literature revealed that there is no or less quantitative ethnobotanical survey is carried out in Mayurbhanj district, Odisha state, India. Therefore, present study is more peculiar for future works in medicinal plants and traditional knowledge of the state.

Plate 2: Herbarium of selected medicinal plants in present study, 1) *Vitex negundo*, 2) *Celastrus paniculatus,* 3) *Cleistanthus collinus,* 4) *Cryptolepis buchananii,* 5) *Holarrhena pubescens,* 6) *Jatropha gossypiifolia,* 7) *Mimosa pudica,* 8) *Morinda pubescens,* 9) *Schleichera oleosa,* 10) *Terminalia chebula*

Conclusion

The present study provides a comprehensive overview of the ethnobotanical uses of medicinal plants in Mayurbhanj district, Odisha, India. The data reveals a rich traditional knowledge system, with 55 informants providing information on 10 plant species used to treat various ailments. The plants are used to treat a range of diseases, including dental problems, skin infections, eye problems, gastrointestinal disorders, and muscle pain. The Informant Consensus Factor (ICF) analysis reveals a high level of agreement among informants about the use of certain plant species for specific diseases. The Fidelity Level (FL%) analysis also highlights the importance of certain plant species, such as *Jatropha gossypiifolia* and *Vitex negundo*, in traditional medicine. The Use Value (UV) analysis provides insights into the versatility and importance of each plant species. The Relative Frequency of Citation (RFC) analysis highlights the cultural and medicinal importance of certain plant species within a local community. Overall, the study demonstrates the significance of traditional knowledge in healthcare practices and highlights the need for conservation and sustainable use of these medicinal plants. The study's findings have important implications for the development of new drugs and conservation efforts. The documentation of traditional knowledge also helps to preserve cultural heritage and recognize the contributions of local communities to healthcare practices. By highlighting the importance of medicinal plants, the study can inform policies and programs aimed at promoting sustainable use and conservation of these valuable resources. Further research is needed to validate the medicinal properties of these plant species and to explore their potential for drug development. Additionally,

studies on the conservation status and sustainable use of these plants are essential to ensure their continued availability for future generations. Collaboration with local communities, researchers, and policymakers is necessary to develop effective conservation strategies and to promote the sustainable use of these valuable medicinal plants.

References

Acharya B, Behera A, Sahu PK and Behera S. (2024). Sustainable health practices: ethnobotanical insights into seasonal plants of Kalahandi, Western Odisha, India for food and medicine. Ethnobotany Research and Applications. 29(7): 1-26. DOI: http://dx.doi.org/10.32859/era.29.7.1-26

Agarwal B, Rathore S, Krishnan R, Jaiswal A, Panda A, Hegde L and Kumar S. (2023). A check list on wild nutraceutical tuberous plants of India. Indian Forester. 149(5): 587-590.

Anadka Y and Gulimane K. (2024). Ethnobotanical investigation on herbal remedies for musculoskeletal disorders in Dakshina Kannada district, Karnataka, India. Ethnobotany Research and Applications. 29(9): 1-48. DOI: http://dx.doi.org/10.32859/era.29.9.1-48

Anas EM, Mohamed K, Said B, Mourad N, Chaimae S, Boutaina L, Abderrahman N, Essediya C, Taha B and Chaimae R. (2024). Traditional and biodiversity of medicinal plants in the Taounate region for treating human diseases: an ethnobotanical perspective. Ethnobotany Research and Applications. 29(30): 1-22. DOI: http://dx.doi.org/10.32859/era.29.30.1-22

Aradhana S, Manjula BL and Kumar S. (2022). Scientific validation of tribal claims on the plants used in diabetes by Santhal community, Mayurbhanj, Odisha, India. Medicinal Plants. 14(4): 513-517.

Aradhana S, Manjula BL and Kumar S. (2022). Scientific validation of tribal claims on the plants used in diabetes by Santhal community, Mayurbhanj, Odisha, India. Medicinal Plants. 14(4): 513-517.

Arjona-García C, Blancas J, Beltrán-Rodríguez, L. et al. (2021). How does urbanization affect perceptions and traditional knowledge of medicinal plants? Journal of Ethnobiology Ethnomedicine. 17: 48. DOI: https://doi.org/10.1186/s13002-021-00473-w

Basole S, Jena N and Kumar S. (2024). Indian Medicinal Plants, Volume I. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.14523569

Behera AK. (2015). Primary education among tribal people of Mayurbhanj district of Odisha: an evaluative study. International Journal of Humanities and Social Science Invention. 4(2): 43-54.

Das A, Das K, Mishra S and Kumar S. (2024). Medicinal Poaceae of India, Volume 1. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.13938277

Das L, Mishra S, Das A, Dimri R and Kumar S. (2022). Some common flora of temple city of Odisha, India: source for ethno-medico-cultural values. Indian Forester. 148(2): 207-212.

Das M and Behera B. (2012). Management of Similipal Biosphere Reserve Forest. Advances in Forestry Letter. 1(1): 7-15.

Das MK, Das PK, Kumar S and Singh NR. (2020). Flora of Khandagiri & Udayagiri, an urban heritage of Odisha. Indian Forester. 146(6): 509-518.

Devi RS, Satapathy KB and Kumar S. (2022). Ethnomedicinal plants of Phumdi, Loktak lake, Manipur, India. Asian Pacific Journal of Health Sciences. 9(4): 77-80.

Devi RS, Satapathy KB and Kumar S. (2023). Validation of tribal claims for formulation of future drugs through evaluation of ethno-pharmacological values of *Ludwigia adscendens.* Medicinal Plants. 15(4): 691-697.

Devi RS, Satapathy KB and Kumar S. (2024). Loktak Lake of the state Manipur: A review to educate the intellectuals and awareness on its biowealth. Educational Administration: Theory and Practice, 30(5), 6936–6947. DOI: https://doi.org/10.53555/kuey.v30i5.4064

Dikshit N, Sivaraj N and Dikshit S. (2016). Ethnobotany and traditional health care practices in Similipal Biosphere Reserve, Odisha. Ecology, Environment and Conservation. 22(3): 1191-1197.

El-Ghazouani F, Boukhanfer R, Yacoubi B and Zekhnini A. (2024). Ethnobotanical study of medicinal plants used in the rural area of the Western High Atlas (Morocco). Ethnobotany Research and Applications. 29(15): 1-26. DOI: http://dx.doi.org/10.32859/era.29.15.1-26

Espinosa MM, Bieski IGC and Martins DTO. (2013). Sampling in ethnomedicinal studies of medicinal plants. Springer Nature Link. Methods and Techniques in Ethnobiology and Ethnoecology. Pp: 197-212.

Estrada A, Garber PA, Gouveia S, Fernández-Llamazares Á, Ascensão F, Fuentes A, Garnett ST, Shaffer C, Bicca-Marques J, Fa JE, Hockings K, Shanee S, Johnson S, Shepard GH, Shanee N, Golden CD, Cárdenas-Navarrete A, Levey DR, Boonratana R, Dobrovolski R, Chaudhary A, Ratsimbazafy J, Supriatna J, Kone I and Volampeno S. (2022). Global importance of Indigenous Peoples, their lands, and knowledge systems for saving the world's primates from extinction. Science Adv. 8(32): eabn2927. DOI: 10.1126/sciadv.abn2927.

Gervaise KA, Konan Y, Youssouf S, Etienne OK, Cherry PS, Adama B, Honora TBF and Witabouna KM. (2024). Medicinal plants used to treat and manage menopausal symptoms in Grand-Lahou and Katiola Districts, Cote d'Ivoire. Ethnobotany Research and Applications. 29(38): 1-12. DOI: http://dx.doi.org/10.32859/era.29.38.1-12

Gómez-Baggethun E, Corbera E and Reyes-García V. (2013). Traditional Ecological Knowledge and Global Environmental Change: Research findings and policy implications. Ecol Soc. 18(4):72. DOI: 10.5751/ES-06288-180472.

Jaiswal A, Hossain E, Kumar N and Kumar S. (2024). Plants & Secondary Metabolites, Volume II. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.13995335

Jana NC, Banerjee A and Ghosh PK. (2023). Sustainable livelihoods of tribal communities in Odisha, India. The Case of Mayurbhanj. Cambridge Scholars Publishing. Pp: 12-14.

Jena N and Devi RS. (2024). Some common native medicinal plants used by tribals in Odisha, India. Journal of Biodiversity and Conservation. 8(1): 75-82.

Joshi SK, Gupta S, Tripathi K, Mishra S and Kumar S. (2024). Antiviral plants of India, Volume 1. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.14040292

Karan PP. (1953). Economic regions of Chot Nagpur, Bihar, India. Economic Geography. 29(3): 216-250.

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, Switzerland. DOI: 10.1007/978-3-319-43901-3-9.

Kumar S, PK Jena, Sabnam S, Kumari M and Tripathy PK. (2012). Study of plants used against the skin diseases with special reference to *Cassia fistula* L. among the king (Dongaria Kandha) of Niyamgiri: a primitive tribe of Odisha, India. International Journal of Drug Development and Research. 4(2): 256-264.

Kumar SN, Mishra S and Kumar S. (2021). Documentation of Indigenous Traditional Knowledge (ITK) on Commonly Available Plants in Koira Range, Bonai Forest Division, Sundargarh, Odisha, India. Asian Plant Research Journal. 8(4): 83-95.

Madani S, Amel B, Noui H, Djamel S and Hadjer H. (2017). An ethnobotanical survey of galactogenic plants of the Berhoum district (M'sila, Algeria). Journal of Intercultural Ethnopharmacology. 3(6): 311-315. DOI: https://doi.org/10.5455/jice.20170811073514

Mechaala S, Bouatrous Y, Adouane S. (2022). Traditional knowledge and diversity of wild medicinal plants in El Kantara's area (Algerian Sahara gate): An ethnobotany survey. Acta Ecologica Sinica 42: 33-45. DOI: https://doi.org/10.1016/j.chnaes.2021.01.007

Mishra S, Agrawal B, Rathore S, Mishra AK and Kumar S. (2022). Medicinal grasses of Eastern Ghats of Odisha, India. Indian Forester. 148(11): 1172-1174.

Mohanta RK, Rout SD and Sahu HK. (2006). Ethnomedicinal plant resources of Similipal Biosphere Reserve, Orissa, India. Zoos' Print Journal. 21(8): 2372-2374.

Mohanty B. (2020). Age- group population dynamics to study demographic profile of Mayurbhanj district. International Journal of Innovative Research and Advanced Studies. 7(1): 73-75.

Mukherjee S, Mudalkar S, Singh G and Kumar S. (2024). Medico-Biowealth of India, Volume 17. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.13924509

N'do JY, Pare D, Bonde L, Guenne S, Hilou A and Kiendrebeogo M. (2024). Indigenous knowledge and uses of medicinal plants in Ouagadougou, Burkina Faso. Ethnobotany Research and Applications. 29(22): 1-15. DOI: http://dx.doi.org/10.32859/era.29.22.1-15

Nayak S and Kumar S. (2023). Medicinal plants used by tribals of Odisha. APRF & SMPB, Odisha; APRF Publishers, India. ISBN: 978-81-958404-9-6. Pp 1-665.

Panda SK. (2014). Ethno-medicinal uses and screening of plants for antibacterial activity from Similipal Biosphere Reserve, Odisha, India. Journal of Ethnopharmacology. 151(1): 158–175.

Parida S and Mishra S. (2023). The tribal society of Mayurbhanj, Odisha. International Journal of Interdisciplinary Research and Innovations. 11(4): 35-42.

Radi M, Benlakhdar S, Ailli A, Ayyad FZ, Balafrej T, El Balghiti El Alaoui A, Hadi N, Khamar H, Asserraji R, El Imache A and Zair T. (2024). Ethnobotanical study of medicinal plants with therapeutic interest in the province of Khemisset, Morocco. Ethnobotany Research and Applications. 29(43): 1-22. DOI: http://dx.doi.org/10.32859/era.29.43.1-22

Ray M and Patro H. (2016). Temporal rainfall distribution characteristics at Mayurbhanj, Odisha, India. Plant Archives. 16(1): 413-418.

Ray M, Patro H, Sahoo KC, Biswasi S and Nanda A. (2016). Estimation of crop water requirement of some major crops of Mayurbhanj, Odisha for irrigation planning. National Academy of Agricultural Science. 34(6): 17-21.

Rout SD and Panda SK. (2010). Ethnomedicinal plant resources of Mayurbhanj district, Orissa. Indian Journal of Traditional Knowledge. 9(1): 68-72.

Saha M, Roy AB, Kumar S and Datta BK. (2022). Ethnobotanical diversity of some wetland plants of North-East India: implications for conservation. Indian Forester. 148(11): 1149-1154.

Sahoo T, Panda J, Swain S, Sahoo SS, Maurya M, Hembram M, Rath P, Maity JP, Sahu A and Sahu R. (2024). Integrated geochemical analysis of groundwater quality and human health risks by using multivariate statistical methods: a case study of Mayurbhanj District, Odisha, India. Research Square. Pp: (1-22). DOI: https://doi.org/10.21203/rs.3.rs-4204728/v1

Sahu LM, Das K, Sahu JK, Das A, Behera B and Kumar S. (2024). Eco-social Services of Native Tree species: A Conservation Approach. Indian Forester. 150(7): 630-634.

Sethi S, Jena S and Sahu HK. (2022). Physico-chemical parameters and ichthyofaunal checklist of Budha Balanga River, Mayurbhanj district, Odisha. International Journal of Current Advanced Research. 11(3): 507-511.

Sharma BP, Stalin AN, Dehar PS and Kumar S. (2024). Animal-Plant Interaction, Volume V. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.14582389

Shivanna KR. (2022). Climate change and its impact on biodiversity and human welfare. Proc. Indian Natl. Sci. Acad. 88(2): 160–171.

Singh RK and Kumar S. (2024). Medico-Biowealth of India, Volume 18. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.14581320.

Sinha MK, Hegde L, Marndi S and Kumar S. (2024a). Medicinal Plants of India, a pictorial guide, Volume I. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.13336929

Sinha MK, Panda A, Mishra S and Kumar S. (2024b). Medicinal Combretaceae of India, Volume I. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.14582202

Sinha P, Das PK and Mallick SN. (2021). Ethnobotanical study of medicinal plants sold at weekly market of Karanjia in Mayurbhanj district, Odisha, India. International Journal of Botany Studies. 6(6): 515-520.

Willis KJ, Gillson L and Knapp S. (2007). Biodiversity hotspots through time: an introduction. Philos Trans R Soc Lond B Biological Science. 362(1478): 169-174.