

# ON THE OCCURRENCE OF A LEAFLESS *CYMBIDIUM* IN WESTERN HIMALAYA

Jagdeep Verma, Kranti Thakur<sup>1</sup>, Jaspreet K Sembi<sup>2</sup>, Kusum<sup>3</sup>, and Promila Pathak<sup>2</sup>

Department of Botany, Government College, Rajgarh- 173 101, Himachal Pradesh, India

<sup>1</sup>Department of Botany, Shoolini Institute of Life Sciences and Business Management, Solan- 173 212, Himachal Pradesh, India

<sup>2</sup>Department of Botany, Panjab University, Chandigarh- 160 014, U.T., India

<sup>3</sup>Department of Botany, St. Bede's College, Navbahar, Shimla- 171 002, Himachal Pradesh, India

## Abstract

Cymbidiums are popular worldwide for their beautiful and long lasting flowers. They grow as epiphytes, terrestrials, lithophytes or very rarely as leafless plants. The present communication deals with one such leafless taxon, *Cymbidium macrorhizon* and its occurrence along the Western Himalayan range.

## Introduction

WESTERN HIMALAYAN region in India comprises of Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Ladakh States and Union Territories (UTs). It represents one of the most diverse orchid habitats in the country with nearly 240 documented species under 72 genera (Jalal and Jayanthi, 2015). During our surveys across this Himalayan segment, we came across many orchid species, majority of which were ground growing in habit. A few of these were observed lacking leaves throughout their whole life. One such leafless orchid was *Cymbidium macrorhizon* Lindl. We found it growing on partially shady to shady forest floors in Himachal Pradesh and Uttarakhand. Recently, it has also been reported to occur in Jammu and Kashmir (Thakur and Dutt, 2020). Here we provide notes on taxonomy, distribution, habitat characteristics, phenology and conservation of this interesting taxon in reference to its occurrence in Western Himalaya.

## Material and Methods

Field surveys were conducted in Himachal Pradesh, Uttarakhand, and Jammu and Kashmir (2012-2018), and information pertaining to the morphological features, distribution, habitat characteristics, and phenology of *Cymbidium macrorhizon* was collected. Plants were described based on fresh material, and identified following standard Floras (Deva and Naithani, 1986; Duthie, 1906; Vij *et al.*, 2013). The information on this taxon was also augmented by surveying relevant literature available on its taxonomy and distribution (Chowdhery and Wadhwa, 1984; Deva and Naithani 1986, Duthie, 1906; Jalal and Jayanthi, 2013, 2015; Seidenfaden and Arora, 1982; Singh *et al.*, 2019a;

Thakur and Dutt, 2020; Vij *et al.*, 2013). Seed characters (shape, size, testa cells, and per cent air space) were studied using light microscope following Vij *et al.* (1992).

## Results

*Cymbidium* Sw. (Orchidaceae) is a genus of more than seventy species, which are distributed mainly in tropical and subtropical regions of Asia and Australia (Govaerts *et al.*, 2021). It is represented by 29 species in India, of which six species *i.e.* *Cymbidium aloifolium* (L.) Sw., *C. bicolor* subsp. *obtusum* Du Puy and P. J. Cribb, *C. cyperifolium* Wall. ex Lindl., *C. iridioides* D. Don, *C. lowianum* (Rchb. f.) Rchb. f., and *C. macrorhizon* Lindl. occur naturally in Western Himalaya (Singh *et al.*, 2019a). Only one of these species, *C. macrorhizon* grows as a leafless herb exhibiting a partially mycoheterotrophic mode of nutrition.

## Taxonomic Treatment

***Cymbidium macrorhizon* Lindl.**, Gen. Sp. Orchid. Pl. 162. 1833; Hook. f., Fl. Brit. India 6: 9. 1890; Duthie, Ann. Roy. Bot. Gard. (Calcutta) 9: 134. t. 114. 1906; Seidenfaden, Opera Bot. 72: 66-67. t. 35. 1983; Chowdhery & Wadhwa, Fl. Himachal Pradesh 3: 681. 1984; Deva & Naithani, Orch. Fl. N. W. Himal. 379. t. 217. 1986. *Cymbidium aphyllum* Ames & Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4: 73. 1919. *nom. illeg.* *Pachyrhizanthe macrorhizos* (Lindl.) Nakai, Bot. Mag. (Tokyo) 45: 109. 1931. *Cymbidium macrorhizon* var. *aberrans* (Finet) P. J. Cribb & Du Puy, Gen. Cymbidium, ed. 2: 330. 2007. *Cymbidiopsis macrorhiza* (Lindl.) H. J. Chowdhery, Indian J. Forest. 32: 155. 2009.

Terrestrial, leafless herb, partially mycoheterotrophic. Stem underground, fleshy and creeping rhizome,

branched, warted, with distinct nodes and internodes, nodes scaly. *Pseudobulbs* and leaves absent. *Inflorescence* erect raceme, 10-20 cm, 2-8 flowered, basal sheaths 3-4, elongated, ovate, 14-16 × 7-8 mm. *Floral bracts* membranous, acute, 8-15 × 4-5 mm. *Flowers* cream coloured, flushed with pink or pinkish-white, 3-6 cm across. *Sepals* spreading, lanceolate, acute, tinged with pink, 15-25 × 4-5 mm. *Petals* lanceolate, acute, tinged with pink, arch over the column, 17-18 × 5-6 mm. *Lip* shorter than or equal to the sepals, cream white, with purple blotches, ovate, 15-16 × 9-10 mm, obtuse, 3-lobed; mid lobe oblong, apex curving downwards, with wavy margins, disc with two thick elongated ridges between the lateral lobes; *the lateral lobes* minute, narrow, erect, rounded, with inflexed margins. *Column* whitish, 10-12 × 3-3.5 mm, inner surface streaked with pink, curved. *Anther* papillose, with creamy cap. *Pollinia* 4, in two pairs, globular, yellowish, sessile on the crescent shaped gland. *Fruit* stalked erect capsule, 3-4.5 cm long, ridged, green during initial development and growth, fusiform (Fig. 1A-D).

#### General Distribution

This taxon is widely distributed in India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Arunachal Pradesh, Sikkim, West Bengal, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Karnataka, Tamil Nadu, Jharkhand, Chhattisgarh, Madhya Pradesh), Bhutan, Nepal, Pakistan, China, Myanmar, Japan, Korea, Thailand, Indo-China (Singh *et al.*, 2019a).

#### Occurrence in Western Himalaya

Himachal Pradesh: Chamba (Dalhausie), Shimla (Shogi, Mashobra), Solan (Bajhol, Chail, Chywanibhattan near Chandi, Jatoli, Kasauli), Sirmaur (Deedag, Nauradhar, Rajgarh). Jammu and Kashmir: Rajouri (Darhal forest range). Uttarakhand: Dehradun (Baneg near Mussoorie, Kalinga Hills near Nalapani, Rajpur Sal Forest), Nainital (Bhim Tal, Sat Tal), Pithoragarh (Satta-Ghorpatta), Tehri Garhwal (Tehri), Uttarkashi (Barkot, Gangnani, Indravati).

#### Habitat Characteristics

*Cymbidium macrorhizon* grows in temperate climates mainly between 1200-2500 m altitudes. It was observed growing as individual plants or in small groups of 3-5 plants on the humus rich and partially shady floors of coniferous/broad leaved/mixed forests. Open grasslands were very rarely inhabited. *Brachycorythis obcordata*, *Crepidium acuminatum*, *Habenaria pectinata*, *Herminium lanceum*, and *Satyrium nepalense* were usually found as its neighbouring growing orchids.

#### Partially Mycoheterotrophic Nature

Though presence of thick and attractive foliage makes cymbidiums as dedicated ornamentals even during their pre- and post-flowering life, but leafless *Cymbidium macrorhizon* is rather of high interest for researchers focusing on the nutritional aspects. It is a well-known fact that orchids remain associated with specific fungal species atleast at some stage of their life cycle. But those which lack leaves and chlorophyll possess comparatively stronger mycorrhizal obligation, which is usually lifelong. *C. macrorhizon* completely depends on mycorrhizal fungi to meet its carbon demand during seed germination and early life stages. However, the plants bearing green fruits have been found to obtain a significant proportion of required carbon through photosynthesis (Kobayashi *et al.*, 2021). It means that the plants act as total mycoheterotrophs before reaching the fruiting stage. If they develop green fruits, they can supplement their carbon requirement via photosynthesis, but if fruit development does not occur due to any reason, they have no other option except continuing as total mycoheterotrophs throughout their life. Therefore, this taxon is partially mycoheterotrophic in its mode of nutrition.

#### Phenology

*Cymbidium macrorhizon* plants were observed coming out as dark pink and sheathed scapes on humus rich forest floors during June to July. The scapes possessed little floral buds, which opened into fully developed flowers during June end to September. Fruiting occurred during early July to October. Mature fruits contained enormous tiny dust-like seeds (0.16 × 0.05 mm) which were spatulate in shape. The testa cells had sinuous or undulate walls. Embryos were minute occupying only about twenty per cent of the total seed space.

#### Threats and Conservation

Loss of habitat (natural or anthropogenic) is the main threat not only for this orchid but for the whole biota occurring throughout the Himalaya. Being geodynamically young, the top soil layer of the Himalayan range is thin and fragile, and is often exposed to land slips and floods. Additionally, the forests are being cleared for a variety of activities mainly related to construction of houses, expansion of agricultural and horticultural fields, and raising hydroelectric power projects. Native species are also facing threat due to gradual colonization of some invasive taxa, especially *Lantana camara* and *Parthenium hysterophorus*. Orchids exhibit higher degree of habitat specificity, which is more pronounced in case of leafless taxa owing to their comparatively complex nutritional requirements.

Changes in and around their natural homes, may affect them directly or indirectly (*e.g.* affecting associated

fungi, pollinators *etc.*). Therefore, protection of natural habitats is the most effective conservation strategy and



Fig. 1 A-D. *Cymbidium macrorhizon*: A-B, Illustrations showing general morphology of the plant (note the underground warted rhizome and sheathed scape) and a flower; C, Flowering and fruiting plants in natural habitat; D, A plant bearing pinkish white flowers (such individuals were rare in occurrence). Scale bar=1 cm.

is also need of the hour. Furthermore, *in vitro* mass multiplication and rehabilitation back to natural or natural-like habitats can also play important role in strengthening conservation efforts. Earlier, studies on orchid diversity and *in vitro* propagation and conservation of some of these Indian orchids have been made by a few researchers (Balkrishna *et al.*, 2020; Barman *et al.*, 2016; Bhandari *et al.*, 2018; Bhatti *et al.*, 2017; Devi *et al.*, 2018; Kumar *et al.*, 2016, 2018, 2019; Kumari and Pathak, 2020; Lal and Pathak, 2020; Pathak *et al.*, 2017; Prakash and Pathak, 2019; Prakash *et al.*, 2018; Shapoo *et al.*, 2020; Sharma *et al.*, 2017; Singh *et al.*, 2019b; Thakur and Pathak, 2020; Vasundhra *et al.*, 2019).

### Specimen Examined

BSD: Arora 36473, Bhattacharyya 33647, Karki 82098, Naithani 44223, Pant 31896, Rau 15631. PAN: Vij & Verma 225. WII: Jalal 13767.

## References

- Balkrishna, Acharya, Rajesh Juyal, Reema Devi, Jitender Kumar, Ankush Prakash, Promila Pathak, Ved Priya Arya, and Ashwani Kumar. 2020. Ethnomedicinal status and pharmacological profile of some important orchids of Uttarakhand (NorthWestern Himalayas), India. *J. Orchid Soc. India*, **34**: 137-47.
- Barman, T., J. Malhotra, A. Kumari, S. Marpa, M. Lal, A. Singh, P. Sharma, and S. S. Samant. 2016. Diversity, distribution and status of orchids in Upper Beas Catchment and Parvati of Kullu District, Himachal Pradesh. *J. Orchid Soc. India*, **30**(1-2): 57-64.
- Bhandari, P. K., Julie Thakur, Sachin Sharma, and P. L. Uniyal. 2018. Orchid diversity in Basukedar region (Rudraprayag District) of Uttarakhand. *J. Orchid Soc. India*, **32**: 73-79.
- Bhatti, S. K., Jagdeep Verma, Jaspreet K. Sembi, and Promila Pathak. 2017. Symbiotic seed germination of *Aerides multiflora* Roxb.- A study *in vitro*. *J. Orchid Soc. India*, **31**: 85-91.
- Chowdhery, H. J. and B. M. Wadhwa. 1984. *Flora of Himachal Pradesh*. Vol. 3. Botanical Survey of India, Calcutta, India.
- Deva, S. and H. B. Naithani. 1986. *The Orchid Flora of North West Himalaya*. Print and Media Associates, New Delhi, India.
- Devi, K., S. S. Samant, S. Puri, and S. Dutt. 2018. Diversity, distribution pattern and indigenous uses of orchids in Kanawar Wildlife Sanctuary of Himachal Pradesh, North Western Himalaya. *J. Orchid Soc. India*, **32**: 17-23.
- Duthie, J. F. 1906. The Orchids of North Western Himalaya. *Ann. Royal Bot. Gard. Calcutta*, **9**(2): 81-211.
- Govaerts, R., P. Bernet, K. Kratochvil, G. Gerlach, G. Carr, P. Alrich, A. M. Pridgeon, J. Pfahl, M. A. Campacci, D. H. Baptista, *et al.*, 2021. *World Checklist of Orchidaceae*. The Royal Botanic Gardens, Kew, U.K. (<http://apps.kew.org/wcsp/>) Retrieved June 2021.
- Jalal, J. S. and J. Jayanthi. 2013. Current status and distribution of mycoheterotrophic orchids of India. *Richardiana*, **13**: 137-55.
- Jalal, J. S. and J. Jayanthi. 2015. An annotated checklist of the orchids of Western Himalaya, India. *Lankesteriana*, **15**(1): 7-50.
- Kobayashi, K., K. Suetsugu, and H. Wada. 2021. The leafless orchid *Cymbidium macrorhizon* performs photosynthesis in the pericarp during the fruiting season. *Plant Cell Physiol.*, **62** (3): 472-81.
- Kumar, D., P. Kumari., S. S. Samant, and S. Paul. 2016. Assessment of orchid diversity in selected sacred groves of Kullu District, Himachal Pradesh, India. *J. Orchid Soc. India*, **30**: 89-95.
- Kumar, A., S. S. Samant, L. M. Tewari, and S. Paul. 2018. Diversity, distribution, indigenous uses and status of orchids in Kalatop - Khajjjar Wildlife Sanctuary, Chamba district, Himachal Pradesh. *J. Orchid Soc. India*, **32**: 93-98.
- Kumar, V., O. Prakash, A. Singh, M. Lal, S. Marpa, S. S. Samant, and M. Bodh. 2019. Status, distribution and conservation of orchids in Great Himalayan National Park of Himachal Pradesh, NorthWestern Himalaya. *J. Orchid Soc. India*, **31**(1-2): 1-8.
- Kumari, Anamika and Promila Pathak. 2020. Medicinal orchids of Shimla hills, Himachal Pradesh (NorthWestern Himalayas), threats, and conservation measures. *J. Orchid Soc. India*, **34**: 45-56.
- Lal, Roshan and Promila Pathak. 2020. Substratum analysis of some therapeutically significant and/or endangered orchids of Shimla hills (Himachal Pradesh), NorthWestern Himalayas and their conservation. *J. Orchid Soc. India*, **34**: 101-11.
- 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.
- Prakash, Ankush and Promila Pathak. 2019. Orchids of Water Catchment Wildlife Sanctuary, Shimla (Himachal Pradesh), NorthWestern Himalayas: Their diversity, status, indigenous uses, and conservation status. *J. Orchid Soc. India*, **33**: 65-77.
- Prakash, O., S. S. Samant, V. Kumar, A. K. Yadava, and S. Dutt. 2018. Orchid Diversity of Pangi Valley of Himachal Pradesh, NorthWestern Himalaya. *J. Orchid Soc. India*, **32**(1-2): 45-54.
- Seidenfaden, G. and C. M. Arora. 1982. An enumeration of the orchids of the north-western Himalaya. *Nord. J. Bot.*, **2**: 7-27.
- Shapoo, Gowhar A., Zahoor A. Kaloo, Aijaz Hasaan Ganie, and Seema Singh. 2020. Development of agro-techniques for *ex situ* conservation of *Dactylorhiza* Neck. ex Nevski (Orchidaceae) species growing in Kashmir Himalaya, India. *J. Orchid Soc. India*, **34**: 123-30.
- Sharma, A., S. S. Samant, S. Bhandari, and J. S. Butola. 2017. Diversity, distribution, and conservation status of orchids along an altitudinal gradient in Himachal Pradesh, North Western Himalaya. *J. Orchid Soc. India*, **31**(1-2): 23-32.

- Singh, A., S. S. Samant, S. Naithani, V. Kumar, and T. Barman. 2019b. Ecological assessment of sub-alpine and alpine orchids of Great Himalayan National Park in Himachal Pradesh, NorthWestern Himalaya. *J. Orchid Soc. India*, **33**: 1-9.
- Singh, S. K., D. K. Agrawala, J. S. Jalal, S. S. Dash, A. A. Mao., and P. Singh. 2019a. *Orchids of India - A Pictorial Guide*. Botanical Survey of India, Kolkata, India.
- Thakur, S. and H. C. Dutt. 2020. *Cymbidium macrorhizon* Lindl. (Orchidaceae): A new record for flora of Jammu and Kashmir, India. *Natl. Acad. Sci. Lett.*, <https://doi.org/10.1007/s40009-020-00985-1>.
- 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.
- 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.
- Vij, S. P., J. Verma, and C. Sathish Kumar. 2013. *Orchids of Himachal Pradesh*. Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Vij, S. P., P. Kaur, S. Kaur, and P. S. Kaushal. 1992. The orchid seeds: Taxonomic, evolutionary and functional aspects. *J. Orchid Soc. India*, **6**: 91-107.