

Original Research Article

Assessing the Orchid Diversity in Dimoria Tribal Belt, Kamrup District of Assam, India

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Abstract: The present study on various wild orchid species was conducted in Dimoria Tribal Belt, due to day-by-day increasing human pressure on the natural environment, and its ecological complexities, and its popularity among the indigenous people of Assam. The orchid species were explored by observing a 1km long horizontal transect in the forest of all three sites and each orchid species was recorded, photographed, and preserve. A total of 8 species of 7 genera of Orchid was recorded. Out of 7 genera, 8 species were recorded from site 1 (Khetri), 6 species were from site 2 (Maloibari) and 5 species were from site 3 (Topatali). Of these, 5 species are common in all three zones. The most abundant orchid species were *Aerides multiflora* in Khetri, *Aerides odorata* in Maloibari, *Papilionanthe teres* in Topatali. According to the Shannon Weiner Index (H') the diversity was found to be 0.674 in Khetri, in Maloibari village it was 0.531, in Topatali it was 0.0511. According to Margalef's richness index (D_{Mg}) was found to be highest in the Khetri at (T_3) and the lowest value was recorded at Topatali at (T_1). The highest value of evenness (J') index was found at Khetri (0.746) and the lowest value was recorded at Maloibari (0.682). Mean Density of the Khetri (0.18) was recorded highest and the lowest density at Maloibari (0.05). The study refers to Topatali have a higher dominant orchid species calculated by using Berger-Parker Dominance (0.579) and lowest at Khetri (0.294). Orchid habitats were mostly epiphytic and terrestrial.

Key words: Abundant, Density, Evenness, Epiphytic, Orchids, Terrestrial

Introduction

20,000 species of Orchids with 760 genera are well documented globally, as it is the largest family among flowering plants (Dressler, 1993). The Himalayas and the peninsula of India are the main hotspots of orchid distribution. So far, 1500 species belonging to 150 genera are confined in India, North Western Himalayan houses large-flowered orchids, whereas epiphytes in North-Eastern region, and small flowering orchids in the Western Ghats (Chadha, 1991). Also, nearly 300 species belonging to 60 genera are found in Peninsular India (Rao, 2000).

Northeast India claims the largest share with about 72% of species that cover about 825 species under 145 genera. Among the Northeastern States, Arunachal Pradesh hosts more than 500 species, Sikkim's floral wealth has a treasure chest of some 600 orchids, and Meghalaya also provides a habitat for various Orchids. About 300 species of orchids are reported in Assam that represents 44.39% of the northeastern species and 24.42% of species occurring in India (<https://nenow.in/environment/conservation-rare-orchids.html>)

i.e. nearly 193 species belonging to 74 genera of which 27 species are endemic, 26 are endangered and threatened, whereas 7 species are near-extinct (Hegde, 2000; Chowdhery, 2009; Gogoi *et al.*, 2009). In Assam, there is the traditional importance of Orchids among different tribes of Assam (Barua, 2001).

Due to day-by-day increasing human pressure on the natural environment and its ecological complexities and its popularity among the indigenous people of Assam encourages protection and conservation of Orchids. Also, orchids are included in the Red Data Book (IUCN) the whole family falls under Appendix-II of CITES, where strict control of its trade and commerce is monitored. Thus this study will emphasize the diversity of orchid species in Dimoria Tribal Belt, Kamrup District of Assam, determines the species richness, abundance, evenness, dominance of the species in the region and also determines traditional medicinal values of orchids.

Materials and methods

Study area

The Dimoria Tribal Belt is situated in the South-Eastern part of the Kamrup Metro district of Assam and on the south bank of the Mighty River Brahmaputra. It is bounded by the state of Meghalaya on the south, by the Morigaon district of Assam on the northeast, and by greater Guwahati Metro city on the west up to Jorabat Amerigog. Dimoria developmental block lies between $26^{\circ}N$ and $26^{\circ} 14' N$ latitudes and $91^{\circ} 51'$ and $92^{\circ} 10' E$ longitude (Medhi *et al.*, 2018; Sharma, 2018; Bhuyan & Sharma, 2017; Medhi & Sharma, 2017; Baishya & Sharma, 2017). The climate of this region is extensively and heavily influenced by the subtropical monsoon climate. The average annual temperature is $27^{\circ} C$ and the average annual rainfall is about 200cm. Dimoria Development Block is geographically 261.64 km^2 of which an area of 16.58 km^2 is under forest. Dimoria Block is consisting of 12 Gaon Panchayat and under these 144 villages are present. The name of Gaon Panchayat is *Barkhat, Baruahbari, Dhupguri, Digaru, Hahara, Kamarkuchi, Khetri, Nartap, Topatoli, Maloibari, Sonapur, Tetelia*. Many communities are harmoniously living together in Dimoria Block, i.e. Assamese, Bengali, Bodo, Karbi, Mising, Rabha, Tiwa, Nepali, and Garo. Karbi's are the major

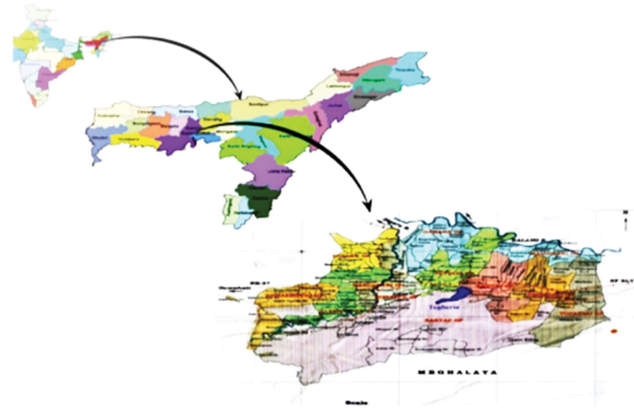


Fig. 1. Study Area.

tribes in Dimoria Development Block and Assamese is the main mode of communication in the region (Sharma, 2018). Research was conducted in three Gaon Panchayat of Dimoria Block *viz.* Khetri, Maloibari and Topatuli.

Methodology

Orchids were sited and photographed in their natural habitat with the help of a DSLR Camera (cannon 1300D 18-55, 55-200 mm lens). A global positioning system (GPS; E Terex, Garmin USA) was used to record the geographical coordinates during the survey.

The orchid species were explored by observing orchids in 3 transect of 1km long and each orchid species was recorded and species diversity and other ecological parameters were measured (Jacquemyn *et al.*, 2005). Orchid samples (including flowers, leaves, and roots) were also collected from the sites for herbarium preparation (Jain & Rao, 1977) and preservation solution of mercuric chloride and 90% ethanol has been used (Rajkumar *et al.*, 2006). Relevant data from the field were recorded. Photographs of orchid species were also captured. The voucher specimens were stored in the Department of Eco-restoration, Dimoria College, Khetri. Secondary Data collection was done through different Books, Journals, Research Papers, and also by visiting Kaziranga National Orchid and Biodiversity Park to identifying the orchid species.

Data was collected to compute the species diversity, species richness evenness. Density, abundance, relative abundance Shannon-Wiener diversity index (H'), Margalef's richness index (D_{mg}), Evenness Index (J'), Berger Parker Index of Dominance (d) were analyzed in accordant to orchid

zonation plot. Diversity indices like Shannon Diversity Index (H'), Evenness Index (J'), and Berger Parker Index of Dominance (d) of orchid species across sites were computed using the package Biodiversity Professional Version 2 for Window 1997.

Margalef's richness index (DMg)=S-1/lnN (Margalef, 1958)

Shannon Diversity index (H')= -∑ pi ln pi (Shannon & Weaver,1949)

Berger - Parker Index Dominance (d) = Nmax/N (May, 1975)

Evenness Index (J') = H'/Hmax (Pielou, 1966)

Density = $\frac{\text{Total no of individuals in all sampling units}}{\text{The total no of sampling units studied}}$ (Curtis, 1959)

Relative Abundance = $\frac{\text{Total no. of individuals of the species}}{\text{The total no. of individual of all species}} \times 100$

It has been calculated according to Engelmann's scale (Engelmann, 1978) based on relative abundance of each 3 sites- Relative abundance (RA)<1% = Subrecedent (SR); 1.1 -3.1% = Recedent (R); 3.2 -10% = Subdominant (SD); 10.1 - 31.6% = Dominant (D) and > 31.7% = Eudominant (ED).

Results

7 Genera with 8 species have been recorded from the Tribal belt of Dimoria, of them, 1 species with 1 genus was terrestrial 7 species with 6 genera were epiphytes. The total numbers of recorded species of each genus are *Aerides* with 2 species and *Bulbophyllum*, *Cymbidium* *Denodrobium*, *Eulophia* (terrestrial), *Papilionanthe*, *Rhynchosytilis* with 1 species each. *Papilionanthe teres* (149)

was the highest counted orchid species followed by *Aerides odorata* (126), *Cymbidium aloifolium* (98), *Aerides*

multiflora (63), *Rhynchosytilis retusa* (26), whereas, *Dendrobium fimbriatum* (2), *Bulbophyllum crassipes* (1) and *Eulophia mannii* (1) were recorded the lowest. In many research like Focho et al. (2010) reported from Mount Cameroon found 49 species belonging to 14 genera were

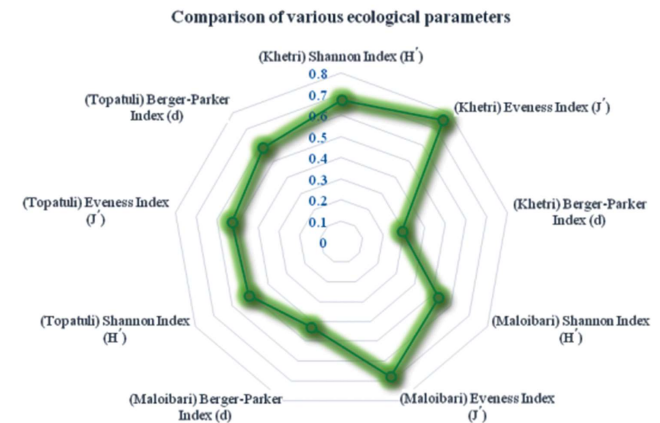


Fig. 3. Comparison of various ecological parameters.

identified. O' Malley (2009) reported from Danum valley recorded 42 orchids from 8 genera.

Wibowo et al. (2015) studied the diversity of orchids in Mount Batukau, Indonesia, and assessed 81 orchids' species from 32 genera of which 67 were epiphytic and 16 were

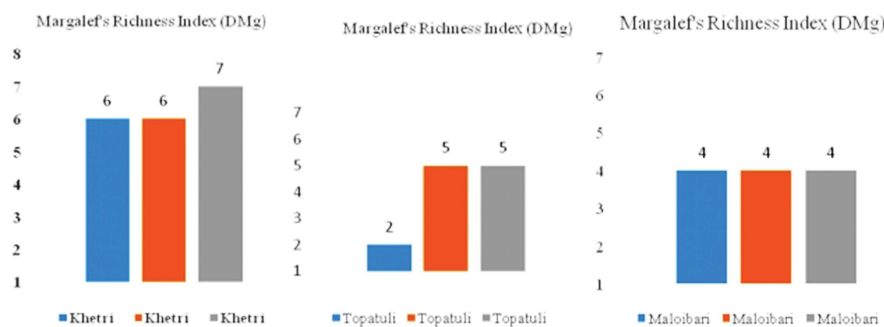


Fig. 2. Species Richness in the three GoanPanchayats.

Table 1. Ecological status of Orchids in the study area.

H.ID	Scientific Names	Sites			Relative Abundance(Engelmann's scale)			Shannon Diversity Index (Hc)			
		S1	S2	S3	S1	S2	S3	H'S1	H'S2	H'S3	
DCK_ER_001/20	<i>Aerides multiflora</i>	59	1	3	63	22.3 (D)	1.3 (R)	29.2(D)	0.65	0.53	0.51
DCK_ER_002/20	<i>Aerides odorata</i>	78	32	16	126	29.4 (D)	42.6 (ED)	6.6 (SD)	Evenness Index (Jc)		
DCK_ER_003/20	<i>Bulbophyllum crassipes</i>	1	-	-	1	0.4 (SR)	-	-	J'S1	J'S2	J'S3
DCK_ER_004/20	<i>Cymbidium aloifolium</i>	43	30	25	98	0.4 (SR)	40.0 (ED)	24.4 (D)	0.75	0.68	0.73
DCK_ER_005/20	<i>Dendrobium fimbriatum</i>	1	1	-	2	0.4 (SR)	1.3 (R)	-	Berger-Parker Index Dominance (d)		
DCK_ER_006/20	<i>Eulophia mannii</i>	1	-	-	1	0.4 (SR)	-	-			
DCK_ER_007/20	<i>Papilionanthe teres</i>	69	7	73	149	26.0 (D)	9.3 (SD)	53.3 (ED)	(d)S1	(d)S2	(d)S3
DCK_ER_008/20	<i>Rhynchostylis retusa</i>	13	4	9	26	4.9 (SD)	5.3 (SD)	13.3 (D)	0.29	0.42	0.58

H.ID= Herbarium ID, S1=Khetri, S2=Maloibari,, S3=Topatuli, D=Dominant, SR=Subrecent, SD=Subdominant, ED=Eudominant, R=Recedent

Table 2. Medicinal uses of orchid parts along with their host plants in Dimoria Tribal Belt.

Orchid Name	Host Plant	Parts Used	Status
<i>Aerides multiflora</i>	<i>Mangifera indica</i>	LBR _o	Cultivated (A)
Leaves are used to treat cuts and wounds. Plants parts possess antibacterial properties (Subedi et al., 2013)			
<i>Aerides odorata</i>	<i>Phyllanthus emblica</i>	L	Cultivated (A)
Antibacterial properties, Paste of leaves used externally to treat wounds (Subedi et al., 2013)			
<i>Bulbophyllum crassipes</i>	<i>Artocarpus heterophyllum</i>	L Pb	En
Fresh pulp of pseudobulb is used in burns, powdered leaves are used to cause abortion and recovery during childbirth (Subedi, 2002).			
<i>Cymbidium aloifolium</i>	<i>Mangifera indica</i> , <i>Albizia lebbek</i> , <i>Dalbergiasissoo</i>	RhR _o B	Cultivated (A)
The dried powder is used as a tonic against diarrhea. Fresh paste applied externally over fractured or dislocated bones (Gewali, 2008)			
<i>Dendrobium fimbriatum</i>	<i>Psidium guajava</i>	W	VL
Used in liver upset and nervous debility (Baral & Kurmi, 2006; Pant & Raskoti, 2013)			
<i>Eulophia mannii</i>	No Host Plant (its terrestrial Orchid)	No Parts	R
No Medicinal value			
<i>Papilionanthe teres</i>	<i>Albizia lebbek</i>	W	Cultivated (A)
Paste externally applied to treat dislocated bones. (Manandhar, 2002)			
<i>Rhynchostylis retusa</i>	<i>Mangifera indica</i> , <i>Dalbergia sissoo</i>	W	Cultivated VL
Leaves juice is used externally on skin as emollient and to treat rheumatism, root juice is applied to cuts and wounds (Thakur et al., 2010)			

A=Abundance, En=Endangered, R= Rare, VL= Vulnerable, L=Leaves, B=Bulbs, R_o=Root, Rh=Rhizome, Pb=Pseudobuds, W=Whole Plant

terrestrial species. There were similar records from the work of Nurfadilah et al., (2015); Gogoi et al., (2012) and Pant et al., (2002).

Based on the relative abundance of species in all the three sites, it is evident that *Papilionanthe teres* (S3), *Aerides odorata* (S2), *Cymbidium aloifolium* (S2), falls under Eudominant (ED, > 31.7%) in the Engelmann's scale in site 3 (Topatuli), followed by dominant (D, 10.1 – 31.6%) species: *Aerides odorata* (S1), *Aerides multiflora* (S1,S3), *Papilionanthe teres* (S1), *Cymbidium aloifolium* (S3), *Rhynchostylis retusa* (S3), for subdominant (SD, 3.2 -10%) species: *Papilionanthe teres* (S2) *Aerides odorata* (S3), *Rhynchostylis retusa* (S2,

S1), for Recedent (R, 1.1-3.1%) species: *Aerides multiflora* (S2) and *Dendrobium fimbriatum* (S2), for Subrecent (SR, <1%) species: *Bulbophyllum crassipes*, *Cymbidium aloifolium*, *Dendrobium fimbriatum*, and *Eulophia mannii* falls under this range in S1 (Table 1).

Considering Margalef's Richness Index (DMg), it is estimated that the Transect (T) understudy in Site 1 (Khetri) was the highest with an average of 6.3, but the richness was somewhat similar with an average of 4.0 in the other two sites i.e. Site 2 (Maloibari) and Site 3 (Topatuli) (Fig. 2).

Various other ecological parameters were also estimated, to understand the orchid status in three study sites

(Khetri, Maloibari, and Topatuli). According to the Shannon Diversity Index (H'), which ranges from 1.5-3.5 (Magurran, 2004) for a healthy diversity of species, but none of the sites under study is within this range. It is estimated that Site 1 (Khetri) has the highest diversity of 0.67 followed by Site 2 (Maloibari) 0.53, and Site 3 (Topatuli) has the lowest diversity of 0.53 in comparison. This is a sign that the study area indicates that there are pollution and degradation of habitat structure. Again it is estimated for Evenness Index (J') which too follows the trend of highest evenness in Khetri, Site 1 (0.75) followed by Topatuli, S3 (0.73), and then Maloibari, Site 2 (0.68) which accounts for the lowest. Similarly, when we talk about dominance and that too based on Berger-Parker we calculated that the highest dominance in Topatuli, Site 3 (0.58), followed by Maloibari, Site 2 (0.43), and then at last Khetri, Site 1 (0.3). Thus we can say that Diversity and Evenness are highest in Site 1 (Khetri), whereas Dominance is highest in Site 3 (Topatuli) (Fig. 3).

Discussion

In Assam, as many as 193 species of orchids belonging to 74 genera were identified. But this study only accounts for 8 orchid species belonging to 7 genera in three different sites in Dimoria Development Block, though the diversity of this species is very less despite its hard availability in the region, it is seen that the local indigenous people use these orchids for treating various illness (Table 2). *Aerides multiflora* and *Aerides odorata* which are most cited in (Mango Tree) *Mangifera indica* and (Indian gooseberry) *Phyllanthus emblica* tree respectively, its leaves, roots, and bulbs of the former and only leaves of the latter are used to treat cuts and wounds as these possess antibacterial properties. Research by Subedi et al., (2013) in Nepal also confirms similar findings. *Bulbophyllum crassipes* mainly on (Jack Fruit tree) *Artocarpus heterophyllus*, its leaves and pseudo bulb are used in burns, powdered leaves is used to cause abortion and recovery during childbirth. The same results were also discussed by Subedi (2002) in his research findings in Pokhara Valley, Nepal. *Cymbidium aloifolium* with their host plant *Mangifera indica*, *Albizia*

lebbeck, and *Dalbergia sissoo*, during diarrhea, the dried powder is used as a tonic and fresh paste applied externally over fractured or dislocated bones. Its rhizome, roots and bulbs are mostly used for these treatments. These findings are also supported by Gewali (2008) who reported the same medicinal use of this orchid. The whole parts of *Dendrobium fimbriatum* used in liver upset and nervous debility. It is mostly found hanging in *Psidium guajava* tree. Respective research by Baral & Kurmi (2006) and Pant & Raskoti (2013) also clarifies the same mode of action in Nepal. *Rhynchostylis retusa* seen in *Albizia lebbeck*, its whole parts are used to make a paste which is externally applied to treat dislocated bones, Manandhar (2002) has reported similar findings in his book Plants and People of Nepal. Whereas *Rhynchostylis retusa* cited in *Mangifera indica* and *Dalbergia sissoo*, its leaf juice is externally applied on as emollient and to treat rheumatism, also its root juice is applied on cuts and wounds. Similar findings were reported by Thakur et al., (2010) in Makwanpur district of Nepal. Finally, *Eulophia mannii* is the only terrestrial orchid assessed in the study area. This species is not been used for any treatment of illness but, researchers Narkhede et al., (2016) has reported *Eulophia mannii* possesses better antioxidant potentials for scavenging free radical.

Conclusion

This study has left us with a serious need to check the decreased diversity of orchids in the forest of this region. Protection and conservation of orchids in their natural habitat have left Conservation Biologist in urgency, due to its high ecological/economic/cultural/medicinal use-values. Also, it is known that orchids are very sensitive to any ecological or anthropogenic disturbances, absence of public awareness, no conservation strategies, Habitat fragmentation, overexploitation of natural resources, commercialization of agricultural and forestry and slash & burn to farm (Jhum) are the major cause of low diversity of orchids in this region. Thus, together with the State Government and based on Traditional Ecological Knowledge (TEK) among the local

indigenous communities could categorize the sustainable management process to conserve the orchids in the region.

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