

## Diversity and Distribution of *Eria* Lindley (Orchidaceae) in Darjeeling region of Eastern Himalaya in India

Rajendra Yonzon<sup>1</sup>, D. Lama<sup>1</sup>, R. B. Bhujel<sup>2</sup>, Khyanjeet Gogoi<sup>3</sup> and Samuel Rai<sup>4</sup>

<sup>1</sup>Department of Botany, St. Joseph's College, North Point, 734104, Darjeeling, W. B., India

<sup>2</sup>Taxonomy & Ethnobiology Research Laboratory, Cluny Women's College,  
P.O. Kalimpong, 734301, Darjeeling, W. B., India

<sup>3</sup>Daisa Bordoloi Nagar, Talap, 786156, Tinsukia, Assam, India

<sup>4</sup>Darjeeling Krishi Vigyan Kendra, Uttar Banga Krishi Viswavidyalaya,  
P.O. Kalimpong, 734301, Darjeeling, W.B., India

Corresponding author: e-mail: ryonzone99@gmail.com

[Received Revised 19.10.2012; Accepted 09.11.2012]

### Abstract

Present paper deals diversity, distribution and status of 16 species of *Eria* Lindley (Orchidaceae) from the Darjeeling part of Eastern Himalaya in India. Recorded 16 species are presented alphabetically with their correct botanical names, voucher specimen numbers, habitat, locality (place of occurrence within Darjeeling), and their availability in different altitudinal range, date of collection, flowering period and local availability status mentioned in details.

**Key words:** Orchidaceae, *Eria* species, Diversity, Distribution, Darjeeling Himalaya.

### INTRODUCTION

Orchids are considered to be the most highly evolved among the monocotyledons (Cronquist 1988). They exhibit incredible diversity in shape, size, structure, colour and fragrance of flowers (Kalita 2006) and are pretty admired among the professional and amateur Orchid lovers of the world (Arora 1985). In India, Orchids form 10 % of the world Orchid flora with Himalayas as their natural home (Medhi & Chakrabarti 2009) and the largest and commercially important flowering plants (Mulgaonkar & Dabhade 2010). It is estimated that over 22,500 species with 779 genera are distributed throughout the world (Mabberly 2008). There are 1331 species belonging to 186 genera widely distributed throughout the country (Chowdhery 2009; Misra 2007).

### Botanical description

The genus *Eria* was established in 1825 by John Lindley in the *Botanical Register*. The genus comprises of about 500 species, widely distributed in Tropical Asia, Malaysia to New Guinea, Australia, Polynesia and adjacent Islands. There are 51 species in India (Pearce & Cribb 2002).

Plants epiphytic, rarely lithophytic perennial herbs. Pseudobulbs elongated to form stem. Leaves terete. Inflorescence terminal or axillary, usually spike, rarely 1 or 2 flowered. Flowering rachis hirsute or woolly. Sepals free, glabrous or hirsute, adnate to the elongate



**Fig. 1:** Location map of the study area [not to the scale]

foot of the column and form mentum. Lip sessile. Column short, broad, often winged. Anther 4-8 chambered. Pollinia 8, pyriform.

### Study area

Darjeeling is the northernmost district of West Bengal, India. The district is subdivided into four Sub-Divisions *viz.*, Darjeeling sadar; Kalimpong, Kurseong and Siliguri (Fig. 1). The region lies between 26°31' and 27°31' North latitude and between 87°59' and 88°53' East longitude in the Eastern Himalayan region of India. It is bordered by Sikkim in the North, Terai and Doars in the South, Bhutan in the East and Nepal in the West. The district has two topographical features. Darjeeling, Kurseong and Kalimpong Sub-Divisions form the hill areas whereas Siliguri Sub-Division is stationed at the foothill in a vast stretch of the plains. The shape of the district is triangular. The total area of district is 3254.7 sq km which is 3.68 percent of the total areas of West Bengal state. The hilly region covers 2320 sq km and the remaining 934.7 sq km of the area falls in the Terai and plains. The altitudinal variations of the district range from 130 m at Siliguri to 3660 m at Sandakphu-Phalut with a sharp physiographic contrast between the plain and the mountainous regions. The climate of the region is conducive for growing of Orchids and it harbours numbers of Orchid species (Yonzon *et al* 2012a). In the present investigation, diversity and distribution of different species of *Eria* Lindley in Darjeeling Himalayan region of Eastern Himalaya of India was carried out to find out the diversity and distribution of this genus in the study area.

### Physiographic Features

The hilly part of Darjeeling in general, is composed of steep hills. The spurs of the Himalayas rise up from the plains to various altitudes in this zone. Mountain peaks of various heights and deep valleys constitute the characteristic physical features of Darjeeling hills.

## Climate

The climatic condition in places of higher reaches in Darjeeling is sharply different from that of the places in plains. The variation in climate is strongly correlated with the variation in altitude. As there is considerable difference in the altitude of the different segments of the hill areas, the climate also varies greatly from one place to another. While in plains the climate is chiefly tropical, it is subtropical in places like Kurseong, Kalimpong and Mirik. The Darjeeling subdivision are is predominantly temperate and it is subalpine in places situated above 3000 m like Sandakphu and Phalut. The subalpine region generally remains snow-covered for 1 to 4 months of the year and there is no any permanently snow-covered region in Darjeeling.

## Rainfall

The rainfall varies at different altitudes and hill situations. Overall, it is a high rainfall area. The average rainfall varies from 250 to 300 cm of which 80 % is received during June to September. Rainfall is not certain during November to March.

## Temperature

The average maximum and minimum temperature range round the year is  $\pm 20^{\circ}\text{C}$  and  $\pm 2^{\circ}\text{C}$  respectively. The temperature in this zone also varies monthly due to altitudinal variation. Even in a small area, the hilltops and foothills show considerable difference in temperature. January is the coldest month when the temperature at Darjeeling often goes down to  $-5^{\circ}\text{C}$  and May is the hottest month when the temperature reaches to  $34^{\circ}\text{C}$  in Teesta river valley of Kalimpong subdivision.

## Relative Humidity

The relative humidity also varies from 70 to 80 % depending on the locality and season of the year. At higher altitudes, humidity more often causes accumulation of fog and inhibiting the intensity of light.

## MATERIALS AND METHODS

Intensive field survey was conducted during the year 2007 – 2012 covering all the seasons of the year in the entire Darjeeling Himalaya and Sub-Himalaya regions including the forest areas, floral nurseries and farms covering all the altitudinal ranges as low as Siliguri  $\pm 130$  m to as high as Sandakphu – Phalut 3660 m above the mean sea level. While working on Orchid flora of Darjeeling Himalayan region, different species of *Eria* Lindley were collected and recorded in the field note book. The specimens collected were processed into mounted herbarium-sheets following Jain & Rao (1977); and identified and authenticated with the help of the *Flora of British India* (Hooker 1888 – 1890); *Orchids of the Sikkim Himalaya* (King & Pantling 1898); *Indian Orchids Guide to Identification and Culture*, Vol. II (Pradhan 1979); *Orchid Flora of Arunachal Pradesh* (Chowdhery 1998); *Orchids of India* (Bose & Bhattacharjee 1999); *Orchids of Sikkim and North East Himalaya* (Luckson 2007); *The Flora of Bhutan* (Pearce & Cribb 2002) and confirmed by matching at CAL. Finally, one set of Voucher specimens of *Eria* species were deposited in the NBU, Herbarium of Taxonomy and Environmental Biology Laboratory, Department of Botany, North Bengal University, Siliguri, West Bengal, India and remaining sets were deposited in the herbarium of Department of Botany, St. Joseph's College, North Point, Darjeeling and at Taxonomy and Ethnobiology Research Laboratory, Cluny Women's College, Kalimpong. All

the recorded species of *Eria* Lindley are enumerated alphabetically to their species epithet and with exsiccatae, places and altitudinal range of local distribution, habitat, phenology and local availability status.

## RESULTS AND DISCUSSION

Different species of *Eria* Lindley are widely distributed throughout the study region. During present survey in areas where Orchids grow in natural habitat, 16 species of *Eria* were recorded from the Darjeeling Himalayan and Sub-Himalayan regions of Eastern Himalaya in India (Table 1). Also an artificial key provided below for the identification of recorded species in Darjeeling hills. All the recorded species are epiphytic. Further, *E. amica* Reichenbach f. grows in wide altitudinal range of 500 to 1600 m; others like *E. lasiopetala* (Willdenow) Ormerod, *E. biflora* Griffith and *E. acervata* Lindley are available in the altitudinal range of 400 to 900 m. Some other species viz., *E. bractescens* Lindley within 400 to 1700 m, *E. stricta* Lindley available within 400 to 1400 m, *E. pumila* Lindley within 200 to 600 m, *E. pannea* Lindley within 600 to 1000 m, *E. paniculata* Lindley at 700 to 1600 m, *E. spicata* (David Don) Handel-Mazzetti at 400 to 2300 m and other species like *E. bambusifolia* Lindley, *E. clausa* King & Pantling, *E. coronaria* (Lindley) Reichenbach f., *E. excavata* Lindley, *E. graminifolia* Lindley and *E. vittata* Lindley are available above 1100 m extending upto 3320 m above mean sea level. The flowering time also varies greatly among different species and only *E. biflora* Griffith flower during September to October and other two like *E. coronaria* (Lindley) Reichenbach f. and *E. bambusifolia* Lindley flower during October to December while other was flowers during February to August.

### Key to the species

- 1a. Pseudobulbs with 1 distinct internodes ..... 2
- 1b. Pseudobulbs with several internodes ..... 6
- 2a. Lip simple ..... *Eria vittata*
- 2b. Lip 3-lobed ..... 3
- 3a. Pseudobulbs narrowly cylindric, more than 4 cm tall ..... 4
- 3b. Pseudobulbs conical, ovoid or flask shaped, less than 3 cm tall ..... 5
- 4a. Flowers more than 2 cm long; pseudobulbs 5-18 cm tall, always 2-leaved; flowering  
October to January ..... *E. coronaria*
- 4b. Flowers less than 1.3 cm long; pseudobulbs 4-9 cm tall, 2 to 6-leaved; flowering in  
April ..... *E. bractescens*
- 5a. Rachis glabrous; lip with 5-7 sinuous lamellae; pseudobulbs always 2-leaved, ovary  
7 – 9 mm long ..... *E. clausa*
- 5b. Rachis reddish-pubescent; ovary 1-1.5 cm long; lip with 2 lamellae at base;  
pseudobulbs more than 2-leaved ..... *E. excavata*
- 6a. Plants reed-like; more than 30 cm tall; stems more than 7-leaved ..... 7
- 6b. Plants pseudobulbous; less than 30 cm tall; stems less than 7-leaved ..... 8
- 7a. Leaves terete to flat, less than 1 cm wide; inflorescence densely many-flowered  
..... *E. paniculata*
- 7b. Leaves narrowly elliptic-oblong, more than 2 cm wide; inflorescence laxly few-  
flowered ..... *E. bambusifolia*
- 8a. Leaves terete, less than 4 mm wide ..... *E. pannea*
- 8b. Leaves flat, more than 4 mm wide ..... 9

- 9a. Inflorescence globose-capitate, 0.4-1 cm across; lateral sepals not forming a tubular mentum; lateral lobes of lip lanceolate-acuminate ..... *E. pumila*  
 9b. Inflorescence not as above ..... 10  
 10a. Inflorescence secund (or in 2 opposite ranks); flowers white-woolly; peduncle glabrous ..... *E. stricta*  
 10b. Inflorescence racemose ..... 11  
 11a. Inflorescence glabrous throughout (apart from ovary) ..... 12  
 11b. Inflorescence wooly, tomentose or pubescent ..... 13  
 12a. Inflorescence less than 1 cm long; 2 or 3-flowered ..... *E. biflora*  
 12b. Inflorescence more than 2 cm long; densely many-flowered ..... *E. spicata*  
 13a. Inflorescence densely white-tomentose ..... *E. lasiopetala*  
 13b. Inflorescence pubescent, not tomentose ..... 14  
 14a. Pseudobulbs long-cylindric; sepals and petals pure white ..... *E. graminifolia*  
 14b. Pseudobulbs flask-like, stacked; sepals and petals tinged with green/ yellow .. 15  
 15a. Sepals - petals white tinged with green; leaf tip obtuse, emarginated ..... *E. acervata*  
 15b. Sepals and petals buff-yellow to greenish-yellow; leaf apex acute .... *E. amica*

In comparison with other vascular plant species, the members of Orchidaceae are more vulnerable toward extinction in the natural habitat throughout the study area. Destruction of habitat cause drastic loss of these species. Man's multifarious activities are the major threats (Yonzzone *et al* 2011). We are lucky to have these plants still surviving, though many of those in the nature are facing extremely high level of threat to the extinction. The random killing and removal of host trees and deforestation associated with commercial plantations need to be stopped immediately (Yonzzone *et al* 2012). But if effective conservational steps are taken immediately, we can save at least some of these species in their natural habitat.

**Table 1.** List of species of *Eria* Lindley recorded from Darjeeling Himalayan region along with their habitat, reference to voucher specimen, local distribution in Darjeeling, flowering time and local availability status

Botanical names of <i>Eria</i> species, habit; Exsiccatae with date of collection [dd.mm.yyyy]	Place of occurrence in Darjeeling with Altitudinal range (amsl)	Flowering time	Local availability Status
<i>Eria acervata</i> Lindley in J. Hort. Soc. London 6: 57. 1851. [Epiphytic]; Rajendra <i>et al</i> 0608, dt. 02.08. 2008	Kalijhora (Kurseong sub-division); Relli, Najoke, Jholung, Mungpong (Kalimpong sub-division) [200 – 900 m]	June – August	Rare
<i>Eria amica</i> Reichenbach f., Xenia Orchid. 2: 162, t.168. 1870. [Epiphytic]; Rajendra <i>et al</i> 0786, dt. 20.03. 2009	Forest areas in Kumsi, Panbu, Algarah, Samthar, Pareng, Gasoke (Kalimpong sub-division) [500 – 1600 m]	March – June	Sparse
<i>Eria bambusifolia</i> Lindley in J. Proc. Linn. Soc., Bot. 3: 61. 1859. [Epiphytic]; Rajendra <i>et al</i> 0405, dt. 20.05. 2008	Sukiapokhari (Darjeeling sub-division); Godok-Todey, Tangta (Kalimpong sub-division); Rambi forest (Kurseong sub-division) [1900 – 2800 m]	October-December	Rare
<i>Eria biflora</i> Griffith, Not. Pl. Asiat. 3: 302. 1851. [Epiphytic]; Rajendra <i>et al</i> 1517, dt. 28.10. 2010	Najok-Sepkhola, 27 <sup>th</sup> mile N.H.P.C. project sides (Kalimpong sub-division) [400 – 900 m]	September -October	Rare
<i>Eria bractescens</i> Lindley in Bot. Reg. 27: misc. 18, no. 46. 1841. [Epiphytic]; Rajendra <i>et al</i> 089, dt. 20.06. 2009	Algarah, Pareng, Nimbong (Kalimpong sub-division); Tinchulay, Dow hill, Lathpanjar, Mungpoo (Kurseong sub-division) [400 – 1700 m]	May –July	Rare

Botanical names of <i>Eria</i> species, habit; Exsiccatae with date of collection [dd.mm.yyyy]	Place of occurrence in Darjeeling with Altitudinal range (amsl)	Flowering time	Local availability Status
<i>Eria clausa</i> King & Pantling in J. Asiat. Soc. Bengal 65(2): 121. 1896. [Epiphytic]; <i>Rajendra et al 0779</i> , dt. 09.03. 2009	Ramam – Darjeeling sub-division; Neora Valley (Kalimpong sub-division); Senchale (Kurseong sub-division) [1100 – 2000 m]	February – May	Rare
<i>Eria coronaria</i> (Lindley) Reichenbach f. in Walpers, Ann. Bot. Syst. 6: 271. 1864. [Epiphytic]; <i>Rajendra et al 0175</i> , dt. 27.10. 2007	Joreline-Nimbong, Kafer, Lungsel, Nokdara, Lava, Damsang forest, Todey – (Kalimpong sub-division); Lopchu – (Darjeeling sub-division); Chimney (Kurseong sub-division) [1100 – 2300 m]	October-December	Common
<i>Eria excavata</i> Lindley Gen. Sp. Orchid. Pl.: 67. 1830. [Epiphytic]; <i>Rajendra et al 0233</i> , dt. 19.03. 2008	Relli, Panbu, Kumsi, Todey-Tangta forest – (Kalimpong sub-division); Teesta river sides, Lopchu – (Darjeeling sub-division) [1000 – 2300 m]	March – June	Frequent
<i>Eria graminifolia</i> Lindley in J. Proc. Linn. Soc., Bot 3: 54. 1859. [Epiphytic]; <i>Rajendra et al 1206</i> , dt. 30.05. 2010	Toroyok – (Kurseong sub-division); Serikhola, Ramam – (Darjeeling sub-division); Tangta forest (Kalimpong sub-division) [1900 – 3320 m]	May – August	Rare
<i>Eria lasiopetala</i> (Willdenow) Ormerod in Opera Botanica 124: 22. 1995. [Epiphytic]; <i>Rajendra et al 0227</i> , dt. 19.03. 2008	Relli, Kambal, Bagrakot, Seokbir khani, Jholung, Chitrey-Teesta, Solok (Kalimpong sub-division); Kalijhora, Lohapul, (Kurseong sub-division); Sevoke (Siliguri sub-division) [200 – 700 m]	March – July	Common
<i>Eria paniculata</i> Lindley in Wall., Pl. Asiat. Rar. 1: 32, t.36. 1830. [Epiphytic]; <i>Rajendra et al 0342</i> , dt. 26.04. 2008	Lungshel Beong khola, Algarah – (Kalimpong sub-division); Mirik – (Kurseong sub-division) [700 – 1600 m]	February – May	Rare
<i>Eria pannea</i> Lindley in Bot. Reg. 28: misc.64, no.79. 1842. [Epiphytic]; <i>Rajendra et al 1592</i> , dt. 10.05.2011	Kumsi forest, Kambal, Chisang-Godok – (Kalimpong sub-division); Sittong (Kurseong sub-division) [600 – 1000 m]	May – July	Rare
<i>Eria pumila</i> Lindley Gen. Sp. Orchid. Pl.: 68. 1830. [Epiphytic]; <i>Rajendra et al 1307</i> , dt. 07.07.2010	Kalijhora – (Kurseong sub-division); Jaldhaka, Mungpong (Kalimpong sub-division); Sevoke – (Siliguri sub-division) [200 – 600 m]	May - August	Rare
<i>Eria spicata</i> (David Don) Handel-Mazzetti Symb. Sin. 7: 1353. 1936. [Epiphytic]; <i>Rajendra et al 0601</i> , dt. 07.08. 2008	Lungshel, Kumsi, Nokdara, Lava, Todey – (Kalimpong sub-division); Lopchu – (Darjeeling sub-division); Rambhi forest (Kurseong sub-division) [400 – 2300 m]	February - August	Frequent
<i>Eria stricta</i> Lindley Coll. Bot. 8: t.41b. 1826. [Epiphytic]; <i>Rajendra et al 0043</i> , dt. 14.02.2007	Suruk, Samalbong, Chuikhim, Kumsi, Chisang-Godok – (Kalimpong sub-division); Latpanjar, Guling forest – (Kurseong sub-division) [400 – 1400 m]	January – April	Sparse
<i>Eria vittata</i> Lindley in J. Proc. Linn. Soc., Bot. 3: 51. 1859. [Epiphytic]; <i>Rajendra et al 1053</i> , dt. 23.02. 2010	Todey-Tangta, Neora Valley – (Kalimpong sub-division); Senchale, Tiger Hill (Darjeeling sub-division) [1500 – 2600 m]	February – April	Rare

### Acknowledgements

First author is thankful to the University Grants Commission, New Delhi for awarding Rajiv Gandhi National Fellowship.

## LITERATURE CITED

- Arora, Y.K. 1985. Conservation and Trade of Orchids. *Biology, Conservation, and Culture of Orchids*, Proc. Vol. ed. Vij, S.P., East – West Press, 381 – 386.
- Bose, T.K. & Bhattacharjee, S.K. 1999. *Orchids of India*. Revised Edition. Naya Prokash. Calcutta, India.
- Chowdhery, H.J. 1998. *Orchid Flora of Arunachal Pradesh*. Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Chowdhery, H.J. 2009. Orchid Diversity in North – Eastern States of India. *J. Orchid Soc. India*. 23 (1 & 2): 19 – 42.
- Cronquist, A. 1988. *The Evolution and Classification of Flowering Plants*. 2<sup>nd</sup> Edn. The New York Botanic Garden, New York
- Hajra, P.K. & De, Aparajita. 2011. Orchids of Assam and their *in-situ* conservation. *Phytotaxonomy*. 11: 28 – 36.
- Hooker, J.D. 1888 – 1890. *The Flora of British India*. Vol. 5 & 6. L. Reeve & Co. London.
- Jain, S.K. & Rao, R.R. 1977. *Field and Herbarium Methods*. Today and Tomorrow's Printers and Publishers. New Delhi, India.
- Kalita, P.C. 2006. Diversity in orchids of Bhahmaputra Valley, Central Assam, India. *Phytotaxonomy*. 6: 96 – 98.
- King, G. & Pantling, R. 1898. The Orchids of the Sikkim – Himalaya. *In Annals of the Royal Botanic Garden*, Calcutta 8, India.
- Lucksom, S.Z. 2007. *The Orchids of Sikkim and North East Himalaya: Development Area*, Jiwan Thing Marg, Gangtok, East Sikkim, India.
- Mabberley, D.J. 2008. *Mabberley's Plant book: A portable dictionary of plants, their classification and uses*. 3<sup>rd</sup> edition. Cambridge University Press, Cambridge.
- Medhi, R.P. & Chakrabarti, S. 2009. Traditional Knowledge of NE people on conservation of wild orchids. *Indian J. Tradn. Knowl.* 8(1): 11 – 16.
- Misra, S. 2007. *Orchids of India*. Bishen Singh Mahendra Pal Singh, Dehradun, India
- Mulgaonkar, M.S. & Dabhade, G.T. 2010. Pollen study of six species of terrestrial orchids under scanning electron microscopy (SEM) from the Western Ghats of Maharashtra. *Phytotaxonomy*. 10: 63 – 69.
- Pearce, N.R. & Cribb, P.J. 2002. *Flora of Bhutan. The Orchids of Bhutan*. Vol. 3, Part 3. Royal Botanic Garden, Edinburgh.
- Pradhan, U.C. 1979. *Indian Orchids Guide to Identification and Culture*, (Vol. II) Premulaceae Books, Kalimpong, India.
- Yonzone, Rajendra.; Lama, D.; Bhujel, R.B. & Rai, Samuel. 2011. Epiphytic Orchid species Diversity of Darjeeling Himalaya of West Bengal, India. *Asian J. of Pharm. & Life Sci. (AJPLS)* 1(4): 449 – 465.
- Yonzone, Rajendra.; Lama, D.; Bhujel, R.B.; Gogoi, Khyanjeet. & Rai, Samuel. 2012. First report of intraspecific variation in floral morphology of *Eria amica* Rchb. f. (Orchidaceae) and its current status in Darjeeling Himalaya of India. *The McAllen International Orchid Society Journal (The MIOS Journal)* 13(2): 11 – 16.