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No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road, Saravanampatti,
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Ph: +91 9385339863 | www.threatenedtaxa.org
Email: sanjay@threatenedtaxa.org

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Cover: A female Javan Leopard *Panthera pardus melas* in rehabilitation phase at Cikananga Wildlife Center. © Yayasan Cikananga Konservasi Terpadu.



A survey of ethno-medicinally important tree species in Nauradehi Wildlife Sanctuary, central India

Tinku Kumar¹ , Akash Kumar² , Amit Jugnu Bishwas³ & Pramod Kumar Khare⁴

¹⁻⁴ Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh 470003, India.

¹tinkurajput658@gmail.com (corresponding author), ²akashkumarbot@gmail.com, ³ajbishwas@gmail.com, ⁴p.k.khare@gmail.com

Abstract: The study was carried out in Nauradehi Wildlife Sanctuary, central India. The forest is classified as a tropical dry deciduous type, with teak *Tectona grandis* as the predominant species. Extensive field trips were carried out during 2018–2020 to document the medicinally important tree species. The medicinal importance of these plants was recorded through interviews, group discussions with local tribal communities and on the basis of the literature available. Enumeration of tree species in this area showed occurrence of 50 tree species belonging to 37 genera and 21 families. The study further observed that several species were being used as traditional medicine by the local tribal folks, traditional healers in the study area, and also by pharmaceutical industries. The study observed that some species in the sanctuary were rare due to several developmental projects, forest destruction, and over-exploitation. The study provides details about the botanical identity, family, local name, plant parts utilised and uses for treatment of diseases. The present paper identified the tree species for their conservation status and accordingly recommends the priority for their conservation in the study area. We recommend that tree species documentation might be helpful for drug formulation and the preservation of traditional knowledge.

Keywords: Ethnobotany, forest trees, Madhya Pradesh, traditional medicines, tropical dry deciduous forest.

Hindi: यह अध्ययन मध्य भारत के नौरादेही वन्यजीव अभयारण्य में किया गया था। जंगल को एक उष्णकटिबंधीय शुष्क पर्णपाती प्रकार के रूप में वर्गीकृत किया गया है, जिसमें सागौन (टेक्टोना ग्रेण्डिस) प्रमुख प्रजाति के रूप में हैं। औषधीय रूप से महत्वपूर्ण वृक्ष प्रजातियों का दस्तावेजीकरण करने के लिए 2018-2020 के दौरान व्यापक क्षेत्र यात्राएं की गईं। इन पौधों के औषधीय महत्व को साक्षात्कार, स्थानीय आदिवासी समुदायों के साथ समूह चर्चा और उपलब्ध साहित्य के आधार पर दर्ज किया गया था। इस क्षेत्र में वृक्ष प्रजातियों की गणना में 37 जेनरा और 21 परिवारों से संबंधित 50 वृक्ष प्रजातियाँ देखी गईं। अध्ययन में आगे पाया गया कि स्थानीय आदिवासी लोगों, अध्ययन क्षेत्र के पारंपरिक चिकित्सकों और दवा उद्योग द्वारा कई प्रजातियों का उपयोग पारंपरिक चिकित्सा के रूप में किया जा रहा था। अध्ययन में पाया गया कि कई विकास परियोजनाओं, वन विनाश और अति-शोषण के कारण अभयारण्य में कुछ प्रजातियाँ दुर्लभ थीं। यह अध्ययन वानस्पतिक पहचान, परिवार, स्थानीय नाम, पौधों के उपयोग और रोगों के उपचार के लिए उपयोग के बारे में विवरण प्रदान करता है। वर्तमान शोध पत्र में वृक्ष प्रजातियों की उनके संरक्षण की स्थिति के लिए पहचान की गई और तदनुसार अध्ययन क्षेत्र में उनके संरक्षण के लिए प्राथमिकता की सिफारिश की गई है। हम अनुशंसा करते हैं कि वृक्ष प्रजातियों के दस्तावेज औषधि निर्माण और पारंपरिक ज्ञान के संरक्षण के लिए सहायक हो सकते हैं।

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Author details: TINKU KUMAR (TK) is currently a research scholar in the Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh. He is passionate about the plant taxonomy, ethnobotany, plant ecology and biodiversity conservation. AKASH KUMAR (AK) completed post-graduation degree in botany. He is currently a research scholar in the Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh. His area of interest is plant ecology. AMIT JUGNU BISHWAS (AJB) is working as an Assistant Professor in the Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh. His area of interest is plant ecology, regeneration biology, and ethnobotany. P.K. KHARE (PKK) is working as a Professor in the Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh. His area of interest is plant ecology, soil science, environmental science, forestry, plant taxonomy and biodiversity conservation.

Author contributions: TK collected the data, conduct the field work, analysis and designed the manuscript, AK helped to conduct the field work, AJB helped in the manuscript writing and field work, PKK helped in plant identification and manuscript writing.

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INTRODUCTION

Biodiversity is an essential component of our health and existence (Ogunkunle et al. 2019). India is the largest producer of medicinal herbs and hence termed as the 'botanical garden' of the world (Seth & Sharma 2004). It is estimated that more than 50,000 plant species are utilised for medicinal purpose around the world (Schippmann et al. 2002). Ethno-botany is a growing field of research that studies the utilization of various plant species and their qualities as food, medicine, and other purposes (Prescott-Allen & Prescott-Allen 1990). Nature has been a source of medicines for thousands of years, and plant-based system continues to play an essential role in primary health care for 80% of the world's population (Gupta 2001). In the beginning, these were the main sources of folk or ethno-medicine (Bargali & Shrivastava 2002). During the last few decades, there has been an increasing interest in the study of medicinal plants and their traditional use in different parts of the world (Hanazaki et al. 2000; Al-Qura'n 2005). In India, since early times, human beings have been exploring plants for various uses such as fodder, food, medicines, fuel-wood, resins, timber, gums, papers, tannins, spices, and beverages (Samant et al. 1998; Bargali et al. 2009; Swamy et al. 2010). Madhya Pradesh has the biggest proportion of India's tribal population. According to the 2011 census, the state's tribal population is 15.31 million which constitutes about 21.1 percent of the total population. Madhya Pradesh harbors 46 tribal communities with over 100 ethnic groups. The state has a high level of biodiversity and ethno-diversity. The indigenous people are dependent on the forest for food, shelter, medicine, and clothing. To meet their daily needs, they harvest non-timber forest products (NTFPs) such as roots, tubers, flowers, fruits, fibres, gum, resin, dye, tannins, honey, and wax. A major part of the Sanctuary is covered by dense forest in which Gond tribes are predominant. Medicinal plants are the only easily accessible health care alternative for most of the population in rural and tribal area. About 85% of the rural population of India depends on wild varieties of medicinal plants for the treatment of various diseases. It is still considered the first line of primary health-care even in the present age to major segments of the population worldwide (Jain et al. 2011; Gwalwanshi & Bishwas 2016). Even today, plant materials continue to play a major role in primary health care as therapeutic cures in many developing countries (Lawal et al. 2010). It has been reported that natural products (their derivatives and analogues) represent over 50% of all drugs in clinical

use, in which natural products derived from higher plants represent about 25% of the total (Cragg & Newman 2013). The World Health Organization assessed that over 80% of the people in developing countries depend on traditional remedies, for their day to day needs and about 855 traditional medicines including crude plant extracts (Tilburt & Kaptchuk 2008). With the growing threat of losing traditional knowledge in the recent time, several efforts have been made to record and publish this knowledge. In the past few years, there has been a renewed interest in traditional medicine worldwide. The traditional knowledge of herbal medicine and practises transferred from generation to generation has been challenged by modern medicine and technology. Many of these traditional remedies have been largely forgotten or are really no longer practiced (Gruyal et al. 2014). Knowledge or information about traditional herbal medicine is no longer recognised as beneficial particularly among the younger and more educated population (Ducusin 2017). This present study was conducted to document the knowledge of indigenous plant utilization and healthcare practices utilizing tree species by tribals and villagers in the Nauradehi Wildlife Sanctuary and to enumerate the tree species richness and their ethnomedicinal values.

MATERIALS AND METHODS

Study area

The Nauradehi Wildlife Sanctuary in central India covers an area of about 1,197.042 km². It lies between 23.083–23.716 N and 79.083–79.416 E, at an average altitude of 600 m above mean sea level (Figure 1). It comprises the reserved and protected forests of South Sagar, Damoh, and Narsingpur forest divisions. Based on average annual rainfall, temperature and humidity conditions, the climate of the Sanctuary can be broadly termed as seasonal. The year is divisible into three well-marked seasons, i.e., rainy (mid June–September), winter October–February), and summer (March–mid June). The average annual rainfall of the area is 1,200 mm. About 90% of the annual rainfall is received during the south-west monsoon period, only 5.5% and about 4.5% during winter and summer seasons, respectively. January is the coldest month with temperature as low as 5 °C. Highest temperature reaches up to 48 °C during the month of May.

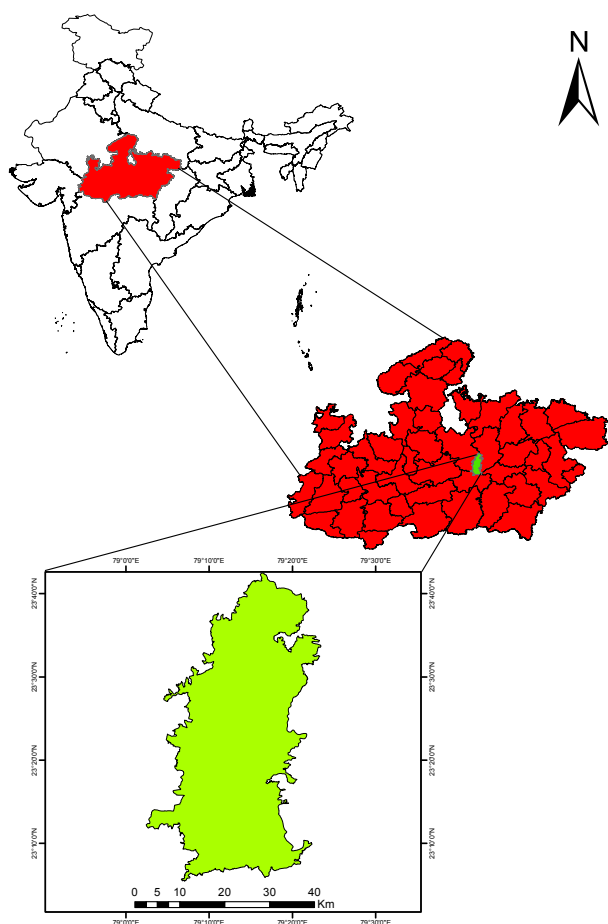


Figure 1. Map of Nauradehi Wildlife Sanctuary.

Sampling

Field survey of the sanctuary was done during 2018–2020 in different seasons of each year to collect all the forest tree species from each sub habitat, i.e., plateau, slopes, and plains. Further, areas with varying microclimate conditions such as moist, dry, and mesic places were given emphasis for plant collection. Specimens were shown to local indigenous people for local names and their medicinal uses. Their traditional knowledge for use and preparation of decoction/powdering was also documented. These specimens were dried and pressed in the field and transported to the laboratory and were prepared and deposited in the Herbarium, Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh. For identification, micro-morphological characters of the plant were detailed. All the specimens were critically examined and identified with the help of different flora and published literature (Mudgal et al. 1997; Singh et al. 2001; Verma et al. 1993). The threat status of the identified plant species were assessed after consultation

with relevant literature (IUCN 2021; Khanna et al. 2021; Vattakaven et al. 2016). Medicinal plant species are alphabetically addressed in tabular form, accompanied by the author's abbreviations, family name, local name, parts used and disease treatment (Table 1).

RESULTS AND DISCUSSION

Across the study area, a total of 50 species belonging to 37 genera and 21 families were recorded. Fabaceae was found to be the most abundant family with 14 species followed by Combretaceae (06), Moraceae (05), and Myrtaceae with 04 species. All other families were found to have two or one species (Figure 2). The trees species recorded in field surveys are listed in Table 1 along with their botanical name, vernacular/local name, family, parts used, and their ethnobotanical uses in alphabetical order. The study shows that, various parts of plants such as rhizome, roots, fruits, and leaves are used to cure various ailments. Constructive dialogue with the local people revealed that, they have unique knowledge to cure human diseases and disorders by using these tree species. These are administered in the form of medicinal recipes such as extract, powder, juice, paste, oil, etc. Sometimes, various domestic substances like ghee, milk, oil, and turmeric powder are also employed for preparing medicinal recipes. A number of species of trees were found to have multiple uses. Among the five tribal zones in India, this sanctuary belongs to the central zone, dominated by the Gond tribe descended from Rajgonds, a principal tribe of the Dravidian family and perhaps the most important of the non-Aryan or forest tribes in India (Dubey 2004). Information on traditional knowledge related to India is also shared by CSIR's TKDL (Traditional Knowledge Digital Library). Further to protect the knowledge from patenting, the National Biodiversity Authority (NBA) and state biodiversity boards (SBBS) have taken steps to conserve and digitize this information. Overexploitation of some tree species particularly for the collection of roots and underground parts from trees is shrinking their extent. Therefore, there is a need to create awareness among the local people for the importance as well as conservation of these tree species in their original habitat. The importance of various forms of knowledge, particularly Indigenous and local knowledge, in understanding and managing climate change is becoming more widely recognised (IPCC 2022).

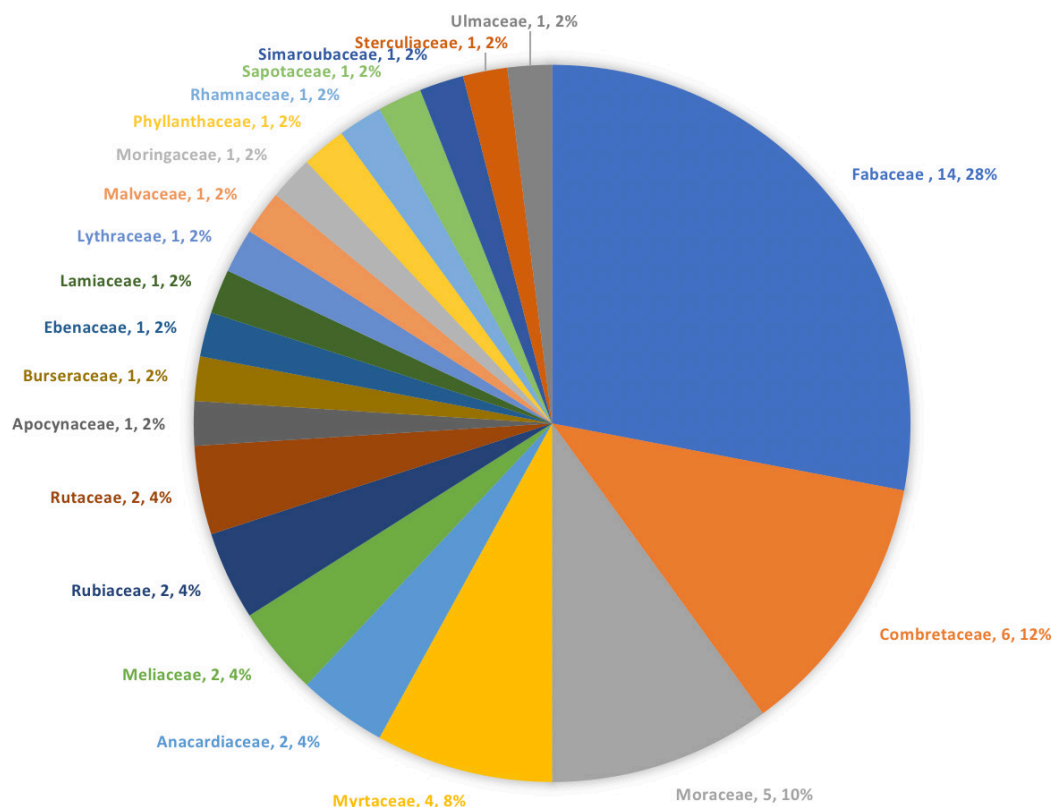


Figure 2. Families with tree species of Nauradehi Wildlife Sanctuary.

CONCLUSION

Wild medicinal plants of Nauradehi Wildlife Sanctuary were documented to initiate a framework for traditional medicinal investigation in Central India. This study provides suitable data for ethnomedicinal plant researchers to further identify new biomolecules for the treatment of various illnesses. There is an urgent need to acquire and preserve this traditional system of medicine by proper documentation and identification of species. The information is also useful for sustainable development of a small-scale pharmaceutical industries for the welfare of the community. It is recommended to formulate conservation strategies for tree species as per their threatened status before they are pushed to extinction.

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Table 1. Details of forest tree species recorded during the survey from Nauradehi Wildlife.

	Botanical name	Family	Local name	Parts used	Ethnomedicinal uses	Status
1	<i>Acacia catechu</i> (L.f.) Willd.	Fabaceae	Khair	Root, Bark	The root bark of <i>Anogeissus latifolia</i> , <i>Acacia catechu</i> , <i>Ziziphus xylopyrus</i> and whole plant of <i>Viscum articulatum</i> given orally with water in bleeding piles, as well as when there is bleeding from nose and mouth.	Near Threatened
2	<i>Acacia leucophloea</i> (Roxb.) Willd.	Fabaceae	Reonja	Seed	Seed paste obtained by rubbing, taken orally to cure dysentery.	Least concern
3	<i>Acacia nilotica</i> (L.) Willd. ex Delile	Fabaceae	Babool	Flower	Flower powder of this plant mixed with water is given orally to an animal twice a day to cure jaundice.	Least concern
4	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	Bael	Fruit	Pulp of ripened fruit is used in diarrhoea. Local people use ripe fruit to cure the digestive disorder.	Near Threatened
5	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	Mahaneem	Leaves	Decoction of leaves is used in ague (malarial fever) in cattle.	Not Evaluated
6	<i>Albizia lebbek</i> (L.) Benth.in Hook.	Fabaceae	Kala siris	Latex	Milk of goat mixed with latex of plant, is used as eye drops to cure conjunctivitis.	Least concern
7	<i>Albizia procera</i> (Roxb.) Benth.	Fabaceae	Gurar	Bark	Bark powder is applied on insect bite.	Least concern
8	<i>Anogeissus latifolia</i> (Roxb.ex DC.) Wall. ex Guill.	Combretaceae	Dhavda	Bark	Bark paste is used for healing wounds.	Near Threatened
9	<i>Anogeissus pendula</i> Edgew.	Combretaceae	Kardhai	Bark	Stem bark used in wound healing.	
10	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Kathal	Leaves	Leaves are effective in healing cuts, wounds and abscesses.	Not Evaluated
11	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Bark, Leaves	Leaf juice is given for treat of fever. Bark decoction is used to cure diarrhoea.	Least concern
12	<i>Bauhinia racemose</i> Lamk.	Fabaceae	Kachnar	Root	Pieces of root cuttings are hung around the neck for maggot wounds.	Not Evaluated
13	<i>Bauhinia variegata</i> L.	Fabaceae	Maahuli	Flower	The flowers are used in piles, oedema.	Least concern
14	<i>Bombax ceiba</i> L.	Malvaceae	Semal	Bark, Leaves	Bark paste is applied on fractured bones, plastered with <i>Bombusa arundinaceae</i> strips and tied with the help of fallen human hairs dipped in mustard oil. Paste of leaves is used over wound.	Least concern
15	<i>Boswellia serrata</i> Triana & Planch.	Burseraceae	Salai	Bark	Bark paste applied on aches.	Vulnerable
16	<i>Buchanania lanzan</i> Spreng.	Anacardiaceae	Chironji	Gum, Leaves	Leaves are used for promoting wound healing. The gum from the bark is used for treating diarrhoea.	Near Threatened
17	<i>Butea monosperma</i> (Lamk.) Taub.	Fabaceae	Palas	Bark	Crushed bark paste used in fractures.	Least concern
18	<i>Cassia fistula</i> L.	Fabaceae	Amaltas	Bark	Stem bark is ground with pepper and garlic and the mixture is given to cure fever.	Least concern
19	<i>Dalbergia latifolia</i> Roxb.	Fabaceae	Dhobin	Leaves	Leaf juice is used for eye ailments.	Vulnerable
20	<i>Dalbergia sissoo</i> Roxb.	Fabaceae	Shisham	Leaves	The infusion of leaves is used for gargling against throats infection. Decoction of leaves is used to cure gonorrhoea.	Least concern
21	<i>Diospyros melanoxylon</i> Roxb.	Ebenaceae	Tendu	Bark	A paste of bark applied to boil and tumours.	Not Evaluated
22	<i>Eucalyptus umbellata</i> Dum.	Myrtaceae	Liptis	Leaves	Heated leaves used to cure headache and cold.	-
23	<i>Feronia limonia</i> (L.) Swingle	Rutaceae	Kaitha	Fruit	Fruits are used as a liver and cardiac tonic.	Not Evaluated
24	<i>Ficus benghalensis</i> L.	Moraceae	Bargad	Latex	Latex is applied on the affected parts.	Not Evaluated

	Botanical name	Family	Local name	Parts used	Ethnomedicinal uses	Status
25	<i>Ficus hispida</i> L. f.	Moraceae	Kathumar	Fruit	Fruit juices along with honey act as a good anti haemorrhagic.	Least concern
26	<i>Ficus racemosa</i> L.	Moraceae	Umar	Root, Bark, Leaves and Fruit	Juice of 250 g of unripe fruit is boiled with water and given to pregnant women thrice a day for 10-12 days for preventing conception. The juice of its leaves extracted by holding them near a fire can be used as an ear drop. Its bark is used to heal wounds. The roots are chewed to prevent gum diseases. (if the woman is already pregnant how can you prevent conception?)	Least concern
27	<i>Ficus religiosa</i> L.	Moraceae	Peepal	Bark	Decoction of bark is given to cure foot & mouth diseases.	Not Evaluated
28	<i>Holarrhena pubescens</i> (Buch. - Ham.) Wall. ex G. Don	Apocynaceae	Doodhi	Bark	Bark is used in dysentery, leaf and seeds as febrifuge.	Least concern
29	<i>Holoptelea integrifolia</i> (Roxb.) Planch.	Ulmaceae	Chirol	Seed	Seeds are externally applied in the form of poultice on injured parts.	Not Evaluated
30	<i>Lagerstroemia parviflora</i> Roxb.	Lythraceae	Karia seja	Leaves	Decoction of leaves is used for asthma.	-
31	<i>Leucaena leucocephala</i> (Lamk.) de Wit.	Fabaceae	Subabul	Seed	The roasted seeds are an emollient.	-
32	<i>Madhuca longifolia</i> (J. Koenig. ex L.) Macbr.	Sapotaceae	Mahua	Flower	Flowers decoction is used to expel stomach worms in a calf.	-
33	<i>Mangifera indica</i> L.	Anacardiaceae	Aam	Leaves, Seed	2-4 drop of fresh leaf juice put in earache. The leaf should be used in luck worm. Powder of seed used in diarrhoea.	Data Deficient
34	<i>Melia azedarach</i> L.	Meliaceae	Bakain	Leaves, Bark	Paste of roots is applied for headache. The bark is boiled in water. After filtration, it is used as mouthwash, very useful in loose teeth.	Least concern
35	<i>Mitragyna parviflora</i> (Roxb.) Korth.	Rubiaceae	Kaim	Root, Bark	Bark and roots are given during fever and colic.	Not Evaluated
36	<i>Morinda pubescens</i> Sm.	Rubiaceae	Ael	Bark, Root	Bark and roots are given during fever and colic.	Not Evaluated
37	<i>Moringa oleifera</i> Lamk.	Moringaceae	Munaga	Leaves	Leaf paste is applied on area of swelling.	-
38	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Aonla	Fruits	Dry fruits pieces mixed with fodder for treating Abdominal disorder.	Least concern
39	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae	Karanj	Bark, Root	Decoction of bark and root are useful in expelling worms from the body.	Least concern
40	<i>Psidium guajava</i> L.	Myrtaceae	Amrood	Fruit	Fruits roasted in hot ash and then administered orally in cough.	Least concern
41	<i>Sterculia urens</i> Roxb.	Sterculiaceae	Kullu	Seed	Extract of the seeds cures dysentery and stomach pain.	Vulnerable
42	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Jamun	Bark	Bark powder is effective in preventing vomiting and diarrhoea.	Least concern
43	<i>Syzygium heyneanum</i> Wall. ex Wight & Arn.	Myrtaceae	Katjamun	Bark	Bark paste is given in diarrhoea	-
44	<i>Tamarindus indica</i> L.	Fabaceae	Imli	Leaves	Powder of dry leaves is useful as gargle for sore throat.	Least concern
45	<i>Tectona grandis</i> L. f.	Verbenaceae	Sagon	Root	Decoction of root is given in anuria.	Not Evaluated
46	<i>Terminalia arjuna</i> (Roxb. ex DC) Wight & Arn.	Combretaceae	Arjun	Roots, bark	Root decoction is used for headache. Bark decoction is used for diabetes and heart problems.	-
47	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Bahera	Root, fruits	Pieces of root cuttings hung around the neck for maggot wounds. Fruit is given 2-3 times a day in hyper acidity.	Least concern

	Botanical name	Family	Local name	Parts used	Ethnomedicinal uses	Status
48	<i>Terminalia chebula</i> Reiz.	Combretaceae	Harra	Seed	Seeds powder mixed with <i>Tamarindus indica</i> in water and the juice is given orally for bloating.	Near Threatened
49	<i>Terminalia elliptica</i> Willd.	Combretaceae	Saaj	Bark	Stem bark made into a paste, 3–6 g is given in diarrhoea and dysentery.	-
50	<i>Zizyphus jujuba</i> Mill.	Rhamnaceae	Ber	Fruit	Fruits of <i>Zizyphus jujuba</i> with <i>Allium cepa</i> are grounded and mixed with hot water and given orally for cough & fever.	Least Concern

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No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road,
Saravanampatti, Coimbatore, Tamil Nadu 641035, India
ravi@threatenedtaxa.org

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