Forest trees of Odisha, India: An updated checklist

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Abstract

An exhaustive taxonomic inventory of forest trees of Odisha in the Eastern Ghats of India was made during 2015–2020, which revealed the presence of a total of 501 species of wild and naturalised trees belonging to 293 genera under 81 families. The family Fabaceae was the most species-rich represented by 58 species, followed by Rubiaceae (28), Moraceae (26), Rutaceae (21), Meliaceae (21), Phyllanthaceae (21) Verbenaceae (19) and Lauraceae (15). The genus Ficus (Moraceae) had highest number of 21 tree species, followed by Diospyros (10 species), Terminalia (8 species), Syzygium (7 species), Sennegalia (7 species), Vitex (7 species) and Albizia (6 species). Notophytopes nymnoniana, Alphonsea lutea, Lasiococca comberi, Siphonodon caesalineus, Searsia paniculata, Syzygium schmidii, Cassipourea ceylonica, Prunus pygeoides, Sonneratia griffithii, Eriolaela hookeriana var. viridis, Tritaxis globella, Garcinia xanthochymus and Litsea glutinosa have been identified as regionally threatened species needing conservation intervention. Cocculus laurifolius is reported here as a new distributional record for the state. Field observation on the occurrence and dominance of tree species in different forest types of Odisha has been discussed. A checklist of the tree species of Odisha is presented in this article, along with the correct botanical name, synonym(s), local name, flowering and fruiting time, locality of occurrence and citation of voucher herbarium specimens.

Keywords

Enumeration, flora, biodiversity, Eastern Ghats

Introduction

Tropical forests are the most species-rich terrestrial ecosystems in the world. Though they cover only 6–7% of the landmass on Earth, more than half of the described and unknown species of plants, animals and microorganisms of the globe are reported to occur in the tropics (1, 2). Due to a wide range of variation in topographic, climatic and edaphic conditions, the world’s tropical forests hold strikingly rich genetic diversity at species and intra-specific levels (3). However, many tropical forests are under tremendous anthropogenic pressure and require management intervention to maintain the overall biodiversity, productivity and sustainability (4). Understanding tree composition and structure of the forest is a vital instrument in assessing the sustainability of the forest, species conservation and management of forest ecosystems (5). Long-term biodiversity conservation depends on the knowledge of the structure, species richness and the ecological characteristics of vegetation, especially trees (6).
Because of their dominance, density and biomass, the trees form the main structural and functional components of tropical forests. They are considered robust indicators of climatic change and man-made alterations at the landscape level (7). Trees are one of the main features of most forest ecosystems of the world, and they make available habitats, food and other resources for a range of epiphytes, mosses, fungi, lichens, birds, insects and other forest-dwelling organisms (8). The biological diversity of tree species in tropics varies according to the geographical location, forest types, habitat conditions and intensity of disturbance (9).

Though trees find a place in general floristic accounts of Odisha (10, 11), no exclusive publications on trees of Odisha have been brought out except that of the Similipal Biosphere Reserve (12). As regards the trees of Odisha state, the Botany of Bihar and Orissa (10) provides an account of the flora and vegetation of the then Bihar and Odisha and as many as 386 tree species have been listed therein. Subsequently, it was mentioned that 475 species of tree in “Flora of Orissa” and later reported the occurrence of Siphonodon celastrineus Griff. from the state (11, 13). In another work, “The wild edible fruit plants of Eastern India” mentioned some 98 species of wild trees producing edible fruits (14). The report on “Floral diversity of Nandankanan Wildlife Sanctuary” records the presence of 175 tree species (15). Subsequently, several tree species such as Sloanea sterculiaea (Benth.) Rehder & Wilson (16), Dysoxylum gotadhora (Buch.-Ham.) Mabb. (17), Sear- sia paniculata (Wall. ex G. Don) Moffett (18) and Notapho- dytes nimmoniana (J. Graham) Mabb. (19) have been added to the list of trees of Odisha. Till date, there is no publication dealing exclusively on diversity, distribution and phenology of forest trees of Odisha state.

Materials and Methods

Study area

The study area covers the entire state of Odisha, located between 17.49° N and 22.34° N latitudes and 81.27° E and 87.29° E longitudes on the east coast of India (Fig. 1). This coastal state covers an area of 155820 km². It is surrounded by the States of Jharkhand, West Bengal, Chhattisgarh, Andhra Pradesh and the Bay of Bengal. One-third of the area of the state is under forest cover and three-fourths of the area is covered with hills and mountainous ranges.

![Fig. 1. Map of study area: (A) Map of India showing the geographical location of Odisha, (B) Map of Odisha showing all the 30 districts.](image)

Based on homogeneity, continuity and physiographic characteristics, Odisha has been divided into 5 major regions such as (i) The Odisha coastal plains, (ii) The middle mountainous and highlands, (iii) The Central plateau, (iv) The western rolling uplands and (v) the major flood plains. Eleven major rivers and their tributaries flow in the state and drain into the Bay of Bengal. Odisha enjoys a tropical monsoon type of climate characterized by high temperature and humidity, medium to high rainfall, and short and mild winters. The average summer temperature can be as high as 45 °C and a minimum of 5 °C in winter. The period from mid-June to September is the monsoon season and the state receives an average annual rainfall about 1500 mm.

Despite degradation, both in extent and density, the existing forests of Odisha can be classified under 5 broad forest types and sub-types as per the classification of Champion and Seth (20). These are (i) Orissa Semi-Evergreen Forests, (ii) Tropical Moist Deciduous Forests, (iii) Tropical Dry Deciduous Forests, (iv) Central Indian Hill Forests and (v) Littoral and Tidal Swamp Forests.

Field and herbarium methods

Regular collection trips were organised in all the 30 districts of Odisha in different seasons of the year, with special emphasis on protected areas like Biosphere Reserve, National Parks, Wildlife sanctuaries and other floristically diversified habitats. Since most of the tree species flower during the summer months, extensive field trips were conducted during this season to collect and photograph flowering specimens. Before collection, general observations on the type of vegetation, dominant species, habitat condition, soil type, plant association, dominance and distribution, level of disturbance etc., of each site were recorded. Authentic field notes were recorded on the spot, which includes place of collection, local name, tree height, GBH, phenology and other characters which cannot be detected in dried specimens. Herbarium specimens were prepared following the standard herbarium techniques (21, 22). Some flowering and fruiting twigs were preserved in polythene bags and brought to the laboratory for subsequent diagnosis, botanical description and correct identification. The voucher specimens have been deposited in the Herbarium of the Regional Plant Resource Centre (RPRC), Bhubaneswar, India.

The identity of the plants was ascertained in consultation with the artificial identification keys and descriptions provided in the local floras such as “The Botany of Bihar & Orissa” (10), its “Supplement” (23), “Flora of Orissa” (11), other floras, monographs and revisions. Some doubtful specimens were taken to Central National Herbarium, Calcutta (CAL) and were matched with authentic materials to ascertain identity.

Results

Tree inventory conducted in the forests of Odisha during the period 2015-2020 revealed the presence of 501 species of wild and thoroughly naturalised trees belonging to 293 genera under 81 families. Fabaceae was the most domi-
nant family represented by 58 tree species, followed by Rubiaceae (28 species), Moraceae (26), Rutaceae (21), Meliaceae (21), Phyllanthaceae (21) Verbenaceae (19) and Lauraceae (15). Some 27 families like Alangiaceae, Aquifoliaceae, Araliaceae, Averrhoaceae, Bixaceae, Caprifoliaceae, Casuarinaceae, Cochlospermaeae, Dipterocarpaceae, Eleocarpaceae, Hernandiaceae, Hippocrateaceae, Icacinaceae had one tree species each. The genus Ficus (Moraceae) included a maximum number of 21 tree species, followed by the genera Diospyros (10 species), Terminalia (8 species), Syzygium (7 species), Senegalia (7 species), Vitex (7 species) and Albizia (6 species).

The enumeration of 501 species of forest trees in Odisha is provided in Table 1.(Supplementary data) The families are alphabetically arranged, and the species under a family also follow alphabetic order. For each species, correct botanical name with author citation, family to which it belongs, local name, flowering and fruiting time, locality of collection from Odisha and herbarium voucher specimen number have been given. The correct name used in this paper is according to the name cited in the online world plant database (http://www.worldfloraonline.org) and the synonym as available in the “Flora of Orissa” (11), “The Botany of Bihar and Odisha” (10) and “Supplement to the Botany of Bihar and Orissa” (23) only have been cited. Photographs of some important tree species collected from the forests of Odisha have been provided (Figs. 2-8).

Discussion

The present study reports the presence of as many 501 tree species against 386 species reported in the Botany of Bihar and Orissa (10) and 475 species listed in The Flora of Orissa (11). The occurrence of several interesting and threatened tree species like Nothopodytes nimmoniana (J. Graham) Mabb., Coccus laurifolius DC., Searsia paniculata (Wall. ex G. Don) Moffett has been reported for the first time by the authors in course of this study. The natural distribution of many species of trees was observed to be restricted to specific forest types and habitat conditions. While the dominant trees in the top storey of semi-evergreen forests were Artocarpus lacucha Roxb. ex Buch.-Ham., Mangifera indica L., Protium serratum (Wall. ex Colebr.) Engl., Magnolia champaca (L.) Baill. ex Pierre, Diospyros malabarica (Desr.) Kostel., Celtis tetandra Roxb., Bridelia retusa (L.) A. Juss., Dillenia pentagyna Roxb., Ficus racemosa L., Ficus nervosa Hayne ex Roth, Firmiana colorata (Roxb.) R. Br., the middle storey was composed of Mesua ferra, Phoebe lanceolata, Huberantha cerasoides (Roxb.) Chawasagu, Polyalthia suberosa (Roxb.) Thw., Macaranga peltata (Roxb.) Mull.-Arg., Litsea nitida (Roxb.) Hook. and a few other small-statured trees. The Tropical Moist Deciduous Forests of Odisha are characterized by predominance of Shorea robusta Gaertn. (sal) in almost pure formations along with associated trees like Terminalia elliptica Wild., Pterocarpus marsupium Roxb., Schleichera oleosa (Lour.) Oken, Careya arbor-ea Roxb., Dalbergia latifolia Roxb., Ougeinia oogeinensis (Roxb.) Hochr., Xylia xylocarpa (Roxb.) Taub., Toona ciliata Roem. etc. Species such as Cleistanthus collinus (Roxb.) Benth.ex Hook., Dendrocalamus strictus (Roxb.) Nees, Terminalia noagissiana Gere & Boatr., Terminalia elliptica Wild., Diospyros melanoxylon Roxb., Boswellia serrata Roxb. ex Celebr. etc., along with Sal (Shorea robusta Gaertn.) are common in the Tropical Dry Deciduous Forest patches in the state. Central Indian Hill Forests are seen between 900-1200 m and the vegetation closely resembles the tropical dry deciduous vegetation with a higher proportion of evergreen species such as Syzygium cumini (L.) Skeels, Manilkara hexandra (Roxb.) Dubard, Fimania simplex (L.) W. Wight, Firmiana colorata (Roxb.) R. Br., Ficus racemosa L., Ficus virens Ait. and Mallotus philipinensis (Lam.) Mull.-Arg.

The estuaries of rivers like the Subarnarekha, the Budhabalang, Baitaran, Mahanadi, Daya and Bansadhara etc., all of which together have built up the coastal alluvium of Odisha harbour Littoral and Tidal Swamp Forests, either as a continuous belt or as broken patches, from Chandipur in the Balasore district to Gopalpur in the Ganjam District. The dominant tree species of tidal swamp (mangrove) forests are Bruguiera parviflora (Roxb.) Wight & Arn. ex Griff., B. gymnorrhiza (L.) Lam., Rhizophora mucronata Lam., R. apiculata Bl., Ceriops decandra (Griff.) W. Theob., Lumnitzerac racemosa Willd., Excoecaria agallocha L., Sonneratia caseolaris (L.) Engl., S. apetala Buch.-Ham., Thespesia populnea (L.) Sol. ex Corr., Hibiscus tiliaceus L., Xylocarpus granatum Koenig., Heritiera littoralis Dryand ex Ait., Aegiceras corniculatum (L.) Blanco, Kandelia can- del (L.) Druce, Avicennia marina (Forssk.) Vierh., A. offici-nalis L. and Phoenix paludosa Roxb.

In the present tree inventory, Nothopodytes nimmoniana (J. Graham) Mabb., Alphonsea lutea (Roxb.) Hook. f. & Thoms., Lasiococca comberi Haines, Siphonodon celastreinus Griff., Coccus laurifolius DC., Searsia paniculata (Wall. ex G. Don) Moffett, Syzygium schmidii Rathakr. & N. C. Nair, Cassipourea ceylonica (Gardn.) Alston, Prunus pygeoides Koehne, Sonneratia griffithii Kurz, Erioloea hookeriana Wight & Arn. var. viridis Haines, Tritaxis gibellata (Thw.) R. Y. Yu & Welzen, Garcinia xanthochymus Hook. f. ex T. Anders. and Litsea glutinosa (Lour.) Robins. have been identified as regionally threatened taxa.

Conclusion

The forest tree inventory of Odisha in this article is the first comprehensive study in the state based on intensive fieldwork, herbarium and literature consultations for about 6 years. It enumerates 501 species of wild and naturalised trees, representing 19.25% of India’s tree diversity, estimated as 2603 species (24) and lists several threatened taxa needing conservation actions. The present work will help the forest managers and conservationists to formulate suitable strategies for conservation of threatened tree species and a better understanding of the tree flora of the state.
Fig. 2. Trees of Odisha. A. Vachellia farnesiana, B. Acronychia pedunculata, C. Alangium salviifolium, D. Careya arborea, E. Aegle marmelos, F. Alstonia venenata, G. Neocinnamomum caudatum, H. Bombax ceiba, I. Calophyllum inophyllum, J. Ceiba pentandra, K. Cassia fistula, L. Chloroxylon swietenia, M. Ougeinia ojoenensis, N. Dillenia indica, O. Dysoxylum gatahoro.
Fig. 3. Trees of Odisha. A. Vachellia leucophloea, B. Alphonsea lutea, C. Ardisia solanacea, D. Buchanania cochinchinensis, E. Saraca asoca, F. Cleistanthus patulus, G. Ehretia aspera, H. Diospyros chloroxylon, I. Garcinia xanthochymus, J. Glochidion lanceolarium, K. Harpullia arborea, L. Kydia colycina, M. Lasiococca comberi, N. Gardenia latifolia, O. Eugenia roxburghii.
Fig. 4. Trees of Odisha. A. Aphanamixis polystachya, B. Artocarpus lacucha, C. Bauhinia purpurea, D. Callicarpa tomentosa, E. Debregeasia longifolia, F. Dillenia pentagyna, G. Erythrina variegata, H. Ficus benjamina, I. Gmelina arborea, J. Holdina cordifolia, K. Lagerstroemia parviflora, L. Lannea coromandelica, M. Leela indica, N. Madhuca longifolia, O. Melia dubia.
Fig. 5. Trees of Odisha. A. Ailanthus excelsa, B. Terminalia anogeissiana, C. Bischofia javanica, D. Psydrax dicoccos, E. Cerbera odollam, F. Ehretia acuminata, G. Dillenia aurea, H. Flacourtia jangomas, I. Mammee suriga, J. Limonia acidissima, K. Miliusa velutina, L. Neolitsea zeylanica, M. Ochna obtusata, N. Phyllanthus emblic, O. Pithecellobium dulce.
Fig. 6. Trees of Odisha. A. Actinodaphne angustifolia, B. Phanera roxburghiana, C. Cleistanthus collinus, D. Dalbergia sissoo, E. Euonymus glaber, F. Ficus semicordata, G. Grewia serrulata, H. Hymenodictyon orixense, I. Ligustrum mini, J. Litsea monopetala, K. Memecylon umbellatum, L. Morinda corea, M. Nothaphytes nimmoniana, N. Oreocnide integrifolia, O. Huberantha cerasoides.
Fig. 7. Trees of Odisha. A. *Antidesma bunius*, B. *Baccaurea ramiflora*, C. *Boswellia serrata*, D. *Cochlospermum religiosum*, E. *Tritaxis glabella*, F. *Discospermum abnorme*, G. *Erythrina suberosa*, H. *Mesua ferrea*, I. *Mitragyna parvifolia*, J. *Naringi crenulata*, K. *Oroxylum indicum*, L. *Pterocarpus marsupium*, M. *Schleichera oleosa*, N. *Semecarpus anacardium*, O. *Sterculia foetida*.
Fig. 8. Trees of Odisha. A. Albizia chinensis, B. Bridelia retusa, C. Crateva magna, D. Diospyros melanoxylon, E. Schrebera swietenioides, F. Sloanea sterculacea, G. Firmiana colorata, H. Suregada multiflora, I. Murraya paniculata, J. Terminalia elliptica, K. Litsea glutinosa, L. Holarrhena pubescens, M. Terminalia bellirica, N. Wrightia arborea, O. Xylosma longifolium.
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Authors contributions
PKD and TS: Plant collection, photography, herbarium preparation, data analysis and draft manuscript preparation. PCP: Plant identification, nomenclature and manuscript correction.

Compliance with ethical standards
Conflict of interest: Authors do not have any conflict of interests to declare.
Ethical issues: None.

Supplementary data
Supplementary. Table 1. Enumeration of tree species of Odisha

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