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A CHECKLIST OF THE ORCHIDS OF THE NORTHERN WESTERN GHATS

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Abstract

The Northern Western Ghats are popularly known as the Sahyadri Mountains. It is a chain of mountains running about 750 km in length parallel to the West Coast of Peninsular India from the river Tapi, South Gujarat to the Northern region of Karnataka till the Kali River. The Northern Western Ghats is characteristic of having flat table top mountains and lateritic plateaus well known for their rich plant diversity including orchids. Several exploration tours were conducted by Botanical Survey of India during 2012 to 2024 to study the family Orchidaceae, in the different parts of the Northern Western Ghats (Goa, Maharashtra, and Karnataka) so as to assess the diversity and status. The present study revealed that there are 109 species belonging to 37 genera. A total of 35 orchid species are reported to be endemic to the Northern Western Ghats. The best represented genus was found as *Habenaria* with 21 species, followed by *Dendrobium* (10 sp.), *Oberonia* (7 sp.), *Eria* (6 sp.), *Eulophia* and *Peristylus* (5 sp.) each. The study also identified five major habitats for orchids in Northern Western Ghats. The highest species diversity was found in semi-evergreen forests, followed by moist deciduous forests and lateritic plateaus.

Introduction

THE FAMILY Orchidaceae is one of most prominent and diverse plant families in India. It is one of the largest families of flowering plants globally and holds a significant place in India's flora. Apart from the Eastern Himalayas, the Western Ghats of India supports a high diversity of orchids in India. The Western Ghats are recognized as a UNESCO World Heritage Site and are one of the eight hottest hotspots of biological diversity in the world. Stretching over 1,600 km parallel to the Western coast of India, they span the states of Gujarat, Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu. Geologically older than the Himalayas, the range significantly influences the Indian monsoon by intercepting the South-Western monsoon winds, resulting in high rainfall on the windward side and creating a distinct climatic gradient. This gradient supports a wide range of ecosystems, from tropical rainforests to montane forests.

The Northern Western Ghats (NWG) also known as the Sahyadri Hills, encompassing parts of Maharashtra, Goa, and Northern Karnataka, represent a distinct sub-region of the larger Western Ghats Mountain range. Geologically, this region is dominated by the Deccan Traps and a vast expanse of layered basaltic lava flows formed during the late Cretaceous period (~66 million years ago). These formations have given rise to a rugged terrain with plateaus, escarpments, and deeply incised valleys, contributing to a mosaic of microhabitats. The Northern Western Ghats exhibit unique floristic characteristics, with a mix of evergreen, semi-evergreen, moist deciduous, and dry deciduous forests. The lateritic plateaus, a key habitat type in this region, support highly specialized and often endemic herbaceous communities adapted to extreme seasonal conditions, wet monsoons followed by prolonged dry periods. Despite being less studied than the Southern Western Ghats, the Northern portion holds significant ecological value due to its floristic diversity, unique geological history, and its role as a transitional zone between the moist forests of the south and the drier ecosystems of central India. This area is also critical for several endemic and threatened flora, including the orchid species.

A total of 305 orchid species belonging to 77 genera are documented from the Western Ghats (Nayar *et al*., 2014). Kerala has the highest number of orchid species diversity, with 265 species from 77 genera. In Tamil Nadu, 251 orchid species belonging to 71 genera have been reported (Karuppusamy *et al*., 2022). Karnataka has recorded 220 species under 70 genera (Ravikumar *et al*., 2021). In Goa, 68 species from 28 genera have been documented (Jalal, 2019), while Maharashtra has 106 species under 32 genera (Jalal and Jayanthi, 2018). Jalal and Jayanthi (2012) compiled a list of endemic orchids from Peninsular India and documented 123 orchid species as endemic to the Western Ghats. In recent years, several new records and species of orchids have been added by the botanists, highlighting the region's ongoing botanical discoveries.

The current research focuses on the revised checklist of orchids found in the Northern Western Ghats. This

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documentation is crucial for the conservation and protection of orchid diversity, as numerous orchid species in this region are rare, endemic, and threatened due to habitat destruction, over-exploitation, and climate change. The current study offers an updated and thorough checklist of orchid species present in the Northern Western Ghats, compiled through extensive field surveys, examination of herbarium specimens, and a critical review of existing literature. To date, there is no comprehensive checklist specifically for the orchids of this area. This research aims to address this deficiency and may prove as a foundational resource for future taxonomic studies, biodiversity evaluations, and conservation strategies in the Northern Western Ghats.

Material and Methods

Study Area

The Northern Western Ghats (NWG) extends approximately 750 km between the latitudes of 15° 482´ and 21° 002´ N (Fig. 1). This range consists of a series of flat-topped mountains that run parallel to the western coastline of the Indian peninsula, beginning in the southern part of Gujarat at the Tapti River, traversing the Western regions of Maharashtra and Goa, and extending to the Northern area of Karnataka at the Kali River (Fig. 1). From a geological perspective, the entire NWG is formed from a substantial Deccan basalt trap, bordered by a narrow coastal strip to the west and featuring plateaus and plains to the east. The predominant types of vegetation found in this region includes tropical semi-evergreen, dry evergreen, and moist deciduous forests. Additionally, a distinctive characteristic of the NWGs is the presence of plateaus, rocky outcrops, and cliffs, which provide habitats for various flora that have adapted to these conditions. The tropical climate of the NWG is marked by a hot summer season from March to May, with peak temperatures reaching 32-33°C, a monsoon season from June to September that brings maximum rainfall of up to 1073 mm, and a winter season from November to February, where temperatures can drop to, between 11°C and 16°C. This area experiences four months of rainfall and an eight-month dry period.

Data Collection

Data were collected from field surveys carried out during 2012-2024, through herbarium consultation of different herbaria (CAL, BSI, BLAT, SUK, BSJO) and literature consultation (Almeida, 2009; Barbhuiya and Salunkhe, 2016; Datar and Lakshminarasimhan, 2013; Jalal, 2019; Jalal and Jayanthi, 2018; Pande *et al.*, 2010; Punekar and Lakshminarasimhan, 2011; Rao, 1986; Santapau and Kapadia, 1966).

Results and Discussion

The present checklist of Northern Western Ghats enumerates a total of 109 species belonging to 37 genera (Table 1). Of which, 55 species are epiphytic and 52 species are terrestrial, including two

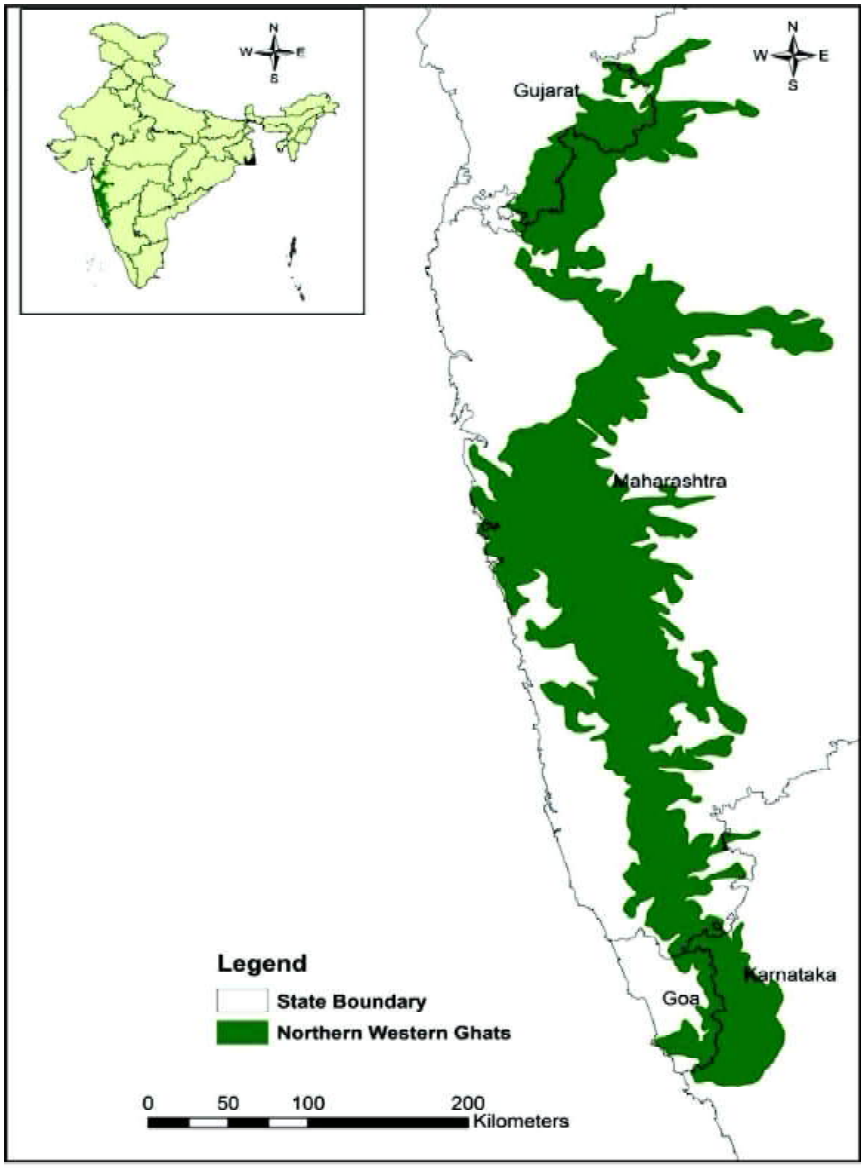

Fig. 1. Map showing the Northern Western Ghats.

Table 1. List of orchids of Northern Western Ghats.

Species	Habit	Flowering	Endemic	Habitat	Voucher number
Acampe praemorsa (Roxb.) Blatt. & McCann	E	Apr.-Dec.		MDF	JSJ 200887 (BSI)
Aerides crispa Lindl.	E	May-June		SEF	JSJ 200720 (BSI)
A. maculosa Lindl.	E	May-July	PI	MDF, SEF	JSJ 203745 (BSI)
A. ringens (Lindl.) C.E.C.Fisch.	E	May-July		MDF	JSJ 203698A (BSI)
Bulbophyllum peyrotii Bosser	E	April-June	WG	SEF	JSJ 200831 (BSI)
B. sterile (Lam.) Suresh	E	May-June	WG, NorthWestern Himalaya	MDF	JSJ 203682 (BSI)
B. stocksii (Benth. ex Hook.f.) J.J.Verm., Schuit. & de Vogel	E	Feb.-Mar.	WG	SEF	SAP 187709 (BSI)
Cheirostylis flabellata (A.Rich.) Wight	T	Aug.-Nov.		SEF	PVB 2244 (BLAT)
C. parvifolia Lindl.	T	Aug.-Oct.		SEF	JSJ 197709 (BSI)
Chiloschista glandulosa Blatt. & McCann	E	Jan.-Mar.	WG	SEF	Punekar and Lakshminarasimhan (2011)
Cleisostoma tenuifolium (L.) Garay	E	June-Nov.		MSD, SEF	JSJ 203615 (BSI)
Coelogyne imbricata (Hook.) Rchb.f.	E	June-July		MDF	JSJ 203614 (BSI)
Cottonia peduncularis (Lindl.) Rchb.f.	E	Mar.-Apr.		MDF	JSJ 203601 (BSI)
Crepidium versicolor (Lindl.) Sushil K.Singh, Agrawala & Jalal	T	July-Sept.		MDF, SEF	JSJ 200498 (BSI)
C. mackinnonii (Duthie) Szlach.	T	Aug.-Sept.		DDF	MRB 33426 (BSJO)
Cymbidium aloifolium (L.) Sw.	E	May-June		MDF	MMS 2031 (SUK)
C. bicolor Lindl. subsp. *bicolor*	E	May-June		MDF	JSJ 203687 (BSI)
Dendrobium aqueum Lindl.	E	Sept.-Dec.	WG	SEF	JSJ 203667 (BSI)
D. barbatulum Lindl.	E	Jan.-May	WG	MDF, SEF	JSJ 203613 (BSI)
D. crepidatum Lindl. and Paxton	E	Jan.-Mar.		MDF	JSJ 203697 (BSI)
D. crispum Dalzell	E	Oct.-Dec.		MDF	JSJ 203743 (BSI)
D. herbaceum Lindl.	E	Feb.-Mar.		SEF	JSJ 203630 (BSI)
D. lawianum Lindl.	E	Mar.-Apr.	WG	SEF	JSJ 203634 (BSI)
D. macrostachyum Lindl.	E	May-June		MDF, SEF	JSJ 203707 (BSI)
D. microbulbon A.Rich.	E	Dec.-Jan.	WG	SEF	JSJ 203666 (BSI)
D. nanum Hook.f.	E	July-Aug.	WG	SEF	JSJ 203632 (BSI)
D. nodosum Dalzell	E	July-Aug.	WG	SEF	JSJ 195195 (BSI)
D. ovatum (L.) Kraenzl.	E	Sept.-Feb.	WG	MDF	JSJ 203696 (BSI)
Didymoplexis pallens Griff.	MH	Apr.-May		SEF	Punekar and Lakshminarasimhan (2011)
Diplocentrum congestum Wight	E	April-May	WG	MDF, SEF	JSJ 203754 (BSI)
Epipogium roseum (D.Don) Lindl.	MH	April-June		SEF	MMS 2035 (SUK)
Eulophia diffusiflora M.W.Chase, Kumar & Schuit.	T	June-July	WG, NE	MDF	MRB 142 (BSJO)
E. epidendraea (J.Koenig ex Retz.) C.E.C.Fisch.	T	Nov.-Mar.		DDF, MDF	BGK 119300A (BSI)
E. herbacea Lindl.	T	June-Sept.		MDF	ZJK 1252 (BLAT)
E. nuda Lindl.	T	May-June		MDF, SEF	JSJ 203628 (BSI)
E. ochreata Lindl.	T	June-Oct.	WG, NE	DDF, MDF	JSJ 195129 (BSI)
E. picta (R.Br.) Ormerod	E	April-June		SEF	JSJ 203742 (BSI)
E. pratensis Lindl.	T	Dec.-Mar.	WG	DDF	VDP 75 (SUK)
Gastrochilus flabelliformis (Blatt. & McCann) C.J. Saldanha	E	April-June	SEF		JSJ203742 (BSI)
Geodorum densiflorum (Lam.) Schltr.	T	June-Aug.		MDF	JSJ 195170 (BSI)
Habenaria brachyphylla (Lindl.) Aitch.	T	Aug.-Sept.	WG	SEF	JSJ 200423 (BSI)
H. commelinifolia (Roxb.) Wall. ex Lindl.	T	Aug.-Oct.		SEF	JSJ 194908 (BSI)
H. crinifera Lindl.	T	July-Aug.		SEF	JSJ 195200 (BSI)
H. digitata Lindl.	T	July-Aug.		MDF, SEF	JSJ 194987 (BSI)
H. diphylla (Nimmo) Dalzell	T	Aug.-Sept.		LP	JSJ 200871 (BSI)

Table 1. List of orchids of Northern Western Ghats (contd.).

Species	Habit	Flowering	Endemic	Habitat	Voucher number
H. elwesii Hook.f.	T	Aug.-Sept.	WG	SEF	JSJ 203765 (BSI)
H. foliosa A.Rich.	T	July-Aug.	WG	SEF	JSJ 200840 (BSI)
H. furcifera Lindl.	T	Aug.-Sept.		DDF, SEF	JSJ 195146 (BSI)
H. grandifloriformis Blatt. & McCann	T	May-July		PL	JSJ 200539 (BSI)
H. heyneana Lindl.	T	July-Sept.	WG	PL	JSJ 200533 (BSI)
H. hollandiana Santapau	T	Aug.-Sept.		PL	**
H. laciniata Dalzell	T	July-Aug.	WG	SEF	JSJ 195154 (BSI)
H. longicorniculata J.Graham	T	Aug.-Sept.		PL	JSJ 200546 (BSI)
H. marginata Colebr.	T	Sept.-Oct.		SEF	JSJ 200891 (BSI)
H. multicaudata Sedgw.	T	Aug.-Sept.	WG	SEF	JSJ 195181 (BSI)
H. modesta Dalzell.	T	Aug.-Sept.	WG	SEF	JSJ 195184 (BSI)
H. perrottetiana A.Rich.	T	Aug.-Sept.	WG	SEF	MMS 4341 (SUK)
H. plantaginea Lindl.	T	Aug.-Sept.		MDF	JSJ 200889 (BSI)
H. rariflora A.Rich.	T	July-Aug.	WG	PL, SEF	JSJ 203768 (BSI)
H. rhynchocarpa (Thwaites) Trimen	T	Aug.-Sept.		SEF	Bachulkar 3501 (SUK)
H. suaveolens Dalzell	T	July-Sept.	WG	PL	JSJ 200444 (BSI)
H. viridiflora (Rottler ex Sw.) R.Br. ex Spreng.	T	Aug.-Sept.		LP	**
Liparis deflexa Hook.f.	T	Aug.-Sept.		MDF	MND179179 (BSI)
L. odorata (Willd.) Lindl	T	June-Sept.		MDF, SEF	JSJ 195107 (BSI)
L. viridiflora (Blume) Lindl.	E	Sept.-Jan.		SEF	SAP 186530 (BSI)
Luisia macrantha Blatt. & McCann	E	Mar.-May		DDF	SAP 178469 (BSI)
L. zeylanica Lindl.	E	May-June		MDF	JSJ 203621 (BSI)
Nervilia concolor (Blume) Schltr.	T	May-Aug.		MDF, SEF	JSJ 195123 (BSI)
N. simplex (Thouars) Schltr.	T	May-Aug.		SEF	JSJ 200522 (BSI)
N. infundibulifolia Blatt. & McCann	T	May-June		MDF, SEF	JSJ 200566 (BSI)
N. plicata (Andrews) Schltr.	T	May-June		MDF, SEF	JSJ 200489 (BSI)
Oberonia brachystachys Lindl.	E	May-June		MDF, SEF	JSJ 195015 (BSI)
O. bicornis Lindl.	E	Sept.-Oct.		SEF	BGG 61 (BLAT)
O. brunoniana Wight	E	Feb.-Mar.	WG	MDF, SEF	JSJ 200772 (BSI)
O. ensiformis (Sm.) Lindl.	E	Dec.-Jan.		MDF	NYD 3203 (BLAT)
O. falconeri Hook.f.	E	Aug.-Sept.		DDF	MRB 33431 (BSJO)
O. mucronata (D.Don) Ormerod & Seidenf.	E	Sept.-Oct.		MDF	JSJ 203715 (BSI)
O. verticillata Wight	E	Sept.-Oct.	WG	MDF	JSJ 203708 (BSI)
Pachystoma pubescens Blume	T	Feb.-Mar.		SEF	Bachulkar 323 (SUK)
Pecteilis gigantea (Sm.) Raf.	T	Sept.-Oct.		SEF	JSJ 203766 (BSI)
P. korigadensis Jalal & Jayanthi	T	Sept.-Oct.	WG	SEF	JSJ & JJ 197752 (BSI)
Peristylus aristatus Lindl.	T	July-Sept.		SEF	JSJ 200479 (BSI)
P. caranjensis (Dalzell) Ormerod & C.S.Kumar	T	July-Aug.	IE	DDF, MDF, SEF	JSJ 194976 (BSI)
P. densus (Lindl.) Santapau & Kapadia	T	July-Sept.		PL	JSJ 203643 (BSI)
P. goodyeroides (D.Don) Lindl.	T	Aug.-Sept.		MDF	ASP s.n. (BSI)
P. lawii Wight.	T	July-Sept.		MDF	JSJ 200854 (BSI)
P. plantagineus (Lindl.) Lindl.	T	July-Sept.		MDF, SEF	JSJ 194967 (BSI)
Phalaenopsis deliciosa Rchb.f.	E	Aug.-Sept.		SEF	CRJ184871
Porpax jerdoniana (Wight) Rolfe	E	June-July		SEF	JSJ 194921 (BSI)
Porpax exilis (Hook.f.) Schuit., Y.P.Ng & H.A.Pedersen	E	Oct.-Dec.	WG	SEF	JSJ 203642 (BSI)

Table 1. List of orchids of Northern Western Ghats (contd.).

Species	Habit	Flowering	Endemic	Habitat	Voucher number
P. filiformis (Wight) Schuit., Y.P.Ng & H.A.Pedersen	E	July-Aug.	WG	MDF, SEF	JSJ 203604 (BSI)
P. microchilos (Dalzell) Schuit., Y.P.Ng & H.A.Pedersen	E	July-Aug.	WG	MDF, SEF	JSJ 203648 (BSI)
Pinalia mysorensis (Lindl.) Kuntze	E	June-Aug.	WG	SEF	Woodrow s.n. (CAL)
P. polystachya (A.Rich.) Kuntze	E	July-Aug.	WG	SEF	Cooke no. 447 (BSI)
Porpax reticosa (Wight) Schuit.	E	May-June		SEF	JSJ 203649 (BSI)
P. reticulata Lindl.	E	April-June		MDF, SEF	JSJ 194922 (BSI)
Pteroceras monsooniae Sasidh. & Sujanapal	E	May-July		SEF	SAP 188650 (BSI)
Rhynchostylis retusa (L.) Blume	E	June-July		MDF	JSJ 203729 (BSI)
Smithsonia maculata (Dalzell) C.J.Saldanha	E	May-June	WG	SEF	**
S. straminea C.J.Saldanha	E	May-June	WG	MDF, SEF	JSJ 194914 (BSI)
S. viridiflora (Dalzell) C.J.Saldanha	E	May-June	WG	SEF	JSJ 195071 (BSI)
Thunia alba var. *bracteata* (Roxb.) N.Pearce & P.J.Cribb	E	Aug.-Sept.		SEF	JSJ 194971 (BSI)
Tropidia angulosa (Lindl.) Blume	T	Jan.-Feb.		SEF	MND187515
Vanda tessellata (Roxb.) Hook. ex G.Don	E	May-June		MDF	JSJ 203741 (BSI)
V. testacea (Lindl.) Rchb.f.	E	May-June		MDF	JSJ 203607 (BSI)
V. wightii Rchb.f.	E	Sept.-Oct.		MDF	JSJ 203700 (BSI)
Zeuxine gracilis (Breda) Blume	T	Feb.-Mar.		SEF	MMS 2045 (SUK)
Z. longilabris (Lindl.) Trimen	T	Feb.-Mar.		SEF	JSJ 203611 (BSI)
Z. strateumatica (L.) Schltr.	T	Jan.-Mar.		ML	RVK 78369 (BSI)

E, Epiphytic; T, Terrestrial; MH, Mycoheterotrophic; WG, Western Ghats; PI, Peninsular India; IE, Indian Endemic; SEF, Semi-evergreen Forest; MDF, Moist Deciduous Forest; DDF, Dry Deciduous Forest; PL, Lateritic Plateau; ML, Marshy Land; **-Included from published record.

mycoheterotrophic (*Didymoplexis pallens* and *Epipogium roseum*) species. *Habenaria* was observed as a largest genus with 21 species, followed by *Dendrobium* (10 sp.), *Oberonia* (7 sp.), *Eria* (6 sp.), *Eulophia* (5 sp.), and *Peristylus* (5 sp.). A total of 35 endemic orchid species belonging to 15 genera are also documented in Northern Western Ghats. Of these, 32 species are endemic to Western Ghats (*Bulbophyllum fimbriatum, B. stocksii, Chiloschista glandulosa, Cleisostoma tenuifolium, Dendrobium aqueum, D. barbatulum, D. lawianum, D. microbulbon, D. nanum, D. ovatum, Diplocentrum congestum, Porpax exilis, P. filiformis, P. microchilos, Pinalia mysorensis, P. polystachya, Eulophia pratensis, Flickingeria nodosa, Habenaria brachyphylla, H. elwesii, H. foliosa, H. heyneana, H. laciniata, H. multicaudata, H. modesta, H. rariflora, H. suaveolens, Oberonia verticillata, Pecteilis korigadensis, Plectoglossa perrottetiana, Smithsonia maculata, S. straminea*, and *S. viridiflora*); one species is endemic to Peninsular India (*Aerides maculosa*) and two species are endemic to India (*Eulophia diffusiflora* and *Peristylus caranjensis*). Nine species are found to be near-endemic and distributed to Sri Lanka, Nepal, and Myanmar (*Aerides ringens, Cheirostylis flabellata, C. parviflora*, *Cottonia peduncularis, Crepidium versicolor, Dendrobium herbaceum, Habenaria crinifera*, *Peristylus aristatus,* and *Vanda wightii*).

The habitat wise analysis shows that orchids in the Northern Western Ghats are predominantly found in the Semi-evergreen forests (62 species), Moist deciduous forests (48 species), Dry deciduous forests (8 species), Lateritic plateaus (9 species), and one species in marshy habitat (*Zeuxine strateumatica*). The present study also revealed that *Cheirostylis flabellata*, *Pinalia mysorensis*, *P. polystachya, Habenaria hollandiana, H. viridiflora, Oberonia bicornis, O. ensiformis, Pachystoma pubescens, Pectilis korigadensis, Phalaenopsis deliciosa, Plectoglossa perrottetiana, Pteroceras monsooniae, Smithsonia maculata,* and *Tropidia angulosa* are still known from single locality and have not been collected after their first report in Northern Western Ghats.

The Northern Western Ghats are at a greater risk from climate change events as compared to the southern parts. It is susceptible to flash floods, landslides, forest fires, *etc*. Habitat degradation and habitat loss across the landscape remains the most significant threat to orchid diversity in the Northern Western Ghats due to anthropogenic activities. Several studies and

field observations have documented a notable decline in the number of orchid species, particularly on the lateritic plateaus of the Northern Western Ghats. Felling of trees is one of the causes of depletion of epiphytic orchid diversity and tourism, mining and other anthropogenic activities leading to habitat fragmentation and degradation where many orchids such as *Habenaria suaveolens* and *Pectilis gigantea* are completely wiped off in some of the plateau areas in the Northern Western Ghats. Overharvesting by local people also causes population decline of some of the terrestrial orchids. Besides these threats to the orchids, lot of conservation initiatives have been taken for conservation of habitats. For example, the Northern Western Ghats has been declared as the UNESCO world heritage site and recognition of many of the micro endemic centres of the NWGs are given protection. Similarly, several eco-sensitive zones have been identified. There are 17 protected areas falling in Northern Western Ghats [Bhimgad wild life sanctuary (WLS), Vansda National Park, Kalsubai Harishchandragad WLS, Phansad WLS, Tahmini WLS, Koyna WLS, Sanjay Gandhi National Park, Tansa WLS, Bhimashankar WLS, Radhanagari WLS, Chandoli National Park, Bondla WLS, Madei WLS, Cotigaon WLS, Netravali WLS, Bhagawan Mahavir National Park, Anshi National Park], where orchids are protected. However, some of the orchid diverse areas such as lateritic plateaus, grasslands, and other forest areas need to be protected from disturbance in the unprotected areas such as Lonavala-Khandala, Mahabaleshwar-Panchgani, Durgawadi-Ambegaon *etc*. Recently the IUCN threat assessment of some of the orchids found in NWGs has been assessed as Near Threatened *i.e. Habenaria grandifloriformis* (Patil, 2022), *Smithsonia maculata* (Dalzell) C.J.Saldanha (Jalal *et al*., 2025a), *Smithsonia straminea* C.J.Saldanha (Jalal *et al*., 2025b), and *Smithsonia viridiflora* (Dalzell) C.J.Saldanha (Jalal *et al*., 2025c).

Hence, this documentation aims to establish a foundational understanding for implementing conservation measures focused on either species-specific or habitat-specific priorities, thereby contributing to the conservation of the country's orchid flora. In this connection, it is worthwhile to mention that some successful attempts have been made to conserve some of the threatened species of diverse habits and habitats by developing mass propagation protocols using different explants (Anuprabha *et al*., 2017; Arora *et al.,* 2014, 2016; Bhowmik and Rahman, 2023; Dhillon and Pathak, 2023; Dhiman *et al*., 2007; Hossain *et al*., 2009, 2012; Jaryal *et al*., 2025a,b; Kaur *et al*., 2006, 2017; Kirti *et al*., 2023; Kumari and Pathak, 2021; Mutum, *et al*., 2022; Pathak *et al*., 2017, 2022, 2023; Sembi *et al*., 2011; Sunita *et al*., 2021; Thakur and Pathak, 2020, 2021; Tripura *et al.,* 2022; Vasundhra *et al*., 2019, 2021; Verma *et al*., 2013). However, still much needs to be learnt about the nutritional requirements of a large number of orchid species as the present available data is meagre.

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References

Almeida, M. R. 2009. *Flora of Maharashtra*- Vol.5a. Blatter Herbarium, St. Xavier's College, Bombay, India.

Anuprabha, Promila Pathak, Ankush Prakash, and Jitender Kumar. 2017. Regeneration competence of *Dendrobium nobile* Lindl. through pseudobulb segments: A study *in vitro. J. Orchid Soc. India*, **31**: 71-75.

Arora, S., Anuprabha, and Promila Pathak. 2014. Regenration competence of *Arundina graminifolia* (D.Don) Hochr. through stem disc culture: A study *in vitro. J. Orchid Soc. India*, **28**: 109-14.

Arora, S. K., Promila Pathak, Shivani Verma, Ankush Prakash, Kriti Dhiman, and K. C. Mahant. 2016. Mass propagation of *Dendrobium amoenum* Wall. ex Lindl. through stem nodal explants: A study *in vitro. J. Orchid Soc. India*, **30**: 51-55.

Barbhuiya, H. A. and C. K. Salunkhe. 2016. Orchids of Maharashtra, India: A review. *Richardiana,* **16**: 111-40.

Bhowmik, T. K. and M. M. Rahman. 2023. *In vitro* seed, seedling and SPSs development in *Habenaria digitata* Lindl. on different growth additives and PGRs supplemented MS medium. *J. Orchid Soc. India*, **37**: 59-67.

Dhillon, M. K. and Promila Pathak. 2023. Asymbiotic seed germination in a medicinally important and near threatened terrestrial orchid, *Crepidium acuminatum* (D.Don) Szlach. from NorthWestern Himalayas: A study *in vitro. J. Orchid Soc. India*, **37**: 49-57.

Dhiman, A., Promila Pathak, and S. P. Vij. 2007. Regeneration from foliar explants in *Bletilla striata* Reichb. F.: A study *in vitro. J. Orchid Soc. India*, **31**: 71-75.

Datar, M. N. and P. Lakshminarasimhan. 2013. Checklist of wild angiosperms of Bhagwan Mahavir (Molem) National Park, Goa, India. *Checklist,* **9**: 186-207.

Hossain, M. M., M. Sharma, and Promila Pathak. 2009. Cost effective protocol for *in vitro* mass propagation of *Cymbidium aloifolium* (L.) Sw.- A medicinally important orchid. *Eng. Life. Sci*., **9**: 444-53.

Hossain, M. M., M. Sharma, and Promila Pathak. 2012. *In vitro* propagation of *Dendrobium aphyllum* (Orchidaceae)- Seed germination to flowering. *J. Plant Biochem. Biotechnol.,* **22**: 157-67.

Jalal, J. S. 2019. Diversity and distribution of orchids of Goa, Western Ghats, India. *J. Threat. Taxa,* **11**(15): 15015-42.

Jalal, J. S. and J. Jayanthi. 2018. An updated checklist of the orchids of Maharashtra, India, *Lankesteriana,* **18**:(1): 23-62.

Jalal, J. S. and J. Jayanthi. 2012. Endemic orchids of peninsular India: a review. *J. Threat. Taxa*, **4**(15): 3415-25.

Jalal, J. S., J. Jayanthi, D. K. Agrawala, and P. Kumar. 2025a. *Smithsonia maculata*. *The IUCN Red List of Threatened Species* 2025: e.T15051215A15054974. https://dx.doi.org/10.2305/IUCN.UK.20251.RLTS.T15051215A15054974.en. Accessed on 03 August 2025.

Jalal, J. S., J. Jayanthi, D. K. Agrawala, and P. Kumar. 2025b. *Smithsonia straminea*. *The IUCN Red List of Threatened Species* 2025: e.T15051222A 239925049. https://dx.doi.org/10.2305/IUCN.UK.20251.RLTS.T15051222A239925049.en. Accessed on 03 August 2025.

Jalal, J. S., J. Jayanthi, D. K. Agrawala, and P. Kumar. 2025c. *Smithsonia viridiflora*. *The IUCN Red List of Threatened Species* 2025: e.T15051227A 15054984. https://dx.doi.org/10.2305/IUCN.UK.20251.RLTS.T15051227A15054984.en. Accessed on 03 August 2025.

Jaryal, Pratibha, Promila Pathak, and A. R. Warghat. 2025a. An efficient clonal propagation of a medicinally important and endangered Himalayan herb, *Dactylorhiza hatagirea* D. Don Soo using shoot meristem culture and genetic fidelity analysis. *PCTOC*, **160**(1): 20.

Jaryal, Pratibha, Promila Pathak, V. Jaiswal, and A. R. Warghat. 2025b. Identification of an endangered and medicinally important Himalayan orchid, *Dactylorhiza hatagirea* D. Don Soo using DNA barcodes and development of an efficient *in vitro* propagation protocol utilizing embryo culture technique. *In vitro Cell. Dev. Biol. Plant*, 1-13.

Kaur, S., Promila Pathak, and S. P. Vij. 2006. Regeneration response of *Saccolabium papillosum* Lindl. root segements: A study *in vitro*. *J. Orchid Soc. India*, **20**(1-2): 77-80.

Kaur, S., Promila Pathak, Ankush Prakash, Anamika, and A. Sharma. 2017. *Ex situ* conservation of a floriculturally and medicinally important endangered orchid, *Coelogyne cristata* Lindl. *J. Orchid Soc. India*, **31**: 15-22.

Kirti, Promila Pathak, and K. C. Mahant. 2023. Asymbiotic seed germination and seedling development in commercially important and endemic orchids of Western Ghats, *Aerides crispa* Lindl.- A study *in vitro*. *J. Orchid Soc. India*, **37**: 141-49.

Kumari, Anamika and Promila Pathak. 2021. De novo plantlet regeneration from leaf explants of *Rhynchostylis retusa* (L.) Blume: A study *in vitro*. *J. Orchid Soc. India*, **35**: 47-53.

Karuppusamy S, Prasad K, Pullaiah T, 2022. *Orchids of Tamil Nadu, India*. Scientific Publishers, Jodhpur, India.

Mutum, R. D., N. M. Chanu, T. N. Khanganba, and B. Thongam. 2022. Propagation and conservation of selected orchids of Manipur. *J. Orchid Soc. India*, **36**: 95-101.

Nayar, T. S., A. S. Beegam, N. Mohanan, and G. Rajkumar. 2014. *Flowering Plants of Western Ghats* Vol. 2 (Monocots). Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvananthapuram, Kerala, India.

Pande, S. A., N. Sant, V. Vishwasrao, and M. Datar. 2010. *Wild Orchids of Northern Western Ghats*. Tata Power, and Ela Foundation, Pune, India.

Pathak, Promila, Shivani Verma, Ankush Prakash, and K. C. Mahant. 2017. Regeneration competence of an ornamentally important epiphytic orchid, *Rhynchostylis gigantea* (Lindl.) Ridl. through leaf segments: A study *in vitro*. *J. Orchid Soc. India*, **31**: 97-101.

Pathak, Promila, Anamika Kumari, Brent D. Chandler, and Lawrence W. Zettler. 2023. *In vitro* propagation and phytochemical analysis of therapeutically endangered orchid, *Vanda cristata* Wall. ex Lindl. *S. Afr. J. Bot.,* **153**: 109-23.

Pathak, Promila, Sunita, Anamika Kumari, Babita Thakur, Vasundhra, and Madhu. 2022. Regeneration competence of an endangered orchid, *Vanda cristata* Wall. ex Lindl. using leaf explants: A study *in vitro*. *S. Afr. J. Bot.*, **151**: 1018-24.

Patil, A. 2022. *Habenaria grandifloriformis*. *The IUCN Red List of Threatened Species* 2022: e.T13424554A 13424557. https://dx.doi.org/10.2305/IUCN.UK.20221.RLTS.T13424554A13424557.en. Accessed on 03 August 2025.

Punekar, S. A. and P. Lakshminarasimhan. 2011. *Flora of Anshi National Park, Western Ghats-Karnataka*. Biospheres Publication, Pune, India.

Rao, R. S. 1986. *Flora of Goa, Diu, Daman, Dadra and Nagar Haveli*. Vol. II. Botanical Survey of India, Calcutta, India.

Ravikumar, K., A. C. Tangavelou, and Navendu Page. 2021. *Seed Plants of Karnataka, India: A Concise Dictionary*. Foundation for Revitalization of Local Health Traditions – Transdisciplinary University (FRLHT-TDU). Bengaluru, Karnataka, India.

Santapau, H. and Z. Kapadia. 1966. *The Orchids of Bombay*. Manager of Publications, Delhi, India.

Sembi, J. K., J. Verma, Promila Pathak, and S. P. Vij. 2011. Regeneration competence of *Aerides multiflora* root segements: A study *in vitro*. *J. Orchid Soc. India*, **25**(1-2): 5-8.

Sunita, Promila Pathak, and K. C. Mahant. 2021. Green pod culture of an endangered and medicinally important orchid, *Vanda cristata* Wall. ex Lindl. from Himachal Pradesh. *J. Orchid Soc. India*, **35**: 25-33.

Thakur, Babita and Promila Pathak. 2020. *In vitro* propagation of *Herminium lanceum* (Thunb. ex Sw.) Vuijk (Orchidaceae), through asymbiotic seed germination: A therapeutically important and endangered orchid from NorthWestern Himalayas. *J. Orchid Soc. India*, **34**: 61-67.

Thakur, Babita and Promila Pathak. 2021. Application of organic additives for the enhancement of seed germination and seedling development in an endangered and medicinal

orchid, *Rhynchostylis retusa* (L.) Blume through asymbiotic culture. *J. Orchid Soc. India*, **35**: 99-107.

Tripura, A., M. A. Sumi, T. K. Bhowmik, and M. M. Rahman. 2022. *In vitro* seed germination and phytochemical screening of an epiphytic medicinal orchid, *Pholidota imbricata* W. J. Hook. of Bangladesh. *J. Orchid Soc. India*, **36:** 137-45.

Vasundhra, Promila Pathak, and Ankush Prakash. 2019. *In vitro* shoot induction and regeneration potential of floral buds in *Crepidium acuminatum* (D.Don) Szlach., a medicinal ayurvedic plant from NorthWestern Himalayas. *J. Orchid Soc. India*, **33**: 43-48.

Vasundhra, Promila Pathak, and Anuprabha. 2021. *In vitro* asymbiotic seed germination and regeneration competence of leaf explants in *Satyrium nepalense* D.Don, a medicinally important, and an endangered terrestrial orchid of Kasauli Hills, Himachal Pradesh (NorthWestern Himalayas). *J. Orchid Soc. India*, **35**: 73-82.

Verma, Shivani, K. Dhiman, K. C. Mahant, and Promila Pathak. 2013. Mass propagation of *Cymbidium bicolor* Lindl. using *in vitro* asymbiotic seed culture technique. *J. Orchid Soc. India*, **27**(1-2): 79-85.