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DIVERSITY AND DISTRIBUTION OF *DENDROBIUM* SPECIES OF ORCHIDACEAE IN DARJEELING DISTRICT OF EASTERN HIMALAYA OF INDIA

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ABSTRACT

Diversity and distribution of 34 species of *Dendrobium* Orchid species of Darjeeling district of Eastern Himalaya of India is reported. The current ecological studies were carried out and based on the findings, it is proposed that out of 34 species, 8 species should be placed as rare; 1 threatened; 2 species endangered; other 2 species frequent; 11 species sparse, 1 abundant and remaining 9 species are planted by local people. Besides these, 4 of them were found to be medicinal and ethnobotanical importance. The studies indicated the immediate need of formulation of conservation strategy to save these plants from being vanish forever.

Key words : Orchids, *Dendrobium* spp., Darjeeling, Eastern Himalaya, Diversity.

Introduction

Orchids are considered to be the most highly evolved in the floral specialization and diversified form of plants among the monocotyledons. In India, Orchids from 9% of our flora are the largest and highly advanced family of higher plants. It is estimated that at about 25,000-35,000 species with 800-1,000 genera are distributed throughout the world. About 1300 species with 140 genera of Orchid species are found in India with temperate Himalayas as their natural home (Yonzone and Ashan, 2008).

The genus *Dendrobium* was established in 1799 by O. Swartz in *Nova Acta Regiae Societatis Scientiarum Upsaliensis*. The genus *Dendrobium* comprises of nearly 1400 species distributed across India to Japan, South to Malaysia, Indonesia and East to New Guinea, Australia, New Zealand and the Pacific Island. The Darjeeling district of Eastern Himalaya possesses good resources of Orchid species (Yonzone, 2009; Lucksom, 2007; Pradhan, 1979). Among them the species of *Dendrobium* are widespread throughout the region. Habitat of *Dendrobium* species is epiphytic rarely lithophytic. Plant herbaceous, perennial, stem erect and internodes covered with sheathing bract. Leaves elliptic-oblong to linear-lanceolate, apex acute. Inflorescence solitary or many either fascicles or raceme. Flower resupinate or non-resupinate, with or without mentum. Lateral sepals often adnate to the foot of column to form spur. Petals similar to sepals. Lip simple, 3-lobed, sessile or clawed at the base, side lobes embracing the column or spreading; apical lobe broad or narrow, flat, convex, concave a saccate; the disc sometimes lamellate. Column short.

Material and Methods

Study area

Darjeeling is the northernmost district of West Bengal. The district is subdivided into four Sub-divisions *viz*., Darjeeling sadar; Kalimpong, Kurseong and Siliguri. The region lies between $26^0$31' and $27^0$31' north latitude and between $87^0$59' and $88^0$53' east longitude in the Eastern Himalayan region of India. It is bordered by Sikkim in the north, Terai and Dooars in the south, Bhutan in the east and Nepal in the west. The district has two topographical features. Darjeeling, Kurseong and Kalimpong form the hill areas whereas Siliguri is stationed at the foothill in a vast stretch of the plains. The shape of the district is triangular. The total area of the triangular shaped district is 3254.7 km^2 which is 3.68 per cent of the total areas of West Bengal state. The hilly region covers 2320 km^2 and the remaining 934.7 km^2 of the area falls in the Terai and plains. The altitudinal variations of the district range from 150 m at Siliguri to 3636 m at Sandakphu – Phalut with a sharp physiographic contrast between the plain and the mountainous regions. In the present investigation, diversity and distribution of *Dendrobium* species of orchids of Darjeeling district in Eastern Himalaya was studied.

The intensive field survey was conducted during the year 2007-2011 covering all the seasons of the year in

Out of 34 species of *Dendrobium* Orchids, 8 species are proposed to be placed as rare, 1 threatened, 2 species as endangered and frequent while 11 species as sparse.

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the entire Darjeeling district including the forest areas and floral nurseries. The selection of survey villages, forests and nurseries were done based on their altitude wise location so as to cover the entire altitudinal range of the study area. For entering national parks, a prior permission from the forest department, Govt. of West Bengal was taken. The survey regions were divided into 4 different zones *viz*., Sub-Alpine zone (3000–3700m), Temperate and Sub-Temperate zone (1800–3000m), Sub-Tropical zone (1000–1800m) and Tropical zone (120–1000m). For sub-alpine zone, places selected were Sandakphu, Phalut. Similarly for temperate and sub-temperate zone, Neora Valley National Park, Rachela, Todey, Tangta, Kalpokhari, Bikhaybhanjang, Tonglu, Rammam, Megma; for Sub-Tropical Zone, Algarah, Damsang Gari, Lava, Lopchu, Takdah and for Tropical Zone, Kumsi, Najok, Suruk, Birik, Kalijhora, Sevoke, Siliguri, Sukuna, Tindharay, Panighatta, Jaldhaka, Lesh Khola, Relli, Kambal, Bagrakot were carried during field survey. The survey team was divided into four groups to cover survey areas at the same time of the year. Village elders and forest guards and officials of national parks were also interviewed in a proforma prepared in advance to gather information by showing them photographs and sketches of *Dendrobium* species.

The authors also visited Singhalila National Park in Darjeeling and Neora Valley National Park in Kalimpong and remote far flung villages covering all the altitudinal ranges as low as Siliguri located at 150m to as high as Sandakphu – Phalut 3636m of entire Darjeeling district of West Bengal, India. All the available *Dendrobium* Orchid species found were recorded in the field note book with their necessary information. The relevant data from the field note books were then transferred to the labels of the herbarium sheets and in computer. The plant specimens were also collected without uprooting and disturbing the plants in the nature. Normally, 2-3 specimens of each species in flowering or fruiting stage were collected and life form photographs were prepared. The specimens so collected were processed, preserved and mounted on herbarium sheets following the standard herbarium techniques given by (Jain and Rao, 1977); and described, properly identified and authenticated with the help of Flora of British India (Hooker, 1888–1890); Flora of Bhutan (Pearce and Cribb, 2002) and from the herbarium of Department of Botany, North Bengal University, Siliguri; Central National Herbarium - CAL, Indian Botanical Garden, Sibpur, Howrah. All the plant specimens are arranged systematically as per their altitude wise distribution in the area with botanical names, habitat, family and ecological status. Following the classification given by King and Pantling (1898); Duthie (1906); Pradhan (1979); Hedge (1984); Kataki (1986); Chowdhery (1998); Bose and Bhattacharjee (1999); Pearce and Cribb (2002) and Lucksom (2007). Drawing, dissection and data compilation works was done in the laboratory. Recent nomenclature has been checked with available literatures. The observations and data collection was done on morphological character *viz.* plant height, number of flowers per plant, flower colour, colour shades on labellum and time of flowering. The data were plotted in graph. The current ecological status was studied following Raunkiaer's Ecological Statistics (Raunkiaer, 1934). Finally, all the voucher specimens were deposited in the Herbarium of Department of Botany, St. Joseph's College, North Point, Darjeeling and Taxonomy and Ethnobiology Research Laboratory, Cluny Women's College, Kalimpong.

Results and Discussion

Detail survey of the literature and findings of earlier workers revealed that no such studies were carried out in Darjeeling district of Eastern Himalaya on *Dendrobium* Orchid species. There were 34 species of *Dendrobium* found distributed in Darjeeling district of Eastern Himalaya. Of them, 9 were planted, one was found in abundant, 2 were frequent, 11 were sparse and 8 were rare, one was threatened and 2 were endangered (Table 1). Some of them are introduced from North Eastern States like Manipur, Assam, Mizoram, Nagaland and Arunachal Pradesh *viz., Dendrobium chrysotoxum, D. crepidatum, D. cumulatum, D. devonianum, D. falconeri, D. jenkinsii, D. lindleyi, D. ochreatum and D. pendulum* are found in the planted condition at Holumba Floral Nursery of Kalimpong (Yonzone, 2009). Species like *Dendrobium chrysanthum, D. densiflorum, D. denudans, D. moschatum* and *D. nobile* are frequently found in lithophytic habitat in the regions. April to July is the peak flowering months of many *Dendrobium* species. Many of these species like *Dendrobium nobile, D. farmeri, D. crepidatum, D. pendulum, D. densiflorum, D. transparens, D. falconeri, D. devonianum* and *D. fimbriatum* are showy and can be cultivated as pot flowers in floriculture trade. Some of them are medicinal and ethnobotanical importance *viz*., fresh leaf of *Dendrobium densiflorum* is recommended for bone fracture and stem bark used in ear ring; decoction of flowers and leaves of *Dendrobium fimbriatum* var. *oculatum* is used for liver upsets and nerves debility. Poultice of fresh leaves used to cure boils and pimples. Fresh leaves and flowers used to cure cholera; fresh leaf juice of *Dendrobium moschatum* is used in Meghalaya for earache and whole plant parts of *Dendrobium nobile* is

Table 1: List of Dendrobium Orchid species found in Darjeeling district of Eastern Himalaya of India.

Sl. No.	Botanical name of *Dendrobium* species with Voucher specimen number	Habitat	Local distribution within Darjeeling district of Eastern Himalaya of India	Altitudinal range of availability (m)	Date of collection	Flowering and fruiting time	Current Status
1	*Dendrobium aduncum* Lindl. ex. Lindl. *[Rajendra et al., 1286]*	Epiphytic	Panighatta – Kurseong Sub-Division; Kumsi forest - Kalimpong Sub-Division	300-900	4 Jul. 2010	May-Jul.	Rare
2	*Dendrobium amoenum* Wall. ex Lindl. *[Rajendra et al., 0376]*	Epiphytic	Bara Suruk, Samalbong forest, Jaldhaka, Lesh khola – Kalimpong Sub-Division	300-800	12 May 2008	May-Jun.	Sparse
3	*Dendrobium anceps* Sw. *[Rajendra et al., 0243]*	Epiphytic	Forest areas in Relli – Kalimpong Sub-Division; Rambi, Kalijhora – Kurseong Sub-Division; Sevoke – Siliguri Sub-Division	150-600	19 Mar. 2008	Mar.-May	Sparse
4	*Dendrobium aphyllum* (Roxb.) C.E.C. Fischer *[Rajendra et al., 0276]*	Epiphytic	Forest areas in Suruk, Samalbong, Jholung, Kambal – Kalimpong Sub-Division; Birik – Kurseong Sub-Division	300-1800	7 Apr. 2008	Mar.-Jun.	Abundant
5	*Dendrobium bicameratum* Lindl. *[Rajendra et al., 0551]*	Epiphytic	Forest areas in Lungshel, Todey – Kalimpong Sub-Division	500-2100	14 Jul. 2008	Jul.-Aug.	Rare
6	*Dendrobium candidum* Wall. ex Lindl. *[Rajendra et al., 0457]*	Epiphytic	Forest areas in Rammam, Meghma – Darjeeling Sub-Division; Rachela - Kalimpong Sub-Division	1000-2600	28 May 2008	May-Jun.	Sparse
7	*Dendrobium cathcartii* Hook. f. *[Rajendra et al., 0237]*	Epiphytic	Forest areas in Rambi – Kurseong Sub-Division; Sevoke – Siliguri Sub-Division	150-800	19 Mar. 2008	Mar.-Sep.	Rare
8	*Dendrobium chrysanthum* Wall. ex Lindl. *[Rajendra et al., 0687]*	Epiphytic	Forest areas in Algarah, Lava, Nokdara, Lungsel, Todey – Kalimpong Sub-Division	800-2200	6 Sep. 2008	Jul.- Oct.	Frequent
9	*Dendrobium crepidatum* Lindl. and Paxt. *[Rajendra et al., 0801]*	Epiphytic	Holumba Floral nursery - Kalimpong Sub-Division	800-1200	3 Apr. 2009	Apr.-May	Planted
10	*Dendrobium chrysotoxum* Lindl. *[Rajendra et al., 1613]*	Epiphytic	Holumba Floral Nursery - Kalimpong Sub-Division	1300-1800	26 May 2011	May-Jun.	Planted
11	*Dendrobium cumulatum* Lindl. *[Rajendra et al., 1281]*	Epiphytic	Holumba Floral Nursery - Kalimpong Sub-Division	350-600	28 Jun. 2010	Jun.-Jul.	Planted
12	*Dendrobium densiflorum* Lindl. *[Rajendra et al., 0331]*	Epiphytic	Forest areas in Suruk, Najok, Relli – Kalimpong Sub-Division; Lopchu – Darjeeling Sub-Division	300-2100	24 Apr. 2008	Apr.-Jul.	Sparse
13	*Dendrobium denudans* D. Don *[Rajendra et al., 0109]*	Epiphytic	Suruk, Samalbong, Nimbong forest – Kalimpong Sub-Division	600-1800	18 Sep. 2007	Sep.-Oct.	Frequent
14	*Dendrobium devonianum* Paxt. *[Rajendra et al., 0861]*	Epiphytic	Holumba Floral Nursery - Kalimpong Sub-Division	800-2100	17 May 2009	Apr.-May	Planted
15	*Dendrobium eriiflorum* Griff. *[Rajendra et al., 0718]*	Epiphytic	Mangzing, Nimbong, Kumsi forest – Kalimpong Sub-Division; Soureni-Mirik – Kurseong Sub-Division	800-2000	18 Oct. 2008	Sep.-Nov.	Sparse
16	*Dendrobium falconeri* Hook. *[Rajendra et al., 1151]*	Epiphytic	Holumba Floral Nursery - Kalimpong Sub-Division	1500-2200	2 May 2010	Apr.-Jun.	Planted
17	*Dendrobium farmeri* Paxt. *[Rajendra et al., 1140]*	Epiphytic	Kalijhora forest – Kurseong Sub-Division	200-1000	22 Apr. 2010	Mar.-May	Threatened

18	*Dendrobium fimbriatum* Hook. *[Rajendra et al., 1579]*	Epiphytic	Forest areas in Kumsi, Algarah - Kalimpong Sub-Division	600-1660	27 Apr. 2011	Apr.-may	Sparse
19	*Dendrobium fimbriatum* Hook. var. *oculatum* Hook. *[Rajendra et al., 0283]*	Epiphytic	Suruk, Relli forest –Kalimpong Sub-Division	300-1100	7 Apr. 2008	Mar. -May	Rare
20	*Dendrobium heterocarpum* Lindl. *[Rajendra et al., 1081]*	Epiphytic	Forest areas in Todey, Neora Valley – Kalimpong Sub-Division	1300-2300	14 Mar. 2010	Feb-Apr.	Rare
21	*Dendrobium jenkinsii* Wall. ex Lindl. *[Rajendra et al., 1574]*	Epiphytic	Holumba Floral nursery - Kalimpong Sub-Division	1100-1400	26 Apr. 2011	Apr.-May	Planted
22	*Dendrobium lindleyi* Steudel. *[Rajendra et al., 1120]*	Epiphytic	Holumba Floral nursery - Kalimpong Sub-Division	800-1600	5 Apr. 2010	Feb.-Apr.	Planted
23	*Dendrobium longicornu* Lindl. *[Rajendra et al., 0151]*	Epiphytic	Forest areas in Lava, Lungshel, Algarah, Todey – Kalimpong Sub-Division	1400-3000	25 Oct. 2007	Aug.-Dec.	Sparse
24	*Dendrobium moschatum* (Buch.-Ham.) Sw. *[Rajendra et al., 0061]*	Epiphytic	Forest areas in Relli, Samalbong Busty – Kalimpong Sub-Division	500-1300	21 Jun. 2007	May-Jul.	Sparse
25	*Dendrobium nobile* Lindl. *[Rajendra et al., 0421]*	Epiphytic	Relli forest, 8th Mile-Kalimpong Sub-Division and Rimbik– Darjeelng Sub-Division; Tindharay – Kurseong Sub-Division	300-2200	27 May 2008	May-Jun.	Sparse
26	*Dendrobium nobile* Lindl. var. *virginalis* Hort. *[Rajendra et al., 1551]*	Epiphytic	Forest areas in Lava, Damsang Gari – Kalimpong Sub -Division; Takdah - Darjeeling Sub-Division	1800-2400	20 May 2008	May-Jun.	Sparse
27	*Dendrobium ochreatum* Lindl. *[Rajendra et al., 1571]*	Epiphytic	Holumba Floral Nursery -Kalimpong Sub-Division	950-1100	23 Apr. 2011	Apr.-May	Planted
28	*Dendrobium pendulum* Roxb. *[Rajendra et al., 1559]*	Epiphytic	Holumba Floral Nursery -Kalimpong Sub-Division	1200-1600	26 Mar. 2011	Mar. -Apr.	Planted
29	*Dendrobium porphyrochilum* Lindl. *[Rajendra et al., 0475]*	Epiphytic	Tangta – Kalimpong Sub-Division; Rammam forest - Darjeeling Sub-Division	2000-2700	31 May 2008	May-Jul.	Rare
30	*Dendrobium praecinctum* Rchb. f. *[Rajendra et al., 1284]*	Epiphytic	Todey-Tangta forest – Kalimpong Sub-Division	1100-1900	30 Jun. 2010	Jun.-Jul.	Endangered
31	*Dendrobium stuposum* Lindl. *[Rajendra et al., 1314]*	Epiphytic	Takdah forest – Kurseong Sub-Division; Dilaram - Kurseong Sub-Division	1400-2300	10 Jul. 2010	May-Jul.	Rare
32	*Dendrobium sulcatum* Lindl. *[Rajendra et al., 0998]*	Epiphytic	Forest areas in Kumsi, Najok – Kalimpong Sub-Division	550-1000	26 Oct. 2009	Apr.-May	Rare
33	*Dendrobium terminale* Parish and Rchb. f. *[Rajendra et al., 1325]*	Epiphytic	Lesh khola forest – Kalimpong Sub-Division	300-800	20 Jul. 2010	Jun.-Sep.	Endangered
34	*Dendrobium transparens* Wall. ex Lindl. *[Rajendra et al., 0417]*	Epiphytic	Forest areas in Kalijhora –Kurseong Sub-Division; Mim Tea Estate – Darjeeling Sub-Division; Bagrakot – Kalimpong Sub-Division	200-1700	22 May 2008	May-Jun.	Sparse

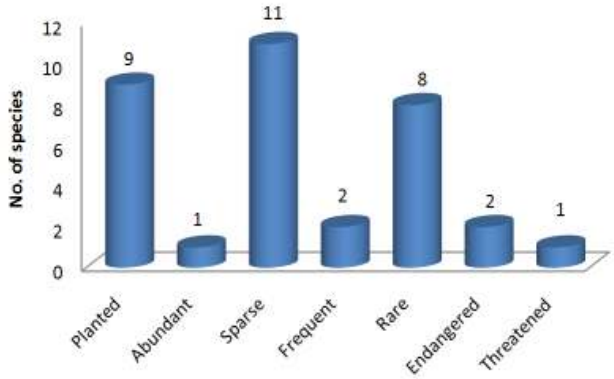

Fig.1 : Current status of *Dendrobium* Orchid species in Darjeeling district

used in treatment of pulmonary tuberculosis, flatulence, general debility, cuts and wounds, dyspepsia, night sweat, fear and anorexia. It is antiphlogistic, pectoral, stomachic and tonic. Besides these, some species like, *D. nobile* and *D. densiflorum* are strongly fragranced and can be successfully utilized for the extraction of aroma for confectionary purpose. The fragrance can be transferred from these species to other through hybridization, which can be easily multiplied by tissue culture for commercialization to upgrade rural economy for economic upbringing of farmers. Habitat destruction by means of deforestation, falling of old host trees for timber and firewood purposes, frequent land slides and indiscriminate collection by local traders are the major threat for epiphytic Orchid species like *Dendrobium* in the region. It is observed that the lavish growth and diversity of the Orchid species in the undisturbed sites of the study area and the meager development in distressed sites clearly indicates the change in the microclimatic conditions in habitat by anthropogenic activities. The extension of agricultural lands, rapid deforestation and various developmental projects directly harm the natural population of Orchid species in Darjeeling Himalaya. (Yonzone *et al*., 2012a). Wherever, Orchid species exist in nature, the falling of host plants should be cleared only after examination of such trees by conservationists or botanists (Yonzone *et al*., 2012b)

Conclusion

High risk of threat persists on the whole Orchidaceous family throughout the district. Many developmental works, rapid urbanization, deforestation, indiscriminate collection, habitat destruction, toxic effects of pesticidal pollution and frequent land slides cause the great loss and push to rare status of many epiphytic Orchid species in the study regions. So immediate conservative measures are necessary to overcome the threat.

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भारत के पूर्वी हिमालय के दार्जीलिंग में आर्किडेसाई की *डेंडोबियम* प्रजाति का वैविध्य एवं वितरण

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सारांश

भारत के पूर्वी हिमालय के दार्जीलिंग जिले में *डेंडोबियम* आर्किड प्रजाति की उपप्रजातियों का वैविध्य तथा वितरण रिकार्ड किया गया है। वर्तमान पारितंत्रीय अध्ययन किये गये जिनके नि"कर्षो से पता चला कि 34 प्रजातियों में से 8 प्रजातियों को दुर्लभ, 7 को खतरे में, 2 प्रजातियों को संकटापन्न, अन्य 2 प्रजातियों को निरंतर, 11 प्रजातियों को यत्र-तत्र, 7 को बाहुल्यपूर्ण तथा शेष 9 प्रजातियों को स्थानीय लोगों द्वारा रोपित किया जाता है। इसके अलावा इनमें से 4 को औषधीय और मानवीय महत्व का पाया गया। ये पादप विलुप्त होने की कगार पर है। इन्हें बचाने के लिए सरंक्षण रणनीति को तुरन्त सूचीबद्ध करना आव"यक है।

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