



## An account of family Orchidaceae in a part of Northern Western Ghats India

The Western Ghats of India is known across the world as a biodiversity hotspot due to its rich plant and animal diversity (Hajra & Mudgal 1997, Chitale *et al.* 2014, Kulkarni *et al.* 2015). Orchids are most abundant in this humid tropical and subtropical region. India has 1331 orchid species distributed over 186 genera, of which 400 are endemic (Misra 2007). Many orchid species have been reported from Mulshi (18°25'–18°41'N and 73°24'–73°36'E; area 240 km<sup>2</sup>; alt. 600–1,131 m a.s.l.) which falls in the Northern Western Ghats of Maharashtra (Graham 1839, Dalzell & Gibson 1861, Gammie 1905–1912, Cooke 1908, Blatter & McCann 1931, 1932, Santapau & Kapadia 1966, Reddy 1969, 1970, Ganorkar 1987, Lakshminarasimhan 1996, Nayar 1996, Watve *et al.* 2003, Sardesai & Yadav 2004, Datar *et al.* 2008, Almeida 2009, Ingahalikar 2009, 2010, Jalal & Jayanthi 2012, Mahajan *et al.* 2012, Jalal & Singh 2015, Barbhuiya & Salunkhe 2016, Bhagat 2018, Jalal 2018). Recently, Jalal & Jayanthi (2018, 2019) recorded 32 genera and 107 species of orchids from the northern Western Ghats. The vegetation is diverse from moist to dry deciduous forests with some semi evergreen elements and open grasslands (Champion & Seth 1968).

Extensive field surveys were undertaken in Mulshi over four years (2016–2020) to explore and document the orchid species with reference to their habit, habitats, flowering season, and local distribution, and to update their current status. The area receives an average rainfall of 2,841 mm (700–6500 mm range). The average temperature is 24.3 °C and the highest temperature is 34 °C in the month of May. Frequent field surveys in different seasons and in different habitats were made for documenting the various orchid species. Habitats were identified based on physical features and forest types. We used the random walk method for listing the species. Observations of each individual orchid

species were recorded (not collected). The plants were photographed in the field to record habits, habitats and locations. These photographs were also used for later identification. Unidentified taxa were identified with the help of photographs, literature, and online databases (e.g., POWO 2019, FPI 2023, FI 2023). The identifications were also confirmed by experts.

Our investigations resulted in the enumeration of 48 taxa of the family Orchidaceae (listed alphabetically in Appendix). These taxa were from 22 genera. Forty-six were species and two were varieties. Out of the 22 genera 11 were epiphytic and 11 were terrestrial. Of all taxa, 15 were new site records for the Mulshi region (Appendix). Of the 48 taxa, seven were endemic to the Western Ghats and eighteen were endemic to India sensu Singh *et al.* (2000), Kumar *et al.* (2001) and Jalal & Jayanthi (2012).

Out of 48 taxa, 12 (25%) were distributed in moist and semi-evergreen forests, 11 (23%) in the grasslands and semi-evergreen forests, and only 6 (12%) in dry and moist deciduous forests. Six (13%) were common in occurrence, and 2 (4%) were in cultivated habitats. The prominent flowering period for terrestrial taxa is July–September, but epiphytic taxa were observed flowering during February–April. The most common orchid genus was *Habenaria* with 10 species and two varieties. *Acampe*, *Geodorum*, *Liparis*, *Malaxis*, *Oberonia*, *Pecteilis*, *Porpax*, *Rhynchostylis*, *Smithsonia*, *Spathoglottis*, *Thunia*, *Vanda* and *Zeuxine* were represented by only a single species. Terrestrial orchid species were mostly found in open grasslands or forest fringes and shady forest floors. Whereas, the epiphytic taxa were confined to large forest patches along the foothills, and to some extent in open forest areas on fourteen host plant species: *Tectona grandis* (Lamiaceae), *Terminalia elliptica* (Combretaceae), *Terminalia bellirica* (Combretaceae), *Syzygium cumini* (Myrtaceae), *Ficus arnottiana* (Moraceae), *Memecylon umbellatum* (Melastomaceae), *Catunaregam spinosa* (Rubiaceae), *Careya arborea* (Lecythidaceae), *Lagerstroemia parviflora*

(Lythraceae), *Heterophragma quadriloculare* (Bignoniaceae), *Mangifera indica* (Anacardiaceae), *Ficus racemosa* (Moraceae), *Bombax ceiba* (Bombacaceae), and *Bridelia retusa* (Phyllanthaceae).

The land use pattern in this region helps to protect orchid taxa. The Mulshi region is rich in sacred groves. There are 68 sacred groves in Mulshi (Bhagat 2018), which harbor high species diversity and shelter many orchid species. It is one of the important land uses of the Mulshi region, which also includes isolated agricultural farms, exposed rocks, single crop agriculture, settlements, and reserved forest. However, many newly proposed hill cities (like the Aamby valley project) are in this region, and these will pose serious threat to habitat sensitive orchids. Most also face threats on a larger scale, from habitat loss/ alteration, forest fragmentation, and other anthropogenic activities. The presence of such high numbers of species of orchids in this region indicates a very high conservation value. Hence these orchids, along with their habitat, need to be conserved; and the status of these species needs to be assessed for IUCN Red List.

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#### Literature cited

- Almeida, M.R. (2009). Flora of Maharashtra. Volumes 5A & 5B. Orient Press, Mumbai: 567pp.
- Barbhuiya, H.A. and C.K. Salunkhe (2016). Orchids of Maharashtra, India: a review. *Richardiana*, 16: 111–140.
- Bhagat, R.B. (2018). *Floristic Diversity of Mulshi: Northern Western Ghats*. A.R. Printers, Pune: 297pp.
- Blatter, E. and C. McCann (1931–1932). Revision of the Flora of the Bombay Presidency. *Journal of Bombay Natural History Society*, 35: 13–736; 36: 13–795.
- Champion, H.G., S.K. Seth (1968). *A Revised Survey of the Forest Types of India*. Reprinted Edition. Natraj Publications, New Delhi: 404pp.
- Chitale, V.S., M.D. Behera, P.S. Roy (2014). Future of endemic flora of biodiversity hotspots in India. *PLoS ONE*, 9(12): e115264.
- Cooke, T. (1908). *The Flora of the Presidency of Bombay III*. Botanical Survey of India, Calcutta: 649pp.
- Dalzell, N.A. and A. Gibson (1861). *The Bombay Flora*. Education Society's Press, Calcutta: 332pp.
- Datar, M., N. Sant, S. Pande, V. Vishwasrao (2008). *Wild Orchids of Northern Western Ghats*. Ela Foundation, Pune: 274pp.
- FI (2023). Flowers of India <URL> Accessed on 01 January 2023.
- FPI (2023). Flora of Peninsular India <URL> Accessed on 01 January 2023.
- Gammie, G.A. (1905–1910) The orchids of Bombay Presidency. Part I–XIII. *Journal of Bombay Natural History Society* 16: 429–569; 17: 31–942; 18: 88–834; 19: 139–626; 20: 126–602; 21: 171–1130.
- Ganorkar, R.P. (1987). *Vegetational Studies of Mulshi Area*. Ph.D. Dissertation. University of Poona, Pune: 187pp.
- Graham, J. (1839). *A Catalogue of the Plants Growing in Bombay and its Vicinity, Spontaneous, Cultivated or Introduced, as far as They have been Ascertained*. Agricultural Society of Western India. Government Press, Bombay: 254pp.
- Hajra, P.K. and V. Mudgal (1997). *Plant diversity hotspots in India – An overview*. Botanical Survey of India, Kolkata: 179pp.
- Ingalhalikar, S. (2009) *Flowers of Sahyadri*. Today and Tomorrows Printers & Publishers, Pune: 210pp.
- Ingalhalikar, S. (2010) *Further Flowers of Sahyadri*. Today and Tomorrows Printers & Publishers, Pune: 529pp.
- Jalal, J.S. (2018). *Orchids of Maharashtra*. Botanical Survey of India, Calcutta: 236pp.
- Jalal, J.S. and J. Jayanthi (2012). Endemic orchids of peninsular India: a review. *Journal of Threatened Taxa*, 4(15): 3415–3425.
- Jalal, J.S. and J. Jayanthi (2018). An updated checklist of the orchids of Maharashtra, India. *Lankesrteriana* 18(1): 23–62.
- Jalal, J.S. and J. Jayanthi (2019). *Pecteilis korigidensis* (Orchidaceae: Orchidoideae), a new terrestrial orchid from the northern Western Ghats, India. *Phytotaxa*, 388(2): 167–173
- Jalal, J.S. and P. Singh (2015). Threatened orchids of Maharashtra: A preliminary assessment based on IUCN regional guidelines and conservation prioritization. *Journal of Orchid Society of India*, 29: 1–14.
- Kulkarni, A.V., D.M. Mahajan, A. Bhore *et al.* (2015). Tree species assessment at Lohgad and Visapur Fort – A part of Western Ghats, Maharashtra (India). *Indian Forester*, 141(5): 549–553.
- Kumar, C.S., B.V. Shetty, S.S.R. Bennet *et al.* (2001). *Endemic Orchids of the Western Ghats: Conservation Assessment and Management Plan (C.A.M.P.) Workshop*. Wildlife Information Liaison Development (WILD)

- Society and Zoo Outreach Organization, Coimbatore: 195pp.
- Lakshminarasimhan, P. (1996). Orchidaceae. Pp 8–64. *In*: Sharma, B.D., S. Karthikeyan, N.P. Singh (eds.). *Flora of Maharashtra State - Monocotyledons*. Botanical Survey of India, Calcutta.
- Mahajan, D.M., V.R. Gunale, M.R. Shindikar *et al.* (2012). *Nature's Wonder at Symbiosis – Flora at University Campus*. Symbiosis International University, Pune: 295pp.
- Misra, S. (2007). *Orchids of India - A Glimpse*. Bishen Singh Mahendra Pal Singh, DehraDun: 402pp.
- Nayar, M.P. (1996). *Hot spots of endemic plants of India, Nepal and Bhutan*. Tropical Botanic Garden and Research Institute, Thiruvananthapuram: 252pp.
- POWO (2019). Plants of the World Online <URL> The Royal Botanic Gardens Kew. Accessed on 31 March 2019.
- Reddy, B.V. (1969). The flora of Sakharpathar and Ambavne region of Poona District - 2. *Bulletin of Botanical Survey of India*, 11(3-4): 249–259
- Reddy, B.V. (1970). The flora of Sakharpathar and Ambavne region of Poona District - 3. *Bulletin of Botanical Survey of India*, 12(1-4): 213–225.
- Sardesai, M.M. and S.R. Yadav (2004). Genus *Habenaria* Willd. (Orchidaceae) in Maharashtra. Pp. 144–172. *In*: Pulliah, T. (ed.). *Biodiversity of India*. Volume III. Regency Publications, New Delhi: 244pp.
- Santapau, H. and Z. Kapadia (1966). *The Orchids of Bombay*. Govt. of India Press, Calcutta: 239pp.
- Singh, N.P., S. Karthikeyan, P. Lakshminarasimhan, and P.V. Prasanna (2000). *Flora of Maharashtra State – Dicotyledons*. Volume 1: Flora of India Series 2. Botanical Survey of India, Calcutta: 898pp.
- Watve, A., R.V. Gandhe, and K.R. Gandhe (2003). Vegetation structure and composition of semi-evergreen forest fragments in Mulshi area of northern Western Ghats. *Annals of Forestry*, 11(2): 155–165.

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**Appendix.** List of Orchid species documented from the Mulshi, northern Western Ghats; SG = sacred Grove; VP = valley point; P = plateau; Source: NR = new record (This study), RB = Bhagat (2018), BVR = Reddy (1969–1970), JJ = Jalal & Jayanthi (2012–2019); forest type and habitat: DMDF = dry and moist deciduous forest, CF = coastal forest, SEF = semi-evergreen forest, MDFF = moist and dark forest floor, OGS = open grassy slopes, LP = lateritic plateaus; \*species previously recorded from the region but not sighted in this study

Botanical Name	Flowering Season	Forest type / Habitat	Location
<b>Habit: Epiphytic</b>			
<i>Acampe praemorsa</i> (Roxb.) Blatt. & McCann	Apr–Jun	DMDF, CF	<sup>NR</sup> Adarwadi, Vinjai SG
<i>Aerides crispa</i> Lindl.	Apr–Jun	SEF	<sup>RB</sup> Mulshi, Tamhinigaon
<i>A. maculosa</i> Lindl.	May–Jul	DMDF, SEF	<sup>RB</sup> Vinjai SG, Shedani, Gutke
<i>Bulbophyllum fimbriatum</i> (Lindl.) Rchb.f.	Dec–May	SEF	<sup>NR</sup> Bhamburde
<i>B. sterile</i> (Lam.) Suresh	Dec–May	SEF	<sup>NR</sup> Bhamburde
<i>Conchidium filiforme</i> (Wight) Rauschert	Jul–Aug	DMDF, SEF	<sup>NR</sup> Kundalika VP, Pimpri
<i>C. microchilos</i> (Dalzell) Rauschert	Jul–Aug	DMDF, SEF	<sup>RB</sup> Ghutke, Pimpri
* <i>Dendrobium aphyllum</i> (Roxb.) Fisch	Feb–Mar	DMDF, SEF	<sup>RB</sup> Cultivated
<i>D. aqueum</i> Lindl.	Sep–Oct	SEF	<sup>RB</sup> Majgoan
<i>D. barbatulum</i> Lindl.	Jan–May	DMDF, SEF	<sup>RB</sup> Barpe, Bhamburde, Shedani
<i>D. herbaceum</i> Lindl.	Feb–Mar	SEF, DMDF,	<sup>RB</sup> Nandivali,
<i>D. microbulbon</i> A. Rich.	Dec–Jan	DMDF, SEF	<sup>RB</sup> Chandivali, Pomgaon
<i>D. ovatum</i> (L.) Kraenzl.	Sep–Feb	DMDF, SEF	<sup>NR</sup> Bhamburda, Tamhinigaon
<i>Oberonia recurva</i> Lindl.	Oct–Mar	DMDF, SEF	<sup>RB</sup> Shedani, Tamhini, Nive
<i>Porpax reticulata</i> Lindl.	Apr–Jun	DMDF, SEF	<sup>RB</sup> Adharban, Devghar
<i>Rhynchostylis retusa</i> (L.) Blume	Jun–Jul	DMDF	<sup>RB</sup> Tamhinighat, Nivegaon
<i>Smithsonia viridiflora</i> (Dalzell) C.J. Saldanha	May–Jun	SEF	<sup>RB</sup> Vainjai SG, Atvan
* <i>Thunia alba</i> var. <i>bracteata</i> (Roxb.)	Aug–Sep	SEF	<sup>BVR</sup> Korigad
<i>Vanda testacea</i> (Lindl.) Rchb. f.	Mar–Jun	DMDF	<sup>NR</sup> Adgaon

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Botanical Name	Flowering Season	Forest type / Habitat	Location
<b>Habit: Terrestrial</b>			
<i>Cheirostylis parvifolia</i> Lindl.	Dec–Feb	MDF	<sup>NR</sup> Tail-Baila, Kalkaimata SG
* <i>Eulophia ochreatea</i> Lindl.	Jun–Jul	DMDF (rocky)	<sup>RB</sup> Mulshi Tehsil
<i>E. spectabilis</i> (Dennst.) Suresh	May–Jun	DMDF, SEF	<sup>RB</sup> Male, Pimpri, Saltar
* <i>Geodorum densiflorum</i> (Lam.) Schltr	Jun–Jul	MDF, SEF	<sup>RB</sup> Mulshi Tehsil
<i>Habenaria brachyphylla</i> (Lindl.) Aitch.	Aug–Oct	SEF, OGS	<sup>RB</sup> Devghar
<i>H. commelinifolia</i> (Roxb.) Wall. ex Lindl.	Aug–Nov	OGS, DMDF, SEF	<sup>NR</sup> Tamhini Ghat, Sanaswadi
<i>H. digitata</i> Lindl.	Aug–Sep	SEF	<sup>NR</sup> Ambavne P, Ghangad
<i>H. foliosa</i> var. <i>foliosa</i> A. Rich.	Jul–Aug	SEF	<sup>RB</sup> Vinjai SG, Nive, Sarole
<i>H. foliosa</i> var. <i>foetida</i> (Blatt. Et. McCann)	Jul–Aug	SEF	<sup>NR</sup> Nive, Sarole
<i>H. foliosa</i> var. <i>gibsonii</i> (Hook. F.) Bennet	Jul–Aug	SEF	<sup>NR</sup> Vandre, Varak
<i>H. grandifloriformis</i> Blatt. & McCann	May–Jul	LP, OGS	<sup>RB</sup> Saltar, Male, Kundalika VP
<i>H. heyneana</i> Lindl.	Jul–Sep	LP, OGS	<sup>RB</sup> Saltar, Ghangad, Tail-Baila
<i>H. longicorniculata</i> J. Graham,	Jul–Dec	LP, OGS	<sup>RB</sup> Shedani, Pimpri
<i>H. marginata</i> var. <i>marginata</i> Colebr.	Aug–Oct	DMDF, OGS	<sup>RB</sup> Ambavne P, Ghangad
<i>H. marginata</i> var. <i>flavescens</i> (Hook. F.)	Aug–Oct	DMDF, OGS	<sup>NR</sup> Ambavne P
<i>H. plantaginea</i> Lindl.	Aug–Oct	SEF	<sup>NR</sup> Tail-Baila Road
<i>H. rariflora</i> A. Rich.	Jul–Sep	LP (wet rocky)	<sup>RB</sup> Tamhinighat, Ghangad
<i>Liparis nervosa</i> (Thunb.) Lindl.	Jun–Sep	SEF	<sup>RB</sup> Valane, Pimpri, Andharban
<i>Malaxis versicolor</i> (Lindl.) Abeyw.	Jul–Aug	SEF	<sup>RB</sup> Vinjai SG, Bhamburde
<i>Nervilia concolor</i> (Blume) Schltr.	May–Aug	DMDF, SEF	<sup>RB</sup> Nandivali
<i>N. infundibulifolia</i> Blatt. & McCann	May–Jun	SEF	<sup>RB</sup> Bayajikhind, Tamhini
* <i>Pecteilis korigadensis</i> Jalal & Jayanthi	Sep–Oct	OGS	JJMulshi Tehsil
<i>P. gigantea</i> (Sm.) Rafin.	Sep–Oct	OGS, DMDF, SEF	<sup>RB</sup> Pimpri, Gutke, Akole
<i>Peristylus densus</i> (Lindl.) Santapau & Kapadia	Aug–Sep	LP (rocky)	<sup>RB</sup> Tail-Baila Rd, Mhatoba SG
<i>P. lawii</i> Wight	Jul–Sep	DMDF	<sup>NR</sup> Bayaji Khind
<i>P. plantagineus</i> (Lindl.) Lindl.	Aug–Oct	DMDF, SEF	<sup>RB</sup> Pimpri
<i>P. stocksii</i> (Hook.f.) Kraenzl	Jul–Sep	DMDF, SEF	<sup>NR</sup> Bayaji Khind
* <i>Spathoglottis plicata</i> Blume	Jan–Dec	Cultivated	<sup>RB</sup> Cultivated
* <i>Zeuxine strateumaticea</i> (L.) Schltr.	Feb–Mar	OGS (marshy)	<sup>RB</sup> Mulshi Tehsil