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DIVERSITY RESOURCES, DISTRIBUTION AND LOCAL AVAILABILITY STATUS OF *LIPARIS* L.C. RICHARD, ORCHID SPECIES OF DARJEELING HIMALAYA OF INDIA

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ABSTRACT:

The present paper deals sixteen *Liparis* L.C. Richard, Orchid species diversity, distribution and local availability status in Darjeeling Himalaya of India. Of them, nine are epiphytic and the rest seven are terrestrial. This attempt is the first step to correct taxonomic identification to workout currently accepted botanical names with brief description, artificial key to the species, voucher specimen numbers, status, habitat, altitudinal ranges, phenology and local and geographical distribution of *Liparis* species in the regions.

KEY WORD: *Liparis* Orchid Species; Diversity; Distribution; Local Availability Status, Darjeeling Himalaya, India.

INTRODUCTION:

Orchids are considered to be the most highly evolved among the monocotyledons (Hajra and De, 2011). 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 and Chakrabarti, 2009) and the largest and commercially important flowering plants (Mulgaonkar and 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).

The genus *Liparis* was described in 1818 by L.C. Richard in the *Memoires du Muscum d'Histoire Naturelle, Paris*. The genus comprises about 250 species widespread in the tropics of the world and less common, but still widespread in the temperate regions.

Plant herbaceous, annual or perennial, terrestrial, lithophytic or epiphytic with sympodial growth habit. Pseudobulbs present in epiphytic and corms in terrestrial and lithophytic species. Leaves 1 to several, plicate, sheathing at base. Inflorescence terminal, erect, racemose, laxly few to many-flowered. Flowers small. Sepals free, spreading. Petals filiform to linear. Lip recurved, entire to 3-lobed, acute, obtuse or emarginated, sometimes callose. Column elongate, incurved, narrowly winged above; pollinia 4.

STUDY REGION:

Darjeeling is the Orchid species resourceful Northern most district of West Bengal, India. The district is subdivided into four Sub – Divisions viz., Darjeeling sadar; Kalimpong, Kurseong and Siliguri (Fig. 1). 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 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. The present investigation deals with diversity and the distributional record with Voucher specimen, habitat, local distribution within Darjeeling, date of collection, flowering and fruiting time, altitudinal ranges, general distribution of sixteen *Liparis* Orchid species available in Darjeeling Himalaya of West Bengal, India.

Physiographic Features

The Darjeeling in general, is composed of steep hills that form a part of the Himalayan mountain range and terraced sloppy lands. The mountain spurs of the Himalaya rise up from the plains to various altitudes in the zone. Mountain peaks of various heights and deep valleys constitute the characteristic physical features of Darjeeling hills.

Climate

The climatic condition of Darjeeling is sharply different from that of the 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.

Rainfall

The rainfall varies at different altitudes and hill situations. Overall, it is a high rainfall area. The average rainfall varies from 2500 to 3000 mm of which 80% is received during June to September. Rainfall is not certain during the months from 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 altitude. 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 sub-division.

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 METHOD:

The intensive field survey was conducted during the year 2007 – 2012 covering all the seasons of the year in the entire Darjeeling district including the forest areas, floral nurseries and farms of as low as Siliguri which is located at 150m to as high as Sandakphu-Phalut located at 3636m of the entire Darjeeling district of West Bengal. While working on Orchid flora of Darjeeling Himalaya, the *Liparis* species found were also studied intensively. All the relevant data are recorded in the field notebook with their necessary information. The collected specimens were dissected and examined in the laboratory during flowering period. Observations on habitat, local availability status and photography were done in the fields. Herbarium specimens were prepared by standard methods (Jain and Rao, 1977), specimens so collected were processed, preserved and mounted on herbarium sheets and described, properly identified and authenticated with the help of *The Flora of British India* (Hooker, 1888 – 1890); *The Orchids of the Sikkim Himalaya* (King and Pantling, 1898); *Indian Orchids Guide to Identification and Culture*, Vol. II (Pradhan, 1979); *Orchid Flora of Arunachal Pradesh* (Chowdhery, 1998); *Orchids of India* (Bose and Bhattacharjee, 1999); *Orchids of Sikkim and North East Himalaya* (Lucksom, 2007); *The Flora of Bhutan* (Pearce and Cribb, 2002)) and confirmed at Central National Herbarium, Botanical Survey of India, CAL. 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. All the plant specimens are arranged alphabetically as per their altitude wise distribution in the area with local availability status, botanical names, date of collection, voucher specimen numbers, habitat, phenology, local and geographical distribution.

KEY TO THE SPECIES:

- 1. Plants with non-jointed, usually membranous. Leaves; usually terrestrial.....2
- 1a. Plants with jointed, often coriaceous. Leaves; usually epiphytic.....9
- 2. Plants with 1 leaf.....3
- 2a. Plants with 2 or more leaves.....4
- 3. Leaf cordate, more than 7.5 cm wide; floral bracts more than 7 mm long; flower more than 1 cm long, *L. cordifolia*
- 3a. Leaf not cordate, less than 4 cm wide, floral bracts less than 5 mm long; flowers less than 5 mm long..... *L. gamblei*
- 4. Pseudobulb without rhizome.....6
- 4a. Pseudobulbs connected with rhizome.....8
- 5. Pseudobulbs tuberoids; leaves 2, broadly elliptic *L. deflexa*
- 5a. Pseudobulb not tuberoides; Leaves more than 2, narrowly elliptic lanceolate..... *L. odorata*
- 6. Leaves broadly ovate to elliptic-ovate, sub-acute; lip obovate, apex truncate, erose, cuspidate.....*L. cathcartii*
- 6a. Leaves broadly elliptic-ovate, acuminate amplexicaul base, with long sheathing petiole.....7
- 7. Flowers yellowish-green, tinged with purple, lip oblong, concave, deflexed from middle, 2 outer lamellae about hypochile and 2 inner lamellae within hypochile, 2 calli at base,*L. nervosa*
- 7a. Flowers yellowish-green; lip cuneate, deflexed about middle, with 5-lamellae, *L. dongchenii*
- 8. Pseudobulb with 1 leaf.....10
- 8a. Pseudobulb with 2 leaves.....12
- 8b. Pseudobulb with more than 2 leaves.....14

9. Pseudobulb with more than 2.5 cm long and leaf more than 8 cm long..... *L. bootanensis*
- 9a. Pseudobulbs less than 2.5 cm long; leaf less than 12 cm long.....11
10. Lip broadly oblong, concavity without any thickened processes..... *L. cespitosa*
- 10a. Lip broadly quadrate, concavity with two thickened processes...
L. duthiei
11. Pseudobulb less than 5 cm long; leaf less than 15 cm long, inflorescence 7-20 cm long, flowers less than 4-7 mm long13
- 11a. Pseudobulb more than 5 cm long, leaf more than 15 cm long, inflorescence 16-25 cm long, flowers more than 2 cm long.....*L. plantaginea*
12. Pseudobulb laterally compressed; inflorescence pendulous.....*L. viridiflora*
- 12a. Pseudobulb laterally not compressed; inflorescence erect.....*L. somai*
13. Lip deflexed about the middle; 4 calluses on claw, the apical lobe cordate with apiculate tip, base with a small crescentric nectar and 2-divaricating callosities, column ovate broad base with triangular wing.....*L. platyrachis*
- 13a. Lip deflexed from base, oblong-ovate; 2 calluses on claw, apex broad, obtuse, margin incurved, saggitate at base and with an elliptic nectar; column with 2-filiform pendent process from each wing.....*L. resupinata*
- 13b. Floral parts larger than the *L. resupinata**L. resupinata* var. *ridleyi*

SYSTEMATIC ENUMERATION:

Liparis bootanensis Griffith, Itin. Pl. Khasyah Mts.: 98. 1848; Not. Pl. Asiat. 3: 278. 1851; Plant epiphytic, 13-21 cm tall. Pseudobulbs 2.2-3.5 x 0.8-1.3 cm, narrowly cylindric. Leaf solitary, 13-18 x 2.2-

3.2 cm, from apex of pseudobulb, linear-oblong to oblanceolate, acute. Inflorescence 16-19 cm long, laxly 9 to 15 flowered. Flowers 0.5-0.6 cm long, pale brown to pinkish white. Sepals subsimilar, linear-lanceolate, 1-veined. Dorsal sepal 0.8-1 x 0.1-0.2 cm, weakly reflexed; lateral sepals 18 x 1 mm, projecting beyond the lip. Petals 0.7-0.9 x 0.1-0.2 cm, linear, obtuse, decurved. Lip 0.8-1 x 0.6-0.8 cm, wedge-shaped to oblong. [Fig. 8]

Voucher specimen: [Rajendra *et al.* 1337]; *Habitat:* Epiphytic; *Flowering:* June – August; *Date of collection:* 20 July 2010; *Status:* Sparse; *Altitudinal ranges:* 1300 – 2300m; *Local distribution within Darjeeling:* Forest areas in Todey, Lava – Kalimpong; Takdah, Rimbick – Darjeeling; Toroyok, Jalapahar – Kurseong sub-division; *Geographical distribution:* N.E. India, Myanmar, China, Thailand, Vietnam, Japan, Malaysia and the Philippines.

Liparis cathcartii Hooker f., *Icon. Pl. ser.*3(19): t.1808. 1889; *Fl. Brit. India* 5(2): 694. 1890; Plant terrestrial, 11-22 cm tall. Pseudobulbs 1.4-2 x 0.7-1.1 cm, narrowly ovoid. Leaves 2, 4-9 x 2.5-5 cm, subopposite, broadly ovate to elliptic-ovate. Inflorescence laxly many-flowered. Flowers 1.1-1.5 cm long; sepals and petals green, lip purple with a yellow anterior edge. Sepals similar, 7-8 x 1.2-1.5 mm, oblong, obtuse, spreading; lateral sepals 7-8 x 0.8-1 mm, appressed to lower surface of lip. Petals 9.5-12 x 0.2-0.4 mm, linear, curved and reflexed. Lip 0.8-1 x 0.7-0.9 cm, flat, obovate; base cawed, cordate, with 2 obscure calluses.

Voucher specimen: [Rajendra *et al.* 0313]; *Habitat:* Terrestrial; *Flowering:* April –July; *Date of collection:* 18 April 2008; *Status:* Rare; *Altitudinal ranges:* 2000 – 2700m; *Local distribution within Darjeeling:* Forest areas in Jarebutti-Neora Valley – Kalimpong; Senchale – Darjeeling; Tonglu, Kalpokhari – border areas of India and Nepal; *Geographical distribution:* N.E. India and China.

Liparis cespitosa (Lamarck) Lindley in *Bot. Reg.* 11: sub t.882. 1825; Plant epiphytic, 7-14 cm tall. Pseudobulbs 1.6-2.2 x 0.8-1.1 cm, ovoid, smooth. Leaf solitary, 7-12 x 1-1.4 cm, from apex of pseudobulb, stiff, oblanceolate. Inflorescence 8-10 cm long, densely 13 to 30 flowered. Flowers 1.6-2.1 mm long, non resupinate, greenish-yellow to creamy yellow. Sepals similar, ovate, acute, reflexed; dorsal sepal 2-2.7 x 0.6-0.9 mm. Lateral sepals 2.4-2.9 x 0.9-1 mm. Petals 2-3 x 0.8-1 mm, linear, obtuse. Lip 2.5-2.7 x 1.5-2 mm, oblong, concavity without any thickened processes. [Fig. 6]

Voucher specimen: [Rajendra *et al.* 0538]; *Habitat:* Epiphytic; *Flowering:* June – September; 29 June 2008; *Status:* Sparse; *Altitudinal ranges:* 1800 – 2200m; *Local distribution within Darjeeling:* Lava, Todey, Nockdara – Kalimpong; Rimbick, Manaybhanjang, – Darjeeling; Sonada – Kurseong sub-division; *Geographical distribution:* Widespread from Africa to the Pacific.

Liparis cordifolia Hooker f., Icon. Pl. ser.3(19): t.1811. 1889; Plant terrestrial, up to 10-17 cm tall. Pseudobulbs 2-3.8 x 1.3-2.3 cm long, crowded, compressed, ovoid, acute. Leaf solitary, 3.5-9.3 x 3.2-8.2 cm, cordate, acuminate. Inflorescence subdensely 7 to 19-flowered. Flowers 1.4-1.9 cm long, uniformly apple-green. Sepals similar, 9-10 x 1.4-1.8 mm, linear-lanceolate, acute, 3-veined. Petals 9-10 x 1.1-1.3 mm, linear, spreading. Lip 8-9 x 9-10 mm, obovate-deltoid, triangular, flat with concavity at base.

Voucher specimen: [Rajendra *et al.* 1515]; *Habitat:* Terrestrial; *Flowering:* October – November; *Date of collection:* 27 October 2010; *Status:* Threatened; *Altitudinal ranges:* 550 – 2200m; *Local distribution within Darjeeling:* Forest areas in Takdah – Darjeeling; Algarah and Damsang forest – Kalimpong sub-division; *Geographical distribution:* India (N.W. Himalaya to Assam) and China. [Fig. 4]

Liparis deflexa Hooker f., Fl. Brit. India 5(2): 697. 1890; Icon. Pl. ser. 4(21): t.2008; 1892. Plant terrestrial, up to 30 cm tall. Pseudobulbs 0.8-1 x 0.5-0.7 cm, cylindric, tuberoids. Leaves 2, 7-10 x 3-5 cm, basal, subopposite, elliptic-lanceolate, acuminate, 7-veined. Inflorescence laxly up to 20- flowered. Flowers up to 5 mm long, uniformly yellow. Sepals subsimilar, narrowly oblong, 4-6 x 1-2 mm; Dorsal sepal acute; lateral sepals obtuse. Petals linear-oblong, obtuse, reflexed with recurved margins, 4-6 x 0.3-0.4 mm. Lip fat, orbicular-reniform to flabellate, contracted at junction with the column.

Voucher specimen: [Rajendra *et al.* 1649]; *Habitat:* Terrestrial; *Flowering:* July – August; *Date of collection:* 15 July 2011; *Status:* Rare; *Altitudinal ranges:* 600 – 1500m; *Local distribution within Darjeeling:* Forest areas in Algarah, 15th mile – Kalimpong; *Geographical distribution:* India, Nepal and Myanmar.

Liparis dongchenii S.Z. Lucksom in Indian Journal of Forestry vol. 23(1) 113 – 115, 2000; Plant terrestrial, stem 10-11 cm long, erect, green. Leaves 4-5, 11-15 x 2-8 cm, elliptic ovate, slightly acuminate, sheathing base. Inflorescence 10-42 cm, erect, ribbed or winged with 8 to many pedicellate flowers. Flowers 1.3-2 cm across, greenish yellow. Sepals sub-equal; the linear reflexed, obtuse, convolute, glabrous, light green; dorsal sepal 1.2-1.5 x 0.18-0.2 cm oblong ovate, 3-nerved; lateral pair 1-1.3 x 0.35-0.4 cm, 3-nerved. Petals 1-1.3 x 0.4-0.5 cm, light green, convolute margin and reflexed. Lip c1.5 x 1.1 cm, broadly cuneate, concave at base, deflexed about middle, 5-lamellae arises from the base of hypochile.

Voucher specimen: [Rajendra *et al.* 0593]; *Habitat:* Terrestrial; *Flowering:* June – September; *Date of collection:* 01 August 2008; *Status:* Rare; *Altitudinal ranges:* 600 – 1000m; *Local distribution within Darjeeling:* Forest areas in Kumsi, Panbu, Nimbong, Pudung-Sendaybong – Kalimpong sub-division; *Geographical distribution:* Darjeeling and Sikkim.

Liparis duthiei Hooker f. op. cit. t.1857B. 1889; Plant epiphytic. Pseudobulb 0.7-1.3 x 0.6-1 cm, tufted, ovoid, dark-green. Stem erect, from the base of mature pseudobulbs, oblong. Leaf solitary, 3.8-9 x 0.6-1.1 mm, linear-oblong. Inflorescence 2.5-7 cm long, erect; 8-17 laxly pedicellate flowers. Flowers 3 mm long, (measured from the tip of dorsal sepal to tip of lateral sepal), pale whitish green. Sepal sub-equal, elliptic-oblong, sub-acute, 2-nerved, reflexed; dorsal sepal 1.9-2.7 x 0.3-0.4 mm; lateral pair 1.9-2.9 x 0.5-0.9 mm. Petals 2-2.2 x 0.2 mm long, linear, recurved, very narrow. Lip 2.5 x 1.7 mm long, quadrate, slightly narrowed to the base, decurved about the middle, the edges near the base with two thickened processes. [Fig. 7]

Voucher specimen: [Rajendra *et al.* 1321]; *Habitat:* Epiphytic; *Flowering:* June – August; *Date of collection:* 13 July 2010; *Status:* Threatened; *Altitudinal ranges:* 400 – 1500m; *Local distribution within Darjeeling:* Rambhi, Relli River side – Kalimpong; Manaybhanjang – Darjeeling sub-division; *Geographical distribution:* N.W. India, Sikkim, Paschimbanga.

Liparis gamblei Hooker f., Icon. Pl. ser.3(19): t.1821. 1889; Plant terrestrial rarely lithophytic, 13-18 cm tall. Pseudobulbs ovoid, 0.8-1.5 x 1-1.3 cm. Leaf solitary, 4-10 x 3-4.7 cm, oblong-elliptic, acute to acuminate. Inflorescence subdensely many-flowered; Flowers 5-6.5 mm long; sepals dark green, lip with a broad margin of brownish-purple. Sepals similar, ovate-lanceolate, acute, 1-veined, 6-7 x 1.6-2 mm. Petals linear, spreading, 1-veined, 5-8 x 0.3-0.4 mm. Lip 5-6.5 x 2-4mm, simple, elliptic-obovate, apex acute, margin wavy-crenate, 2-callose at base.

Voucher specimen: [Rajendra *et al.* 1259]; *Habitat:* Terrestrial; *Flowering:* June – July; *Date of collection:* 24 June 2010; *Status:* Rare; *Altitudinal ranges:* 1600 – 2400m; *Local distribution within Darjeeling:* Megma, Jalapahar – Darjeeling; Budhabaray – Kalimpong, Senchale – Kurseong sub-division; *Geographical distribution:* N.E. India.

Liparis nervosa var. *nervosa* (Thunberg) Lindley, Gen. Sp. Orchid. Pl.: 26. 1830; Plant terrestrial, 29-40 cm tall. Pseudobulbs conical, enveloped in leaf sheaths. Stem erect, longer than the leaves, glabrous. Leaves 4-7, 7-20 x 3.2-7.1 cm, plicate, ovate, ovate elliptic to ovate-lanceolate. Inflorescence laxly many-flowered. Flowers 1.5-1.9 cm across, opening in succession; sepals uniformly pale yellow to yellowish-purple to green, petals yellowish-green to purple, lip yellowish-green with purple markings, column white to greenish-white. Sepals subsimilar, reflexed; dorsal sepal 9-11 x 1-1.6 mm, oblong to elliptic-oblong, acute to obtuse, margins revolute, 3-vein; lateral sepals 7-9 x 1.7-2.5 mm, falcate-ovate, acute to obtuse, margins revolute, 3-veined. Petals 7-9 x 0.7-1 mm, reflexed, linear-oblong to linear-spathulate, 1-veined. Lip 7-9 x 3-4 mm, oblong, wedge-shaped, labellate, 2-lobed in front, strongly recurved, with 2 calli at base.

Voucher specimen: [Rajendra et al. 1116]; *Habitat:* Terrestrial; *Flowering:* April – July; *Date of collection:* 05 April 2010; *Status:* Sparse; *Altitudinal ranges:* 900 – 2300m; *Local distribution within Darjeeling:* Dello Hill, forest areas in Algarah, Lava – Kalimpong; Takdah, Manaybhanjang – Darjeeling; Rambi forest – Kurseong sub-division; *Geographical distribution:* Widespread in the old and new world tropics.

Liparis odorata (Willdenow) Lindley, Gen. Sp. Orchid. Pl.: 26. 1830; Plant terrestrial, 15-34 cm tall. Pseudobulbs 1.3-1.8 x 0.1-1.9 cm, narrowly ovoid-conical. Leaves 2 or 3, 7-20 x 2.4-3.5 cm, alternate, narrowly ovate-lanceolate to elliptic-lanceolate. Inflorescence 6 to 20-flowered. Flowers 0.6-0.7 cm across, green, lip dull purple. Dorsal sepal 6-7 x 2 mm long, linear, obtuse, spreading, margins recurved; lateral sepals 5-6 x 3 mm long, broadly ovate, 5-veined, recurved. Petals 6-7 x 1 mm long, linear, obtuse, reflexed, margins recurved. Lip 3-4 x 4.5-4.7 mm long, quadrate, deflexed at the middle, edges entire; apex broad, emarginated, erose, with a short apiculus; calluses 2, erect tooth-like. [Fig. 9]

Voucher specimen: [Rajendra et al. 0587]; *Habitat:* Terrestrial; *Flowering:* July – September; *Date of collection:* 01 August 2008; *Status:* Frequent; *Altitudinal ranges:* 800 – 1900m; *Local distribution within Darjeeling:* Dello Hill, Kafer forest, Durpin, Todey – Kalimpong sub-division; *Geographical distribution:* India, Nepal, Myanmar, China, Thailand, Laos, Vietnam, Japan, Taiwan and Guam.

Liparis plantaginea Lindley, Gen. Sp. Orchid. Pl.: 29. 1830; Plant epiphytic, 28-34 cm tall. Pseudobulbs 5-8 x 1-1.6-2.9 cm, narrowly ovoid-cylindric. Leaves 2, 20-34 x 5.7-6.5 cm, subopposite, sessile to petiole, oblong-elliptic to oblanceolate-oblong, acute. Inflorescence laxly up to 10-14-flowered. Flowers 2-2.5 cm long, green. Sepals similar, 0.9-1.2 x 0.2-0.3 cm, oblong-lanceolate, subacute, margins revolute; dorsal sepal spreading; lateral sepals parallel, under the lip. Petals 1.1 x 0.1 cm long, decurved, linear, revolute. Lip 0.9-1 x 0.9-1.1 cm, concave, clawed, suborbicular, margins erose-dentate, decurved near base; callus 2-lobed.

Voucher specimen: [Rajendra et al. 0665]; *Habitat:* Epiphytic; *Flowering:* July – September; *Altitudinal ranges:* 1800 – 2400m; *Date of collection:* 13 August 2008; *Status:* Common; *Local distribution within Darjeeling:* Forest areas in Lava, Neora Valley, Todey, Tangta – Kalimpong; Takdah, Sukiapokhari, Manaybhanjang, Dhotrey – Darjeeling sub-division; *Geographical distribution:* India, Thailand and Vietnam.

Liparis platyrachis Hooker f., Icon. Pl. ser.3(19): t.1890. 1889; Fl. Brit. India 5(2): 706. 1890. Plant epiphytic, 5-13 cm tall. Pseudobulbs 1.2-1.5 x 0.3-0.4 cm, tufted, cylindric, compressed. Leaves 3-5, linear-lanceolate, acute, base sessile. Inflorescence pendent, elongate, many-flowered. Flowers 4-5 mm

wide, uniformly pale yellow-ochre, column and base of lip pale green. Dorsal sepal elliptic (when spread), obtuse, 1-veined, 2.6-3 x 0.8-1 mm; lateral sepals elliptic, subacute, margins recurved, 3-veined, 2-3 x 0.4-0.5 mm. petals linear, obtuse, decurved, margins revolute, 1-veined, 2-3 x 0.05-0.1 mm. Lip quadrate to subpandurate, deflexed at the middle, 1.8-2 x 0.8-1.2 mm; base with 4 calluses, 2 conical, erect, lateral to nectar, 2 triangular, depressed; apex broad, round, apiculate.

Voucher specimen: [Rajendra *et al.* 1705]; *Habitat:* Epiphytic; *Flowering:* October – November; *Date of collection:* 09 October 2011; *Status:* Rare; *Altitudinal ranges:* 1000 – 1300m; *Local distribution within Darjeeling:* Todey, Algarah forest, Durpin, Kafer – Kalimpong; Takdah, Lopchu forest – Darjeeling subdivision; *Geographical distribution:* Nepal, N.E. India and China.

Liparis resupinata Ridley in J. Linn. Soc., Bot. 22: 290. 1886; Plant epiphytic, 9-15 cm tall. Pseudobulb 1.6-2.8 x 0.6-0.9 cm, tufted, ovoid-cylindric, sheathed. Leaves 2-4, 6-11 x 0.7-1 cm, alternate, membranous, linear-lanceolate, acute to acuminate, sessile. Inflorescence laxly 10-35-flowered. Flowers 4.5-7 mm long, uniformly golden-brownish to creamy. Sepals subsimilar, 4-5 x 1.5-2 mm, oblong, obtuse; dorsal sepal retroflexed; lateral sepals spreading, margins recurved. Petals 4.5-5 x 0.6-0.8 mm, linear, obtuse, spreading. Lip 2.5-3 mm long, broadly oblong to ovate, sagittate basically; apex obtuse, margins incurved, pouched; calluses 2, at base. [Fig. 2]

Voucher specimen: [Rajendra *et al.* 0737]; *Habitat:* Epiphytic; *Flowering:* October – February; *Date of collection:* 16 November 2008; *Status:* Frequent; *Altitudinal ranges:* 1600 – 2100m; *Local distribution within Darjeeling:* Forest areas in Lava, Algarah, Todey, Kafer – Kalimpong; Chimney – Kurseong subdivision; *Geographical distribution:* India (Himalaya); Bhutan, China, Nepal.

Liparis resupinata var. *ridleyi* King and Pantling in Ann. Roy. Bot. Gard. (Calcutta) 8: 37, t.49. 1898; Plant epiphytic. Pseudobulb 2.7-6 x 0.7-1 cm, ovoid-cylindric. Leaves 3-4, 4.5-8 x 0.7-1 cm, linear-lanceolate, acute. Inflorescence 16-24 cm long, sub-pendulous, glabrous. Flowers 1.25-1.5 cm long, pale-green. Sepals sub-equal, oblong obtuse, translucent-green, glabrous externally keeled; the dorsal sepal 5.8-6.1 x 1.9-2.2 mm, externally, retroflexed; the lateral pair 6-7 x 2-2.5 mm, translucent yellowish-green. Petals 5-5.8 x 0.5-0.6 mm, linear, obtuse, spreading, margin curved. Lip 4.8-5 x 2.3-2.9 mm, generally ovate, subacute, with sagittate base; the apical lobe lie parallel to the column, tip margin of apical lobe incurved, pouched; calluses 2, at base. [Fig. 3]

Voucher specimen: [Rajendra *et al.* 0737]; *Habitat:* Epiphytic; *Flowering:* October – February; *Date of collection:* 02 December 2011; *Status:* Sparse; *Altitudinal ranges:* 1600 – 2100m; *Local distribution*

within Darjeeling: Forest areas in Lava, Algarah, Damsang, Todey, Charkhol – Kalimpong;
Geographical distribution: India (Sikkim and Darjeeling).

Liparis somai Hayata, Icon. Pl. Formos. 4: 33, t.6. 1914; Plant epiphytic, 13-18 cm tall. Pseudobulb 3.1-4.2 x 1.9-2.5 cm, ovoid, smooth, enveloped in 3 or 4 sheaths. Leaves 2, 10-14 x 1.9-2.8 cm, apical, narrowly elliptic-oblong, mucronate. Inflorescence erect, many-flowered. Flowers 4.7-5 mm long, glabrous; sepals and petals white, lip yellowish-white, column pale green. Sepals subequal, spreading; dorsal sepal 2.3-2.8 x 0.5-0.6 mm, oblong, obtuse, revolute, reflexed; lateral sepals 2.2-2.4 x 0.6-0.9 mm, ovate, subacute, revolute. Petals 1.9-2.2 x 1.4 mm, oblong, obtuse. Lip 1.7-2 x 1.5-1.9 mm, simple, narrowly oblong, obtuse, deflexed from the middle, ecallose. [Fig. 5]

Voucher specimen: [Rajendra *et al.* 0969]; *Habitat:* Epiphytic; *Flowering:* August – October; *Date of collection:* 07 October 2009; *Status:* Rare; *Altitudinal ranges:* 800 – 1800m; *Local distribution within Darjeeling:* Samalbong, Sangsay Bhalukhop Busty, Algarah, Lungshel – Kalimpong sub-division; *Geographical distribution:* China and Taiwan.

Liparis viridiflora (Blume) Lindley, Gen. Sp. Orchid. Pl.: 31. 1830; Plant epiphytic, 12-22 cm tall. Pseudobulbs 1.5-3.5 x 1.3-2.5 cm, laterally compressed, clustered, stem like, ovoid at base. Leaves 2-3, 8-17 x 2-3 cm, obovate-oblong to oblanceolate, obtuse, acute or acuminate. Inflorescence pendulous, cylindrical, slender, densely many flowered. Flowers 4-5.5 mm across; sepals and petals white with a yellow lip. Sepals similar, revolute, linear to oblong, free, obtuse; dorsal sepal 3-4.5 x 1-1.5 mm; lateral sepals 3.5-4.2 x 1.2-2 mm, spreading. Petals 3.4-4 x 0.3-0.5 mm wide, linear, subacute, spreading to reflexed. Lip 2.8-3.5 x 2-2.5 mm wide, simple, recurved, broadly ovate, subacute, rather fleshy, ecallose.

Voucher specimen: [Rajendra *et al.* 0944]; *Habitat:* Epiphytic; *Flowering:* September – December; *Date of collection:* 13 September 2009; *Status:* Sparse; *Altitudinal ranges:* 1300 – 2100m; *Local distribution within Darjeeling:* forest areas in Todey, Neora Valley – Kalimpong; Ramam forest – Darjeeling; Chimney forest – Kurseong sub-division; *Geographical distribution:* Sri Lanka, India, Thailand, China to Indo – China and Malaysia.

RESULTS AND DISCUSSIONS:

During recent field studies in the Darjeeling Himalaya of West Bengal, India, sixteen *Liparis* Orchid species were recorded both in epiphytic and terrestrial habitat. Of them, nine species viz., *Liparis bootanensis* Griff., *L. cespitosa* (Lamarck) Lindl., *L. duthiei* Hook. f., *L. plantaginea* Lindl., *L. platyrachis* Hook. f., *L. resupinata* Ridley, *L. resupinata* var. *ridleyi* King and Pantling, *L. somai* Hayata and *L. viridiflora* (Bl.) Lindl. are epiphytic and the rest seven species like *L. cathcartii* Hook. f., *L. cordifolia*

Hook. f., *L. deflexa* Hook. f., *L. dongchenii* S.Z. Lucksom, *L. gamblei* Hook. f., *L. nervosa*, var. *nervosa*, (Thunberg) Lindl. and *L. odorata* (Willdenow) Lindl. are terrestrial. Flowering of these species occurred almost throughout the year. *Liparis resupinata* and *L. resupinata* var. *ridleyi* flower in November to March; *L. cathcartii* bloom in April to July; *L. nervosa* in April to August; *L. duthiei*, *L. gamblei*, *L. cespitosa*, *L. deflexa* and *L. bootanensis* flower in June to August; *L. duthiei* is closely resembles with *L. cespitosa*, but is a smaller plant with a less decurved lip with thickened auricular processes at the base and column of *L. duthiei* is longer than *L. cespitosa*. Other species like *L. odorata*, *L. plantaginea*, *L. dongchenii*, *L. viridifolia* flower in August to October and *L. platyrachis*, *L. cordifolia* and *L. somai* flower in October to December. Availability of these species greatly varies from altitudinal ranges. *Liparis bootanensis* and *L. viridifolia* found in an altitudinal ranges of 1300 to 2300m; *L. gamblei*, *L. plantaginea*, *L. resupinata* and *L. cespitosa* found in an around 1600 to 2400m; *L. deflexa*, *L. somai*, *L. odorata*, *L. duthiei* and *L. dongchenii* available in 400 to 1900m altitudinal ranges and *L. cordifolia* and *L. nervosa* var. *nervosa* found in wide variation of altitudinal ranges *i.e.*, 550 to 2300m. Species like *L. cathcartii* found in the highest elevation of 2000 to 2700m but *L. dongchenii* available in 600 to 1000m. The local availability status of these 16 different species are, 2 threatened, 6 rare, 5 sparse and 3 frequently available in the region (Fig. 10).

CONCLUSION:

It is observed that the available *Liparis* species as well as whole Orchidaceae family facing high risk of threat in a natural habitat in comparison with other plant species in the study areas (Yonzon *et al.*, 2011). Rapid destruction of natural habitat by many means like deforestation, extension of agricultural lands, urbanization, frequent landslides, top layer soil erosion, overgrazing of cattle and goats, developmental schemes, atmospheric pollution, pesticide and weedicide pollution, indiscriminate collection of floral nursery business, ignorance and many more anthropogenic activities in the study areas are the main reasons of threats (Yonzon *et al.*, 2012). Therefore, protection and conservation of natural habitat are the only prominent way to save our precious natural wealth like Orchid species of the regions.

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

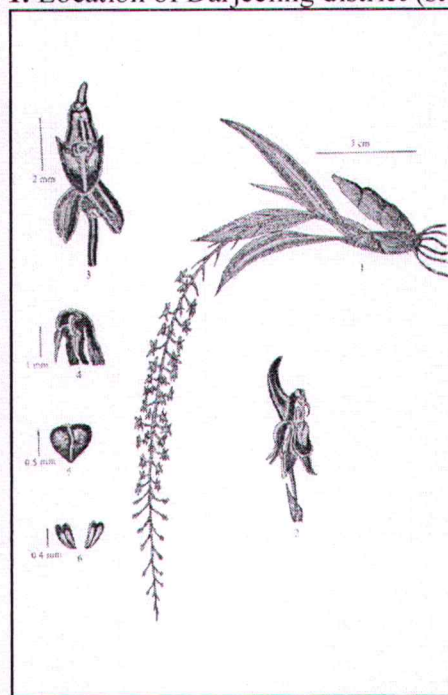


Fig. 2.

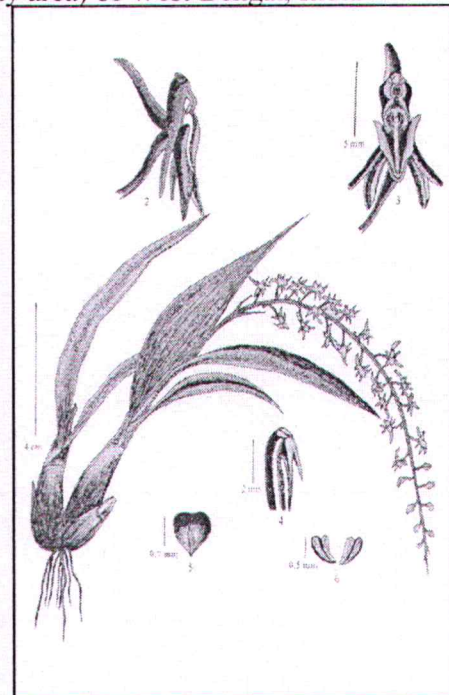


Fig. 3

.Fig. 2. *Liparis resupinata* Ridley, 1. Habit (plant with inflorescence); 2. Side view of flower; 3. Front view of flower; 4. Angled view of column with pendent filiform, apical process; 5. Anther; 6. Pollinia. Fig. 3. *Liparis resupinata* var. *ridleyi* King and Pantling, 1. Habit (whole plant with mature inflorescence); 2. Side view of flower; 3. Front view of flower; 4. Side view of column with anther *in situ* and pendent, filiform, apical process; 5. Anther; 6. Pollinia.

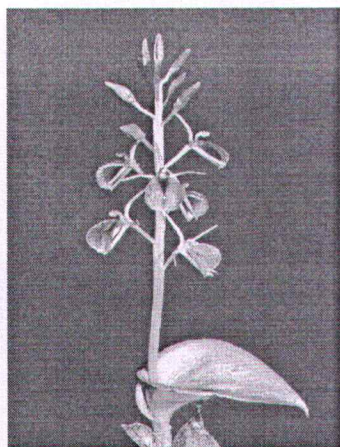


Fig. 4. *L. cordifolia*

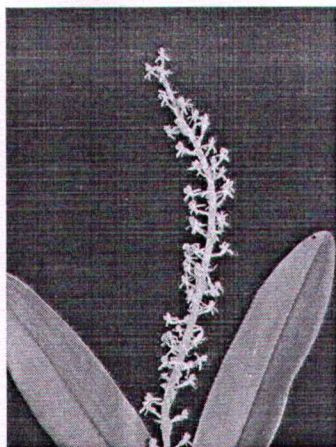


Fig. 5. *L. somai*

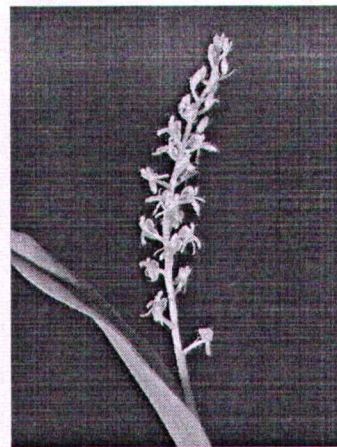


Fig. 6. *L. cespitosa*



Fig. 7. *L. duthiei*

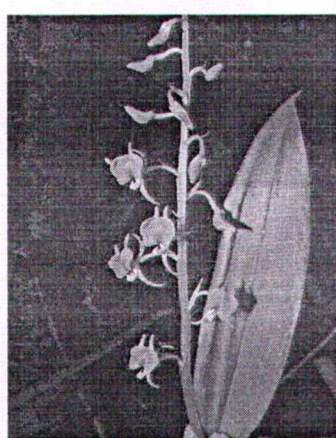


Fig. 8. *L. bootanensis*

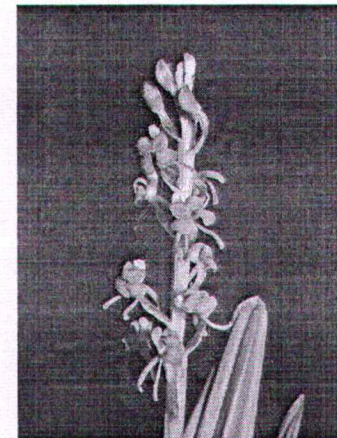


Fig. 9. *L. odorata*

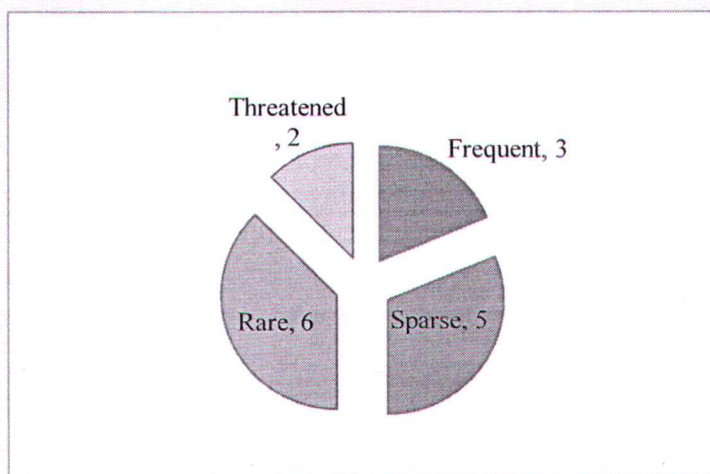


Fig. 10. Local availability status of *Liparis* species in Darjeeling Himalaya