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DIVERSITY, INDIGENOUS USES, MORPHOLOGICAL DESCRIPTION, AND CONSERVATION STATUS OF ORCHIDS OF KARERI LAKE AND TRIUND HILL IN DISTRICT KANGRA OF HIMACHAL PRADESH, NORTHWESTERN HIMALAYAS

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Abstract

Orchids comprise one of the largest families of flowering plants covering 10% of the flowering plants in India. Like other parts of the Indian Himalayan Region, Himachal Pradesh also supports unique orchid flora. The location, climate, and topography of Himachal Pradesh are endowed with a rich and diverse life form. In the present investigation, extensive field surveys were conducted during 2018-2020 to study the diversity, indigenous uses, and conservation status of orchids of Kareri lake and Triund hill in Kangra district, Himachal Pradesh. During the exploration of floristic diversity, a total of 10 orchid species under 9 genera (*Crepidium, Dienia, Epipactis, Goodyera, Habenaria, Herminium, Platanthera, Satyrium*, *Spiranthes*) belonging to sub-families Orchidoideae and Epidendroideae were recorded from the study area. A major problem with fieldwork is that in the tropics in a given month, only the species (typically between 10 and 20%) are found in the flowering stage. The flowers are essential for us to describe a species, because many orchids may have similar vegetative parts (leaves and stems) while their flowers are highly different. Hence, it is preferable to explore any area for orchids during their flowering time, accordingly. In this communication, geographic distribution along with the detailed description and photographs for the recorded species are provided.

Introduction

ORCHIDS ARE an exclusive group of flowering plants and an important component of natural vegetation. These are widely distributed in all continents except Antarctica and hot deserts with their maximum diversity in humid tropical regions. Orchidaceae, a perfect epitome of beauty, representing the zenith of flowering plant evolution, is amongst the largest and most diverse families of flowering plants, with 28,484 accepted species spanning 800 genera (Govaerts *et al*., 2017). In India, the family is represented by a total strength of about 1,256 species in 155 genera (Singh *et al.,* 2019), distributed mainly in Eastern Himalayas, the Western Ghats, and Western Himalayas (Barua *et al.,* 2019; Devi *et al.,* 2018; Kumar *et al.,* 2019; Prakash and Pathak, 2019). According to IUCN Action Plan (1999), orchids are identified as amongst the world's most diverse and widely distributed plants (cf. Sibin *et al.,* 2014). They show a wide range of habits and prefer specific macroclimatic for their growth and development. These plants stand distinct from other plants in having intricately fabricated and colourful flowers; microscopic seeds with highly reduced embryos and suppressed development of endosperm; and dependence on a fungal infection for germination and growth in nature (Manoharachary, 2019). Besides ornamental importance, many orchids also show effective medicinal properties (Kumar *et al.,* 2019; Pathak *et al*., 2010; Prakash *et al*., 2018). Due to high demand and anthropogenic pressures on these medicinally and floricultural important orchids, their number in natural populations are decreasing in many parts of the world. The entire family is now included in Appendix-II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2017).

The Indian Himalayan Region (IHR) is one of the mega-diverse regions of India and supports about 8,000 flowering plants species (Samant *et al*., 1998). The diversity of orchids decreases from NorthEast to NorthWest Himalayas because of their unique habitats, large altitudinal range, and diverse weather conditions (Barman *et al.,* 2016; Deva and Naithani, 1986; Kumar *et al*., 2017; Marpa and Samant, 2012; Pangtey and Samant, 1991; Samant, 2002, 2009; Samant *et al.,* 1995). Like other parts of IHR, Himachal Pradesh also supports unique orchid diversity. The state is a repository of medicinal and aromatic plants. It is a mountainous Indian state with the vast geographical expense (55,672 km^2) and remarkable altitudinal variation (350-7000 m amsl). It is located in NorthWestern part (30° 22' to 33° 12' N latitude, 75° 47' to 79° 04' E longitude) of IHR. It supports supreme, natural, and socio-economically important orchids and with 85 species, orchids represent an important component of the state Flora (Vij *et al.,* 2013). Many of these are quite popular because of their strikingly beautiful flowers and/or curative properties. Floristic studies on orchids of Himachal Pradesh have also been made by some workers (Chowdhery and Wadhwa, 1984; Collett, 1902; Dhaliwal and Sharma, 1999, Kaur and Sharma, 2004; Rana *et al.,* 2008; Sharma, 2008; Sharma,

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2013; Singh and Rawat, 2000; Singh and Sharma, 2006). Presently an attempt was made to i) assess the orchid diversity in Triund hill and Kareri Lake (Kangra); ii) analyse their status and threat categories; and iii) assess their indigenous uses and conservation status.

Material and Methods

Study Site

Sprawling seamlessly across the lap of the Dhauladhar ranges in Himachal Pradesh, Triund stands at a height of 2,827 m, also known as the *crown jewel* of Dharamshala. The reason it's called Triund is because of the 3 mountains that a person can see from that point; *Tri* means three and *Und* means Mountains. These 3 mountains are usually snow-capped throughout the year. It has steep and slippery terrain, with verdant oak and deodar trees towering over and around with moist and shady areas along the way favourable for orchid growth. The climate and geography of the Kareri lake track, however, provide an inhabitable environment for orchids. Kareri Lake is a high altitude, shallow, freshwater lake, South of the Dhauladhar range, approximately 9 km NorthWest of Dharamshala in Kangra district, Himachal Pradesh. It lies at an altitude of 2934 m amsl. These regions are extensively explored for locating the diversity of orchids (Fig. 1).

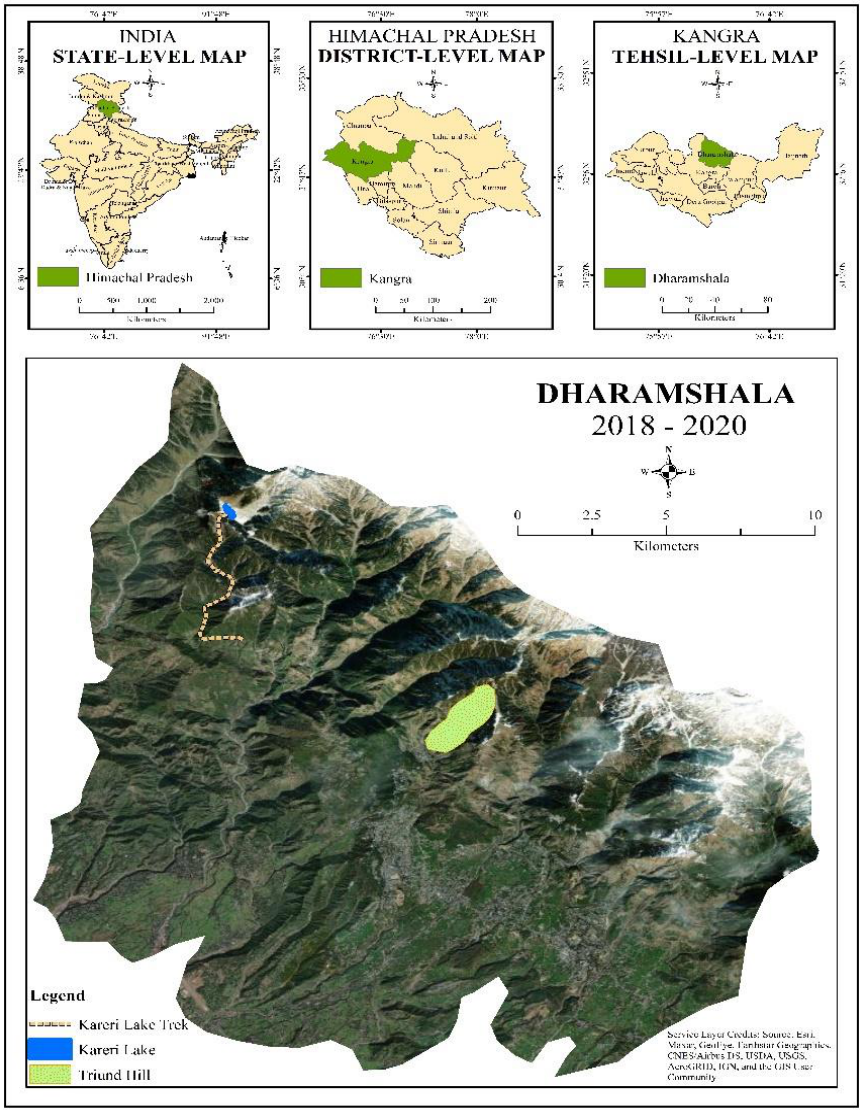

Fig. 1. Map showing the study area.

Field Surveys and Data Collection

Extensive surveys were conducted in the Triund Hill and Kareri Lake region of district Kangra for orchid diversity from June to September (2018-2020). For each species encountered, field notes (date, locality, habitat preferences, associated vegetation and brief identification features) were recorded. The species were identified by using floras and literature (Aswal and Mehrotra, 1994; Chowdhery and Wadhwa, 1984; Collett, 1902; Deva and Naithani, 1986; Dhaliwal and Sharma, 1999; Duthie, 1906; Pangtey *et al.,* 1991; Singh and Rawat, 2000; Vij *et al*., 2013). The species were also photographed in their natural habitats. The uprooting of the plants was avoided as the population density was already low.

Results

Diversity and Distribution Patterns

A total of 10 orchid species under nine genera (*Crepidium, Dienia*, *Epipactis, Goodyera, Habenaria, Herminium, Platanthera, Satyrium*, *Spiranthes)* belonging to sub-families Orchidoideae and Epidendroideae were presently recorded from the study area. These orchid species were found in diverse habitats *i.e.,* shady moist forest, riverine, roadside slopes, grassland and rocky habitats. Of these orchid species, 6 species were recorded in 1000-1500 m, 10 species in 1501-3000 m, and 1 species in >3000 m altitudinal zones (Fig. 2). Amongst these, *Crepidium acuminatum* and *Habenaria intermedia* were observed to be the most abundantly distributed in Triund Hill and Kareri lake track respectively.

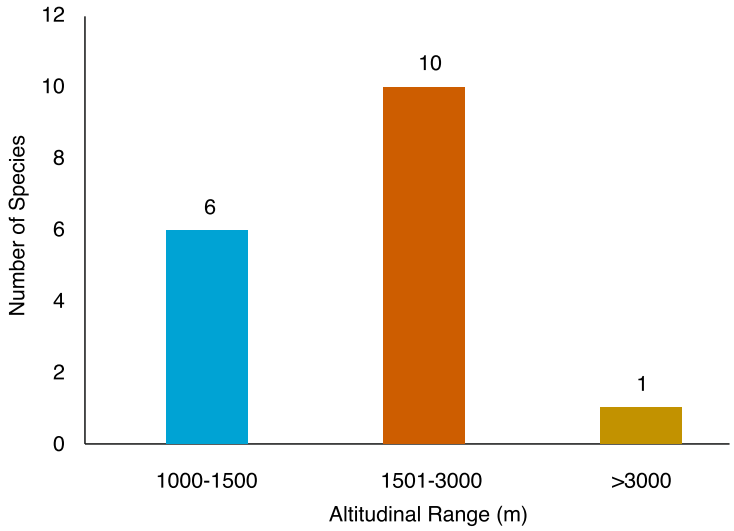

Fig. 2. Altitudinal distribution of orchids in Himachal Pradesh.

Threat Categorization

Amongst the orchid species, 3 species namely, *Crepidium acuminatum, Dienia cylindrostachya,* and *Satyrium nepalense* were categorized as Near Threatened; 4 species namely *Epipactis helleborine, Goodyera repens, Platanthera latilabris,* and *Spiranthes sinensis* were considered as Least Concern; 2 species *Habenaria intermedia* and *Herminium lanceum* were considered as Endangered; and 1 species namely *Habenaria edgeworthii* was considered as Vulnerable (Table 1; Fig. 3).

Indigenous Uses and Traditional Practices

All the orchid species studied in the present paper were adapted to terrestrial habitat. The whole plant or different plant parts namely, leaves, pseudobulbs, rhizomes, roots, tubers of different orchid plants were used by the inhabitants for various therapeutic uses (Fig. 4.). The tubers of *Habenaria intermedia* (Ridhi) and *Platanthera edgeworthi* (Vridhi) were well known to purify the blood and cure blood diseases. *Crepidium acuminatum* (Jeevak) was considered a key Ashtavarga plant and used to cure rheumatism and as an aphrodisiac. Likewise, other species were used for curing various ailments such as fever, diarrhoea, dysentery, malaria, eczema, sores, haemorrhage, male sterility, cold, cuts, wounds, asthma, leprosy, insect and snake bite, swelling and pain *etc.* and also used as expectorant, rejuvenator, and tonic (Table 1; Fig. 4).

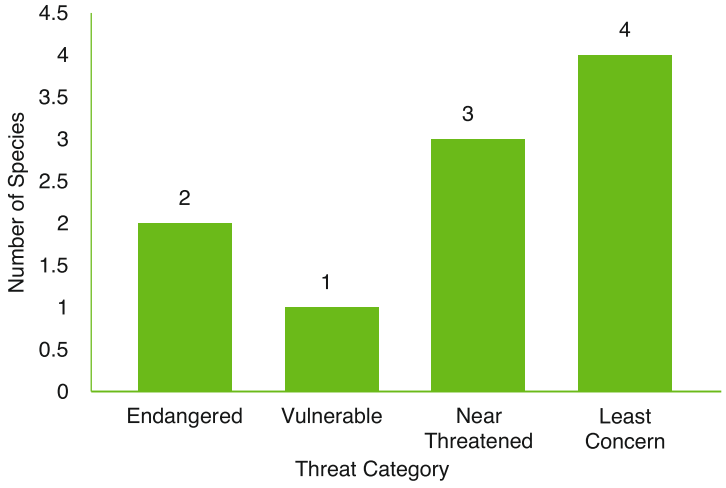

Fig. 3. Threat categories of orchid species studied.

Morphological Description

The morphological description of presently studied orchid species is as follows:

Crepidium acuminatum (D.Don) Szlach.

Plant terrestrial or lithophytic. *Pseudobulb* ovoid or oblong, tufted, 2.5-5 × 1-2 cm. *Stem* 12-25 cm long, base covered with few sheaths. *Leaves* 3-4, ovate, acute with undulated margin, sheathing leaf base in lower one, 7-13 × 4-6 cm,. *Inflorescence* terminal raceme, 6-10 cm, lax with many flowers. *Flowers* small, yellowish green with purple tinge at centre. *Sepals* sub-equal; lateral sepal broader obtuse; dorsal sepal shorter than lateral, sub-acute. *Petals* equal or longer than sepals, linear, 3 nerved, recurved, obtuse. *Labellum* narrowly ovate or triangular, tip 2 lobed, auricles widely separated or slightly overlapping. *Column* small, *ca* 2 mm. *Pollinia* 4, obovoid. *Fruit* capsule, fusiform.

Etymology

The epithet *acuminatum* (Latin: narrowed at both ends) refers to the leaf character of the species.

Distribution

India (Himachal Pradesh to Arunachal Pradesh, Meghalaya, Assam, Nagaland, Manipur, Mizorum, Tripura, Madhya Pradesh), Nepal, Bhutan, Myanmar, China, Thailand.

Flowering

July-August

Fruiting

August-September

Table 1. Distribution, nativity, flowering period, threat status, and plant part used (medicinal purpose) and indigenous uses of orchids in Kareri lake and Triund hill.

Species	Common name	Distribution		Nativity	Flowering	Threat status	Part used	Indigenous uses
		Altitudinal range (m) amsl	Frequency					
Crepidium acuminatum (D.Don) Szlach.	Jeevak	1200-2000	Common	Himalayan Region	June-September	NT	Pb	In Ashtavarga it is used in Chyawanprash; and to cure blood disorders, burning sensation in the body, male sterility, fever, dysentery, external and internal haemorrhage, and general weakness. It is also used as an aphrodisiac, against insect bites, and rheumatism
Dienia cylindrostachya Lindl.	Adder Mouth Orchid	2200-3500	Not Common	Pakistan to Tibet and Myanmar	July-August	NT	Pb	Used as a tonic. Decoction of tuber used to strengthen kidneys
Epipactis helleborine (L.) Crantz	Broad-leaved helleborine	2000-2800	Common	Eurasia	July-August	LC	Rh, Lf	Used for curing fever, blood purification, and as an aphrodisiac
Goodyera repens (L.) R.Br.	Creeping lady's-tresses	2800-3000	Common	North America and Eurasia	August-October	LC	WP	Paste is externally applied in syphilis; the extract is taken as a blood purifier
Habenaria intermedia D. Don	Riddhi	1500-2800	Common	Himalayan Region	July-August	EN	Tb, Rt, Lf	Used as tonic, expectorant, rejuvenator, for curing fever, skin disease, and blood disorder, asthma, leprosy
Platanthera latilabris Lindl.	Bog Orchid	1500-3000	Not Common	Himalayan Region	July-August	LC	Tb, Rt, Lf	Used in herbal medicine
P. edgeworthii (Hook.f. ex Collett)	Vriddhi	1500-3000	Common	Himalayan Region	July-September	V	Rt, Lf	A decoction is used as a blood purifier, rejuvenator cooling, and spermopiotic
Herminium lanceum (Thumb. ex Sw.) Vuijk	Jalya	1200-3000	Common	Himalayan Region	July-October	EN	WP	To treat cold and fever, rheumatism, typhoid fever, hernia, sores, eczema, snake bites, and for reducing swelling and pain. The extract of the plant is also given to cure suppressed urination
Spiranthes sinensis (Pers.) Ames	Chinese spiranthes	1500-2500	Not Common	Asia and Australia	May-September	LC	Tb	Decoction of the plant given in intermittent fever; tubers used as a tonic. Paste of roots and stem is applied in sores
Satyrium nepalense D.Don	Salam misri	1600-2500	Common		July-August	NT	Tb	Used as a tonic, and to cure diarrhoea, dysentery, and malarial fever. Fresh tubers are cooked and consumed, dried ones sold as-salam misri and regarded as tonic, juice of leaf used to cure fever, cuts, and wounds. Fresh tuber is considered as an aphrodisiac. Tuber extract shows potent antibacterial activity against four bacterial strains *i.e., Streptococcus mutans, Pseudomonas aeruginosa, Staphylococcus aureus,* and *Klebsiella pneumonia*

EN, Endangered; NT, Near Threatened; LC, Least Concern; V, Vulnerable; Tb, Tuber; Pb, Pseudobulb; Rh, Rhizome; Wp, Whole Plant; Lf, Leaf; Rt, Root; T, Terrestrial

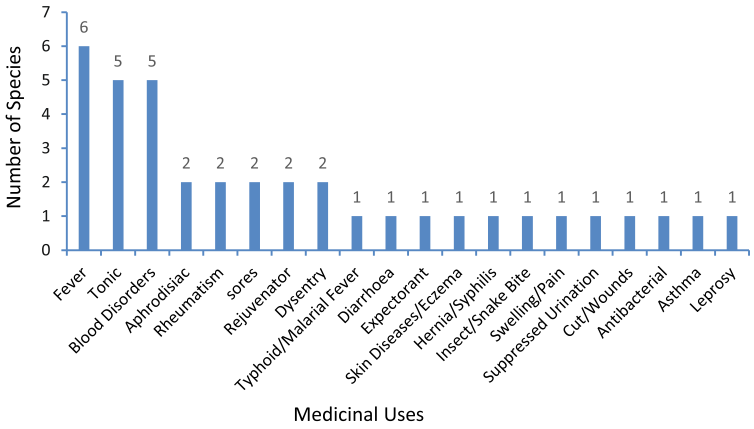

Fig. 4. Medicinal uses of presently studied orchids.

Habitat Ecology

Crepidium acuminatum found in moist, shady, and humus rich soils and was observed to grow in groups of 5-15 plants on the semi exposed forest borders and road side situations. Grasses, ferns, members of Asteraceae *etc.* are its common co-habitants. Amongst orchids, *Herminium lanceum* was found to be associated with this species.

Dienia cylindrostachya Lindl.

Plant erect, sympodial terrestrial herb, up to 28-37 cm tall. *Pseudobulbs* geophytic, conical, 1-1.2 cm in diameter enclosed in white membranous sheaths. *Stem* arising from base of pseudobulb, sheathed, 3-10 cm. *Leaf* solitary, simple with entire margin, amplexicaul, 10.2 × 3.8 cm, narrowly to broadly elliptic with parallel venation, acute apex and sheathing base. *Inflorescence* raceme 12.8 cm with 60-65 flowers. *Flowers* zygomorphic, pedicellate, bracteate, non-resupinate up to 4 mm long, green to yellowish-green in colour. *Floral Bract* lanceolate, 1.5 × 0.5 mm; dorsal sepal, ovate-lanceolate, 2.5-2.8 × 0.9-1.4 mm, entire margins, acuminate apex; lateral sepals, linear-lanceolate, 1.5-2.5 × 0.9-1.4 mm with acuminate apex. *Petals* filiform - linear or linear-lanceolate, 1.8-2.2 × 0.3-0.4 mm with rounded apex. *Lip* ovate 2.2 × 1.8 mm, slightly concave with acuminate apex. *Pollinia* 2, yellow. *Column* samall *ca* 1 mm. *Fruit* Capsules erect, ellipsoid, 3-5 × 3 mm with persistent calyx.

Etymology

The epithet *cylindrostachya* (Latin: with a cylindric spike) refers to the cylindrical inflorescence of the species.

Distribution

India (Himachal Pradesh, Jammu and Kashmir to Arunachal Pradesh), Nepal, Bhutan, China, Myanmar.

Flowering

June- July

Fruiting

July - August

Habitat Ecology

Grows in temperate to subarctic climates. Grasses, ferns, and other herbs comprise the associated vegetation. *Habenaria intermedia* was the other orchid species in its vicinity.

Epipactis helleborine (L.) Crantz

Plant terrestrial. *Rhizome* fleshy. *Stem* erect, leafy 25-45 cm tall. *Leaves* 4-8, ovate or lanceolate, acute apex 4-18 × 2-8.5 cm. *Inflorescence* raceme, lax to moderately dense, 7-16 cm long. *Floral bracts* spreading, linear to narrowly lanceolate often exceeding flowers. *Flowers* 15-40, small. *Sepals* greenish, often suffused with purple; lateral sepals 8-12 × 5-6 mm, apex oblique. *Petals* ovate, pale green, pink, purple, or yellowish, 9-11 × 4-6 mm. *Lip* indistinctly veined, constricted at middle into 2 parts, proximal part purplish to brownish, deeply concave, not papillose, 9-12 × 8 mm, distal part recurved, pink, broadly triangular-ovate, 5 × 5 mm. *Column* 3-6 mm. *Ovary* glabrous. *Capsules* obovoid, 9-14 mm.

Etymology

The epithet *helleborine* (Latin: like a Helleborine) refers to the leaves of the species resembling those helleborine.

Distribution

India (Himachal Pradesh, Jammu and Kashmir to Arunachal Pradesh) Nepal, Bhutan, Afganistan, Pakistan, Europe, Iraq, North Africa, Hong Kong, Japan, Myanmar.

Flowering

June-July

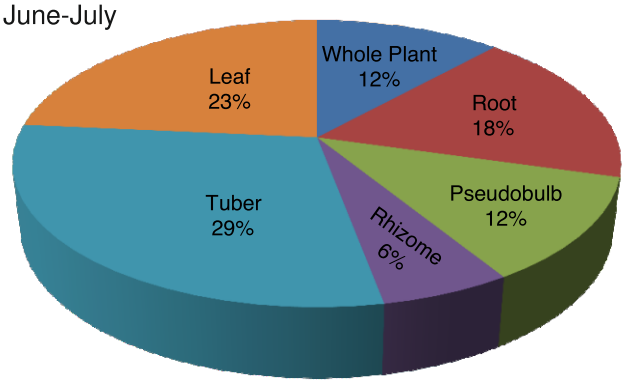

Fig. 5. Plant parts used for their medicinal properties.

Fig. 6. A-J. Orchid species reported at Triund Hill and Kareri Lake Track: A, *Crepidium acuminatum;* B, *Dienia cylindrostachya*; C, *Epipactis helleborine*; D, *Goodyera repens*; E, *Habenaria intermedia*; F, *Herminium lanceum*; G, *Platanthera edgeworthii*; H, *P. latilabris*; I, *Spiranthes sinensis*; J, *Satyrium nepalense.*

Fruiting

July-August

Habitat Ecology

Grows in open or partially shady floor of forest and generally grow individually. Grasses and ferns comprise the associated vegetation. Several orchids like *Platanthera edgeworthii* and *Spiranthes sinensis* occasionally grow in its vicinity.

Goodyera repens(L.) R.Br.

Plant terrestrial. *Rhizome* creeping, slender, stoloniferous. Stem erect, stout, glabrous, bracteate, 10-23 cm. *Roots* long, cord like. *Leaves* spread out in a circle at the base, ovate to ovate-elliptic, sub-acute, dark green with white venation, 1.5-2.4 cm long; petiole sheathing in lower half, more or less 1 cm long. *Inflorescence* a receme, 2.5-5 cm long; narrowly cylindric, sub-secund, with dense flowering, *rachis* pubescent. *Flowers* 3.5 mm across, white small pedicel. *Bracts* linear-lanceolate, acuminate. *Sepals* ovate, acute, glandular pubescent or glabrous outside. *Petals* nearly equal to sepals but narrower, apex acute, adhering on the inner margins of dorsal sepal. *Lip* as long as sepal, saccate at the base, apical lobe short, ovate, subacute, concave, the edges somewhat undulate, sac smooth inside.

Column short, without appendages. *Pollinia* 2, yellow, clavate, sessile.

Etymology

The specific epithet *repens* refers to creeping habit.

Distribution

India (Himachal Pradesh, Jammu and Kashmir to Arunachal Pradesh, Assam), Pakistan, Myanmar, China, Japan, Korea, Russia, Europe, North America.

Flowering

June-August

Fruiting

July-August

Habitat Ecology

It is a green underground creeper grows on moist, shady forest floors or somewhat exposed areas in temeperate and arctic climates. *Cedrus deodara, Rhododendron arboretum, etc.* are associated trees in its habitats. *Crepidium acuminatum, Dienia cylindrostachya, Platanthera edgeworthii etc.* were some orchids sharing same habitat.

Habenaria intermedia D.Don

Terrestrial, 25-70 cm in height. *Tuberoids* small, fleshy. *Stem* terete, based covered with 2-3 loose sheath. *Leaves* 3-5, alternate, ovate-oblong, 6-13 × 3-4.5 cm. *Inflorescence* raceme, stout, lax with 3-6 flowers. *Floral Bracts* leaf like, lanceolate, shorter than or equal to or longer than ovary, acuminate, 5-6 × 1.5-2. *Flowers* white od greenish white. *Sepals* persistant; the dorsal smaller but broader than the laterals, ovate lanceolate, acute, forming hood with petals, 2-2.5 × 1 cm, apex recurved; laterals spreading, lanceolate, acuminate, tips reflexed. *Petals* white, obtuse. *Labellum* green, except the longer white claw, 3-lobed, 3-4 cm, mid lobe linear, side lobes deeply pectinate. *Spur* longer than ovary, tapering toward apex, 4-6 cm, more or less curved. *Column* short with foot. *Pollinia* 2, granular, with slender caudicles as long as pollina, viscidium minute. *Fruit* capsule, fusiform, beaked.

Etymology

The specific epithet denotes the intermediate nature of species between *Habenaria gigantea* and *Habenaria pectinata.*

Distribution

India (Himachal Pradesh to Sikkim, Meghalaya), Pakistan, Nepal, Tibet.

Flowering

July-August

Fruiting

August-September

Habitat Ecology

Habenaria edgeworthii grows in the temperate regions and common under shady moist area to somewhat exposed regions. The species was found to grow alone or in small groups of 3-5 plants on exposed grassy slopes and road embankments. It shares the habitat with grasses and ferns. Amongst orchids, *Epipactis helleborine, Platanthera edgeworthii, P. latilabris,* and *Satyrium nepalense* were found growing in its vicinity.

Herminium lanceum(Thunb. ex Sw.) Vuijk

Plant terrestrial, 20-40 cm tall. *Tubers* oblong or ellipsoid, 1-3 × 1-2.5 cm. *Stem* slender, 18-40 cm long, based covered with tubular sheaths. *Leaves* usually 3, rarely 2, drooping, linear-lanceolate, 9-25 × 0.7-1 cm, apex acuminate. *Inflorescence* spike, 8-20 cm long, cylindrical, dense with many flowers. *Floral Bracts* linear-lanceolate, ovary shorter than or nearly as long as bracts. *Flower* 50-60 or more, green. *Sepals* sub-equal, ovate oblong, 3-4 × 1.2-1.5 mm, apex obtuse; the dorsal sepal and petal adhering to form a hood lateral pair spreading. *Petals* narrowly oblong or lanceolate, mainly 1-nerved, 3-3.5 × 0.6-0.8 mm, contracted at base. *Lip* often pendulous, oblong, 3-5 × 1 mm, base dilated, deeply 3- lobed, disk ridged, mid lobe 0.5 mm, lateral lobe linear 2-5 mm. *Column* 0.6-0.8 mm. *Pollinia* 2, globose, pyriform, viscidium minute.

Etymology

The epithet *lanceum* (Latin: lanceolate) is in reference to lanceolate leaves.

Distribution

India (Himachal Pradesh, Jammu and Kashmir to Arunachal Pradesh, Assam, Meghalaya, Manipur, Nagaland, Mizorum, Tripura), Nepal, Bhutan, Myanmar, China, Taiwan, Korea, Thailand, Phillipines, Vietnam, Malaysia, Japan.

Flowering

July-August

Fruiting

August-September

Habitat Ecology

Herminium lanceum grows in the sub-tropical to temperate regions. It was found to grow alone or in small groups of 2-3 plants under shady conditions but sometimes it is also available in open grasslands. It shares the habitat with grasses, mosses, and other herbaceous plants. Amongst orchids, *Epipactis helleborine, Platanthera edgeworthii, Crepidium acuminatum,* and *Satyrium nepalense* were found to grow in the vicinity.

Platanthera edgeworthii (Hook.f. ex Collett) R.K. Gupta

Terrestrial, 27-50 cm in height. *Tuberoids* small, fleshy oblong or sub-globose, 1.5-3 × 1-2.5 cm. *Stem* erect, base covered with loose sheath, 18- 45 cm long. *Leaves* 3-5, alternate, ovate or oblong-lanceolate, acute or acuminate, 4-10 × 2-4 cm. *Inflorescence* spike, 8-20 cm long, dense with many flowers. *Floral Bracts* lanceolate, acuminate 7.5-9 × 3-4 mm. *Flowers* yellow green, 1-1.5 cm. *Sepals* green, unequal, pubescent; the dorsal small, broadly ovate or sub orbicular, forming hood with petals, 3-4 × 3.5 mm; the laterals larger, deflexed, obliquely ovate, 5-6 × 3-4 mm. *Petals* yellow, 4-5 × 3 mm. *Labellum* yellow, entire, longer than sepal 5-6 mm long. *Spur* longer than ovary 1.2-1.5 cm long curved upwards with tip curved down. *Column* short without, 2-4 mm. *Pollinia* 2, pyriform, curved caudicles, viscidium minute. *Fruit* capsule, fusiform, beaked.

Etymology

This species commemorates Michael Pakanham Edgeworth (1812-1881), a British Civil Servant and Botanist in India. He contributed several family treatments for J.D. Hooker's Flora of British India. The genus name Edgeworthia Meissner (Thymelaeaceae) also commemorates this botanists. As many as 35 species of plants are also named after Edgeworth.

Distribution

India (Himachal Pradesh, Jammu and Kashmir, Uttrakhand), Pakistan, Nepal.

Flowering

July-August

Fruiting

August-September

Habitat Ecology

Platanthera edgeworthii grows in the temperate regions and was common under shady moist area to somewhat exposed regions. The species was found to grow alone or in small groups of 3-5 plants on exposed grassy slopes and road embankments. It shares the habitat with grasses and ferns. Amongst orchids, *Epipactis helleborine, Habenaria intermedia, Platanthera latilabris,* and *Satyrium nepalense* were found growing in its vicinity.

Platanthera latilabris Lindl.

Plant terrestrial, upto 40 cm in height. *Tubers* conical, fusiform, 1.5-2.5 × 1-1.5 cm. *Stem* stout, base covered with loose sheaths. *Leaves* 3-4, spreading, alternate, elliptic to oblong, acuminate, 5-10 × 2-3 cm. *Inflorescence* spike with laxly arranged flowers. *Floral bracts* lanceolate, longer than the ovary, acuminate. *Flowers* green in colour. *Sepals* subequal, green, 3-5 nerved; dorsal sepal concave, erect, broadly ovate, smaller than the laterals, 3-4 × 4-5 mm; lateral sepals somewhat larger, oblong, 5-6mm long, reflexed. *Petals* green, 5-6 mm long, apically curved inwards forming a hood with dorsal sepal. *Labellum* entire, linear, 7-9 mm long, strapshaped, margin inrolled, gradually narrowing towards the apex. *Spur* longer than ovary, turned downwards or sideways, never turned upwards. *Column* short, footless. *Pollinia* 2, pyriform *ca* 1 mm, granular, viscidium minute. *Fruit* capsule, fusiform, shortly beaked, curved.

Etymology

The epithet *latilabris* (Latin: broad lips) refers to widely spreading lip.

Distribution

India (Himachal Pradesh, Jammu and Kashmir to Arunachal Pradesh, Madhya Pradesh), Pakistan, Nepal, Tibet.

Flowering

July-August

Fruiting

August-October

Habitat Ecology

This species grows in the temperate regions. This species grows alone or in small groups of 2-3 plants on exposed grassy slopes and road embankments. It shares the habitat with grasses, mosses and other herbaceous plants. Amongst orchids, *Epipactis helleborine, Habenaria intermedia, Platanthera edgeworthii,* and *Satyrium nepalense* were found to grow in the vicinity.

Satyrium nepalense D.Don

Robust, terrestrial herb, 30-80 cm tall. *Tuberoids* ovoid-oblong. *Stem* leafy below, densely covered with sheaths above, glabrous. *Leaves* 2, rarely 4, oblong or ovate lanceolate, 5-20 × l-8 cm, acute, sheathed at base. *Inflorescence* spike, densely flowered, 6-15 cm long . *Floral Bracts* oblong-lanceolate, longer than ovary, acuminate apex. *Flowers* small, rose-pink, occasionally pure white, musk-scented. *Sepal* sub-equal in length; dorsal sepal linear-oblong; lateral sepals obliquely-oblong. *Petals* linear, twisted at the mouth of the lip. *Labellum* broad, oblong, erect, hooded, upto 8 mm long, 10 mm broad, with 2 parallel spurs at base, tapering into a fine point, variable and sometimes unequal in length, 10-15 mm long. *Column* slightly curved. *Pollinia* 2, pyriform. *Fruit* capsule, fusiform, *ca.* 10 × 5 mm.

Etymology

The specific epithet nepalense (Latin: from Nepal) refers to the type locality/country where it is first located.

Distribution

India (Jammu and Kashmir to Arunachal Pradesh, Nagaland, Manipur, Meghalaya, South India), Pakistan, Nepal, Bhutan, Tibet, Myanmar, Sri Lanka. This species is abundant throughout Western Himalaya.

Flowering

August-September

Fruiting

September-October

Habitat Ecology

Satyrium nepalense predominantly grow of the open grassy slopes singly or in groups of 4-6. Grasses, ferns, *Rumex* sp. *etc*. represented associated vegetation. Amongst orchids, *Habenaria intermedia*, *Platanthera edgeworthii,* and *Herminium lanceum* were found to grow in the vicinity.

Spiranthes sinensis (Pers.) Ames

Plant terrestrial. *Stem* erect, slender 15-30 cm tall. *Leaves* 2-5, erect, alternate and spreading, broadly linear to broadly linear-lanceolate, rarely narrowly oblong, 3-10 × 0.5-1 cm, apex acute or acuminate, with an indistinct petiole-like base. *Inflorescence* erect, 10-25 cm, glabrous with many spirally arranged flowers. *Floral Bracts* ovate-lanceolate, apex acuminate. *Flowers* purplish red or pink; pedicel, glabrous. *Sepal* sub-equal, lanceolate, acute; dorsal sepal forming a hood with petals, narrowly oblong, *ca*. 4 × 1.5 mm, glabrous, apex subacute; lateral sepals lanceolate, slightly oblique, *ca*. 5 × 2 mm. *Petals* rhombic-oblong, oblique, *ca*. as long as dorsal sepal, thinly textured, ligulate, apex obtuse. *Lip* obovate, margin crisped, apical portion rose purple, somewhat constricted in the middle, basal whitish, base biglandular near the column. *Column* erect, *ca*. 2 mm. *Pollinia* 4, in 2 pair, clavate, soft-granular. *Fruit* capsule, fusiform.

Etymology

The epithet *sinensis* (Latin: Chinese) refers to the Chinese origin of discovery of the species.

Distribution

India (Himachal Pradesh, Jammu and Kashmir to Arunachal Pradesh, Odisha) Afghanistan, Pakistan, Nepal, Bhutan, Myanmar, Sri Lanka, Maylasia, Vietnam, Philipines, China, Japan, Australia, New Zealand, Mongolia, Siberia.

Flowering

July-August

Fruiting

August-September

Habitat Ecology

Grows in temperate climate as individual or in groups of 4-8 in shaded moist forest floors amongst tall grasses. Grasses and ferns comprised the associated vegetation. *Epipactis helleborine, Platanthera edgeworthii etc.* were other orchid species in vicinity.

Conclusion

The NorthWestern Himalayas are mostly known for terrestrial orchids (Vij *et al.,* 2013). These orchids are the most threatened species amongst the flowering plants as they demand specific habitat and circumstances in order to grow and thrive. These plants are also declining at an alarming rate due to their high importance for various reasons; habitat loss due to anthroprogenic activities such as grazing of cattles, building of roads, *etc.* and natural calamities; high medicinal value because of the presence of number of phytochemicals makes them a target of drug industries which is also one of the reasons for their over-exploitation and illegal trade; resulting in disappearance of some orchids completely from certain regions where they use to thrive earlier and some are at rare and endangered levels. Therefore, periodical monitoring of habitats using standard ecological methods is essential. The state of Himachal Pradesh covers the parts of Trans

and NorthWestern Himalayan biogeographic provinces. It supports relatively low number of orchids in comparison to Central, Eastern, and Western Himalayas (Deva and Naithani, 1986; Devi *et al*., 2018). It represents about 84 species of orchids (Jalal and Jayanthi, 2015). In different parts of the state, these plants are used for treating various kind of ailments. The plant parts such as tubers, bulbs, rhizomes, and aerial parts are being used in Traditional Medicine System for a long time now for their therapeutic properties.

Declining of natural populations of the presently studied orchid species is unfortunate. Much attention needs to be paid toward conserving these plants and protect them from further loss. Though some attempts have been made in conserving orchids of Himachal Pradesh using efficient *in vitro* mass propagation protocols (Bhattacharjee and Hossain, 2015; Bhatti *et al*., 2017; Decruse and Gangaprasad, 2018; Kaur *et al*., 2017; Pathak *et al*., 1992), there is still a lot to explore and know about their nutritional requirements during *in vitro* cultures.

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