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

Rajendra Yonzone¹, D. Lama¹, R. B. Bhujel², Khyanjeet Gogoi³ and Samuel Rai⁴

¹Department of Botany, St. Joseph’s College, North Point, 734104, Darjeeling, W. B., India
²Taxonomy & Ethnobiology Research Laboratory, Cluny Women’s College, P.O. Kalimpong, 734301, Darjeeling, W. B., India
³Daisa Bordoloi Nagar, Talap, 786156, Tinsukia, Assam, India
⁴Darjeeling Krishi Vigyan Kendra, Uttar Banga Krishi Viswavidyalaya, P.O. Kalimpong, 734301, Darjeeling, W.B., India

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

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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 wooly. Sepals free, glabrous or hirsute, adnate to the elongate

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 Dooars 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 harvours numbers of Orchid species (Yonzone 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 ± 20°C and ± 2°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°C and May is the hottest month when the temperature reaches to 34°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 ±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 (Lucksom 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
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 anartificial key provided bellow 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 up to 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 ................................................................................................. 3
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 flusk-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 (Yonzone 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 (Yonzone 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

<table>
<thead>
<tr>
<th>Botanical names of <em>Eria</em> species, habit: Exsiccatae with date of collection [dd.mm.yyyy]</th>
<th>Place of occurrence in Darjeeling with Altitudinal range (amsl)</th>
<th>Flowering time</th>
<th>Local availability Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Eria acervata</em> Lindley in J. Hort. Soc. London 6: 57. 1851. [Epiphytic]; <em>Rajendra et al</em> 06.08, dt. 02.08. 2008</td>
<td>Kalijhora (Kurseong sub-division); Relli, Najoke, Jholung, Mungpong (Kalimpong sub-division) [200 – 900 m]</td>
<td>June – August</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria amica</em> Reichenbach f., Xenia Orchid. 2: 162, t.168. 1870. [Epiphytic]; <em>Rajendra et al</em> 07.86, dt. 20.03. 2009</td>
<td>Forest areas in Kumsi, Panbu, Algarah, Samthar, Pareng, Gasoke (Kalimpong sub-division) [500 – 1600 m]</td>
<td>March – June</td>
<td>Sparse</td>
</tr>
<tr>
<td><em>Eria bambusifolia</em> Lindley in J. Proc. Linn. Soc., Bot. 3: 61. 1859. [Epiphytic]; <em>Rajendra et al</em> 04.05, dt. 20.05. 2008</td>
<td>Sukiapokhari (Darjeeling sub-division); Godok-Todey, Tangta (Kalimpong sub-division); Rambi forest (Kurseong sub-division) [1900 – 2800 m]</td>
<td>October- December</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria biflora</em> Griffith, Not. Pl. Asiatic. 3: 302. 1851. [Epiphytic]; <em>Rajendra et al</em> 15.17, dt. 28.10. 2010</td>
<td>Najok-Sepkhola, 27th mile N.H.P.C. project sides (Kalimpong sub-division) [400 – 900 m]</td>
<td>September -October</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria bractescens</em> Lindley in Bot. Reg. 27: misc. 18, no. 46. 1841. [Epiphytic]; <em>Rajendra et al</em> 08.9, dt. 20.06. 2009</td>
<td>Algarah, Pareng, Nimbong (Kalimpong sub-division); Tinchulay, Acowl, Lathpanjar, Mangpoo (Kurseong sub-division) [400 – 1700 m]</td>
<td>May –July</td>
<td>Rare</td>
</tr>
<tr>
<td>Botanical names of <em>Eria</em> species, habit; Exsiccatiae with date of collection [dd.mm.yyyy]</td>
<td>Place of occurrence in Darjeeling with Altitudinal range (amsl)</td>
<td>Flowering time</td>
<td>Local availability Status</td>
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<tr>
<td><em>Eria clausa</em> King &amp; Pantling in J. Asiat. Soc. Bengal 65(2): 121. 1896. [Epiphytic]; <em>Rajendra et al</em> 0779, dt. 09.03. 2009</td>
<td>Ramal – Darjeeling sub-division; Neora Valley (Kalimpung sub-division); Senchale (Kurseong sub-division) [1100 – 2000 m]</td>
<td>February – May</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria coronaria</em> (Lindley) Reichenbach f. in Walpers, Ann. Bot. Syst. 6: 271. 1864. [Epiphytic]; <em>Rajendra et al</em> 0175, dt. 27.10. 2007</td>
<td>Joreline-Nimbong, Kafer, Lungse, Nokdara, Lava, Damsang forest, Todey – (Kalimpung sub-division); Lopchu – (Darjeeling sub-division); Chimney (Kurseong sub-division) [1100 – 2300 m]</td>
<td>October–December</td>
<td>Common</td>
</tr>
<tr>
<td><em>Eria graminifolia</em> Lindley in J. Proc. Linn. Soc., Bot. 3: 54. 1859. [Epiphytic]; <em>Rajendra et al</em> 1206, dt. 30.05. 2010</td>
<td>Toroyok – (Kurseong sub-division); Serikhola, Ramam – (Darjeeling sub-division); Tangta forest (Kalimpung sub-division) [1900 – 3320 m]</td>
<td>May – August</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria lasiopetala</em> (Willdenow) Ormerod in Opera Botanica 124: 22. 1995. [Epiphytic]; <em>Rajendra et al</em> 0227, dt. 19.03. 2008</td>
<td>Reilli, Kambal, Bagrakot, Seokbir khani, Jholung, Chitrey-Teesta, Solok (Kalimpung sub-division); Kalijhora, Lohapul, (Kurseong sub-division); Sevoke (Siliguri sub-division)</td>
<td>March – July</td>
<td>Common</td>
</tr>
<tr>
<td><em>Eria paniculata</em> Lindley in Wall., Pl. Asiat. Rar. 1: 32, t.36. 1830. [Epiphytic]; <em>Rajendra et al</em> 0342, dt. 26.08. 2008</td>
<td>Lungshel Beong khola, Algarah – (Kalimpung sub-division); Mirik – (Kurseong sub-division) [700 – 1600 m]</td>
<td>February – May</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria pannea</em> Lindley in Bot. Reg. 28. misc.64, no.79. 1842. [Epiphytic]; <em>Rajendra et al</em> 1592, dt. 10.05.2011</td>
<td>Kumsi forest, Kambal, Chisang-Godok – (Kalimpung sub-division); Sittong (Kurseong sub-division) [600 – 1000 m]</td>
<td>May – July</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria pumila</em> Lindley Gen. Sp. Orchid. Pl.: 68. 1830. [Epiphytic]; <em>Rajendra et al</em> 1307, dt. 07.07.2010</td>
<td>Kalijhora – (Kurseong sub-division); Jaldhaka, Mungpong (Kalimpung sub-division); Sevoke – (Siliguri sub-division) [200 – 600 m]</td>
<td>May - August</td>
<td>Rare</td>
</tr>
<tr>
<td><em>Eria spicata</em> (David Don) Handel-Mazzetti Symb. Sin. 7: 1353. 1936. [Epiphytic]; <em>Rajendra et al</em> 0601, dt. 07.08. 2008</td>
<td>Lungshel, Kumsi, Nokdara, Lava, Todey – (Kalimpung sub-division); Lopchu – (Darjeeling sub-division); Rambi forest (Kurseong sub-division) [400 – 2300 m]</td>
<td>February - August</td>
<td>Frequent</td>
</tr>
<tr>
<td><em>Eria stricta</em> Lindley Coll. Bot. 8: 414b. 1826. [Epiphytic]; <em>Rajendra et al</em> 0043, dt. 14.02.2007</td>
<td>Suruk, Samalbong, Chukhim, Kumsi, Chisang-Godok – (Kalimpung sub-division); Latpanjar, Guling forest – (Kurseong sub-division) [400 – 1400 m]</td>
<td>January – April</td>
<td>Sparse</td>
</tr>
<tr>
<td><em>Eria vittata</em> Lindley in J. Proc. Linn. Soc., Bot. 3: 51. 1859. [Epiphytic]; <em>Rajendra et al</em> 1053, dt. 23.02. 2010</td>
<td>Todey-Tanga, Neora Valley – (Kalimpung sub-division); Senchale, Tiger Hill (Darjeeling sub-division) [1500 – 2600 m]</td>
<td>February – April</td>
<td>Rare</td>
</tr>
</tbody>
</table>

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LITERATURE CITED


