



Orchidaceae in Ajodhya Hills of Purulia, West Bengal, India: diversity, threats and conservation strategies

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Abstract

Ajodhya Hills of Purulia, West Bengal, form the easternmost part of Chota Nagpur Plateau. In this work 26 orchid species (of which 15 are terrestrial and 11 are epiphytic) belonging to 14 genera have been reported from the recent study carried out in Matha, Jhalda and Ajodhya Hills of Purulia Division. The richness of orchid species comprises 2 % of all available orchids in India. Data have been collected primarily from field surveys conducted from June, 2018 to September, 2020 and through Citizen Science project, secondarily from literature review. Photographs have been taken to facilitate identification and attached as photoplates. The conservation measures to be taken are also discussed. Two possible orchid conservation areas (OCA) have been identified: one in Matha Range and another in Gobaria Valley Range and immediate action measures are proposed. According to the system of Chase *et al.* (2015) a checklist of these 26 orchids was prepared based on data obtained from field surveys as well as previous work by Malick (1977).

Résumé

Les Monts Ajodhya, Purulia, Bengale Occidental, Inde, constituent la partie la plus orientale du Plateau Chota Nagpur. Dans cet article, 26 espèces d'orchidées (dont 15 terrestres et 11 épiphytes), appartenant à 14 genres et observées au cours d'une récente étude menée dans le district de Purulia (Matha, Jhalda et Ajodhya) sont présentées. Cela représente 2 % des espèces d'orchidées enregistrées en Inde. Les informations données ici ont en premier lieu été collectées à partir des observations de terrain menées de juin 2018 à septembre 2020 et à travers le Projet « Citizen Science », puis, en deuxième lieu, à partir de la littérature. Des photographies des plantes ont été prises afin d'aider à leur identification : certaines sont reproduites ici. Les mesures à prendre en vue de la préservation de ces plantes sont également discutées. Deux zones possibles de conservation des Orchidées (OCA = orchid conservation area) ont été identifiées, l'une dans la chaîne Matha et l'autre dans la chaîne de la Vallée de Gobaria, et des actions immédiatement possibles sont proposées.

Keywords: Chota Nagpur Plateau, Jangalmahal.

Mots clés : Jangalmahal, Plateau Chota Nagpur.

Introduction

The easternmost part of Chota Nagpur Plateau (CNP) ecoregion in Purulia district, West Bengal, is popularly known as Manbhum and Jangalmahal. This region gradually slopes down forming hillocks alternating with valleys, steep mountains ranging from 90 to 712 m, with deep forests on the mountain slopes with undulating land mass. CNP in West Bengal covers Ajodhya Hills of Purulia, western part of Jhargram, Bankura and Paschim Medinipur districts while parts of Bankura along with Asansol and Durgapur of Paschim Bardhaman form the connecting link with the Gangetic Plain. The CNP consists mainly of Ranchi, Hazaribagh, Koderma and Singhbhum plateaus of Jharkhand and Manbhum of West Bengal along with parts of Chattisgarh and Orissa (Hains, 1910). It is one of the least explored biogeographic region in India. It has an area of about 120,000 km². The soil is mostly red laterite along with other rock formations. In broader prospect, this plateau belongs to the Indo-Malayan Biogeographic Realm consisting of precambrian rocks which are over 540 millions years old and is a part of

Gondwana substrates which attest the ancient origin of this region. It is part of the Deccan Plate, which broke up from the southern continent during the Cretaceous to embark on a 50 million-year journey that was interrupted by the collision with the Eurasian continent (Hains, 1910; Kumar *et al.*, 2007). The northeastern part of the Deccan plateau, where this ecoregion sits, was the first area of contact with Eurasia. Through its centre, from West to East, runs the coal-bearing, faulted Damodar Valley. Sand mining at Kangsabati and Subarnarekha is one of the most important mineral resources.

This region, the southern part of Penninsular India, Deccan Plateau, is unique in its floristic composition. The plateaus of North-East India are one of the hotspots of orchid species along with Western Ghats and Eastern Himalaya where CNP acts as a junction (Kumar *et al.*, 2007; Kumar & Rawat, 2008). In CNP there are dry to moist deciduous forests dominated by Dipterocarpaceae, Fabaceae, Moraceae, Combretaceae, Meliaceae, Curcubitaceae, Rutaceae, Menispermaceae and Arecaceae species, such as *Shorea robusta*, *Acacia nilotica*, *Butea monosperma*, *Butea superba*, *Bauhinia vahli*, *Ficus* spp, *Terminalia* spp., *Diospyros* spp., *Dioscorea* spp., *Chloroxylon* sp., *Tinospora* spp., *Phoenix* spp., *Borassus* sp. etc. Among orchids various species of *Vanda* spp., *Eulophia* spp., *Habenaria* spp. are most commonly found (Hains, 1910; Malick, 1977). Various parasitic plants like *Aeginetia indica* (Orobanchaceae), *Cuscuta reflexa* (Convolvulaceae), *Viscum orientale* (Santalaceae), *Cassytha filiformis* (Lauraceae) and *Dendrophthoe* spp. (Loranthaceae) also occur (Hains, 1910; 1921-1925; Malick, 1977). Other floriculturally important species such as begonias and lilies are found. The "Traditional Ecological Knowledge" is associated with the culture and rituals of the dwelling tribal communities. Chow Nachh is one of the cultural heritage of this region. Among medicinal plants *Rauwolfia* sp., *Chloriphyton* sp., *Curcuma* spp. *Andrographis* spp., *Butea* spp., *Hemigraphis* sp., *Gloriosa* sp., *Eulophia* spp., *Vanda* spp. are variously used traditionally (Hains, 1910; Malick, 1977; Sanyal, 1993). Fourteen endemic species from CNP ecoregion have been reported by Kumar & Rawat (2008).

Orchidaceae is the largest group of flowering plants distributed throughout the world (Chase *et al.*, 2015). In India the family is represented by 1,256 species belonging to 155 genera and among them 388 species are endemic (Singh *et al.*, 2019) and 460 species and 6 varieties, belonging to 110 genera are known to occur in West Bengal (Mitra *et al.*, 2020); 96 orchid

species have been reported from nearby Simlipal National Park (Prasad *et al.*, 2019). Over 850 Indian species are highly commercially important for their magnificent flowers (Jain, 1985; Singh *et al.*, 2019). In Chota Nagpur part of Jharkhand 64 species of orchids has been reported (Kumar *et al.*, 2007) among which 5 are endemic to this region (Kumar & Rawat, 2008). We must add that the orchid populations are gradually decreasing due to various anthropogenic activities and IUCN Status of most of the taxa have not yet been evaluated.

Methodology

Study area

The study was conducted in western-most part of West Bengal i.e. Ajodhya Hills of Purulia district (Fig. 1). Geographically the forest areas in Purulia Division are lying between 22.430° and 43.420° North latitude and 85.490° and 86.540° East longitude which covers about 620 km², i.e. 0.087% of India. The area is characterised by a tropical to subtropical climate, an annual rainfall of 80-120 mm, an elevation of 90-712 m. The vegetation of Matha and Jhalda is mostly dry tropical and subtropical forest with moist patches and in Ajodhya range mostly moist broad-leaf forest dominated by *Shorea robusta*.

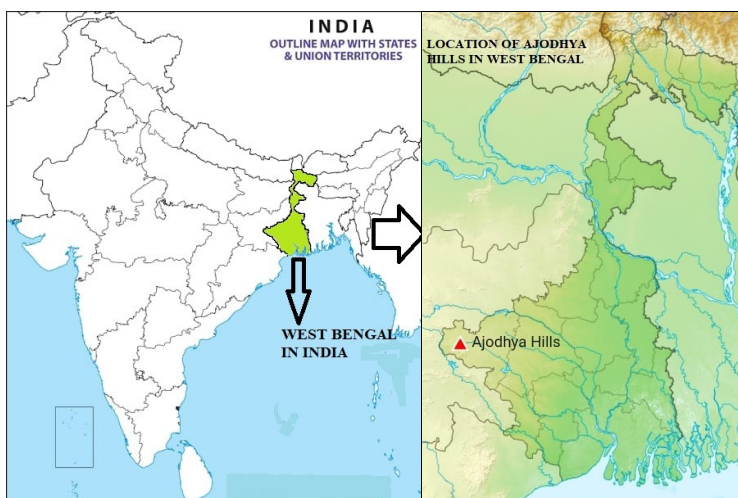


Fig. 1. Location of Ajodhya Hills in India

Data Collection

Data was collected according to three different methods.

(I) Review of literature

Literature such as Bengal Plants (Prain, 1903), Flora of Chota Nagpur including Gangpur and Santal Parganas (Hains, 1910), Flora of Purulia District (Malick, 1977), Flora of Bankura District (Sanyal, 1993) and Checklist of Orchidaceae of Jharkhand (Kumar *et al.*, 2007) was mostly consulted regarding identification of species and preparation of a checklist. Based on this information localities from where the species had been collected were also visited, to know the present status and changes in population size.

(II) Field Survey

Frequent field surveys were carried out throughout forest hillocks at altitude from 90 m to 700 m, in valleys and adjoining villages throughout the years from June, 2018 to September, 2020. Data were also collected via the Citizen Science forum using social media platforms in due course and from literature review. Photographs of the plants were taken to make identification easy.

(III) Identification

Preliminary identification was based on photographs through consulting previous works, e-herbarium K and websites such as Digital Flora of Peninsular India, Flowers of India, International Plant Names Index (IPNI, 2021), Orchid Species (2021), Plants Of the World Online (POWO, 2021), The Plant List (2021), Tropicos (2021) and World Checklist of Selected Plant families (WCSP, 2021); e-library Biodiversity Heritage Library (<https://www.biodiversitylibrary.org>) has also been consulted. Specimens were collected (and dissected) only when available in large populations or unidentifiable from photographs. Otherwise only photographs were taken. Above mentioned literature was consulted for identification.

Discussion

Based on data obtained from field surveys as well as Malick (1977), a checklist of 26 orchid species (Tab. 1 and photographs in appendix) belonging to 14 genera was prepared according to the system of Chase *et al.* (2015). Of these, 15 are terrestrial and 11 are epiphytes. These orchids could benefit from conservation measures – such as restoration (*in situ*) through orchid sanctuaries or conservation by orchidarium (*ex situ*). For some time

Table 1. Checklist of recorded species in the study area

Abbreviations used: PHENOLOGY: Fl: Flowering, Fr: Fruiting; IUCN STATUS: NE= Not Evaluated, LC= Least Concerned

Taxa	Habitat & Phenology	Native Range	IUCN Status
<i>Zeuxine strateumatica</i> (C. Linnaeus) F.R.R. Schlechter	Terrestrial, rare Fl. 01-03 Fr. 02-04	Iran to Central Asia, tropical & subtropical Asia	LC
<i>Habenaria commelinifolia</i> (W. Roxburgh) N. Wallich ex J. Lindley	Terrestrial, rare Fl. 08-09 Fr. 08-09	Indian subcontinent to China (South- West Yunnan)	NE
<i>Habenaria digitata</i> J. Lindley	Terrestrial, rare Fl. 07-01 Fr. 08-01	Indian subcontinent to Indo-China	NE
<i>Habenaria plantaginea</i> J. Lindley	Terrestrial, rare Fl. 07-09 Fr. 08-10	Indian subcontinent to Myanmar, Lesser Sunda Islands	LC
<i>Habenaria marginata</i> H.T. Colebrook	Terrestrial, rare Fl. 07-11 Fr. 09-12	Indian subcontinent to China (South Yunnan)	LC
<i>Habenaria reniformis</i> (D. Don) J.D. Hooker	Terrestrial, rare Fl. 07-11 Fr. 07-12	Nepal to China (Guangdong), North Sumatera	NE
<i>Habenaria malintana</i> (F.M. Blanco) E.D. Merrill	Terrestrial, rare Fl. 07-11 Fr. 07-12	Central Himalaya to Southern China and Indo-China, Philippines, East Timor	NE
<i>Peristylus constrictus</i> (J. Lindley) J. Lindley	Terrestrial, rare Fl. 06-08 Fr. 07-09	Indian subcontinent to Indo-China	LC
<i>Nervilia concolor</i> (C.L. Blume) F.R.R. Schlechter	Terrestrial, rare Fl. 06-07 Fr. 07-09	Tropical & subtropical Asia to West Pacific	NE

Table 1. Continued

Taxa	Habitat & Phenology	Native Range	IUCN Status
<i>Crepidium mackinnoni</i> (J.F. Duthie) D. Szlachetko	Terrestrial, not found Fl. 08-11 Fr. 09-12	Tropical & subtropical Asia to Pacific	NE
<i>Oberonia falconerii</i> J.D. Hooker	Epiphytic, frequent Fl. 09-05 Fr. 10-05	Indian subcontinent to China (South Yunnan) and Peninsular Malaysia	LC
<i>Cymbidium aloifolium</i> (C. Linnaeus) O. Swartz	Epiphytic, rare Fl. 07-04 Fr. 08-04	Himalaya to Western Malesia	NE
<i>Eulophia nuda</i> J. Lindley	Terrestrial, rare Fl. 06-07 Fr. 08-09	Tropical & subtropical Asia to West Pacific	NE
<i>Eulophia explanata</i> J. Lindley	Terrestrial, rare Fl. 06-07 Fr. 08-09	Himalaya to India	NE
<i>Eulophia cernua</i> (Willdenow) M.W. Chase, P. Kumar & A. Schuiteman	Terrestrial, frequent Fl. 06-07 Fr. 08-09	Himalaya to India	NE
<i>Eulophia recurva</i> (W. Roxburgh) M.W. Chase, P. Kumar & A. Schuiteman	Terrestrial, frequent Fl. 06-07 Fr. 08-09	Assam to South China and Indo-China.	LC
<i>Eulophia diffusiflora</i> M.W. Chase, P. Kumar & A. Schuiteman	Terrestrial, frequent Fl. 06-07 Fr. 08-09	West & North East India to Assam.	NE
<i>Acampe praemorsa</i> (W. Roxburgh) E. Blatter & Y.M.C. McCann.	Epiphytic, rare Fl. 04-11 Fr. 05-12	Himalaya to Indo-China	NE

Table 1. Continued

Taxa	Habitat & Phenology	Native Range	IUCN Status
<i>Aerides odorata</i> J. Loureiro	Epiphytic, rare Fl. 05-11 Fr. 06-12	China (West Yunnan, Guangdong) to Tropical	NE
<i>Aerides multiflora</i> W. Roxburgh	Epiphytic, rare Fl. 05-11 Fr. 06-12	Himalaya to Indo-China	NE
<i>Aerides rosea</i> C. Loddiges ex J. Lindley & J. Paxton	Epiphytic, rare Fl. 05-11 Fr. 06-12	Eastern Himalaya to South China and Indo-China	NE
<i>Luisia tristis</i> J.D. Hooker	Epiphytic, rare Fl. 03-08 Fr. 04-09	New Guinea to South West Pacific	NE
<i>Pelatantheria insectifera</i> H.N. Ridley	Epiphytic, rare Fl. 09-12 Fr. 10-01	Indian subcontinent to China (Central Yunnan)	NE
<i>Rhynchostylis retusa</i> (C. Linnaeus) C.L. Blume	Epiphytic, frequent Fl. 05-12 Fr. 06-12	China (South Yunnan, South West Guizhou) to tropical Asia	NE
<i>Vanda tessellata</i> (W. Roxburgh) J.D. Hooker ex G. Don	Epiphytic, frequent Fl. 03-10 Fr. 04-11	Indian subcontinent to Indo-China	NE
<i>Vanda testacea</i> (J. Lindley) H.G. Reichenbach	Epiphytic, rare Fl. 04-07 Fr. 05-08	Indian subcontinent to Thailand	NE

some populations have become extremely low due to habitat loss, mainly linked to various human activities such as deforestation and desertification of certain areas. Agricultural invasion in forest areas, illegal constructions and cutting of trees for their timber are the main causes of deforestation. In addition to illegal constructions, development activities such as dams and

other constructions (hotels and resorts) in forest lands also cause drastic damage to the forest cover.

The introduction of invasive species leads to the destruction of habitats causing considerable damage to biodiversity and degradation of ecosystems. Exotic species such as *Parthenium hysterophorus*, *Chromolaena odorata*, *Lantana camara* and *Mikania micrantha* or plantations of *Eucalyptus* sp. and *Acacia auriculiformis* in forest lands destroy these habitats.

Terrestrial and epiphytic orchids are also confronted with problems of frequent forest fires in the mounts or with climatic disturbances. Heavy rains and cyclones repeated each year cause many flowers to fall, prevent reproduction, and cause a continuous decline of different species.

Here we are aiming for a conservation action plan to declare the selected sites as protected areas.

Conservation measures

According to IUCN (2021) “conservation” is the protection, care, management and maintenance of ecosystems, habitats, wildlife species and populations, within or outside their natural environments, in order to safeguard the natural conditions for their long-term permanence. In India, various steps are taken to conserve the rare, endangered and threatened orchids by Botanical Survey of India, State Forest Departments, Indian Council for Agricultural Research and other governmental institutes. Conservation actions such as orchidariums, orchid trails or orchid reserves have been established in various parts of the country (Lepch, 2018). The following deals with some conservation steps which can be taken.

Floriculture

Some orchids are highly appreciated for their magnificent flowers. Indigenous orchids like *Eulophia diffusiflora*, *Rynchosstylis retusa*, *Pelatantheria insectifera* can be put into ‘restoration-friendly’ cultivation for their attractive flowers. Orchids with high commercial value like *Bulbophyllum*, *Dendrobium*, *Oncidium*, *Cymbidium*, *Habenaria*, *Paphiopedilum* among others can be introduced for commercial propagation purposes.

Restoration

The best measure to conserve endangered orchids would be to restore their natural habitats. To that effect, an orchid sanctuary / reserve can be established at Gobaria (Fig. 2).



Fig. 2. Gobaria Forest Range: a proposed orchid sanstuary

Preservation of sacred groves

Various epiphytic orchid species are confined in sacred groves especially *Diospyros* spp., *Terminalia bellirica*, *Madhuca longifolia*, *Mangifera indica*, *Schleichera oleosa*. These groves are protected by various tribal communities Santal, Munda, Oraon, Kol, Shabar and others locally known as “Jaher Than”, “Goram Than” or “Gram Sthal” etc. for ritual purposes. The Traditional Ecological Knowledge associated with the rituals of the tribal communities is important for their livelihood which in turn preserves the biodiversity with cultural heritage.

Ecotourism

India’s first orchid trail was established by Forest Department in Arunachal Pradesh (Lepch, 2018). To spread awareness among lay persons about the importance of conservation of orchids and their aesthetic aspects. Such trails can be established. Ajodhya Hills is one of the most important tourist attraction in West Bengal, orchid trails at Matha Forest Range (see Fig. 3) will generate awareness to the lay persons at large and also generate revenues to Forest Department.

Citizen science and awareness

In this age of “Social Media” concerned citizens are cordially participating in various citizen science initiatives through social media platforms, websites and *Facebook* or *WhatsApp* groups like *Flowers of India*, *Indian Flora*, *Flora of Chota Nagpur Plateau* etc. where experts, nature enthusiasts and amateurs are sharing data and photographs of plants of various

regions of our state and the country at large. These activities are creating mass awareness.



Fig. 3. Matha Forest Range

Socio-economic aspects

Indigenous orchids that are in danger due to various anthropogenic threats can be put into cultivation and commercialization through micro-propagation and other floricultural techniques in areas adjoining to Ajodhya Hills like Baghmundi, Jhalda and Matha. This will generate sustainable source of income to local people, a large portion of which is marginalized tribal community. For cultivation purposes Micro, Small and Medium Enterprises can be established; propagation could also be done by self-help groups. This in turn will generate sustainable livelihood in a biodiversity rich district like Purulia.

Conclusion

The diversity of orchids in this region comprises 2 % of all available species in India in only 0.087 % forest cover. This richness needs urgent conservation action as suggested earlier like orchid sanctuary, orchidarium or orchid trail at two proposed sites i.e. Gobaria and Matha. To mention a few species *Habenaria spp.*, *Eulophia spp.* along with *Aerides spp.* can be put into restoration-friendly cultivation for their beautiful flowers.

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Appendix
Pictures of some orchids from Ajodhya Hills



Acampe praemorsa



Eulophia diffusiflora



Aerides odorata



Habenaria malintana



Habenaria commelinifolia



Habenaria reniformis



Nervilia concolor



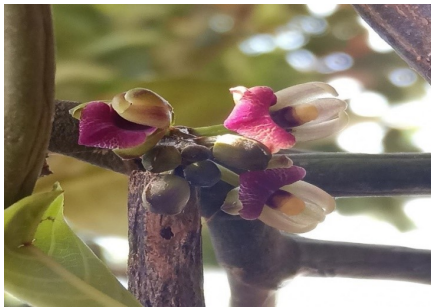
Pelatanthera insectifera



Peristylus constrictus



Rynchostylis retusa



Luisia tristis



Oberonia falconeri



Vanda tessellata



Vanda testacea



Zeuxine stratumatica