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

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

1−4Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh 470003, India.
1tinkurajput658@gmail.com (corresponding author), 2akashumarbot@gmail.com, 3ajbhwash@gmail.com, 4p.kkhare@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.

Editor: Kannan C.S. Warrier, Senior Institute of Forest Genetics and Tree Breeding, Coimbatore, India.

Date of publication: 26 July 2022 (online & print)

Citation: Kumar, T., A. Kumar, A.J. Bishwas & P.K. Khare (2022). A survey of ethno-medicinally important tree species in Nauradehi Wildlife Sanctuary, central India. Journal of Threatened Taxa 14(7): 21442–21448. https://doi.org/10.11609/jott.7819.14.7.21442-21448

Copyright: © Kumar et al. 2022. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.

Funding: None.

Competing interests: The authors declare no competing interests.

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 (AIB) 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, conducted the field work, analysis and designed the manuscript, AK helped to conduct the field work, AIB helped in the manuscript writing and field work, PKK helped in plant identification and manuscript writing.

Acknowledgements: The authors are thankful to Botany Department, Dr. Harisingh Gour University for providing administrative help. The authors also thank Madhya Pradesh forest department staff for providing the support to conduct the fieldwork and financially supported by Department of Biotechnology, Government of India (No. 87/PK/12/899/NOB/30/506/2015 dt. 20/06/2017).
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 practices 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 tribes and villagers in the Nauradehi Wildlife Sanctuary and to enumerate the tree species richness and their ethnomedical 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.
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 ethnomedical 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).
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.

REFERENCES

Al-Qura’n, S. (2005). Ethnobotanical survey of folk toxic plants in southern part of Jordan. Toxicon 46(2): 119–129.

Bargali, S., K. Bargali, L. Singh, L. Ghosh & M. Lakhera (2009). Acacia nilotica-based traditional agroforestry system: effect on paddy crop and management. Current Science 96(4): 581–587.

Bargali, S. & S. Shrivastava (2002). Exploration of valuable medicinal vegetal wealth from the tribal belt of Bastar district in Chhattisgarh.

Cragg, G.M. & D.J. Newman (2013). Natural products: a continuing source of novel drug leads. Biochimica et Biophysica Acta (BBA)-General Subjects 1830(6): 3670–3695.

Ducusin, M. (2017). Ethnomedicinal knowledge of plants among the indigenous peoples of santol, La Union, Philippines. Electronic Journal of Biology 13(4): 360–382.

Gruyal, G.A., R. del Rosario & N.D. Palmes (2014). Ethnomedicinal plants used by residents in Northern Surigao del Sur, Philippines. Natural Products Chemistry & Research 2(4): 1–5.

Gupta, S.K. (2001). Pharmacology and Therapeutics in the New Millennium. Springer Science & Business Media, 772 pp.

Gwalwanshi, D.R. & A.J. Bishwas (2016). Some unique traditional knowledge (ethno medicine) of ethnic healers of Balaghat District, Madhya Pradesh. Madhya Bharti Journal of Science 60(1): 01–05.

Hanazaki, N., J.Y . Tamashiro, H.F. Leitão-Filho & A. Begossi (2000). Diversity of plant uses in two Caçará communities from the Atlantic Forest coast, Brazil. Biodiversity & Conservation 9(5): 597–615.

IUCN (2021). The IUCN Red List of Threatened Species. Version 2021-3. http://www.iucnredlist.org.

Jain, A.K., V.V. Wagh & C. Kadel (2011). Some ethnomedicinal plant species of Jabua district, Madhya Pradesh. Indian Journal of Traditional Knowledge 10(3): 538–540.

Khanna, K.K., P.C. Dubey, A.P . Tiwari & R.L.S. Sikarwar (2021). Studies on Threat Status of Tree species of Madhya Pradesh, India. Indian Forester 147(2): 137–140.

Lawal, I., N. Uzokwe, A. Igboanugo, A. Adio, E. Awosan, J. Nwogwugwu, A. Adesoga (2010). Ethno medicinal information on collation and identification of some medicinal plants in Research Institutes of South-west Nigeria. African Journal of Pharmacy and Pharmacology 4(1): 001–007.

Mudgal, V., K. Khanna & P. Hajra (1997). Flora of Madhya Pradesh. Vol, II, Botanical Survey of India, Calcutta, 676 pp.
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 Acacia catechu (L.f.) Willd. | Fabaceae        | Khair      | Root, Bark | The root bark of Anogeissus latifolia, Acacia catechu, Ziziphus xylopyrus and whole plant of Viscum articulatum given orally with water in bleeding piles, as well as when there is bleeding from nose and mouth. | Near Threatened   |
| 2 Acacia leucophloea (Roxb.) Willd. | Fabaceae        | Reonja     | Seed       | Seed paste obtained by rubbing, taken orally to cure dysentery.                      | Least concern     |
| 3 Acacia nilotica (L.) Willd. ex Dillen | 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 Aegle marmelos (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 Ailanthus excelsa Roxb. | Simaroubaceae   | Mahaneem   | Leaves     | Decoction of leaves is used inague(malarial fever) in cattle.                       | Not Evaluated     |
| 6 Albizia lebbeck (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 Albizia procera (Roxb.) Benth. | Fabaceae        | Gurar      | Bark       | Bark powder is applied on insect bite.                                              | Least concern     |
| 8 Anogeissus latifolia (Roxb.ex DC.) Wall. ex Guill. | Combretaceae | Dhavada    | Bark       | Bark paste is used for healing wounds.                                              | Near Threatened   |
| 9 Anogeissus pendula Edgew. | Combretaceae    | Kardhai    | Bark       | Stem bark used in wound healing.                                                    | Not Evaluated     |
| 10 Artocarpus heterophyllus Lam. | Moraceae        | Kathal     | Leaves     | Leaves are effective in healing cuts, wounds and abscesses.                         | Not Evaluated     |
| 11 Azadirachta indica A. Juss. | Meliaceae       | Neem       | Bark, Leaves | Leaf juice is given for treat of fever. Bark decoction is used to cure diarrhoea.   | Least concern     |
| 12 Bauhinia racemose Lamk. | Fabaceae        | Kachnar    | Root       | Pieces of root cuttings are hung around the neck for maggot wounds.                | Not Evaluated     |
| 13 Bauhinia variegata L. | Fabaceae        | Maahuli    | Flower     | The flowers are used in piles, oedema.                                              | Least concern     |
| 14 Bombax ceiba L. | Malvaceae       | Semal      | Bark, Leaves | Bark paste is applied on fractured bones, plastered with Bombus arundinaceae strips and tied with the help of fallen human hairs dipped in mustard oil. Paste of leaves is used over wound. | Least concern     |
| 15 Boswellia serrata Triana & Planch. | Burseraceae | Salai      | Bark       | Bark paste applied on aches.                                                       | Vulnerable        |
| 16 Buchanania lanzan 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 Butea monosperma (Lamk.) Taub. | Fabaceae        | Palas      | Bark       | Crushed bark paste used in fractures.                                              | Least concern     |
| 18 Cassia fistula L. | Fabaceae        | Amaltas    | Bark       | Stem bark is ground with pepper and garlic and the mixture is given to cure fever. | Least concern     |
| 19 Dalbergia latifolia Roxb. | Fabaceae        | Dhobin     | Leaves     | Leaf juice is used for eye ailments.                                               | Vulnerable        |
| 20 Dalbergia sissoo Roxb. | Fabaceae        | Shisham    | Leaves     | The infusion of leaves is used for gorgling against throats infection. Decoction of leaves is used to cure gonorrhoea. | Least concern     |
| 21 Diospyros melanoxylon Roxb. | Ebenaceae       | Tendu      | Bark       | A paste of bark applied to boil and tumours.                                        | Not Evaluated     |
| 22 Eucalyptus umbellata Dum. | Myrtaceae       | Liptis     | Leaves     | Heated leaves used to cure headache and cold.                                      | -                 |
| 23 Feronia limonia (L.) Swingle | Rutaceae       | Kaitha     | Fruit      | Fruits are used as a liver and cardiac tonic.                                      | Not Evaluated     |
| 24 Ficus benghalensis L. | Moraceae        | Bargad     | Latex      | Latex is applied on the affected parts.                                             | Not Evaluated     |
| Botanical name | Family         | Local name | Parts used     | Ethnomedicinal uses                                                                 | Status          |
|---------------|---------------|------------|----------------|------------------------------------------------------------------------------------|----------------|
| 25 Ficus hispida L. f. | Moraceae | Kathumar   | Fruit          | Fruit juices along with honey act as a good anti haemorrhagic.                     | Least concern   |
| 26 Ficus racemosa 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 Ficus religiosa L. | Moraceae | Peepal     | Bark           | Decoction of bark is given to cure foot & mouth diseases.                          | Not Evaluated   |
| 28 Holarrhena pubescens (Buch. - Ham.) Wall. ex G. Don | Apocynaceae | Doodhi     | Bark           | Bark is used in dysentery, leaf and seeds as febrifuge.                           | Least concern   |
| 29 Holoptelea integrifolia (Roeb.) Planch. | Ulmaceae | Chirol     | Seed           | Seeds are externally applied in the form of poultice on injured parts.            | Not Evaluated   |
| 30 Lagerstroemia parviflora Roxb. | Lythraceae | Karia seja | Leaves         | Decoction of leaves is used for asthma.                                           | -              |
| 31 Leucasena leucecephala (Lamk.) de Wit. | Fabaceae | Subabul    | Seed           | The roasted seeds are an emollient.                                               | -              |
| 32 Madhuca longifolia (J. Koenig. ex L.) Macbr. | Sapotaceae | Mahua      | Flower         | Flowers decoction is used to expel stomach worms in a calf.                      | -              |
| 33 Mangifera indica 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 Melia azedarach 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 Mitragyna parviflora (Roxb.) Korth. | Rubiaceae | Kaim       | Root, Bark     | Bark and roots are given during fever and colic.                                 | Not Evaluated   |
| 36 Morinda pubescens Sm. | Rubiaceae | Ael         | Bark, Root     | Bark and roots are given during fever and colic.                                 | Not Evaluated   |
| 37 Moringa oleifera Lamk. | Moringaceae | Munaga    | Leaves         | Leaf paste is applied on area of swelling.                                        | -              |
| 38 Phyllanthus emblica L. | Euphorbiaceae | Aonla     | Fruits         | Dry fruits pieces mixed with fodder for treating Abdominal disorder.              | Least concern   |
| 39 Pongamia pinnata (L.) Pierre | Fabaceae | Karanji    | Bark, Root     | Decoction of bark and root are useful in expelling worms from the body.           | Least concern   |
| 40 Psidium guajava L. | Myrtaceae | Amrood     | Fruit          | Fruits roasted in hot ash and then administered orally in cough.                  | Least concern   |
| 41 Sterculia urens Roxb. | Sterculiaceae | Kullu   | Seed           | Extract of the seeds cures dysentery and stomach pain.                           | Vulnerable      |
| 42 Syzygium cumini (L.) Skeels | Myrtaceae | Jamun      | Bark           | Bark powder is effective in preventing vomiting and diarrhoea.                    | Least concern   |
| 43 Syzygium heneanum Wall. ex Wight & Arn. | Myrtaceae | Katjamun  | Bark           | Bark paste is given in diarrhoea.                                                 | -              |
| 44 Tamarindus indica L. | Fabaceae | Imli       | Leaves         | Powder of dry leaves is useful as gargle for sore throat.                         | Least concern   |
| 45 Tectona grandis L. f. | Verbenaceae | Sagon      | Root           | Decoction of root is given in anuria.                                             | Not Evaluated   |
| 46 Terminalia arjuna (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 Terminalia bellirica (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       |
|---------------------|-----------------|------------|------------|---------------------------------------------------------------------------------------------------------------|--------------|
| Terminalia chebula  | Combretaceae    | Harra      | Seed       | Seeds powder mixed with Tamarindus indica in water and the juice is given orally for bloating.                 | Near Threatened |
| Terminalia elliptica| Combretaceae    | Saaj       | Bark       | Stem bark made into a paste, 3–6 g is given in diarrhoea and dysentery.                                       | -            |
| Zizyphus jujuba     | Rhamnaceae      | Ber        | Fruit      | Fruits of Zizyphus jujuba with Allium cepa are grounded and mixed with hot water and given orally for cough & fever. | Least Concern |

Ogunkunle, T.J., A. Adewumi & A.O. Adepoju (2019). Biodiversity: overexploited but underutilized natural resources for human existence and economic development. *Environment & Ecosystem Science* 3(1): 26–34.

Prescott-Allen, R. & C. Prescott-Allen (1990). How many plants feed the world? *Conservation Biology* 4(4): 365–374.

Pörtner, H.O., D.C. Roberts, H. Adams, C. Adler, P. Aldunce, E. Ali & Z.Z. Ibrahim (2022). *Climate change 2022: impacts, adaptation and vulnerability*. IPCC.

Samant, S.S., U. Dhar & L.M.S. Palni (1998). *Medicinal Plants of Indian Himalaya*: Gyanodaya Prakashan, 46 pp.

Schippmann, U., D.J. Leaman & A. Cunningham (2002). Impact of cultivation and gathering of medicinal plants on biodiversity: global trends and issues. Biodiversity and the ecosystem approach in agriculture, forestry and fisheries, 21 pp.

Seth, S. & B. Sharma (2004). Medicinal plants in India. *Indian Journal of Medical Research* 120(1): 9.

Singh, N., K. Khanna, V. Mudgal & R. Dixit (2001). *Flora of Madhya Pradesh Volume–III*. Botanical Survey of India, 587 pp.

Swamy, S., C. Dutt, M. Murthy, A. Mishra & S. Bargali (2010). Floristics and dry matter dynamics of tropical wet evergreen forests of Western Ghats, India. *Current Science* 99(3): 353–364.

Tilburt, J.C. & T.J. Kaptchuk (2008). Herbal medicine research and global health: an ethical analysis. *Bulletin of the World Health Organization* 86: 594–599.

Vattakaven T, R. George, D. Balasubramanian, M. Rejou-Mechain, G. Muthusankar, B. Ramesh & R. Prabhakar (2016). India Biodiversity Portal: An integrated, interactive and participatory biodiversity informatics platform. Biodiversity Data Journal 4: e10279: 1–15. http://doi.org/10.3897/BD.4.e10279

Verma, D., N.P. Balakrishnan & R.D. Dixit (1993). *Flora of Madhya Pradesh Volume-I*. Botanical Survey of India, 662 pp.
The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under Creative Commons Attribution 4.0 International License unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

July 2022 | Vol. 14 | No. 7 | Pages: 21331–21486
Date of Publication: 26 July 2022 (Online & Print)
DOI: 10.11609/jott.2022.14.7.21331-21486

Articles

The Javan Leopard Panthera pardus melas (Cuvier, 1809) (Mammalia: Carnivora: Felidae) in West Java, Indonesia: estimating population density and occupancy
– Anton Ario, Senjaya Mercusiana, Ayi Rustadi, Robi Gumiilang, I Gede Gergel Darma Putra Wirawan & Toni Ahmad Slamat, Pp. 21331–21346

Breeding phenology and population dynamics of the endangered Forest Spiny Reed Frog Afrixalus sylvaticus Schinz, 1974 in Shimba Hills, Kenya
– Alfayo Koskei, George Eshiamwata, Bernard Kirui & Phylus K. Cheruiyot, Pp. 21347–21355

Ichthyofaunal diversity of Senkhi stream, Itanagar, Arunachal Pradesh: a comparative status between 2004–05 and 2018–19
– Koj Taro, Lakpa Tamang & D.N. Das, Pp. 21356–21367

First record of Proceratium Roger, 1863, Zasphinctus Wheeler, 1918, and Vollenhovia Mayr, 1865 (Hymenoptera: Formicidae) from the Western Ghats of peninsular India, description of three new species, and implications for Indian biogeography
– Kalesh Sadasivan & Manoj Kripakaran, Pp. 21368–21387

Communications

New queen? Evidence of a long-living Jaguar Panthera onca (Mammalia: Carnivora: Felidae) in Tikal National Park, Guatemala
– Carlos A. Gaitán, Manolo J. García, M. André Sandoval-Lemus, Vivian R. González-Castillo, Gerber D. Gzmáun-Flores & Cristel M. Pineda, Pp. 21388–21395

First camera trap record of Striped Hyena Hyaena hyaena (Linnaeus, 1758) (Mammalia: Carnivora: Hyaenidae) in Parsa National Park, Nepal
– Pramod Raj Regmi, Manohar Chand Pradhan, Prakash Sigdel, Dipendra Adhikari, Naresh Subedi & Babu Ram Lamichhane, Pp. 21396–21401

Range extension and new ecoregion records of the Crocodile Monitor Varanus salvator (Peters & Doria, 1878) (Reptilia: Varanidae) in Papua New Guinea
– Borja Reh & Jim Thomas, Pp. 21402–21408

A checklist of fish and shellfishes of the Poonthura estuary, southwestern coast of India
– Kiranya Bella, Pramila Sahadevan, Giri Bhavan Sreekantan & Rajeev Raghavan, Pp. 21409–21420

A new species of Protosticta Selys, 1885 (Odonata: Zygoptera: Platystictidae) from Western Ghats, India
– Kalesh Sadasivan, Vinayan P. Nair & K. Abraham Samuel, Pp. 21421–21431

A case study on utilization and conservation of threatened plants in Sechu Tuan Nalla Wildlife Sanctuary, western Himalaya, India
– Puneet Kumar, Harminder Singh & Sushil Kumar Singh, Pp. 21432–21441

A survey of ethno-medicinally important tree species in Nauradehi Wildlife Sanctuary, central India
– Tinku Kumar, Akash Kumar, Amit Jugnu Bishwas & Pramod Kumar Khare, Pp. 21442–21448

Short Communications

Effects of a Bengal Slow Loris Nycticebus bengalensis (Primates: Lorisidae) bite: a case study from Murlen National Park, Mizoram, India
– Amit Kumar Bal, Anthony J. Giordano & Sushanto Gouda, Pp. 21449–21452

First record of Garra birostris Nebeshwar & Vishwanath, 2013 (Cypriniformes: Cyprinidae) from Doyang and Dikhu rivers of Brahmaputra drainage, Nagaland, India
– Sophiya Eung, Meteavinu Kechu & Pranay Punj Pankaj, Pp. 21453–21457

Two new records of Lilac Silverline Apharitis lilacinus (Lepidoptera: Lycanidae) from northeastern India
– Monsoon Jyoti Gogoi, Ngulkholal Khongsai, Biswajit Chakdar & Girish Jathar, Pp. 21458–21461

Illustrated description of the mantis Mesopteryx platyccephala (Mantodea: Mantidae) collected from West Bengal, India
– Gauri Sathaye, Sachin Ranade & Hemant Ghate, Pp. 21462–21466

Cetrelia isidiata (Asahina) W.L. Culb. & C.F. Culb. (Pelmieidae) – an addition to the Indian lichen biota
– Gaurav K. Mishra, Pooja Maurya & Dalip K. Upreti, Pp. 21467–21469

Notes

A new southern distribution record for Pacific Marten Martes caurina
– Maximilian L. Allen, Brianne Kenny, Benjamin Crawford & Morgan J. Farmer, Pp. 21470–21471

First Asian record of Light-mantled Albatross Phoebetria palpebrata (Foster, 1785) from Rameswaram Island, Tamil Nadu, India
– H. Byju & N. Raveendran, Pp. 21473–21475

Salvia misella Kunth (Lamiaceae) - a new record for Eastern Ghats of India
– Prabhat Kumar Das, Pradeep Kumar Kamila & Pratap Chandra Panda, Pp. 21576–21579

Salsola oppositifolia Desf. in Great Rann of Kachchh, Gujarat – a new record for India
– Rakesh Gujar, Vinesh Gamit, Ketan Tatu & R.K. Sugoor, Pp. 21580–21483

Extended distribution of Impatiens scapiflora (Balsaminaceae) to the flora of Eastern Ghats, India
– T.S. Saravanan, S. Kaliamoorthy, M.Y. Kamble & M.U. Sharief, Pp. 21484–21486