

An ethnomedicinal survey of medicinal plants from a sacred forest of western Odisha, India.

Antaryami Pradhan¹, Satyendra Prasad Mishra^{1*}, Niranjan Behera²

*Corresponding author:

Satyendra Prasad Mishra

¹School of Life Sciences Sambalpur University Jyoti Vihar, Burla, Odisha, India.

²P.G. Department of Environmental Sciences Sambalpur University Jyotivihar, Burla, Odisha India.

Abstract

Sacred forests are being protected by means of cultural and religious beliefs by the local communities and act as people participatory conservation sites for several important medicinal plants. Sacred forests are one of the oldest forms of biodiversity conservation sites still effectively managed by local people and act as in-situ conservation sites. In this context, the present study was carried out in Andhari sacred forest of Jharsuguda district as to collect the information regarding the traditional ethno medicinal knowledge acquired by the local medical practitioners. Only few indigenous people have adequate knowledge regarding the medicinal plants and their uses. These traditional knowledge were rapidly degrading and if not documented will be lost forever. The present study reveals the presence of 91 plants species belonging to 46 families being used by the practitioners to treat various diseases like dysentery, diarrhea, indigestion, worm infection, wound healing, headache, stomach disorders, Rheumatic disorders, snake bite, poisonous bite, menstrual problem etc. This ethnomedicinal information further needs to be validated by clinical trials for their safe uses. The study also reported the existence of 8 RET (Rare, Endangered and Threatened) medicinally important species which makes this site a biological hotspot and needs further effective conservation efforts.

Keywords: Sacred forests, Ethnomedicine, Traditional knowledge, RET species, Biodiversity conservation.

Introduction

India is a land of diverse natural resources with a strong tradition of nature conservation. Medicinal plants are an important natural resource and act as raw material for many indigenous medicines used in different system of medical practices in India namely, Ayurveda, Unani, Siddha and Tibetan Medicine. It is estimated that up to 70,000 species are used in folk medicine [1]. all over the World. According to a report prepared by WHO, over 21,000 plant species are used for medicinal purpose [2]. and about 7500 plant species are used in ethno medicine in India [3]. As much as 80% of the indigenous population in developing countries all over the world depend on traditional systems of medicine and medicinal plants for their immediate Health care [4]. The ethnic and indigenous people of forests and villages possess a rich knowledge on medicinal plants and their uses [5]. Older people are the main custodian of such traditional knowledge which is rapidly degrading due to modernization of that area and lacking of interest of the younger generation to learn from the older generation, thus many information may be lost in the absence of proper documentation. Another cause of extinction of traditional knowledge is due to the

rapid loss of biodiversity due to urbanization, developmental activities and population explosion, which results in the fast disappearance of medicinal plants in natural environment. However, the sacred natural sites such as sacred groves and sacred forests provide a means of better conservation strategy linking the nature with spiritual and divine forces. These sacred natural sites possess rich diversity of medicinal plants and provide suitable habitat for their sustainable natural regeneration. Sacred forests are virgin forest with rich diversity and being protected by indigenous people for centuries on the basis of cultural and religious beliefs [6]. and it is estimated that more than 1,00,000 sacred groves exist in various parts of the country [7]. Sacred groves act as repositories of several rare and endemic species [8]. and medicinal plants having high economic importance. The role of sacred grove in conservation of medicinal plants has been emphasized in various studies from different part of the country such as West Bengal [9], Manipur [8], Kavus of Kerala [10] and Garhwal Himalaya [11]. etc.

The present paper aims at documentation of this ethno medical knowledge from the indigenous medicine practitioners of a sacred forest of Western Odisha for its scientific consideration and wider

DOI:10.5138/09750185.1843



This article is distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use and redistribution provided that the original author and source are credited.

use of traditional knowledge which is in the verge of extinction. This paper also depicts the role of sacred forest in conservation of several Medicinal plants.

Methodology

Study site

The study site, Andhari sacred forest is situated in the Laikera block of Jharsuguda district, Odisha within N-21°55'43.81"-21°57'59.8" Longitude and E-84 12'58.3" - 84 15'21.6" Latitudes, over an area of 740 hectares. The sacred forest is a hilly tract housing the abode of goddess "Mother Andhari". This is a *Shorea robusta* dominated forest comes under Tropical dry deciduous forest category [12]. The forest is surrounded by fifteen villages. People of the adjoining villages are actively involved in the conservation of the biodiversity by forming a forest conservation society named "Mother Andhari Forest Conservation Society". In addition to daily offerings of prayers by visitors, the deity is worshipped annually in a major festival (Maa Andhari- Vana Durga puja) organised by the village community on the eighth day of the bright lunar fortnight of the month of Kartik (October -November) in Indian Hindu calendar. The management practice adopted for the forest site is a joint and participatory one managed jointly by the local people of the adjoining villages mostly belonging to the Gond tribe and the Government Forest Department. The climate is tropical monsoonal. Monthly mean temperature goes above 18 C. The rainfall is completely dependent on south-west monsoon and starts from June and ends in September. The site experiences an annual precipitation of 1414.8 mm and mean annual temperature of 26.8 C. Month of May is the warmest month of the year when the temperature rises up to 47 C. December is the coldest month of the year when temperature of the region goes down to 5 C. The major occupation of the local inhabitants is agriculture. The local people mainly depends this sacred forest for fuel and fodder collection apart from some economic activities like mahua (flowers of *Madhuca indica*) collection, kendu leaf (*Diospyros melanoxylon*)

collection and broom stick (*Aristida setacea*) collection. However very few people mainly herbal healers and few serpents are depends this forest patch for medicinal purposes. Only few practitioners have adequate knowledge regarding the herbal remedies for different diseases, however most of the local people remain unknown and mainly depends on the modern hospitals and health care system. This folk medicinal system requires further scientific validation for the safe uses.

Data collection

A periodic survey was carried out during the year 2013-14 to collect information on medicinal plants found in the study site. The present data was based on the pre designed questionnaires, personal interviews and routine field trips with local vaidyas and indigenous peoples from the adjoining villages. During the survey, some of the common plants occurring in the site were identified on the spot. Plants which could not be identified were photographed and their flowering twigs were brought to the laboratory and were identified and confirmed using botanical keys available in regional standard flora book [13]. and processed for herbarium to ensure proper identification. The RET medicinal plant species (rare, endangered and threatened for the state of Odisha [14]. encountered during the survey were assigned their status as VU (Vulnerable), EN (Endangered), NT (Near threatened) and CR (Critically endangered).

Results and Discussion

The present study reveals 91 different plant species belonging to 46 families were medicinally used by the indigenous people (Table 1). Fabaceae was the most dominated family with 13 species followed by Combretaceae with 6 species. Most of the ethno medicinal studies confirmed Fabaceae as a dominant ethno medicinally important family [15-16]. Besides the study also reports about the medicinal importance of Combretaceae.

Table 1. List of medicinal plants along with their family affiliation, local names, growth form and uses along with parts used and mode of use recorded from Andhari Sacred natural site.

S.NO	Scientific name	Family	Local name	Habit	Parts used	Mode	Uses
1	<i>Andrographis paniculata</i> (Burm.) Wall. Ex Nees	Acanthaceae	Bhuinimba	Herb	Whole	Boiled	Anti-helminthics, Fever, Malaria
2	<i>Alangium salviifolium</i> (L.f.) Wang	Alangiaceae	Aankel	Tree	Bark	Paste/ steam	Rheumatic Diseases, Body ache, joint pain
3	<i>Achyranthes aspera</i> L.	Amaranthaceae	Apamarga	Herb	Root	Paste	Dysentery, Rabies
4	<i>Aerva lanata</i> juss. ex Sch	Amaranthaceae	Chauldhua	Herb	Root	Paste	Piles
5	<i>Curculigo orchioides</i> Gaertn.	Amaryllidaceae	Talmuli	Herb	Root	Boiled	Anti-aging, Indigestion, Immunity
6	<i>Semecarpus anacardium</i> L.f.	Anacardiaceae	Bhelua	Tree	Fruit	Oil	Cut, Injuries

7	<i>Holarrhena antidysenterica</i> acut. Non (Roth) Wall. Ex. DC.	Apocynaceae	Kure	Tree	Bark	Paste	Mental problems, Skin diseases, Headache
8	<i>Phoenix acaulis</i> Roxb.	Arecaceae	Jhar khajur	Shrub	Root	Paste	Stomach ulcer
9	<i>Aristolochia bractiata</i> Retz.	Aristolochiaceae	Painaeri	Climber	Root	Paste	Indigestion
10	<i>Cryptolepis buchanani</i> Roem. & Schult	Asclepiadaceae	Gopakanhu	Climber	Root	Raw	Enhance Breast milk production
11	<i>Hemidesmus indicus</i> R.Br.	Asclepiadaceae	Anantamula	Herb	Root	Raw	Enhance Breast milk production, wound healing
12	<i>Bidens biternata</i> (Lour.) Merr. & Sherff.	Asteraceae	Mahaneem	Herb	Whole	Juice	Dysentery, Indigestion
13	<i>Elephantopus scaber</i> L.	Asteraceae	Mayur chulia	Herb	Root	Paste	Dysentery, Indigestion, dental problem, diuretic
14	<i>Tridax procumbens</i> L.	Asteraceae	Bisalya karani	Herb	Leaf	Paste	Wound, Bloody stool
15	<i>Bombax cebia</i> L.	Bombacaceae	Semel	Tree	Bark, Root bark	Paste	Menstrual problems, skin disease, bloody stool
16	<i>Boswellia serrata</i> Roxb.	Burseraceae	Sale	Tree	Gum	Powder	Wound healing, crack healing
17	<i>Bauhinia racemosa</i> Lam.	Caesalpiniaceae	Kuthel	Tree	Leaf	Juice	Helminthes
18	<i>Bauhinia variegata</i> L.	Caesalpiniaceae	Kuthel	Tree	Root	Paste	Dysentery, bloody stool
19	<i>Cassia fistula</i> L.	Caesalpiniaceae	Sunari	Tree	Root	Boiled	Cold
20	<i>Celastrus paniculata</i> Willd	Celastraceae	Ping laha	Climber	Root	Paste	Headache
21	<i>Anogeissus latifolia</i> (DC.) Bedd.	Combretaceae	Dhaura	Tree	Bark, Gum, leaf	Paste/ Juice	Dysentery, diarrhea
22	<i>Combretum decandrum</i> Roxb.	Combretaceae	Aatundi	Climber	Leaf	juice	Dysentery
23	<i>Terminalia arjuna</i> (Roxb. Ex DC.) W. & A.	Combretaceae	Kaha	Tree	Bark	Paste	Tuberculosis, asthma, knee pain, dysentery, Rheumatic pains.
24	<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Combretaceae	Bahada	Tree	Fruit	Fried	Constipation, indigestion, piles, cough
25	<i>Terminalia chebula</i> Retz.	Combretaceae	Harida	Tree	Fruit	Fried	Piles, fistula, cough, hair loss, indigestion
26	<i>Terminalia tomentosa</i> (DC.) W. & A.	Combretaceae	Sahaj	Tree	Leaf	Juice	Dysentery
27	<i>Argyrea speciosa</i> (Linn. f.)	Convolvulaceae	Khadu	Climber	Root	Paste	Antiseptic
28	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	Nirmuli	Climber	Whole	Boiled	Acidity
29	<i>Ipomoea hederifolia</i> L.	Convolvulaceae	Painlaha	Climber	Leaf	Paste	Indigestion
30	<i>Costus speciosus</i> (Koenig) Sm.	Costaceae	Keu	Herb	Root	Decoction	Rheumatic diseases, Body ache
31	<i>Mukia maderaspatna</i> (L.) M. Roem.	Cucurbitaceae	Mahakaal	Climber	Seeds, root	Decoction	Rheumatic pain, body ache
32	<i>Dillenia pentagyna</i> L.	Dilleniaceae	Rai	Tree	Bark	Paste	Snake bite

33	<i>Dioscorea alata</i> L.	Dioscoreaceae	Kahaba aalu	Climber	Tuber	Paste	Dysentery, piles
34	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Pita aalu	Climber	Tuber	Paste	Dysentery, piles
35	<i>Shorea robusta</i> Gaertn.f.	Dipterocarpaceae	Sal	Tree	Leaf, seed	Paste/ juice	Dysentery
36	<i>Diospyros melanoxylon</i> Roxb.	Ebenaceae	Kendu	Tree	Tender stem	Paste	Scorpion sting
37	<i>Cleistanthus collinus</i> (roxb.) Benth	Euphorbiaceae	Karla	Tree	Leaf	Paste	Skin diseases
38	<i>Emblica officinalis</i> Gaertn.	Euphorbiaceae	Aamla	Tree	Fruit	Fried/ Raw	Blood purifier, Indigestion, hair loss
39	<i>Mallotus philippensis</i> (Lam.) Muell.	Euphorbiaceae	Kath kamla	Tree	Seeds	Paste/ Powder	Anti-helminthic
40	<i>Arbus precatorius</i> L.	Fabaceae	Gunja	Climber	Root	Paste	Boils, joint pain, Rheumatic pains
41	<i>Atylosia scarabaeoides</i> Benth	Fabaceae	Bana koltha	Climber	Root	Paste/ boiled	Reduce breast size
42	<i>Butea monospema</i> (Lam.) Taub.	Fabaceae	palash	Tree	Seed, gum	Powder	Anti-helminthic, diarrhea, dysentery
43	<i>Butea superba</i> Roxb.	Fabaceae	Laha palash	Climber	Seed	Powder	Birth control
44	<i>Crotolaria albida</i> Var.	Fabaceae	Jhunka	Herb	Root	Steaming	Cheek swelling
45	<i>Dalbergia sissoo</i> Roxb.	Fabaceae	Sissoo	Tree	Leaf	Juice	Diarrhea
46	<i>Dsemodium gangeticum</i> (L.) DC.	Fabaceae	Salaparni	Herb	Root	Paste	Dysentery, digestive complaints
47	<i>Erythrena suberosa</i> Roxb.	Fabaceae	Paldhua	Tree	Bark	Paste	Skin diseases
48	<i>Indigofera tinctoria</i> L.	Fabaceae	Girel	Shrub	Root	Boiled	Fever
49	<i>Mucuna pruriens</i> Baker non. DC.	Fabaceae	baikhujen	Climber	Seed	Powder	Anthelmintic
50	<i>Pongamia pennata</i> L.	Fabaceae	Karanj	Tree	Flower, leaf, seeds	Paste/ juice/ powder	Indigestion, Piles, cold and cough
51	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	Bija	Tree	Leaf	Juice	Dysentery
52	<i>Uraria lagopodioides</i> Desv.	Fabaceae	Krusnaparni	Herb	Root	Paste	Dysentery
53	<i>Anisochilus carnosus</i> (L.) Kuntze	Lamiaceae	Bhutmari	Herb	Leaf	Juice	Cough, cold and heart diseases
54	<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Bantulshi	Herb	Leaves	Juice	Indigestion
55	<i>Ichnocarpus frutescens</i> (L.) Poit.	Lamiaceae	Thapa laha	Climber	Root	Raw	Enhance milk production in female
56	<i>Leucas biflora</i> (Vahl) R.Br.	Lamiaceae	Gubhi	Herb	Whole	Paste	Venomous bite
57	<i>Careya arborea</i> Roxb.	Lecythidaceae	Kumbhi	Tree	Bark	Paste	Snake bite
58	<i>Asparagus racemosus</i> Willd	Liliaceae	Satabari	Climber	Root	Decoction	Jaundice, digestive complaints
59	<i>Gloriosa superba</i> L.	Liliaceae	Panchanglia	Climber	Root	Decoction	Skin disorders, Rheumatic pains, muscular sprains.
60	<i>Smilax zeylanica</i> L.	Liliaceae	Mucher	Climber	Stem	Boiled	Diuretic
61	<i>Woodfordia fruticosa</i> Kurz.	Lythraceae	Dhatuk	Shrub	Root	Paste	Jaundice, dysentery, diaorrhea



62	<i>Sida cordata</i> (Burm.) Borss.	Malvaceae	Bajramuli	Herb	Stem	Paste	Dental problem
63	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Neem	Tree	Leaf	Paste/ oil	Anthelmintics, skin disorders
64	<i>Soymida febriguga</i> A. Juss.	Meliaceae	Ruhen	Tree	Bark	Paste	Dysentery, piles, menstrual disorder
65	<i>Cissampelos pareira</i> L.	Menispermaceae	Akanabindh a	Climber	Root	Boiled	Stomach ulcer
66	<i>Stephania japonica</i> (Thunb.) Miers.	Menispermaceae	Akanabindh a	Climber	Root	Boiled	Stomach ulcer
67	<i>Tinospora cordifolia</i> (willd.) Miers	Menispermaceae	Amari laha	Climber	Whole	Boiled	Diabetes
68	<i>Acacia catechu</i> (L.f.)	Mimosaceae	Khair	Tree	Bark	Paste/ powder	Dysentery, diarrhoea
69	<i>Acacia leucopholea</i> Roxb.	Mimosaceae	guhira	Tree	Bark	Paste	Dysentery, diarrhoea
70	<i>Albizia lebbek</i> Benth.	Mimosaceae	Shirish	Tree	Seed	Powder	Dental problem
71	<i>Mimosa pudica</i> L.	Mimosaceae	Lajkuli	Herb	Root tip, root	Raw/ Paste	Abortive, dysentery, dental problem
72	<i>Ficus religiosa</i> (L.)	Moraceae	Pippal	Tree	Leaf	Juice	Snake bite
73	<i>Embelia tsjeriam – cottam</i> (Roem. & Schult.) A.DC.	Myrsinaceae	Bai bidanga	Shrub	Bark, seed	Powder	Tooth ache, tonic, anti-helminthic
74	<i>Syzygium cumini</i> L.	Myrtaceae	Jam	Tree	Fruit	Raw	Dysentery
75	<i>Nyctathes arbotistis</i> L.	Oleaceae	Gangasiuli	Tree	Leaf	Boiled/ juice	Malaria, fever
76	<i>Ventilago maderaspatana</i> Gaertn.	Rhamnaceae	Keuti laha	Climber	Root	Paste	Cough and cold
77	<i>Ziziphus oenoplea</i> (L.) Miller	Rhamnaceae	baghampara	Climber	Root	Paste	Scorpion sting
78	<i>Adina cordifolia</i> (Roxb.) Hook.f.ex.Bran	Rubiaceae	Haldu	Tree	Tender leaf	Juice	Migraine
79	<i>Canthium dicocum</i> (Gaertn.) Merr.	Rubiaceae	Chikni	Tree	Leaf	Paste	Wound healing
80	<i>Morinda tomentosa</i> Heyne ex. Roth	Rubiaceae	Aachun	Tree	Leaf	Juice	Antihelminthic
81	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Bel	Tree	Leaf, bark, Fruit, pulp	Raw/ juice/ paste/ powder	Digestive, used for early recovery in bone fracture
82	<i>Chloroxylon swietenia</i> DC.	Rutaceae	Bheru	Tree	Bark	Paste	Antiseptic
83	<i>Schleichera oleosa</i> (Lour.) Oken	Sapindaceae	Kusum	Tree	Bark, Fruit	Paste/ oil	Ear pain, skin disorder, Rheumatic pain
84	<i>Madhuca indica</i> Gmel.	Sapotaceae	Mahul	Tree	Flower/ fruit	Steam/ oil	Skin disorder
85	<i>Helicteres isora</i> L.	Sterculiaceae	Murmuri	Shrub	Root	Paste	Skin disorder
86	<i>Sterculia urens</i> Roxb.	Sterculiaceae	Girindel	Tree	Gum	Powder	Feet crack
87	<i>Symplocos racemosa</i> Roxb.	Symplocaceae	Tharro	Tree	Bark	Decoction	Rheumatic diseases, muscular sprains
88	<i>Grewia hirsute</i> Vahl.	Tiliaceae	Sunaragda	Shrub	Root	Paste	Burns, boils, acidity, diarrhea
89	<i>Symphorema polyandrum</i> Wight.	Verbenaceae	Badhichang	Climber	Seeds, leaf	Powder	Snake bite
90	<i>Vitex negundo</i> Linn.	Verbenaceae	Nirgundi	Shrub	Leaf	Decoction	Joint pains, Rheumatic pains
91	<i>Ampelocissus latifolia</i> planch	Vitaceae	Jangli angur	Climber	Root	Steam/ paste	Hydrosil, kidney related disorders

The native people mainly used these plants to cure several diseases like dysentery, diarrhea, indigestion, worm infection, wound healing, headache, stomach disorders, Rheumatic disorders, snake bite, poisonous bite, menstrual problem etc.

The ethno medicinal plants are categorized as their growth from in to Trees, Climbers, Herbs and Shrubs (figure 1). Among these 46.15% are Trees (42 species), 27.47% are Climbers (25 species), 18.68% Herbs (17 species) and 7.69% are shrubs (7 species). Most of the studies shows medicinal importance of herbaceous species [17-21]. where as in this study trees are found to have a key role in preparation of different ailments.

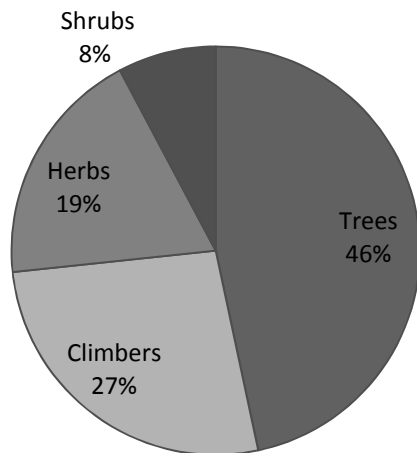


Figure 1.: Categorization of medicinal plants in different growth forms.

People use either single plant or more than one plants mixed together to cure diseases immediately. The plant species used either individually or in combination with other plant parts or animal products according to needs. Generally, most of the traditional healers used fresh materials collected from the wild, however in some preparation sundried plant materials were also used. Different parts were used for different diseases; however some medicinally important plants have more than one part of medicinal importance. Most of the studies reveals that leaves are the major portion of the plant used in treatment of diseases [15,16,19]. Where as in the present study (figure 2) Roots and tuber was the widely used plant part accounting for 36.26% (33) of the plant used followed by leaf 18.68% (17), followed by bark 12.09% (11), followed by fruit and whole part 5.49% (5 each), followed by seed 4.40% (4). Among Other plant parts including stem, flowers and gum contributes 6.59% (6) and plants having more than one medicinal parts accounting for 10.99% (10). Roots as frequently used plant parts for medicine was reported by few studies [15], [22]. Most of the remedies taken orally, followed by external use and in few cases the route of administration are anal.

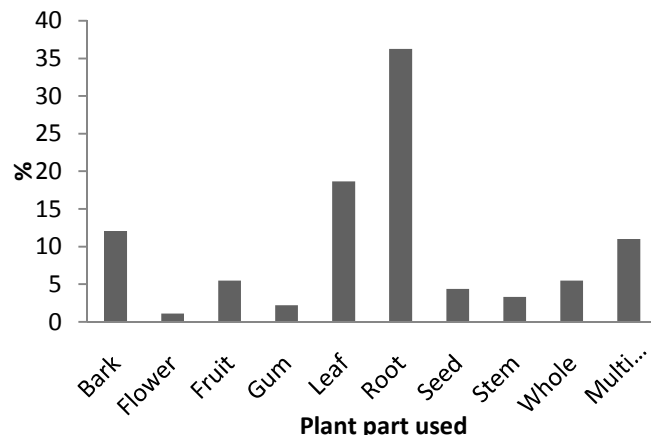


Figure 2.: Plants part used in Preparation of ailments.

The methods of preparation of ailments fall into different categories (figure 3). The plant parts applied as a paste (36.67%), boiled (10%), decoction (6.67%), juice extracted from the fresh plant parts (12.22%), powder made from dried plant parts (8.89%), Raw (4.44%), fried (2.22%), oil and steaming (1.11% each) and 16.67% of ailments were used in many forms. Paste is the main methods of preparation, either for oral or for external administration.

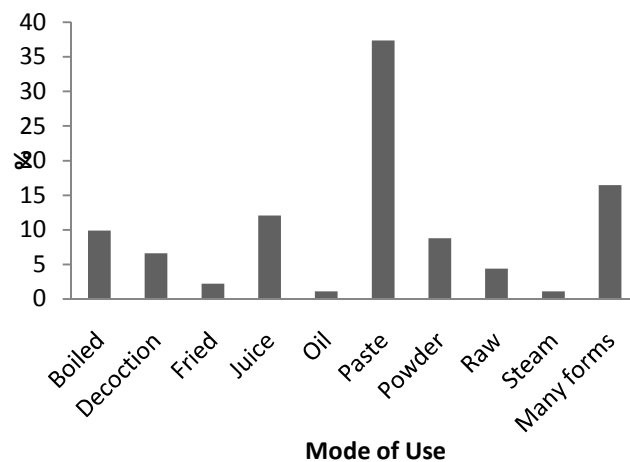


Figure 3.: Mode of use of different ailments. In this present study

Eight Medicinally used plant species were categorized as RET species as per [14] and having a high conservation priority in Odisha (Table.2). The presence of such RET species makes this sacred natural site a natural epicenter for conservation of RET species.

Table 2. List of RET species along with their family affiliation, growth form and conservation status.

Sl.NO	Species	Family	Habit	Status
1	<i>Boswellia serrata</i> Roxb.	Burseraceae	Tree	VU
2	<i>Celastrus paniculata</i> Willd	Celastraceae	Climber	VU
3	<i>Costus speciosus</i> (Koenig) Sm.	Costaceae	Herb	VU
4	<i>Embelia tsjeriam – cottam</i> (Roem. & Schult.) A.DC.	Myrsinaceae	Shrub	VU
5	<i>Gloriosa superba</i> L.	Liliaceae	Climber	EN
6	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	Tree	EN
7	<i>Symplocos racemosa</i> Roxb.	Symplocaceae	Tree	CR
8	<i>Terminalia arjuna</i> (Roxb. Ex DC.) W.& A.	Combretaceae	Tree	NT

VU: Vulnerable, EN: Endangered, CR: Critically Endangered, NT: Near Threatened

Conclusion

The indigenous people who were in close association with nature have the traditional knowledge of several ailments for several diseases. This knowledge is limited to traditional healers and elderly people. This knowledge was gained by either trial and error methods or by their ancestors. Present study provides documentation of ethno botanical data of the medicinal plants used by the local people to cure different diseases. Moreover, this study will promote a practical use of botanicals and must be continued focusing on its pharmacological validation. Further detailed exploration and collection of ethno botanical information, chemical studies and screening for medicinal properties will provide cost effective and reliable source of medicine for the welfare of humanity. The results of the present study also provide evidence that sacred natural sites are conservation epicenter for these medicinal plants and continue to play an important role in the healthcare system of the indigenous people. This sacred natural site also acts as a conservation center for several rare and endangered medicinal plants which are in the verge of extinction.

So there is an urgent need of protection and conservation of such natural sites.

Acknowledgement

The authors are gratefully acknowledge the financial assistance provided by Ministry of Environment and Forest (MoEF). Our sincere thanks to the village residents and medical practitioners, who were very willingly, shared their traditional knowledge and to provide local assistance. A special thanks to Prof. D.R. Naik a local resident of Pakelkhol village adjoining the sacred forest for his local assistance and organizing several meeting with the local elderly people and medical practitioners.

Conflict of Interest

The authors declare no conflict of interest.

References

- [1]. Farnsworth NR, Soejarto DD. Global importance of medicinal plants. In: Akerele O, Heywood V, Syngé H. (Eds). The Conservation of medicinal plants. Cambridge University Press, Cambridge, UK. 1991; 25-51.
- [2]. Groombridge B. (ed.). Global biodiversity. Status of the earth's living resources. Chapman and Hall, London, Glasgow, New York. 1992; p 594.
- [3]. Shankar D, Majumdar B. Beyond the Biodiversity Convention: the challenge facing the biocultural heritage of India's medicinal plants. In: Bodeker, G., Bhat, K.K.S., Burley, J. and Vantomme, P. (eds.). Medicinal plants for forest conservation and health care. Non-wood Forest Products 11. FAO, Rome. 1997; 87-99
- [4]. Ayyanar M. Traditional Herbal Medicines for Primary Healthcare among Indigenous People in Tamil Nadu, India. J Homeop Ayurv Med. 2013; 2(5): 140. doi:10.4172/2167-1206.1000140
- [5]. Khan ML, Khumbongmayum AS, Tripathi RS. The sacred groves and their significance in conserving biodiversity: an overview. International Journal of Ecology and Environmental Sciences. 2008; 34(3):277-291.
- [6]. Khumbongmayum AD, Khan ML, Tripathi RS. An ethno botanical study of medicinal plants in sacred groves of Manipur, Northeast India. Journal of Traditional Ecological Knowledge. 2005; 4(1): 33-38
- [7]. Bhakat RK, Pandit PK. Role of sacred grove in conservation of medicinal plants. Indian Forester. 2003; 129(2):224-232
- [8]. Behera MK, Pradhan TR, Sahoo J.. Role of sacred groves in the conservation and management of

- medicinal plants. *Journal of Medicinal Plant Research*. 2015; 9(29):792-798.
- [9]. Pushpangadan P, Rajendraprasad M, Krishnan PN. Sacred Groves of Kerala - A synthesis on the state of - art - of knowledge. In: *Conserving the Sacred for Biodiversity Management*. (eds. Ramakrishnan, P.S., Saxena, K.G. and Chandra Shekera U.M). Oxford IBH Publishing Co. Pvt. Ltd. New Delhi. 1998: 193-210.
- [10]. Sinha B, Maikhuri RK. "Conservation through 'Socio-cultural-religious Practice' in Garhwal Himalaya: A Case Study of Hariyali Sacred Site." pp. 289-299.
- [11]. Champion HG, Seth SK. *A Revised Survey of Forest Types of India*. Manager of Publications, Govt of India, Delhi. 1968; p 404.
- [12]. Saxena HO, Brahamam M. *The flora of Orissa*. RRL, Bhubaneswar and Forest Development Corporation publication, Orissa. 1994-96; Vol I -IV : 2918.
- [13]. Rawat GS. (Ed.). *Special Habitats and Threatened Plants of India*. ENVIS Bulletin: Wildlife and Protected Areas. Wildlife Institute of India, Dehradun, India. 2008; 11(1): 239.
- [14]. Rout SD, Panda T, Mishra N. Ethnomedicinal plants used to cure different diseases by tribals of Mayurbhanj Distirct of North Orissa. *Ethno-Med*. 2009; 3(1): 27-32.
- [15]. Datta T, Patra AK, Dastidar SG.. Medicinal plants used by tribal population of Coochbehar distirct, West Bengal, India- an ethnobotanical survey. *Asian Pacific Journal of Tropical Biomedicine*. 2014; 4(suppl 1): s478-s482.
- [16]. Pattanaik C, Reddy CS, Das R, Reddy PM. Traditional medicinal practices among the tribal people of Malkangiri distirct, Orissa, India. *Natural product radiance*. 2007; 6(5): 430-435
- [17]. Behera SK, Panda A, Behera SK, Misra MK. Medicinal plants used by the Kandhas of Kandhamal distirct of Orissa. *Indian Journal of Traditional Knowledge*. 2006; 5(4): 519-528.
- [18]. Rout S, Rout S, Sen SK, Satpathy S, Pattanaik D. An ethno-botanical survey of medicinal plants in Semiliguda of Koraput distirct, Odisha, India. *Botany Research International*. 2012;5 (4): 97-107
- [19]. Rout SD, Panda SK. Ethnomedicinal plant resources of Mayurbhanj distirct, Orissa. *Indian journal of traditional knowledge*. 2010; 9 (1): 68-72.
- [20]. Mutthu C, Ayyanar M, Raja N, Ignacimuthu S. Medicinal plants used by traditional healers in Kancheepuram distirct of Tamil Nadu, India. *Journal of Ethnobiology and Ethnomedicine*. 2006; 2(43):1-10.
- [21]. Savitramma N, Linga Rao M, Yugandhar P, Hari Babu R. Ethnobotanical study of Penchalakona forest area of Nellore District, Andhra Pradesh, India. *International Journal of phytomedicine*. 2012; 4: 333-339
- [22]. Mahady GB. () Global Harmonization of Herbal Health Claims. *Journal of Nutrition*. 2001; 131 (3): 1120S-1123S
- [23]. Malhotra KC, Gokhale Y, Chatterjee S, Srivastava S. Sacred groves in India an overview. IGRMS, Bhopal and Aryan Books International, New delhi. 2007; p 186.
- [24]. Perumal Samy R, Ignacimuthu S. Antibacterial activity of some folklore medicinal plants used by tribals in Western Ghats of India. *Journal of Ethnopharmacology*. 2000; 69: 63-71.
- [25]. Ramakrishnan PS, Saxena UM and Chandrashekhara KG. (Eds). *Conserving the Sacred for Biodiversity Management*. Oxford and IBH Publishing Co. Pvt. Ltd.Society. 1998;27: 219-238.