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Research Article

Preliminary study on flora of Orchha wildlife sanctuary (Madhya Pradesh), India.

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Abstract: Assessment of flora species which form an integral part of animal ecology, in wildlife based protected areas is necessary before any meaningful conservation work can commence. Understanding floral diversity is important for helping forests managers to evaluate the complexity and resources. Substantial literature is not available on floral diversity of the Orchha Wildlife Sanctuary as a ready reference and thus require to take up study of flora of the sanctuary to fill the gap. Orchha Sanctuary is situated between Betwa and Jamni rivers of Bundelkhand region of Madhya Pradesh. The total area of the sanctuary is 45.86 square kilometer, which includes both land and water bodies. The extensive floristic exploration of Orchha Wildlife Sanctuary was carried out. The floristic composition was recorded by making visual observations. Specimen samples were collected at different reproductive stages to prepare herbarium and substantiate their correct identity. Forests in Orchha Sanctuary are Southern Tropical Dry Deciduous Forests and Kardhai Forests. The forests are predominately covered by Teak and Kardhai. Other species like Haldu, Sejha, Arjun, Saja, Khair, Achar and mahua are scattered all over the area. 42 genera of Angiosperms comprising 23 families occured in the Sanctuary. The prominently represented family in terms of highest number of genera is Leguminosae comprising 11 genera. The study on floral diversity in the sanctuary will serve as a basic tool that will enable other researcher and managers of the sanctuary to further take up studies on biodiversity assessment and vegetation structure.

Keywords: Flora, Orchha, Sanctuary, Tree species, Madhya Pradesh

Introduction

An estimated 369,000 species of flowering plants are known to science (State of the World's Plants, 2016). The Indian subcontinent has one of the world's richest floras, with more than 17,000 species of flowering plants alone (Arisdason & Lakshminarasimhan, 2017). India is recognized as one of the 12-megadivesity countries of the world and supports a diverse array of habitats or ecosystems such as forests, grasslands, wetlands, coastal, marine and desert and each with rich and unique floristic diversity. Champion & Seth (1968) have recognized 16 major forest types comprising 221 subtypes in the country. The forest cover of the country constitutes about 21.34% (70.17 MHa) of India's total geographical area (FSI, 2015)). To protect some forests areas from anthropogenic pressure, forests have been given legal status of Protected Areas. A network of 668 Protected Areas (PAs) has been established, extending over 16.12 MHa. (4.90% of total geographic area), comprising 102 National Parks, 515 Wildlife Sanctuaries, 47 Conservation Reserves and 4 Community Reserves (MoEF, 2011). Besides, India is the second largest populated country in the world and a majority of its people directly or indirectly depends on forests resources for livelihood (Wagh & Jain, 2016).

Protected area may also prove to be attractive tourist destinations and thus, provide income and livelihood opportunities to the rural people living in and around these protected areas (Das, 2017). People may also depend on these resources to fulfil the need of fodder and firewood. Considering the impact of ever increasing anthropogenic pressure and development on forest resources, there is a need to assess forests from a biodiversity perspective to indicate conservation measures. Assessment of flora species which form an integral part of animal ecology, in wildlife based protected areas is necessary before any meaningful conservation work can commence (Edet & Ijeomah, 2012). Understanding species diversity is also important for helping managers to evaluate the complexity and resources of these forests (Jayakumar & Nair, 2013). Substantial literature is not available on floral diversity of the Orchha Wildlife Sanctuary as a ready reference and thus require to take up study of flora of the sanctuary to fill the gap. Data generated from the study will help take informed decision and formulate effective policies for biodiversity conservation and resource utilization of the sanctuary.

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Material and Methods

Study Area

Orchha Wildlife Sanctuary, also known as Orchha Nature Reserve, is bestowed with unique floral and faunal diversity of Bundelkhand region, which otherwise is on the verge of extinction. It has strategic location adjoining historical town of Orchha with the 17th century monuments situated in the backdrop adds to the importance and aesthetic value of the Sanctuary. This is the only area in the entire region blessed with lush green patch of Teak and Kardhai forests. Once this region was the home of carnivores like Tigers and Panthers, but now has totally lost these species. Orchha Sanctuary is situated between Betwa and Jamni rivers of Bundelkhand region of Madhya Pradesh. The two rivers along with their conjunctions and confluence form the boundary of the Sanctuary. The total area of the nature reserve is 45.86 square kilometer, which includes both land and water bodies. Geographical position of nature reserve is latitude 25^0 13' 45"N to 25^0 22' 30" N and longitude 78^0 33' 45" E to 78^0 40' 15" E. the altitude of the sanctuary varies from 207 to 357 meters above Mean Sea Level.

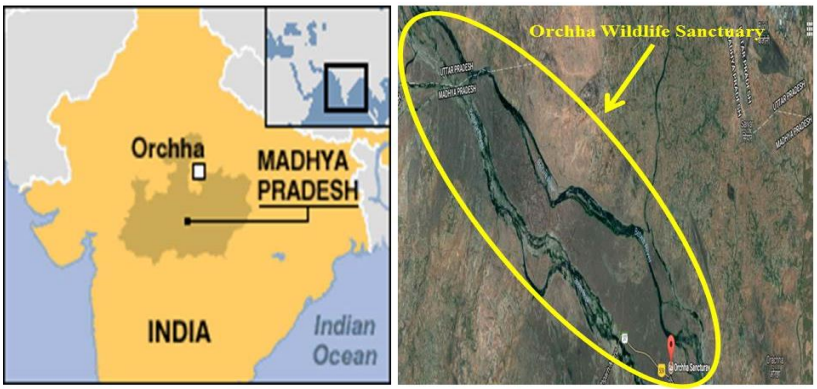

Figure 1. Location Map of Orchha Wildlife Sanctuary, Madhya Pradesh

The present study was conducted from April 2015 to July 2017. The extensive floristic exploration of Orchha Wildlife Sanctuary was carried out during the period. The floristic composition was noted by making visual observation. Specimen samples were collected at different reproductive stages viz. flowering, fruiting, to prepare herbarium (De Vogel, 1987; Jain S. K. and Rao R. R., 1926) and substantiate their correct identity. Specimens of trees and shrubs were collected with flowering and fruiting twigs; small herbs and shrubs were collected with the whole plant and sometimes with roots. Creepers were collected with flowering and fruiting; and grasses were collected with underground parts. Tall aquatic plants' specimens were bent into M, N, and V shape to prepare a herbarium. Plant parts such as bark, root, leaves, and fruits were also collected for correct identification. The plants were identified with the help of literature viz. Flora of Madhya Pradesh (Verma *et al.,* 1994; Mudgal et.al. 1997; Singh *et al.,* 2001), Flora of British India (Hooker 1892-1897), other literature, field keys and monographs (Ray, 1984; Schmid, 1990; Khanna *et al.,* 2001; Dallwitz *et al.,* 2007). The results were crossed checked with the traditional knowledge about flora and fauna of the people of the study area.

Results

Forests in Orchha Sanctuary are Southern Tropical Dry Deciduous Forests (5A/C1b) and Kardhai Forests (5/E1) as per Champion and Seth (1968) classification. The forests are predominately covered by Teak and Kardhai. Other species like Haldu, Sejha, Arjun, Saja, Khair, Achar and mahua are scattered all over the area. River banks and beds are occupied by jamun and Arjun. Present study revealed that 42 genera of Angiosperms comprising 23 families were present in the Orchha Wildlife Sanctuary (Table 1). The prominently represented family in terms of highest number of genera is Leguminosae comprising 11 genera. Dominant species in the sanctuary is *Tectona grandis* (Teak) covered the highest area in the sanctuary and followed by species *Anogeissus pendula* (Kardhai). North of the Sanctuary was dominated by *Anogeissus pendula* whereas southern part of the sanctuary was mostly occupied by *Tectona grandis*. Remaining 40 species scattered across the sanctuary. 13 species of herbs and shrubs belonging to 12 families occurred in the Sanctuary (Table 2). 9 species of climbers and creepers occurred in the sanctuary, some of them belong to the group of high value medicinal plants like *Asparagus racemosus* (Table 3). 8 species of grasses recorded in the sanctuary including *Vetiveria zizanioides, Cymbopogon martini*, (Table 4). 13 Species of aquatic flora mainly consisted of Typha species, Stoneworts, Hydrilla and Diatoms (Table 5).

Table 1. Tree species present in the Orchha Wildlife Sanctuary

S. No.	Common Name	Scientific name	Family
1	Aam	*Mangifera indica*	Anacardaceae
2	Arjun	*Terminalia arjuna*	Combretaceae
3	Achar	*Buchanania lanzan*	Anacardiaceae
4	Amla	*Emblica officinalis*	Euphorbiaceae
5	Amaltas	*Casia fistula*	Leguminosae
6	Bel	*Aegle marmelos*	Rutaceae
7	Ber	*Zizyphus jujuba*	Rhamnaceae
8	Banyan	*Ficus bengalensis*	Moraceae
9	Bahera	*Terminalia bellerica*	Combretaceae
10	Bija	*Pterocarpus marsupium*	Leguminosae
11	Babul	*Acacia nilotica*	Leguminosae
12	Chirol	*Holoptelea integrifolia*	Leguminosae
13	Dhobin	*Dalbergia paniculata*	Leguminosae
14	Dudhi	*Holarrhena antidysentrica*	Apocynoceae
15	Ghont	*Zizyphus xylopyra*	Rhamnaceae
16	Khair	*Acacia catechu*	Leguminosae
17	Kardhai	*Anogeissus pendula*	Combrataceae
18	Kasai	*Bridelia retusa*	Euphorbiaceae
19	Kumbhi	*Careya arborea*	Myrtaceae
20	Kari	*Milusa tomentosa*	Annonaceae
21	Kem	*Mitragyna parvifolia*	Rubiceae
22	Kullu	*Sterculia urens*	Sterculiaceae
23	Mahua	*Madhuca indica*	Sapotaceae
24	Moyen	*Kannea grandis*	Burstraceal
25	Munj	*Saccharum munja*	Gramineae
26	Neem	*Azadirachta indica*	Meliaceae
27	Palas	*Butea monosperma*	Leguminosae
28	Pakar	*Ficus infectoria*	Moraceae
29	Papal	*Ficus religiosa*	Moraceae
30	Rohan	*Soymida febrifuga*	Meliaceae
31	Reunjha	*Acacia leucophloca*	Leguminosae
32	Shisharm	*Dalbergio sissoo*	Leguminosae
33	Safed siris	*Albizia procera*	Leguminosae
34	Kala siris	*Albizia lebbek*	Leguminosae
35	Salai	*Boswellia serrata*	Burseraceae
36	Semal	*Bombox ceria*	Malvaceae
37	Sahja/lendia	*Lagerstoemia parviflora*	Lythraceae
38	Tarmarind (imli)	*Tamarindus indica*	Caesalpiniaceae
39	Teak(sagon)	*Tectona grandis*	Verbenaceae
40	Tendu	*Diospyros melanoxeon*	Ebenaceae
41	Tinsa	*Ougenia oojeinensis*	Leguminosae
42	Haldu	*Adina cordifolia*	Rubiaceae

Table 2. Shrubs and herbs occurred in Orchha Wildlife Sanctuary

S. No	Common Name	Scientific Name	Family
1	Adusa	*Adhatodha vasica*	Acnanthaceae
2	Akol	*Alangium salvifolium*	Cornaceae
3	Aak	*Catotropis gigantea*	Asclepiadaceae
4	Baibirang	*Embelia robusta*	Myrsinaceae
5	Chhind	*Phoenix sylvestris*	Arecaceae
6	Charota	*Cassia tora*	Leguninosae
7	Dudhi	*Holarrheria antidysentrica*	Apocynoceae
8	Gokharu	*Tribulus terrestris*	zygophllaceae
9	Harsingar	*Nyctanthes arbor tristis*	Oleacaae
10	Jangli bhata	*Solanun nigrum*	Solanaceae
11	Karonda	*Carissa opaca*	Apocynaceae
12	Kath jamun	*Eugeria heyneanum*	Mytraceae
13	Nagphani	*Opuntia sp*	Cactaceae

Table 3. Climbers and creepers present in Orchha Wildlife Sanctuary

S. No.	Common Name	Scientific Name	Family
1	Amarbel	*Cuscuta reflexa*	Convolvulaceae
2	Banda	*Loranthus longiflorus*	Loranthaceae
3	Dudhibel	*Marsdenia tencacissdwa*	Apocynaceae
4	Dudhbel	*Vallaris cordifolia*	Memispermaceae
5	Palasbel	*Butea superb*	Fabaceae
6	Kewanch	*Mucana pruriens*	Fabaceae
7	Ratibunchi	*Abrus precatorius*	Fabaceae
8	Nagbel	*Cryptolepis buchanani*	Combertaecae
9	Satawar	*Asparagus racemosus*	Asparagaceae

Table 4. Species of grasses present in Orchha Wildlife Sanctuary

S. No	Comman Name	Botanical Name	Family
1	Kusal sukal	*Heteropogon coniortus, Andropogon contortus*	Gramineae
2	Khas	*Vetiveria zizanioides*	Gramineae
3	Rusa	*Cymbopogon martini*	Gramineae
4	Doob	*Cynodon dactylon*	Gramineae
5	Mussel	*Ischaemum suclatum/ laxum*	Gramineae
6	Munj	*Erianthus munja*	Gramineae
7	Kans	*Saccharum spontanem*	Gramineae
8	Barru	*Arundo danax*	Gramineae

Table 5. Aquatic flora of the Orchha Wildlife Sanctuary

S.No.	Comman Name	Botanical Name	Family
1	Patera	*Typha Species*	Typhaceae
2	Stoneworts	*Nitella Species*	Characeae
3	Curly leaf pond weed	*Potomegeton crispus*	Potamogetonaceae
4	Coontail	*Ceratophyllum demersum*	Ceratophyllaceae
5	Stoneworts	*Chara species*	Characeae
6	Horned pondweed	*Zannichellia species*	Potamogetonaceae
7	Eelgrass	*Vallisneria species*	Hydrocharitaceae
8	Water thyme	*Hydrilla verticillata*	Hydrocharitaceae
9	Blue Green Algae	*Phormidium uncinatum*	Oscillatoriaceae
10	Filamentous Algae	*Oscillatoria curviceps*	Oscillatoriaceae
11	Boat-shaped algae	*Navicula species*	Naviculaceae
12	Diatom	*Diatoms species*	
13	Star Jelly	*Nostac species*	Nostocaceae

Discussion

Madhya Pradesh Situated on the genetic highway connecting of Western Ghats and the North East, two of the biodiversity hotspots in the country, is one of the richest repositories of biological diversity. The State houses a diversity of ecosystems including plateaus, ravines, ridges, valleys, riparian areas and flat plains. The State has three main forest type groups, viz. Tropical Moist Deciduous, Tropical Dry Deciduous and Tropical Thorn Forests. The state provides habitat to a floral diversity with about 5,000 plant species. The present study finds that vegetation in the sanctuary comprised tropical dry deciduous species. A study by Chaubey *et al.,* (2015), reveals that southern tropical Dry Deciduous forest are represented by the dominant status of Tectona grandis along with co-dominant species such as *Buchanania lanzan, Shorea robusta, Diospyros melanoxylon, Butea monosperma, Hardwickia binnata, Boswellia serrata. Tectona Grandis* being the most dominant species, most of the above-mentioned tree species were present in the Orchha sanctuary. According to a study by Jitin *et al.,* (2013), of medicinal angiosperms of Orchha Wildlife Sanctuary region suggests that the percentage of Tree species in Orchha wildlife Sanctuary was very highest (44%), second highest population of herbs (30%), third highest population of shrubs (12%) and 6% under shrubs, 5% climbers, 3% grasses which is in line with the findings of the present study. Some other floral studies carried out to submit MP state biodiversity board in the neighboring regions viz. Plant Diversity of Chambal Region by Jain (2005) finds that tropical dry deciduous forests of Chambal region encompasses mainly trees such as *Anogessius latifolia, Anogessius pendula, Boswellia serrata, Acacia sps., Zizyphus sps., Lannea coromandelica* and *Tectona grandis* etc.; floral study of Bargi hills, Jabalpur by Shrivastava (2007) reveals that the forests mainly comprise of miscellaneous species, *Lagerstoemia parviflora, Butea monosperma, Diospyros melanoxylon, Chloroxylon sweitenia, Cassia fistula, Buchnania lanzan, Terminalia alata, Gardenia laurifolius, Woodfordia fruticosa, Syzygium cumini etc. The shrub layer comprised of Helicteres isora, Grewia hirsuta, Flacourtia indica, Wrightia tinctoria, Ziziphus nummularia, Vitex negundo, Lantana camara, Holarrhena antidysentrica, Indigofera cassioides* and *Flemingia strobilifera*, etc. Most of these miscellaneous tree species also occurred scattered across the Orchha Sanctuary. The herbaceous flora reported in the above-mentioned study of Bargi hill vegetation are *Cocculus hirsutus, Cissempelos pareira, Gymnema sylvestre, Ventilago denticulata, Abrus precatorius* and *Hemidesmus indicus*. These herbs were not common in Orchha Sanctuary. The heterogeneity of herbaceous flora may be the result of some pattern or process such as environmental heterogeneity, biotic control, geography, habitat parameters, and levels of disturbance.

Conclusion

The goal of management is to preserve biodiversity in the sanctuary. There is need to understand how diversity is impacted by different management strategies. Reliable information on the status and trends of forest resources helps give decision makers the prospective necessary for orienting forestry policies and programs. Thus, preliminary study on floral diversity in the Wildlife Sanctuary will serve as a basic tool that will enable other researcher and managers of the sanctuary to further take up ecological studies to quantify floral diversity and vegetation structure.

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