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Orchid Flora of the Newly Established Sikhna Jwhwlao National Park, BTR, Assam, in North-Eastern India: A Comprehensive Review and Inventory

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Abstract

The present study was undertaken to identify, document, and explore the diversity of orchids in the newly established Sikhna Jwhwlao National Park, located in the Bodoland Territorial Region (BTR) of Assam, North-East India. Extensive field survey was carried out across different seasons in the Hultugaon and Chirang Forest Divisions to ensure comprehensive collection. Orchid specimens were collected mainly during their flowering period for accurate identification. Each specimen was photographed in its natural habitat, properly recorded, and preserved as herbarium material as per the standard taxonomic procedures. A total of 60 orchid species belonging to 29 genera were recorded. The genus *Dendrobium* was the most dominant, represented by 13 species (22%), followed by *Calanthe* with five species (9%). Genera such as *Aerides*, *Bulbophyllum*, *Luisia*, and *Pinalia* were each represented by three species (about 5% each). Epiphytic orchids were predominant, comprising 43 species (72%), while 17 species (28%) were terrestrial. Assessment based on IUCN Red List categories and CITES data revealed that 49 species (82%) have not yet been evaluated, whereas 11 species (18%) fall under the endangered category. The findings indicate that the orchid flora of the national park is still insufficiently explored and requires further detailed study. However, the national park is currently facing disturbances. The study provides a baseline data and an updated orchids flora from the national park as well as for the Bodoland Territorial Region, Assam, which may serve as a reference for future taxonomic research, biodiversity conservation, and sustainable management strategies in the region.

Keywords: Orchidaceae, Conservation, *Dendrobium*, Sikhna Jwhwlao National Park, BTR, Assam

Introduction

Orchidaceae is the largest flowering plant family and is cosmopolitan in distribution, occupying a broad spectrum of ecological niches ranging from tropical lowlands to alpine environments. Members of this family are among the most species-rich and evolutionarily specialized groups of angiosperms, characterized by intricate floral morphology and diverse reproductive strategies. Most orchid species are epiphytic. Globally, the family comprises approximately 35,000 species distributed across nearly 1000 genera, inhabiting ecosystems such as tropical rainforests, subtropical woodlands, and temperate grasslands [1]. In the Indian context, orchids constitute an important component of plant biodiversity, with an estimated 1,300 species belonging to approximately 166 genera. This diversity spans multiple phytogeographical regions and includes representatives from all major orchid tribes [2]. The distribution and richness of orchids in India are strongly influenced by climatic and ecological factors, with maximum diversity observed in regions characterized by cool, humid, and temperate conditions. However, several forested and remote areas of the country remain insufficiently explored from a botanical perspective.

The northeastern region of India is widely recognized as the principal centre of orchid diversity in the country. This region encompasses eight states: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, and accounts for approximately 7.7% of India's total geographical area [3]. Despite its relatively small size, it harbours nearly half of the country's floral wealth, with an estimated 8,000

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plant species, of which approximately 31.58% (approximately 2,526 species) are endemic to the region. Orchids constitute a significant component of the vegetation in this biodiversity-rich zone, with nearly 800 species. Assam alone supports approximately 191 orchid species [4], indicating its substantial contribution to regional orchid diversity. In comparison, other major orchid-rich regions of India include the Western Ghats (approximately 267 species), the Western Himalayas (around 255 species), and the Andaman and Nicobar Islands (about 117 species). The exceptional floristic diversity of North-East India can be attributed to its unique biogeographical position at the confluence of the Indo-Malayan, Indo-Chinese, and Himalayan phytogeographic realms. Furthermore, the region's ecological heterogeneity, characterized by dense forest cover, high annual precipitation, humid climatic conditions, and a wide range of altitudinal gradients, creates favourable habitats for orchid species.

Assam is one of the most botanically diverse regions in India, owing to its heterogeneous vegetation and varied forest ecosystems. Floristic assessments indicate the presence of approximately 3,854 taxa (including infraspecific categories) distributed across 1,394 genera and 236 families. Among these, dicotyledons constitute the majority, with approximately 2,752 taxa, followed by monocotyledons (1,080 taxa), whereas gymnosperms are represented by a comparatively smaller group of 22 taxa. Notably, approximately 167 taxa are endemic to the region, underscoring its high conservation value and biogeographical significance [5].

The documentation of Assam's flora dates back to the early nineteenth century, beginning with the exploratory accounts of Buchanan-Hamilton. This was followed by more comprehensive taxonomic treatments, notably in the Flora of British India [6], which incorporated numerous species from Assam and the broader northeastern region. Further systematic floristic investigations were undertaken in the twentieth century by [7] and [8], who collectively recorded approximately 3,431 species and several varieties from northeastern India.

In recent decades, the region has been subjected to systematic floristic surveys and periodic plant collection efforts to document botanical diversity. District-level explorations have been carried out by several academic and research institutions, including the Botanical Survey of India (BSI), Assam University (Silchar), Gauhati University, Dibrugarh University, and Cotton University. Orchid diversity in Assam has received considerable scientific attention, with studies conducted across different localities by various researchers, such as BTR and Assam [9], [10], [11], [12], [13], [14], [15], [16], [17], and [4].

The newly established park remains limited in its studies. The park is characterized by extensive forest cover, including tropical evergreen, semi-evergreen, and moist deciduous forests. The region experiences a warm and humid climate with substantial annual rainfall, creating favourable ecological conditions for high biodiversity, particularly epiphytic flora, such as orchids. The annual temperature typically ranges from 12°C to 35°C, and the elevation rises up to approximately 500 m in the northern part.

The present investigation was undertaken to assess and document the diversity of orchids in Sikhna Jwhwlao National Park. This study aimed to systematically explore and record orchid species distributed across different forest habitats in the Hultugaon and Chirang Forest Divisions. A comprehensive checklist of the recorded orchid taxa was prepared along with their conservation status. The findings of this study provide baseline data that can facilitate future taxonomic research, contribute to the development of an updated floristic account of the Bodoland Territorial Region, and support biodiversity conservation and the sustainable management of orchid resources in the region.

Materials and Methods

Study Area

Sikhna Jwhwlao National Park is a recently designated protected area situated within the Bodoland Territorial Region (BTR) of Assam, India, encompassing parts of Chirang and Kokrajhar districts. The park extends over an area of approximately 316.29 km². Geographically, the park lies between 26°68.18′N and 26°81.18′N latitude and 90°24.44′E and 90°41.90′E longitude. It is the third national park in the Bodoland region and the eighth in Assam. Administratively, the park falls under the Haltugaon and Chirang Forest Divisions. The park is bounded by the Bhutan hills to the north, the Sarmanga River to the west, National

Highway 31 to the south, and the Aie River to the east. It is particularly well known as a "Butterfly haven" because of its high butterfly diversity [18]. It serves as a significant ecological corridor linking multiple adjacent protected landscapes, thereby facilitating species movement and genetic exchanges.

The park comprises several forest ranges, notably Jharbari, Ultapani and Runikhata. Among these, the Ultapani Forest Range, located within the Haltugaon Forest Division in Kokrajhar district, is recognized as a "biodiversity hotspot." It is situated approximately 46 km north of Kokrajhar town and is accessible via the Jharbari range. The Samukha River traverses the Ultapani region, supporting a wide variety of plant species. A notable ecological feature of this area is the presence of pneumatophores in certain plant communities, indicating adaptation to waterlogged or semi-aquatic conditions [19]. Additionally, a localized hot water spring has been reported in the Samukha rivulet, possibly associated with dissolved minerals such as sulphur compounds, calcium carbonate, and calcium silicate.

Methods

Extensive field surveys were conducted in the different forest ranges of the National park during successive flowering seasons to document orchid diversity. The specimens were collected from host trees, particularly from trunks and branches, where epiphytic orchids were observed. Fresh specimens were photographed under natural conditions to capture their morphological features and ecological associations. The collected specimens were processed into herbarium specimens following the standardized herbarium preparation protocols described by [20] and [21]. The prepared herbarium specimens were deposited in the Botanical Herbarium of Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Eraligool (PDUAMEBH) Sribhumi.

Taxonomic identification and authentication of the collected specimens were performed using regional floras, standard taxonomic keys, consultations with orchid experts, and relevant taxonomic literature. Nomenclatural verification was conducted using authenticated online databases, including Plants of the World Online (https://powo.science.kew.org/) and The Plant List (http://www.theplantlist.org/). The conservation status of the recorded species was assessed in accordance with the criteria and categories established by the IUCN Red List (https://www.iucnredlist.org/) and CITES literature.

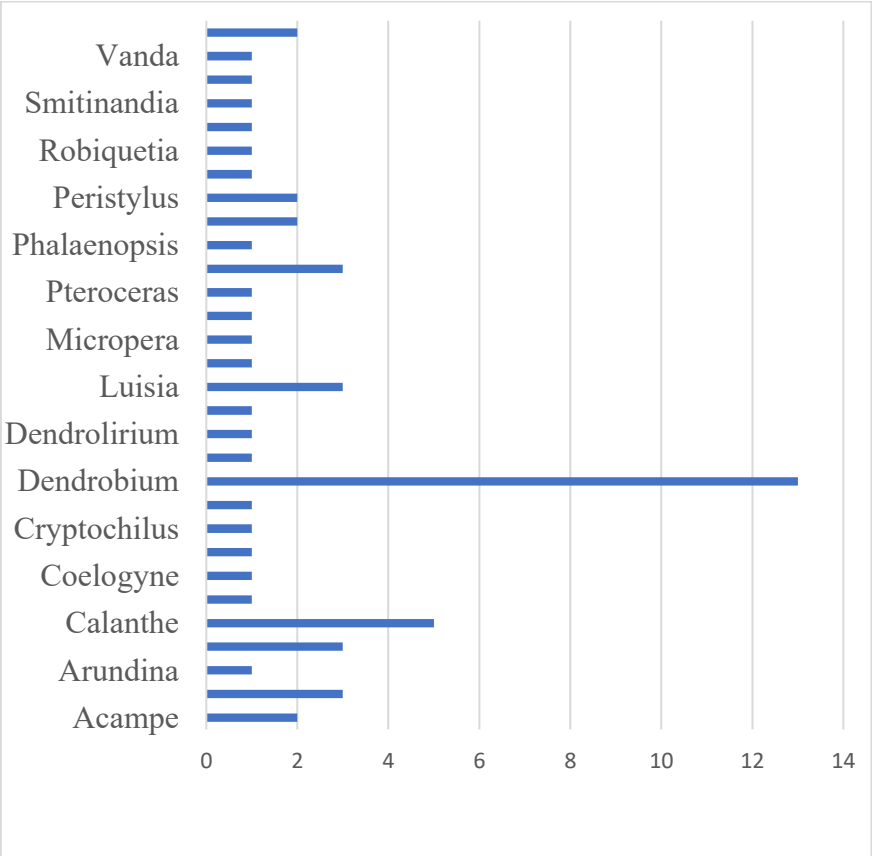


Fig.1. Comparative representation of dominant Orchids genera in Sikhna Jwhwlao National Park, BTR, Assam.

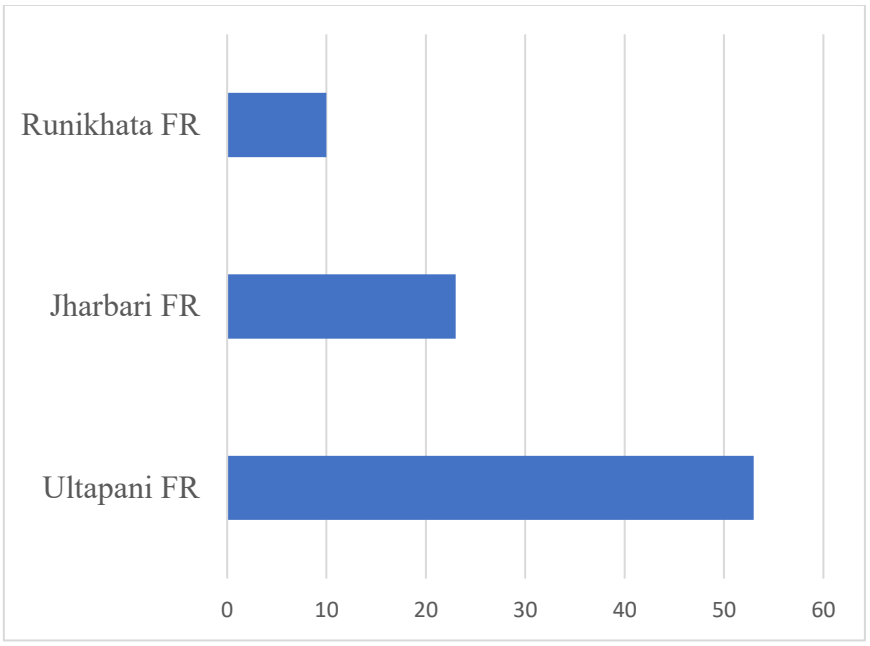


Fig.2. Total number of Orchid species recorded across different forest ranges (FR) of Sikhna Jwhwlao National Park, BTR, Assam.

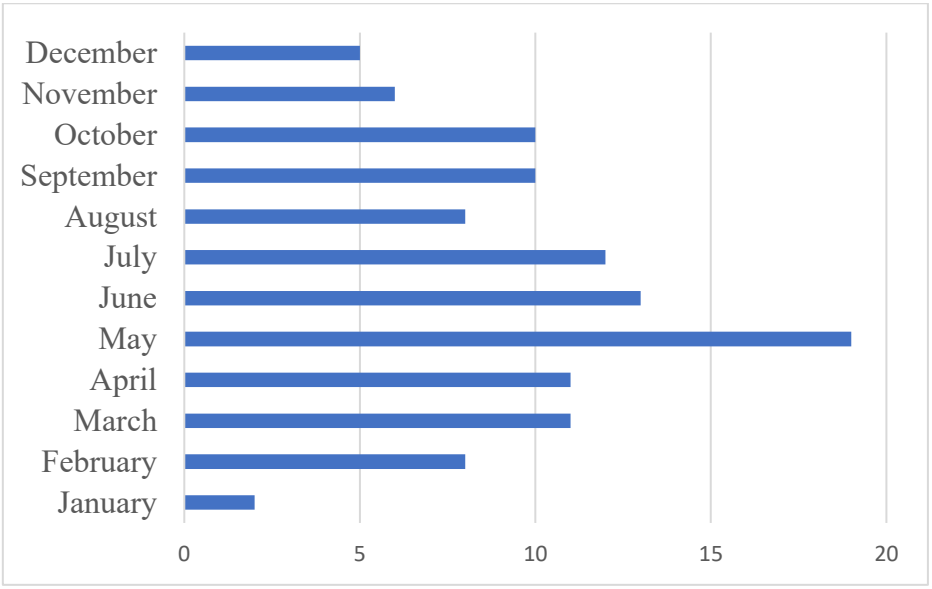


Fig.3. Comparative distribution of flowering periods among Orchid species in Sikhna Jwhwlao National Park, BTR, Assam.

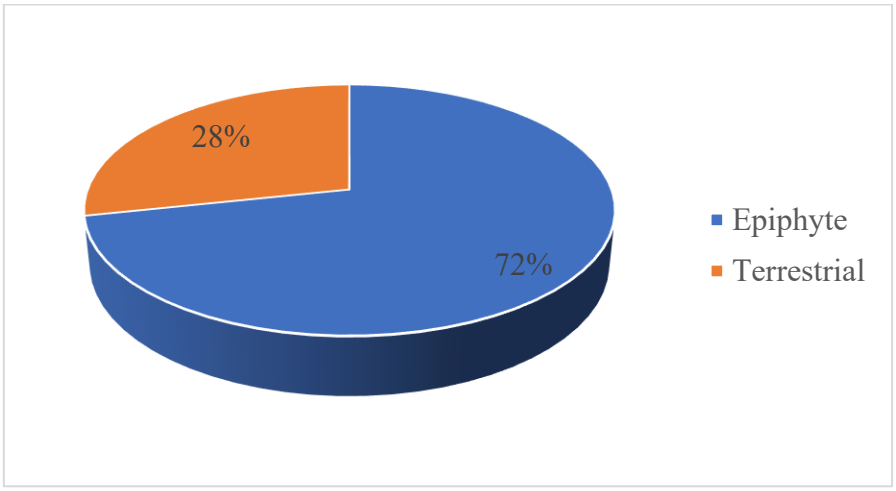


Fig.4. Ecological classification of Orchid flora in Sikhna Jwhwlao National Park, BTR, Assam.

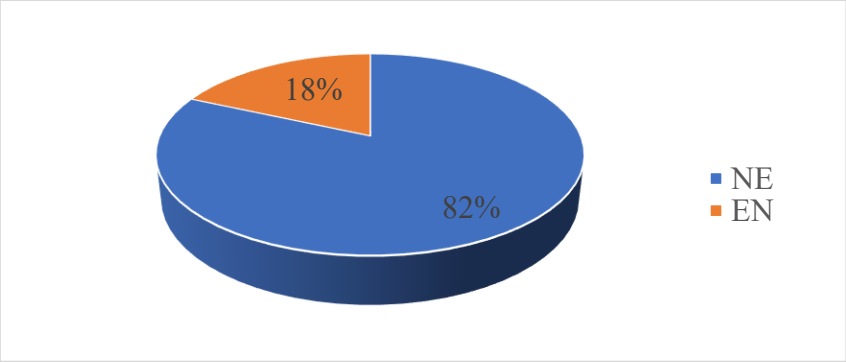


Fig.5. IUCN Red list categories and CITES literature of Orchid flora in Sikhna Jwhwlao National Park, BTR, Assam.

Table.1. List of orchid flora recorded from different forest ranges (FR) of Sikhna Jwhwlao National Park, BTR, Assam. Sribhumi [Bodo (BOD); Not Cited (NC); Not Evaluated (NE); Endangered (EN)]

Sl. No.	Scientific Name	Genus	Local Name	Flowering Seasons	Habit	Distribution in Study Area	Conservation status
1	*Acampe praemorsa* var. *longepedunculata* (Trimen) Govaerts	*Acampe*	Napakul sona (BOD)	October-November	Epiphyte	Ultapani Forest Range	NE
2	*Acampe papillosa* lindl.		NC	September-November	Epiphyte	Ultapani Forest Range	EN
3	*Aerides odorata* Lour.	*Aerides*	NC	May-September	Eiphyte	Ultapani and Jharbari Forest Range	EN
4	*Aerides rosea* Lodd. ex Lindl. & Paxton		NC	May-June	Epiphyte	Jharbari Forest Range	NE
5	*Aerides multiflorum* Roxb.		NC	June -July	Epiphyte	Jharbari Forest Range	NE
6	*Arundina graminifolia* subsp. *graminifolia*	*Arundina*	NC	September-January	Terrestrial	Ultapani Forest range	EN
7	*Bulbophyllum crassipes* Hook.f.	*Bulbophyllum*	NC	July-October	Epiphyte	Ultapani Forest range	EN
8	*Bulbophyllum careyanum* (Hook.) Spreng.		NC	October-December	Terrestrial	Ultapani and Jharbari Forest range	EN
9	*Bulbophyllum cauliflorum* Hook.f.		NC	July	Epiphyte	Ultapani Forest Range	EN
10	*Calanthe masuca* (D.Don) Lindl.	*Calanthe*	NC	June–December	Terrestrial	Ultapani Forest Range	NE
11	*Calanthe odora* Griff.		NC	May to July	Terrestrial	Ultapani Forest Range	NE
12	*Calanthe tankervilleae* (Banks) M.W.Chase, Christenh. & Schuit.		NC	March-April	Terrestrial	Ultapani Forest Range	NE

13	*Calanthe triplicata* (Willemet) Ames		NC	July to October	Terrestrial	Ultapani and Jharbari Forest Range	NE
14	*Calanthe longipes* Hook.f.		NC	October and November	Terrestrial	Ultapani Forest range	NE
15	*Cymbidium aloifolium* (L.) Sw.	*Cymbidium*	NC	May - June	Terrestrial	Ultapani and Jharbari Forest range	EN
16	*Coelogyne imbricata* (Hook.) Rchb.f.	*Coelogyne*	NC	July - September	Epiphyte	Ultapani Forest range	NE
17	*Chrysoglossum ornatum* Blume	*Chrysoglossum*	NC	May-August	Terrestrial	Ultapani Forest range	NE
18	*Cryptochilus strictus* (Lindl.) Schuit., Y.P.Ng & H.A.Pedersen	*Cryptochilus*	NC	November-February	Epiphyte	Ultapani Forest Range	NE
19	*Chiloschista lunifera* (Rchb.f.) J.J.Sm.	*Chiloschista*	NC	February-April	Epiphyte	Ultapani Forest Range	NE
20	*Dendrobium spurium* (Blume) J.J.Sm.	*Dendrobium*	NC	November-August	Epiphytes	Ultapani Forest Range	NE
21	*Dendrobium aduncum* Lindl.		NC	Spring - summer	Epiphyte	Ultapani Forest range	NE
22	*Dendrobium fimbriatum* Hook.		NC	March - May	Epiphyte	Ultapani and Jharbari Forest range	NE
23	*Dendrobium mannii* Ridl.		NC	September-October.	Epiphyte	Ultapani and Jharbari Forest range	NE
24	*Dendrobium fimbriatum* Hook.		NC	March - May	Terrestrial	Ultapani and Jharbari Forest range	NE
25	*Dendrobium aphyllum* (Roxb.) C.E.C.Fisch.		NC	April - May	Epiphyte	Ultapani Forest range	EN
26	*Dendrobium lituiflorum* Lindl.		NC	February - April	Epiphyte	Jharbari and Runikhata Forest range	NE
27	*Dendrobium transparens* Wall. ex Lindl.		NC	May	Epiphyte	Jharbari and Runikhata Forest range	NE
28	*Dendrobium jenkinsii* Wall. ex Lindl.		NC	April-May	Epiphyte	Jharbari and Runikhata Forest range	EN

29	*Dendrobium chrysotoxum* Lindl.		NC	February to July	Epiphyte	Ultapani and Jharbari Forest range	NE
30	*Dendrobium moschatum* (Banks) Sw.		NC	April – June	Epiphyte	Ultapani Forest Range	NE
31	*Dendrobium farmeri* Paxton		NC	March to May	Epiphyte	Ultapani and Jharbari Forest range	NE
32	*Dendrobium fugax* Rchb.f.		NC	March - October	Epiphyte	Ultapani Forest Range	NE
33	*Didymoplexis pallens* Griff.	*Didymoplexis*	NC	March to July	Terrstrial	Ultapani Forest Range	NE
34	*Dendrolirium lasiopetalum* (Willd.) S.C.Chen & J.J.Wood	*Dendrolirium*	NC	January - April	Epiphyte	Ultapani Forest Range	NE
35	*Eulophia obtusa* (Lindl.) Hook.f.	*Eulophia*	NC	June-July	Terrestrial	Ultapani Forest Range	NE
36	*Luisia zeylanica* Lindl.	*Luisia*	NC	February-June	Epiphyte	Ultapani Forest Range	NE
37	*Luisia brachystachys* (Lindl.) Blume		NC	March – May	Epiphyte	Ultapani Forest Range	NE
38	*Luisia inconspicua* (Hook.f.) King & Pantl.		NC	July-October	Epiphyte	Ultapani Forest Range	NE
39	*Mycaranthes floribunda* (D.Don) S.C.Chen & J.J.Wood	*Mycaranthes*	NC	February-May	Epiphyte	Ultapani Forest Range	NE
40	*Micropera rostrata* (Roxb.) N.P.Balakr.	*Micropera*	NC	May–June	Epiphyte	Ultapani Forest Range	NE
41	*Oberonia acaulis* var. *acaulis*	*Oberonia*	NC	June-September	Epiphyte	Runikhata Forest Range	NE
42	*Oberonia mucronata* (D.Don) Ormerod & Seidenf.		NC	September-December	Epiphyte	Ultapani Forest Range	NE
43	*Oberonia orbicularis* Hook.f.		NC	June-September	Epiphyte	Ultapani Forest Range	NE
44	*Pteroceras teres* (Blume) Holttum	*Pteroceras*	NC	April-May	Epiphyte	Ultapani Forest Range	NE
45	*Pinalia connata* (J.Joseph, S.N.Hegde & Abbar.) Ormerod & E.W.Wood	*Pinalia*	NC	July - August	Epiphyte	Ultapani Forest Range	NE

46	*Pinalia pumila* (Lindl.) Kuntze		NC	August	Epiphyte	Ultapani and Jharbari Forest Range	NE
47	*Pinalia bractescens* (Lindl.) Kuntze		NC	November-February	Epiphyte	Ultapani Forest range	NE
48	*Phalaenopsis deliciosa* Rchb.f.	*Phalaenopsis*	NC	April-July	Epiphyte	Ultapani Forest Range	NE
49	*Phalaenopsis mannii* Rchb.f.		NC	March-April	Epiphyte	Ultapani Forest Range	NE
50	*Papilionanthe uniflora* (Lindl.) Garay	*Papilionanthe*	NC	September-October	Epiphyte	Jharbari and Ultapani Forest Range	NE
51	*Papilionanthe teres* (Roxb.) Schltr.		NC	May–June	Epiphyte	Ultapani, Jharbari, Runikhata forest range	NE
52	*Peristylus constrictus* (Lindl.) Lindl.	*Peristylus*	NC	June - August	Terrestrial	Ultapani and Jharbari forest range	NE
53	*Peristylus goodyeroides* (D.Don) Lindl.		NC	June - August	Terrestrial	Ultapani and Jharbari forest range	NE
54	*Robiquetia succisa* (Lindl.) Seidenf. & Garay	*Robiquetia*	NC	September-December	Epiphyte	Runikhata Forest Range	NE
55	*Rhynchostylis retusa* (L.) Blume	*Rhynchostylis*	NC	April to August	Epiphyte	Ultapani, Jharbari, Runikhata forest range	EN
56	*Smitinandia micrantha* (Lindl.) Holttum	*Smitinandia*	NC	May-August	Epiphyte	Ultapani Forest Range	NE
57	*Vanilla borneensis* Rolfe	*Vanilla*	NC	March - May	Epiphyte	Ultapani, Jharbari, Runikhata forest range	NE
58	*Vanda ampullacea* (Roxb.) L.M.Gardiner	*Vanda*	NC	March–May	Epiphyte	Ultapani Forest Range	NE
59	*Zeuxine strateumatica* (L.) Schltr.	*Zeuxine*	NC	December-March	Terrestrial	Ultapani, Jharbari, Runikhata forest range	EN
60	*Zeuxine longilabris* (Lindl.) Trimen		NC	October - February	Terrestrial	Ultapani, Jharbari, Runikhata forest range	NE

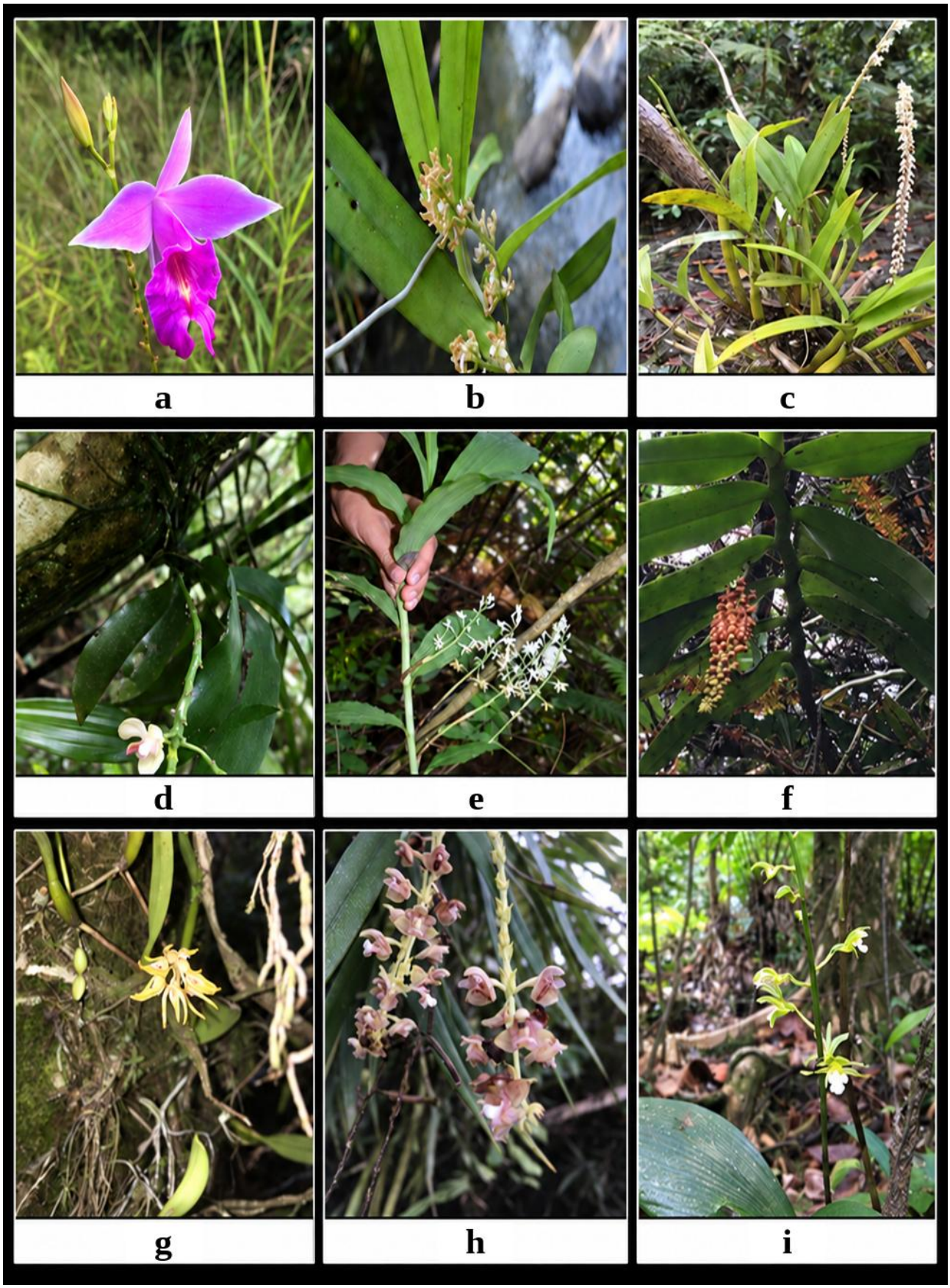


Fig.6. A. *Arundina graminifolia* subsp. *Graminifolia;* B. *Acampe praemorsa* var. *longepedunculata* (Trimen) Govaerts; C. *Cryptochilus strictus* (Lindl.) Schuit., Y.P.Ng & H.A.Pedersen; D. *Phalaenopsis deliciosa* Rchb.f.; E. *Calanthe triplicata* (Willemet) Ames; F. *Bulbophyllum crassipes* Hook.f.; G. *Bulbophyllum cauliflorum* Hook.f.; H. *Mycaranthes floribunda* (D.Don) S.C.Chen & J.J.Wood; I.*Chrysoglossum ornatum* Blume.

Results and Discussion

The present investigation recorded a total of 60 orchid species belonging to 29 genera from Sikhna Jwhwlao National Park, BTR, Assam (Table.1). The observed diversity reflects the complexity of forest ecosystems. However, the relatively high diversity of orchid species recorded within a confined geographical area indicates the rich floristic composition of the BTR region of Assam. This area forms part of the Eastern Himalayan biodiversity hotspot, particularly the Indo-Bhutan border zone, which is well recognized for its high species richness and endemism, especially in orchids.

Among the documented genera, *Dendrobium* was the most dominant, represented by 13 species (22%), suggesting broad ecological amplitude and adaptability within the study area. Members of this genus are predominantly epiphytes that colonize tree trunks and branches in moist, shaded habitats. The genus *Calanthe* was represented by five species (9%), whereas *Aerides*, *Bulbophyllum*, *Luisia*, and *Pinalia* each contributed three species (5%). The remaining genera were represented by one or two species each (Fig.1.)

Epiphytic orchids (43 species, 72%) were the most dominant type in the study area, followed by terrestrial orchids (17 species, 28%) (Fig.4). Epiphytic vegetation is closely associated with dense forest cover, elevated atmospheric humidity, and the availability of suitable phorophytes. The park provides diverse microhabitats, particularly in mature forest stands, where large trees create stable substrates and favorable microclimatic conditions that are essential for epiphytic growth. *Dendrobium* species exhibited optimal growth under these forest conditions, where environmental factors such as high relative humidity, moderate temperatures, and diffused light closely aligned with their ecological requirements. As the comparative distribution of flowering periods among orchid species in the study area Ultapani forest range is only the place where the highest no. of orchid species recorded (53 species) 61%, 23 species (27%) in Jharbari FR, and 10 species (12%) in Runikhata FR (Fig.2. Most flowering orchid species were found in May, followed by June (Fig.3).

Several orchid species were observed growing epiphytically on host trees belonging to the Fabaceae, Moraceae, and Dipterocarpaceae families. These phorophytes provide favourable substrates, including appropriate bark characteristics and moisture-holding capacity, which support orchid attachment, establishment, and growth. Additionally, the presence of perennial streams and dense canopy cover within the forest contributes to elevated humidity levels, creating a suitable microclimate for the survival of epiphytic orchids in the forest. Notably, several species documented in the present study represent new distributional records for the study area, suggesting that the orchid flora of BTR are still inadequately explored. These include *Phalaenopsis deliciosa* Rchb.f., *Dendrobium aduncum* Lindl., *Chrysoglossum ornatum* Blume, *Mycaranthes floribunda* (D.Don) S.C.Chen & J.J.Wood and *Oberonia mucronata* (D.Don) Ormerod & Seidenf. The occurrence of these species emphasizes the need for comprehensive floristic surveys and detailed taxonomic investigations in this region.

Conclusion

Despite the high orchid diversity, the forest ecosystems of the park are increasingly threatened by anthropogenic pressures, such as deforestation, shifting cultivation, and illegal logging. These disturbances lead to habitat degradation and fragmentation, which can significantly affect orchid populations, especially in the forests under the Chirang Forest Division. Epiphytic orchids are particularly vulnerable because of their dependence on specific host trees and stable microclimatic conditions. The removal of mature trees and alterations in forest structure can directly disrupt their life cycles and reduce their population viability. Therefore, the conservation of natural forest habitats is crucial for sustaining the orchid diversity in the region.

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Conflict of Interest

There are no conflicts of interest to declare.

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