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Status, threats and conservation strategies for orchids of western Himalaya, India

Jeewan Singh Jalal

Botanical Survey of India, Western Regional Centre, 7 Koregaon Road, Pune, Maharashtra 411001, India
Email: jeewansinghjalal@rediffmail.com

Abstract: The present study is an attempt to give an account of the current status of orchids based on recent surveys since 2002 to 2010 in various parts of western Himalaya. Based on rarity Index of species, orchids are categorised in four groups,—very rare, sparse, occasional and common. Results show that 40% of orchid species are very rare, 26% are sparse, 19% are occasional and 15% are common in western Himalaya. For the conservation of orchids, two orchid conservation areas are identified in Gori Valley and Mandal Valley.

Keywords: Conservation, Gori Valley, Mandal Valley, orchids, Western Himalaya.

The International Union for Conservation of Nature (IUCN) has played a major role in focusing global concern on the loss or extinction of species and is now the accepted authority on such matters. The first Red Data Book was launched by IUCN in 1966. Now, it is revised annually and called the IUCN Red List, which is available in its electronic version since 2000. Threats to orchid species in the Indian region were first documented by Pradhan (1971, 1975a,b) and Pradhan (1975). Pradhan (1978) contributed the first red data sheet on Indian orchids to the IUCN Plant Red Data Book, which served as a model for the production of Red Data Book of Indian Plants. Nayar & Sastry (1987, 1988, 1990), listed 58 species threatened in India. It also included 13 orchid species of western Himalaya. In 1984, under the banner of IUCN, the Orchid Specialist Group (OSG) was established for orchid conservation. It has many regional groups; ISROSG—Indian Subcontinent Regional Orchid Specialist Group covers the Indian subcontinental region. In the international scenario, several treaties have been formulated for the protection of biodiversity as a whole, which encompasses the protection of wild orchids also. The Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), ratified by India, places all species of Orchidaceae under Appendix II, meaning thereby that their trade will be only through export permits.

Orchids are one such group of plants which grow in a variety of habitats throughout the globe, but they are very sensitive to habitat change. A number of species are rare and threatened throughout the world, including western Himalaya, owing to habitat degradation and fragmentation as a result of various anthropogenic influences such as land development activities, building of dams, constructions of roads, commercial exploitation of the species, overgrazing and frequent forest fires. Some orchid species require unique habitat and microhabitats so they are confined to particular elevations and forest types. Some are naturally rare; others are so because of geographic distribution, narrow habitat requirements, and low-density populations. Several species that have been reported earlier from the region have not been recollected, thus indicating their possible disappearance due to habitat changes. As most of the orchids are insect pollinated, the depletion in the population of insect pollinators may also lead to the depletion in the population of particular orchid species. The present

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study is an attempt to give an account of the present status of orchids based on recent surveys.

Material and Methods

Study area: The study was conducted in western Himalaya of India that lies between 28°45'– 36°20'N & 73°26'–80°24'E (Image 1). The landmass encompasses three states viz., Uttarakhand (UK), Himachal Pradesh (HP) and Jammu & Kashmir (JK), occupies roughly 331,402km² area, which is approximately 10.08% of India's total geographic area. Altitude varies from 300–7800 m.

Data collection: Data was collected from three different sources:

(i) Herbaria: The Botanical Survey of India, Northern Circle (BSD), Forest Research Institute (DD), Wildlife Institute of India (WII), Kumaun University Nainital (NTL), H.N.B Garhwal University, Srinagar (GUH) and Punjab University Herbarium (PAN) were visited and data on habitat, locality, altitude and flowering were gathered. Based on this information past localities from where the species were collected were also visited, to know the present status and changes in population-size.

(ii) Review of literature: Significant literature, namely, Collett (1902), Duthie (1906), Raizada et al. (1981), Vij et al. (1982, 1983), Chowdhery & Wadhwa (1984), Deva & Naithani (1986), Pangtey et al. (1991)

Image 1. Map of western Himalaya

and various research papers published in national and international journals were used.

(iii) Field survey: Extensive field surveys conducted from 2002 to 2010 in different seasons and various localities covering altitudes from 300–4800 m. Various parameters such as habit, altitude, forest types and associate species were recorded. The elevation zone was divided into nine 500m intervals between 300m and 4800m (the higher limit of the orchids in western Himalaya is 4800m), with the starting zone <500m and the final >4000m. Eighteen habitat types were identified for orchids, based on species presence in each habitat.

No assessment has been done for the conservation status of orchids in the past for this region hence assigning IUCN categories is somewhat impractical here. In most of the cases, information is missing even when they were not collected for more than 100 years. These species were kept in doubtful categories and are not included in the analysis (Table 1).

Data analysis: A formula was developed for convenience to assign a status at local level to each species. Six quantification parameters were taken for assessing orchids (Table 2). For getting the rarity value (R) (on the scale of rarity index; 1–5), the sum of all six parameters were divided by six. The species with the least number were ranked rarer in comparison with those with greater values. All the data were entered in an Excel spreadsheet and summarized using descriptive statistics.

$$R = \frac{h^1+s^1+a^1+wh^1+p^1+p^2}{6}$$

where h^1—number of habitats, s^1—number of sites, a^1—altitudinal distribution, wh^1—distribution in western Himalaya, p^1—phytogeographical distribution within the Indian subcontinent, p^2—phytogeographical distribution globally.

Rarity ranking (very rare: 1–2, sparse: 2.1–3, occasional: 3.1–4, common: 4.1–5).

Table 1. List of doubtful species

Sno	Species
1	*Anoectochilus roxburghii*
2	*Aphyllorchis gollani*
3	*Arundina graminifolia*
4	*Calanthe alismifolia*
5	*Calanthe brevicornu*
6	*Chiloschista usneoides*
7	*Coelogyne flaccida*
8	*Coelogyne nitida*
9	*Cymbidium eburneum*
10	*Cymbidium longifolium*
11	*Dendrobium moschatum*
12	*Dendrobium transparens*
13	*Diphylax urceolata*
14	*Eulophia mackinnonii*
15	*Eulophia obtusa*
16	*Gastrochilus garhwalensis*
17	*Geodorum densiflorum*
18	*Habenaria longifolia*
19	*Liparis cordifolia*
20	*Liparis nervosa*
21	*Oberonia iridifolia*
22	*Spiranthes spiralis*

Results and Discussion

Status of orchids: It is very difficult to make an accurate account of orchid species of western Himalaya, with its vast size, remoteness and varied topographic conditions. The study reveals that 40% (88) of orchid species are very rare, 26% are sparse, 19% are occasional and 15% are common in western Himalaya (Fig. 1; Appendix 1).

Threats to orchids: Orchids are a highly specialized group of plants and have modified themselves in such a way that they occur in almost every ecosystem. They have a peculiar habit of interdependence on mycorrhiza for germination and nutrition. Any imbalance in the habitat can cease the regeneration and growth of orchids. Thus, they are more vulnerable to the destruction of habitat. Orchids are usually threatened due to habitat loss, degradation and fragmentation. These can be caused by natural threats, anthropogenic pressures and threats posed by invasive species.

1. Natural threats: Due to the undulating topography and the varying geological set up of western Himalaya, several areas have been identified that are prone to landslides, floods etc., which affect the natural population of many terrestrial and epiphytic orchids leading to their extinction. Many host trees growing along the river banks at lower and mid altitudes are swept away by floods, thus removing several orchids. In many areas, landsides were seen to carry away the

Table 2. Quantification parameters of rarity for each orchid species

Sno	Parameters	Documentation	Scoring (Quantification)
1	Number of Habitats (h^1)	Number of habitats in which each orchid species were found was recorded.	1 to 18 habitats depending on how many habitats, a particular orchid occurred in.
2	Number of Sites (s^1)	Number of sites in which each orchid was found was recorded.	"1" for single site; "2" for <5 sites; "3" for <10 sites; "4"for <15 sites and "5" for >15 sites.
3	Altitudinal distribution (a^1)	<500m to >4000m (total 9 zones) depending on how many species occurred in a particular zone.	1 to 9 zones depending on how many zones a particular species was found in.
4	Distribution in western Himalaya (wh^1)	Divided in to 4 divisions 1. Srinagar valley, Leh, Kargil and Lahul & Spiti 2. Jammu and its adjoining districts and Himachal Pradesh (except Lahul & Spiti) 3. Garhwal division 4. Kumaun Division	1 to 4 divisions depending on the occurrence of species in a particular division.
5	Phytogeographical Distribution (p^1)	Indian sub-continents (Pakistan, Nepal, Bhutan, northeastern states, Sri Lanka, Bangladesh)	Depending on how many species are spread in a particular region.
6	Phytogeographical Distribution (p^2)	Europe, Sino-Japan, China, Indo-Malaya, Africa, Australia, North and South America	Depending on how many species are spread in a particular region.

hill-slopes with them during the rainy season. The terrestrial orchids carried down by landslides are dumped into soil, thus destroyed. The global climatic variation brings a lot of variation in the local climate. The local rainfall patterns are changing and most of the terrestrial orchids are affected by this change. They show active growth at the beginning of rainfall. If the rain is delayed, it hampers the life cycle of most of the rain dependent orchids like *Nervilia* spp. Most of the orchids are pollinated by insects, which may be specific for orchids. Lack of pollinators in nature can affect the survival of orchids.

2. Anthropogenic threats:

Habitat fragmentation: Habitat destruction is identified as the main threat to orchid diversity. It is often a cause of species becoming threatened. The main habitats for orchids are sal forests, riverine forests and oak forests in western Himalaya. Increasing demands of the local people and their dependency on the forests are identified as the main threats to the orchid habitats. Both terrestrial and epiphytic orchids are affected by habitat fragmentation. Many orchids, especially mycoheterotrophic orchids require dense forest cover. Little canopy exposure can wipe out the population. Epiphytic orchids are mainly inhabitants of the riverine forests. These forests provide a suitable climate and humidity for the growth of epiphytic orchids.

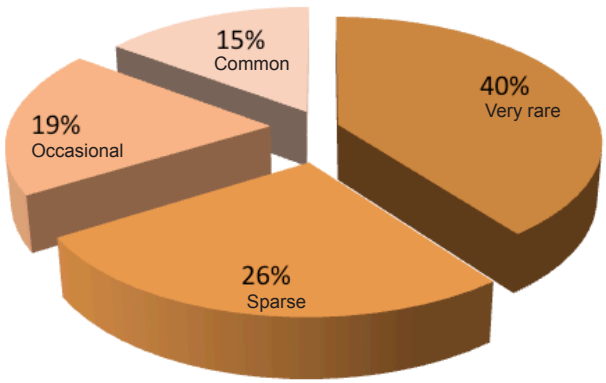

Figure 1. Status representations of orchids (n = 221 species)

Deforestation activities coupled with the lopping of host plants for fodder, fuel and timber causes the riverine forests to change rapidly. Lopping and cutting of the host trees for fodder and fuel are a regular phenomenon in the hills. Therefore, the occurrence and growth of most of the epiphytic orchids are adversely affected. Epiphytic orchids growing on fodder trees have been removed due to the excessive and unscientific ways of lopping. In western Himalaya, oak forests are predominant. Among the oaks, *Quercus leucotrichophora* has been identified as an excellent tree host particularly in many epiphytic orchid dominated areas and it supports fairly large numbers of orchid species. But this tree is a good source of fodder and fuel too. Branches along with leaves are lopped to a great extent making the trees almost naked. Therefore lopping of banj-oak and other fodder species that support a high number of

epiphytic orchids have reduced the abundance of these epiphytic orchids.

Developmental activities: New roads, dams, mines, buildings and other developments strongly contribute to habitat loss in this region, not only directly by damaging forests but also indirectly by displacing them. A typical example is the Snow Orchid *Diplomeris hirsuta* which was reported from Dogaon near Nainital and this was the only locality in western Himalaya where it was found at the time. This locality is very close to the National Highway 87. Naturally, this species is confined to fragile sand stone rocks in the foothills of the area. In 1996, the state government took a decision to widen National Highway 87, the rocks where the species were growing were destroyed and the only remaining population of the species vanished from the area. Recent surveys show only a small remaining population ca. 110 individuals of this species growing in a nearby locality. Another example of developmental activities is Tehri Dam (Uttarakhand). It is one of the largest dams in Asia with a submerge area of 44km^2. This submerge stretch was entirely covered by many small patches of riverine forests which were an ideal habitat for many epiphytic orchids.

Over exploitation: Although very few orchid species are medicinally important in the study area, over exploitation of these species coupled with a lack of awareness, has resulted in their becoming very rare and endangered in natural population and they are bound to become extinct in the near future. Terrestrial orchids such as *Crepidium acuminatum, Malaxis muscifera, Platanthera edgworthii, Eulophia dabia* and *Dactylorhiza hatagirea* are used in the preparation of various medicines by pharmaceutical companies. They have been subjected to ruthless collection from their natural habitats.

Overgrazing: The high altitude grasslands, pastures and meadows are very important habitats for many alpine orchids. These habitats are facing threats due to overgrazing practices by many pastoral communities. The foothills of the study area are inhabited by small groups of nomadic pastoral communities such as Gujjars in Siwalik zone, Himachal Pradesh and Jammu, and Bokshas and Tharus in the eastern Tarai zone. They are forest dwelling, semi-nomadic and pastoral indigenous communities. They own large herds of cattle and use forest land for grazing. The cattle were often found to be eating not only young flowering buds but also whole orchid plants.

Forest fires: Forest fires are another cause of the destruction of orchid host trees and of the thick layer of humus as well as of the pollinators. The forest is often set on fire by the local communities during the summer season to get a good growth of grass following the rains. Sometimes it spreads and destroys vast tracts of valuable forests. During the study, many orchid rich localities were found to be affected by fire. For epiphytic orchids, fires at any time of the year can cause a drastic change in plant abundance. They are mainly affected by burning of plants, degrading or removal of the support substrate and alteration of the microclimate resulting from fragmentation of the canopy. In many places, which were affected by previous fires, this phenomenon was observed, but this has hardly affected the terrestrial orchids such as *Nervilia* spp., which were seen in good abundance.

3. Threats by invasive species:

It was observed during the study that some invasive species were suppressing the growth of native flora including orchids, in many important orchid habitats. A large tract of the foothills and upper Himalayan range up to 2500m has been largely encroached by invasive species such as *Eupatorium adenophorum, Eupatorium odoratum, Eupatorium riparium, Lantana camara, Parthenium hysterophorus* and *Ageratum conyzoides*. Their multifaceted adaptability and fast replicating characteristics have created a serious threat to the indigenous flora including orchids. Several terrestrial orchid species were found to be shockingly less in number in such habitats. Orchids that face threats by these alien species are *Eulophia* spp., *Liparis deflexa, Nervilia* spp., *Goodyera procera, Habenaria marginata*, *H. plantaginea, H. pubescens, Pachystoma pubescens, Peristylus constrictus, P. goodyeroides, P. lawii* etc. Various dead host species were seen heavily loaded with epiphytic orchids in the study area particularly in riverine belts. After death, the bark of the tree gets loose and as the epiphytic orchids attach themselves mainly on the surface of the bark, these epiphytic orchids often fall to the ground due to their own weight and die.

Strategies for conservation

Conservation is "the maintenance of essential ecological processes and life-support systems, the preservation of genetic diversity and the sustainable utilization of species and ecosystems" (Talbot 1980). Orchids are an endangered plant group and protected by national or local laws in many countries including India. International trade and collection of orchids from the wild is banned. The wide range of distribution and habitats of orchids makes it difficult to have a uniform code for conservation. The western Himalaya is such a vast landscape spread over a 331,402km² area and the distribution of orchids is very patchy so it is very difficult to conserve each and every forest patch. The question is: 'Which area should be selected for orchid conservation?' the answer has to be given after a thorough evaluation of many aspects.

Identifying Orchid Conservation Areas (OCAs)

In order to conserve the orchids, it was necessary to identify orchid conservation areas (OCA). Various parameters were used to select a conservation area. First a region wise orchid Index was calculated (Table 3). That was calculated as the ratio of the number of orchids in a particular region multiplied by 1000 (IUCN 1996). This helped to get a broad region for selection. After getting the orchid index value the focus moved to the region that indicated the maximum value. Kumaun region showed the maximum value at 9.69 followed by Garhwal region at 5.33. Based on past and present records, two areas were found to be suitable for OCAs. One is Gori Valley in eastern Kumaun and the other is Mandal Valley in Chamoli District of Garhwal.

Suggestive measures for conservation

As mentioned above, all the orchids are threatened in the study area. For their long term survival in nature, they need to be protected through in situ and ex situ conservation. In situ orchid conservation and habitat preservation is the first line of defense for safeguarding orchid species for the future. The following measures are suggested for the long term conservation of orchids in western Himalaya:

(i) 145 species, which are very rare and sparse in the study area, need immediate action for conservation.

(ii) Banj-oak forests and riverine forests should be protected region wise. Initiate ecological restoration of degraded riverine forests and promote afforestation of suitable host tree species such as *Toona ciliata, Engelhadrtia spicata* and *Quercus leucotrichophora*.

(iii) Endemic and near endemic species need special attention. For example, *Peristylus kumaonensis* is an endemic orchid reported by Dr. J. Renz in 1983 from a locality that is 5km from Nainital towards the north, on the way to Ratighat at an altitude of 1800m and it is restricted to this area alone. At that time, almost 130 individuals were counted in this particular locality (Y.P.S. Pangtey pers. comm. August 2004). During the current survey a drastic change in the whole area was observed due to anthropogenic pressures and the population now remains around 30 individuals only.

(iv) Urgent need to conduct a population monitoring program together with orchid ecology so that we can use this information to design orchid conservation plans for the intact regions of habitat where orchids still thrive.

(v) Establishment of orchid seed bank and germ plasm banks. The conservation of seeds is the most effective means of genetic conservation.

(vi) Local people should be made aware of this wealth by means of awareness programs. Orchid conservation areas can be developed for tourists and college students so that they can visit these areas during their educational trips.

Table 3. Orchid Index table

Sno	Geographical region	Area (km²)	Total Species	Orchid Index
1	Jammu & Kashmir	222,236	46	0.21
2	Himachal Pradesh	55,673	76	1.36
3	Garhwal region	32,448	173	5.33
4	Kumaun Region	21,035	204	9.69

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Appendix I. List of orchids and their status

	Species	Habit	Status
1	*Acampe carinata*	E	C
2	*Acampe rigida*	E	SP
3	*Aerides multiflora*	E	C
4	*Aerides odorata*	E	C
5	*Androcorys josephi*	T	SP
6	*Androcorys monophylla*	T	O
7	*Androcorys pugioniformis*	T	SP
8	*Ascocentrum ampullaceum*	E	VR
9	*Brachycorythis obcordata*	T	C
10	*Bulbophyllum affine*	E	O
11	*Bulbophyllum careyanum*	E	SP
12	*Bulbophyllum cariniflorum*	E	O
13	*Bulbophyllum helenae*	E	VR
14	*Bulbophyllum hirtum*	E	VR
15	*Bulbophyllum hookeri*	E	VR
16	*Bulbophyllum leopardinum*	E	VR
17	*Bulbophyllum polyrhizum*	E	SP
18	*Bulbophyllum reptans*	E	O
19	*Bulbophyllum triste*	E	O
20	*Bulbophyllum umbellatum*	E	O
21	*Bulbophyllum wallichii*	E	VR
22	*Calanthe alpina*	T	VR
23	*Calanthe mannii*	T	VR
24	*Calanthe pachystalix*	T	VR
25	*Calanthe plantaginea*	T	SP
26	*Calanthe puberula*	T	SP
27	*Calanthe tricarinata*	T	C
28	*Cephalanthera longifolia*	T	C
29	*Cheirostylis griffithii*	T	SP
30	*Cleisostoma aspersum*	E	VR
31	*Coeloglossum viride*	T	SP
32	*Coelogyne cristata*	E	C
33	*Coelogyne ovalis*	E	O
34	*Coelogyne stricta*	E	SP
35	*Corallorhiza trifida*	H	VR
36	*Crepidium acuminatum*	T	C
37	*Crepidium biauritum*	T	VR
38	*Crepidium mackinnonii*	T	VR
39	*Crepidium purpureum*	T	O
40	*Cryptochilus luteus*	E	VR
41	*Cymbidium aloifolium*	E	SP
42	*Cymbidium cyperifolium*	E	SP
43	*Cymbidium hookerinum*	E	SP
44	*Cymbidium iridoides*	E	O
45	*Cymbidium macrorhizon*	H	SP
46	*Cypripedium cordigerum*	T	SP
47	*Cypripedium elegans*	T	VR
48	*Cypripedium himalaicum*	T	VR
49	*Dactylorhiza hatagirea*	T	O
50	*Dactylorhiza kafiriana*	T	VR
51	*Dendrobium amoenum*	E	O
52	*Dendrobium aphyllum*	E	SP

	Species	Habit	Status
53	*Dendrobium bicameratum*	E	C
54	*Dendrobium candidum*	E	SP
55	*Dendrobium chrysanthum*	E	SP
56	*Dendrobium chryseum*	E	O
57	*Dendrobium crepidatum*	E	SP
58	*Dendrobium denudans*	E	SP
59	*Dendrobium fimbriatum*	E	VR
60	*Dendrobium fugax*	E	SP
61	*Dendrobium hesperis*	E	VR
62	*Dendrobium heterocarpum*	E	VR
63	*Dendrobium monticola*	E	SP
64	*Dendrobium primulinum*	E	O
65	*Didiciea cunninghamii*	T	VR
66	*Diphylax griffithii*	T	SP
67	*Diplomeris hirsuta*	T	VR
68	*Epipactis gigantea*	T	VR
69	*Epipactis helleborine*	T	C
70	*Epipactis veratrifolia*	T	O
71	*Epipogium aphyllum*	H	VR
72	*Epipogium roseum*	H	VR
73	*Eria alba*	E	O
74	*Eria amica*	E	VR
75	*Eria bipunctata*	E	O
76	*Eria coronaria*	E	VR
77	*Eria globulifera*	E	VR
78	*Eria graminifolia*	E	VR
79	*Eria lasiopetala*	E	O
80	*Eria muscicola*	E	VR
81	*Eria occidentalis*	E	VR
82	*Eria reticosa*	E	VR
83	*Eria spicata*	E	O
84	*Eulophia bicallosa*	T	VR
85	*Eulophia dabia*	T	SP
86	*Eulophia explanata*	T	VR
87	*Eulophia flava*	T	VR
88	*Eulophia graminea*	T	VR
89	*Eulophia herbacea*	T	VR
90	*Galearis roborovskyi*	T	VR
91	*Galearis spathulata*	T	SP
92	*Galeola falconeri*	H	VR
93	*Gastrochilus acutifolius*	E	VR
94	*Gastrochilus calceolaris*	E	C
95	*Gastrochilus distichus*	E	SP
96	*Gastrodia falconeri*	H	VR
97	*Goodyera biflora*	T	O
98	*Goodyera foliosa*	T	VR
99	*Goodyera fusca*	T	SP
100	*Goodyera procera*	T	O
101	*Goodyera repens*	T	C
102	*Goodyera viridiflora*	T	O
103	*Goodyera vittata*	T	VR
104	*Gymnadenia orchidis*	T	SP
105	*Habenaria aitchisonii*	T	O
106	*Habenaria arietina*	T	SP
107	*Habenaria commelinifolia*	T	VR
108	*Habenaria digitata*	T	SP
109	*Habenaria diphylla*	T	SP
110	*Habenaria ensifolia*	T	SP
111	*Habenaria furcifera*	T	SP
112	*Habenaria intermedia*	T	C
113	*Habenaria marginata*	T	O
114	*Habenaria pectinata*	T	C
115	*Habenaria plantaginea*	T	O
116	*Habenaria pubescens*	T	VR
117	*Habenaria stenopetala*	T	SP
118	*Hemipilia cordifolia*	T	O
119	*Herminium kumaunensis*	T	VR
120	*Herminium lanceum*	T	C
121	*Herminium mackinnonii*	T	VR
122	*Herminium monorchis*	T	SP
123	*Ione bicolor*	E	SP
124	*Liparis caespitosa*	E	SP
125	*Liparis deflexa*	T	VR
126	*Liparis glossula*	T	O
127	*Liparis paradoxa*	T	SP
128	*Liparis platyrachis*	E	VR
129	*Liparis resupinata*	T	VR
130	*Liparis rostrata*	T	C
131	*Liparis viridiflora*	T	O
132	*Luisia brachystachys*	E	VR
133	*Luisia trichorrhiza*	E	O
134	*Luisia tristis*	E	C
135	*Luisiopsis inconspicuua*	E	SP
136	*Malaxis cylindrostachya*	T	O
137	*Malaxis latifolia*	T	VR
138	*Malaxis muscifera*	T	C
139	*Neottia acuminata*	H	VR
140	*Neottia inayatii*	H	VR
141	*Neottia listeroides*	H	O
142	*Neottia longicaulis*	T	VR
143	*Neottia mackinnonii*	H	VR
144	*Neottia microglottis*	H	VR

	Species	Habit	Status
145	*Neottia nandadeviensis*	T	VR
146	*Neottia ovata*	T	VR
147	*Neottia pinetorum*	T	VR
148	*Neottia tenuis*	T	SP
149	*Neottianthe calcicola*	T	VR
150	*Neottianthe secundiflora*	T	VR
151	*Nervilia aragoana*	T	O
152	*Nervilia crociformis*	T	C
153	*Nervilia falcata*	T	VR
154	*Nervilia gammieana*	T	O
155	*Nervilia gleadowii*	T	VR
156	*Nervilia infundibulifolia*	T	VR
157	*Nervilia mackinnonii*	T	O
158	*Nervilia pangteyiana*	T	VR
159	*Nervilia plicata*	T	SP
160	*Oberonia acaulis*	E	SP
161	*Oberonia caulescens*	E	VR
162	*Oberonia ensiformis*	E	SP
163	*Oberonia falconeri*	E	O
164	*Oberonia griffithiana*	E	VR
165	*Oberonia myosurus*	E	VR
166	*Oberonia pachyrachis*	E	O
167	*Oberonia prainiana*	E	VR
168	*Oberonia pyrulifera*	E	SP
169	*Oreorchis foliosa*	T	SP
170	*Oreorchis foliosa var. indica*	T	SP
171	*Oreorchis micrantha*	T	O
172	*Ornithochilus difformis*	E	O
173	*Otochilus lancilabius*	E	VR
174	*Pachystoma pubescens*	T	SP
175	*Pecteilis gigantea*	T	SP
176	*Pecteilis triflora*	E	VR
177	*Pelatantheria insectifera*	E	VR
178	*Peristylus affinis*	T	SP
179	*Peristylus constrictus*	T	C
180	*Peristylus duthiei*	T	SP
181	*Peristylus elisabethae*	T	C
182	*Peristylus fallax*	T	C
183	*Peristylus goodyeroides*	T	O
184	*Peristylus kumaonensis*	T	VR
185	*Peristylus lawii*	T	VR
186	*Phaius tankervilleae*	T	SP
187	*Phalaenopsis deliciosa*	E	VR
188	*Phalaenopsis taenialis*	E	SP
189	*Pholidata articulata*	E	C
190	*Pholidata imbricata*	E	C
191	*Platanthera arcuata*	T	VR
192	*Platanthera clavigera*	T	C
193	*Platanthera edgworthii*	T	C
194	*Platanthera latilabris*	T	C
195	*Platanthera leptocaulon*	T	SP
196	*Platanthera stenantha*	T	SP
197	*Pleione grandiflora*	E	VR
198	*Pleione hookeriana*	E	SP
199	*Pleione humilis*	E	VR
200	*Pleione praecox*	E	VR
201	*Ponerorchis chusua*	T	O
202	*Ponerorchis renzii*	T	VR
203	*Pteroceras teres*	E	SP
204	*Rhynchostylis retusa*	E	C
205	*Satyrium nepalense*	T	C
206	*Satyrium nepalense var. ciliatum*	T	VR
207	*Smithandia micrantha*	E	C
208	*Spiranthes sinensis*	T	C
209	*Thelasis longifolia*	E	VR
210	*Thunia alba*	E	C
211	*Thunia alba var. bracteata*	E	SP
212	*Tropidia pedunculata*	T	VR
213	*Vanda alpina*	E	VR
214	*Vanda cristata*	E	C
215	*Vanda pumila*	E	VR
216	*Vanda tessellata*	E	O
217	*Vanda testacea*	E	O
218	*Vandopsis undulata*	E	VR
219	*Zeuxine flava*	T	SP
220	*Zeuxine grandis*	T	VR
221	*Zeuxine strateumatica*	T	O

T - Terrestrial; E - Epiphytic; H - Holomycotrophic; VR - Very rare; SP - Sparse; O - Occasional; C - Common