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STUDIES ON THE GENETIC DIVERSITY, DISTRIBUTION AND CURRENT STATUS OF *COELOGYNE* LINDL. (ORCHIDACEAE) SPECIES OF DARJEELING HILLS OF WEST BENGAL, INDIA

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ABSTRACT

Present paper deals the genetic diversity, distribution and current status with habitat, place of occurrence, altitudinal ranges and flowering times of 16 *Coelogyne* species which are widely distributed throughout the Darjeeling Hills of West Bengal, India. In the present investigation Raunkiaer's Ecological Statistics, given by Raunkiaer, (1934) were laid out to find out the current ecological status of these species from Darjeeling Hills. 7 species viz., *Coelogyne barbata*., *C. occultata*., *C. pantlingii*., *C. pempahesiana*., *C. punctulata*., *C. stricta*., and *C. viscosa*. are rare while 2 species viz., *C. corymbosa* and *C. nitida* were placed under frequent category. The species *C. cristata* was abundant in the region. *Coelogyne raizadae* and *C. ovalis* that were found sparsely while 4 species viz., *C. fimbriata*., *C. flacidida*., *C. fuscescens* and *C. prolifera* are common and found everywhere in the study area.



KEY WORDS

Orchidaceae, *Coelogyne* species, Genetic diversity, Distribution, Current status, Darjeeling Hills.

INTRODUCTION

John Lindley (1821) established the genus *Coelogyne* in *Collectanea Botanica*. The name *Coelogyne* derives from the Greek **koilos** (hollow, cavity) and **gyne** (female), referring to the deeply set stigmatic cavity at the front of the column. This species are widely distributed in South and South East Asia and across to the Southwest Pacific Islands (Pearce and Cribb, 2002). In Darjeeling hills, they are found throughout the district. Most of the *Coelogyne* species are epiphytic but sometimes lithophytic. Orchids are considered to be the most highly evolved in the floral specialization and diversified form among the monocotyledons. In India, Orchids form 9% of our flora and are the largest and highly advanced botanical 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 (Yonzon and Kamran, 2008). Darjeeling is the northernmost district of West Bengal. The district is subdivided into four Sub-Divisions viz., Darjeeling sadar; Kalimpong, Kurseong and Siliguri (Figure 1). The region lies between 26^o31' and 27^o31' north latitude and between 87^o59' and 88^o53' 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 3254.7sq.km. which is 3.68 percent of the total areas of West Bengal state. The hilly region covers 2320sq. km. and

the remaining 934.7sq.km of the area falls in the Terai and plains. The altitudinal variations of the district range from 150m at Siliguri to 3636m at Sandakphu-Phalut with a sharp physiographic contrast between the plain and the mountainous regions. Darjeeling hills which is an integral part of Eastern Himalaya that is declared by International Union for Conservation of Nature (IUCN) as one of the 34 biodiversity hotspot zones of the world and one of the only 3 falling in India. It is very rich in Orchids and many important Orchid species are found here. John Lindley in 1821 established the genus *Coelogyne* in *Collectanea Botanica*. Its Pseudobulbs crowded to form bulky clumps; Pseudobulbs ovoid, conical, base enclosed with scales. Leaves elliptic to obovate, ovate, oblong to linear-lanceolate; tip acute, acuminate, mucronate. Inflorescence terminal or lateral and either heteranthous, proteranthous or hysteranthous, erect or pendulous, 1 to many-flowered, hairy or glabrous. Flowers fleshy or membranous; floral bracts deciduous or persistent and attached the base of the pedicel. Dorsal sepal is symmetrical, lanceolate or elliptic; tip acute to acuminate. Lateral sepals asymmetric, oblong, broadly sessile, ovate, elliptic to obovate, tip acute to acuminate, obtuse, apiculate. Petals symmetrically falcate, recurved; tip acute to acuminate, obtuse. Lip sessile, concave, deeply or obscurely 3-lobed. Lip comprises two parts: hypochile, basal portion and epichile, terminal portion. Column short or long. Anther versatile; pollinia four. In the present investigation, genetic diversity, distribution, altitudinal range, flowering time and current status of *Coelogyne* Lindl. species in Darjeeling hills is carried out.



Figure. 1.
Location of Darjeeling district (study area) of West Bengal, India

MATERIALS AND METHODS

The intensive field survey was conducted during the year 2007-2011 covering all the seasons of the year in the entire Darjeeling Himalaya including the forest areas, floral nurseries and farms. 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 150m to as high as Sandakphu-Phalut 3636m of entire Darjeeling district of West Bengal. All the Orchids species of *Coelogyne* 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 computer. The plant specimens were also collected without uprooting and disturbing the plants in the nature. Normally, only 2-3 specimens of each species in flowering and 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); A century of Indian Orchids (Hooker, 1895); Flora of Bhutan (Pearce and Cribb, 2002) and from the herbarium of Department of Botany, North Bengal University, Siliguri; Central National Herbarium, Indian Botanical Garden, Sibpur, Howrah. Drawing, dissection and data compilation works was done in the laboratory. Correct nomenclature has been checked with recent available literatures. Finally all the authenticated 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. The classification was given by King and Pantling (1898); Seidenfaden (1975); Kataki (1986); Pradhan (1979); Pradhan and Pradhan (1997; Arora (1984); Hedge (1984); Deva and Naithani (1986); Ormerod (1997); Chowdhery



(1998); Bose and Bhattacharjee (1999); Pearce and Cribb (2002) and Luckson (2007). There is no earlier report on the ecological status of these studied species. In the present investigation the

study of ecological status by Raunkiaer's Ecological Statistics, given by Raunkiaer, (1934) were laid out to find out the current status of these species from Darjeeling Hills.

RESULTS AND DISCUSSION

During the field survey conducted in the study area, 16 species of *Coelogyne* were found to occur in Darjeeling Himalaya and most of them are highly fragranced. The detail list of these species along with their botanical names, habitat, place of occurrence, altitudinal range of the availability, flowering and fruiting time and current ecological status are presented in (Table 1). In the present investigation, the study of ecological studies of these 16 species following the method Raunkiaer's Ecological Statistics of frequency method were laid out in each of the major plots in the species habitat rich field for quantification of studies given by Raunkiaer, (1934) and for *Coelogyne* (epiphytic), representative plots of 10m x 10m were laid down, sub plots of 5m x 5m were laid out diagonally in each major plot for regeneration status revealed that 7 species viz., *Coelogyne barbata*., *C. occultata*., *C. pantlingii*., *C. pempahesiana*., *C. punctulata*., *C. stricta*., and *C. viscosa*. are rare shown in (Figure 2). There was one species *C. cristata*., which has been placed under abundant status while 2 species viz., *C. corymbosa* and *C. nitida* were placed under frequent category. There were 2 species viz., *C. raizadae*., *C. ovalis* that were found sparsely while 4 species viz., *C. fimbriata*., *C. flaccida*., *C. fuscescens* and *C. prolifera* are common and found everywhere in the study area. The above ecological status is based on the finding during the survey and it is proposed that all 16 species of *Coelogyne* available in Darjeeling Hills may be placed under these categories as proposed above which is based on the findings following ecological status analysis given by Raunkiaer, (1934). During survey, it was observed that the studied species flower almost the year round. *Coelogyne corymbosa*, *C. raizadae* and *C. occultata* flower during April-June; *C. cristata*, *C. nitida*, *C.*

prolifera and *C. stricta* during February-May; *C. flaccida*, *C. pempahesiana* and *C. viscosa* flower during February-April; *C. fimbriata* and *C. ovalis* during October-November; *C. barbata*, *C. fuscescens* and *C. punctulata* flower during October-December; *C. pantlingii*. flowers during June-July. Species viz., *C. fimbriata* found at as low as 700m Relli-Pala forest area of Kalimpong Block to 1300m at Algarah forest, *C. flaccida* found at 300m at Majitar, Panbu to 1900m at Dello-Durpin hills, *C. fuscescens* found at 700m at Sangsay Bhalukhop to as high as 2000 at Lava forest range, *C. ovalis* found at 800m at Suruk to Lopchu 2000m, *C. prolifera* at 600m at Najok-Kumsi to 1900m at Todey forest, *C. stricta* at 600m Sittong to 1300m at Mirik, and *C. viscosa* 500m at Panbu to as high as 1400m at Godok of Kalimpong sub-division of district Darjeeling. They have wide range of adaptation and the other species found above the 1000m above the mean sea level.

CONCLUSION

An immediate step has to be taken for conservation of these species before they disappear forever specially for the species which are rare, sparse, threatened and endangered. The ever increasing population needs space which are acquired by clearing forest land. Further landslide, expansion of cultivable land for cultivation, forest fire and deforestation for other developmental projects is taking huge toll on valuable Orchid resource that has to be considered seriously in order to save them. We are lucky to have these plants still intact in the nature even if many are in the stage of rare. But if effective steps are taken immediately for conservation, we can save Orchid species germplasm within a targeted time frame.

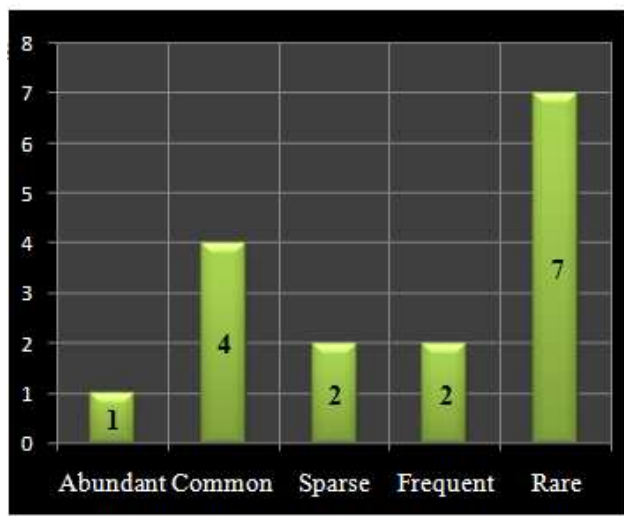


Figure. 2.
Ecological status of available Coelogyne Orchid species in Darjeeling hills

Table. 1.
List of Coelogyne Orchid species with their Voucher specimen, habitat, place of occurrence within Darjeeling, altitudinal range, flowering time and ecological status

Sl. No.	Botanical name with Voucher specimen	*H	Place of occurrence throughout Darjeeling	Altitudinal range	Flowering time	**ES
1	<i>Coelogyne barbata</i> Lindl. ex Griff. [Rajendra et al 0715]	E	Forest areas of Lava, Algarah, Gumbadara, Todey – Kalimpong Sub-Division	1600-2400m	Oct.-Dec.	R
2	<i>Coelogyne corymbosa</i> Lindl. [Rajendra et al 0308]	E	Forest areas of Rimbik, Takdah, Lava – Kalimpong; Tiger Hill, Samenden, Gorkey, Rammam – Darjeeling Sub-Division	1400-3100m	Apr.-June	F
3	<i>Coelogyne cristata</i> Lindl. [Rajendra et al 0217]	E	Forest areas in Lava, Todey-Tangta – Kalimpong; Darjeeling; Mamring, Toroyok, Mungpoo – Kurseong Sub-Division	1200-2700m	Feb.-Apr.	A
4	<i>Coelogyne fimbriata</i> Lindl. [Rajendra et al 1501]	E	Relli-Pala, Algarah forest – Kalimpong Sub-Division	700-1300m	Oct.-Nov.	C
5	<i>Coelogyne flaccida</i> Lindl. [Rajendra et al 0253]	E	Forest areas in Kalimpong 7 th Mile, Majitar, Relli, Panbu, Neol, Joreline, Durpin hill – Kalimpong Sub-Division	300-1800m	Mar.-Apr.	C
6	<i>Coelogyne fuscescens</i> Lindl. [Rajendra et al 0186]	E	Forest areas in Sangsay Bhalukhop, Hill Top, Samthar, Lava, Samalbong-Sinjee,	700-1900m	Oct.-Dec.	C



			Nimbong, Panbu, Kumsi – Kalimpong Sub-Division			
7	<i>Coelogyne nitida</i> (Wall. ex D. Don) Lindl. [Rajendra et al 0195]	E	Forest areas of Nock Dara, Lungshel, Charkhol, Lava, Algarah, Todey-Tangta – Kalimpong; Lopchu, Sukiapokhari – Darjeeling Sub- Division	1400- 2800m	Feb.-May	F
8	<i>Coelogyne occultata</i> Hook. f. [Rajendra et al 1201]	E	Forest areas in Baggonra – Kurseong; Todey-Tangta, Rachela – Kalimpong Sub- Division	1800- 2900m	Apr.-Jun.	R
9	<i>Coelogyne ovalis</i> Lindl. [Rajendra et al 0145]	E	Forest areas in Suruk, Samalbong, Nimbong Panbu – Kalimpong; Tinchulay, Lopchu – Darjeeling Sub-Division	800- 1900m	Oct.-Nov.	S
10	<i>Coelogyne pantlingii</i> S.Z. Lucksom [Rajendra et al 0892]	E	Forest areas in Sukiapokhari, Rammam, Chitrey – Darjeeling; Todey-Tangta – Kalimpong	2000m- 2600m	Jun.-Jul.	R
11	<i>Coelogyne pempahesiana</i> H.J. Chowdhery [Rajendra et al 1146]	E	Tangta forest and Holumba floral nursery (endemic, found only in Kalimpong Sub-Division of Darjeeling District)	1000m- 2800m	Mar.-Apr.	R
12	<i>Coelogyne prolifera</i> Lindl. [Rajendra et al 0269]	E	Forest areas in Hill Top, Nokdara, Godok-Todey, Kumsi, Neol – Kalimpong; Lopchu, Teesta Valley, Tinchulay – Darjeeling Sub-Division	600- 2000m	Feb.-May	C
13	<i>Coelogyne punctulata</i> Lindl. [Rajendra et al 1496]	E	Forest areas in Damsang Gari, Godok-Todey – Kalimpong; Rimbik – Darjeeling Sub- Division	1300- 2200m	Oct. Dec.	R
14	<i>Coelogyne raizadae</i> S.K. Jain & S. Das [Rajendra et al 0821]	E	Forest areas in Rimbik, Lopchu, Sukiapokhari – Darjeeling; St. Marry hill Kurseong Sub- Division	1800- 2400m	Apr.-Jun.	S
15	<i>Coelogyne stricta</i> (D. Don) Schltr. [Rajendra et al 1059]	E	Forest areas in Sittong, Mungpoo – Kurseong; Kumsi, Nimbong – Kalimpong Sub- Division	600- 1300m	Feb.-Apr.; Oct.-Nov.	R
16	<i>Coelogyne viscosa</i> Reichb. f. [Rajendra et al 0767]	E	Forest areas in Panbu, Algarah, Godok-Todey – Kalimpong Sub-Division	500- 1400m	Feb.- Apr.	R

Abbreviation used

*H: Habitat. E=Epiphyte. **ES: Ecological status. C=Common, A=Abundant, S=Sparse, F=Frequent, R=Rare

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