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Diversity, Distribution and Present Status of *Nervilia* Commerson *ex* Gaudichaud (Orchidaceae) in Darjeeling Himalaya, West Bengal, India

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Abstract

The present paper deals with four species of *Nervilia* Commerson *ex* Gaudichaud (Orchidaceae) along with its distribution in Darjeeling Himalayan part of West Bengal, India. The altitudinal range, phenology, habitat structure and geographical distribution has also been discussed.

Key words: *Nervilia*, Orchidaceae, Diversity, Distribution, Darjeeling Himalaya.

INTRODUCTION

Orchids belong to a group of flowering plants under the family Orchidaceae and are considered to be the highly evolved among the monocotyledons (Hajra & De 2011). 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).

Darjeeling Himalaya is the northernmost part of the state of West Bengal and rich in Orchid species diversity resources. This triangular region covers an area of 3254.7 sq kms. It is bordered by Sikkim in the North, Terai and Dooars in the South, Bhutan in the East and Nepal in the West. The Sub–Divisions of Darjeeling are Darjeeling, Kalimpong, Kurseong and Siliguri (Figure 1). The Darjeeling district has two topographical features. Darjeeling, Kalimpong and Kurseong form the hill areas whereas Siliguri is stationed at the foot hills giving way to vast stretches of the plains. Altitudinally, different areas of the district are ranging from 130 m at Siliguri to 3636 m at Sandakphu – Phalut region with a sharp physiographic contrast between the plains and the mountainous. In the present investigation, the diversity, distribution, habitat, altitudinal range and flowering time of the genus *Nervilia* Commerson *ex* Gaudichaud in Darjeeling Himalaya has been carried out in detail.

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Figure 1. Location map of Darjeeling district (study area) of West Bengal, India [not in scale]

Botanical description

The genus *Nervilia* was established in 1820 by the French naturalist Charles Gaudichaud-Beaupre. The genus comprises of about 80 species distributed in tropical Africa, Madagascar, tropical Asia, the Malay Archipelago, the Pacific Islands and North Australia (Pearce & Cribb 2002).

Plants terrestrial with fleshy underground tubers. Leaf solitary, appearing after flowering, petiolate; lamina suborbicular with cordate base, plicate. Inflorescence erect, racemose, hysteranthous, 1 to several–flowered. Flowers not opening widely, pendent. Sepals and petals similar, free, rarely subspreading, lanceolate, acute. Lip erect, simple or 3–lobed. Column elongate, clavate, wingless; anther incumbent; pollinia 2, granulose.

MATERIALS AND METHODS

To record the Orchid-flora of Darjeeling, intensive field survey was conducted during the years 2007 to 2013 covering all seasons of the year in the entire district including the forest areas, floral nurseries and farms situated as low as Siliguri (±130 m) to as high as Sandakphu – Phalut (3636 m amsl). During survey in the Darjeeling Himalayan region, different species of *Nervilia* Commerson *ex* Gaudichaud were recorded in the field note book with necessary information. The collected specimens were studied and processed into mounted herbarium sheets (Jain & Rao 1977) in laboratory and identified using available literature including *Orchids of the Sikkim Himalaya* (King & Pantling 1898); *The Orchids of Sikkim and North East Himalaya* (Lucksom 2007); *The Flora of Bhutan* (Pearce & Cribb 2002) and confirmed at 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.

In the enumeration all the recorded species are arranged alphabetically along with their altitudinal distribution in the area, habitat and phenology and reference to the voucher specimens.

ENUMERATION OF TAXA

Nervilia Commerson *ex* Gaudichaud

Key to the species

1a. Inflorescence with 1 flower …… …..……..…. ***N. macroglossa***
1b. Inflorescence with 2 or more flowers ……..2
2a. Inflorescence with 2 or 3 flowers ..……..…….. ***N. plicata***
2b. Inflorescence with 3 or more flowers ……..……... 3
3a. Sepals not more than 1.8-0.25 cm, hypochile without a sac ….. ***N. aragoana***
3b. Sepals more than 2 cm long, hypochile obscurely forming a sac .. ***N. gammieana***

Nervilia aragoana Gaudichaud in Freycinet, Voy. Uranie: 422, t.35. 1826; *Epipactis carinata* Roxburgh, Hort. Bengal.: 63. 1814, nom. nud.; Fl. Ind. Ed. 1832, 3: 454. 1832; *Pogonia carinata* (Roxburgh.) Lindley, Gen. Sp. Orchid. Pl.: 414. 1840. *P. nervilia* Blume Mus. Bot. 1: 32. 1849; *P. scottii* Reichenbach f. in Flora 55: 276. 1852; *P. gracilis* Blume, Coll. Orchid.: 155, t.57, f.3 1858; *Nervilia scottii* (Reichenbach f.) Schlechter in Bot. Jahrb. Syst. 45: 404. 1911; *N. yaeyamensis* Hayata, Icon. Pl. Formos. 2: 140. 1912; *N. tibetensis* Rolfe in Notes Roy. Bot. Gard. Edinburgh 8: 128. 1913; *Aplostellis flabelliformis* (Lindley) Ridley, Fl. Malay. Penins. 4: 203. 1924; *Nervilia flabelliformis* (Lindley) T. Tang & F.T. Wang in Acta. Phytotax. Sin. 1: 68. 1951.

Plants terrestrial, 20 – 37 cm tall; tuber 2 – 3 x 2 – 2.5 cm, fleshy, globose. Lamina 5 – 14 x 5 – 11 cm, flabellate – reniform or cordate, rounded at base, apiculate, plicate; petiole 11 – 18 cm long. Inflorescence many-flowered; peduncle enclosed in sheaths; rachis 5 – 10 cm long; floral bracts linear-lanceolate. Flowers 1.4 – 2 cm long; pedicellate ovary 0.8 – 1.2 cm long. Sepals and petals similar, greenish – yellow; Sepals less than 2.5 cm long and 0.5 cm wide; lip white or pink nerved with purple, oblong – linear to linear – lanceolate, acuminate, green with 3 dark – purple nerves, externally keeled; dorsal sepal 1.7 – 2.2 cm long; lateral sepals 1.7 – 2.2 cm long; Petals 1.5 – 1.8 cm long, linear, narrowly obtuse, with 3 dark red nerves; Lip 3 – lobed, 1.8 – 2.3 cm long, base cuneate; side lobes ovate – triangular, acute or obtuse; apical lobe ovate to ovate – triangular, acute, obtuse or rounded in front with undulate

margins; disc weakly pubescent in middle. Column 5 – 7 mm long, straight, clavate. Pollinia 1.5 – 1.6 mm long, oblong, yellow. **[Figure 2]**

Habitat: Terrestrial; **Altitudinal ranges:** 300 – 1000 m; **Flowering:** April – May.

Exsiccatae: Forest areas in Kalijhora, Sittong, Geilkhola, Latpanjar – Kurseong Sub – Division; Rajendra *et al* 1568; dated 24 April 2011.

Geographical distribution: India, China, S. & S.E. Asia, Malaysia, Indonesia, the Philippines, Timor, Samoa, Palau, New Guinea and Australia.

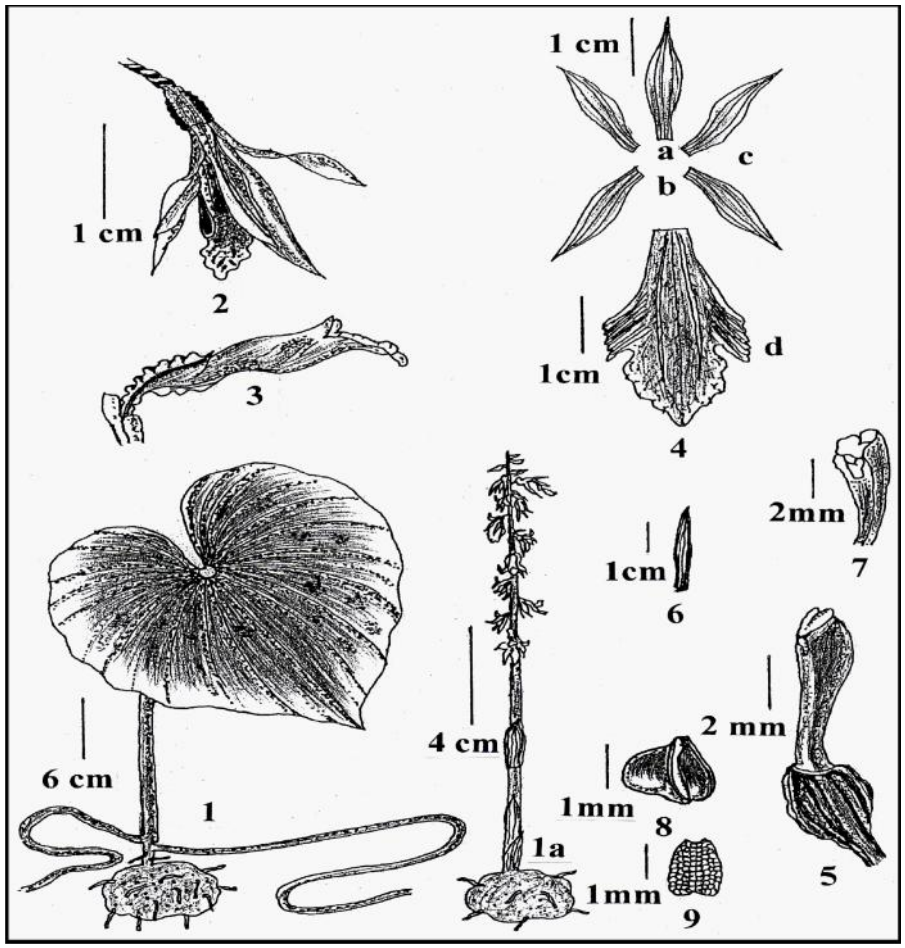

Figure 2. ***Nervilia aragoana*** Gaudichaud, **1.** Habit (with leaf and tuber); **1a.** Habit (with young inflorescence and tuber); **2.** Single flower; **3.** Side view of flower with pedicellate – ovary; **4.** Floral perigone; **a**. dorsal sepal, **b**. lateral sepals, **c.** petals and **d**. Lip; **5.** Tip of ovary, column with anther *in situ*; **6**. Floral bract; **7**. Angled view of column; **8.** Anther; **9**. Pollinia.

Nervilia gammieana (Hooker *f*.) Schlechter in Bot. Jahrb. Syst. 45: 404. 1911; *Pogonia gammieana* Hooker *f*. in Bot. Mag. 109: t.6671. 1883.

lant terrestrial, 14 – 19 cm tall; tuber 2.4 – 3 cm across, fleshy, subglobose. Stem stout; sheaths 1 – 4. Leaf 10 – 14.5 x 9 – 11 cm, petiolate, glabrous, cordate, acuminate, margin undulate, nerved, deep green above and pale below. Inflorescence 5 to 8 – flowered; rachis 5 – 7 cm long, green; floral bracts linear, membranous. Flowers 2 – 2.8 cm long; sepals and

petals pale lilac, streaked with pale pink, lip pale green to yellow, nerved with darker green; pedicellate – ovary 0.7 – 1 x 0.3 – 0.4 cm. Sepals and petals subequal, elliptic – lanceolate, acuminate. Sepals more than 2.5 cm long and 0.6 cm wide. Dorsal sepal 2.2 – 2.5 x 0.5 – 0.6 cm, elliptic – oblanceolate, acuminate, 3 – purple nerves. Lateral sepals 2.2 – 2.6 x 0.6 – 0.9 cm, elliptic – oblanceolate, acuminate, 5 – nerved. Petals 2 – 2.3 x 0.6 – 0.7 cm, elliptic – oblanceolate, acute, 3 – nerved, whitish purple. Lip 3 – lobed, 2.1 – 2.4 x 1.3 – 1.6 cm, clavate, shortly clawed; side lobes convolute around the column; apical lobe orbicular, pubescent along nerves. Column 1 – 1.1 cm long; anther 1.7 – 2 mm long. **[Figure 3]**

Habitat: Terrestrial; **Altitudinal ranges:** 800 – 1300 m; **Flowering:** April – June.

Exsiccatae: Kumsi forest, Suruk, Godok, Rungdung Valley, Relli–Pala forest – Kalimpong Sub – Division; Rajendra *et al* 0834; dated 01 May 2009.

Geographical distribution: India (N.E. India, Sikkim, West Bengal).

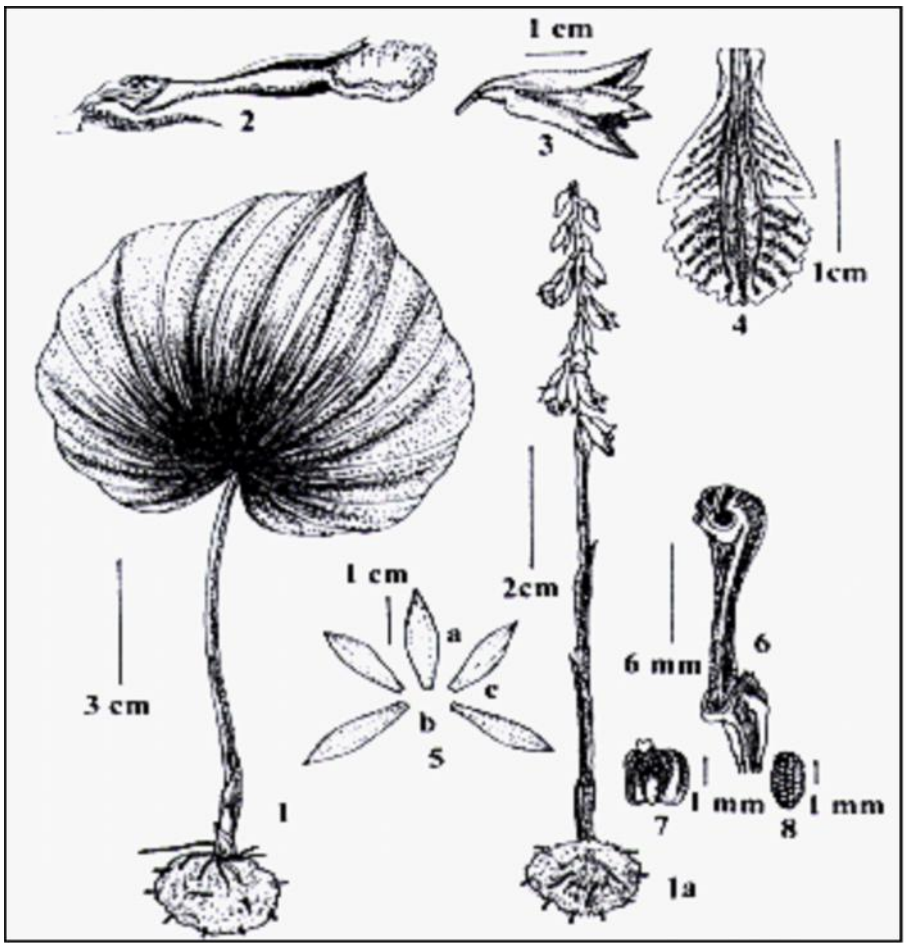

Figure 3. ***Nervilia gammieana*** (Hooker f.) Schlechter, **1.** Habit (plant with leaf and tuber); **1a.** Habit (plant with inflorescence and tuber); **2.** Side view of pedicellate – ovary, lip enclosing column. **3.** Side view of flower; **4.** Flattened view of lip; **5.** Floral perigone, **a.** dorsal sepal, **b.** lateral sepals **c.** petals; **6**. Front view of column with anther *in situ*; **7.** Anther; **8.** Pollinia.

Nervilia macroglossa (Hooker *f*.) Schltr. in Bot. Jahrb. Syst. 45: 403. 1911.

Pogonia macroglossa Hooker *f*., Fl. Brit. India 6(1): 120. 1890; Icon. Pl. 23: t.2195. 1894.

Plant terrestrial, 7-16 cm tall; tuber 1.2-1.5 x 1.2-1.4 cm, globose. Stem 6-13 cm long, slender, glabrous, sheathed; sheaths 2, clasping. Leaf 3.8-4.7 x 4-4.55 cm, petiolate, orbicular-cordate, margins entire; petiole 5.5-7 cm long. Inflorescence 1-flowered; floral bract linear-lanceolate, acute. Flower 2-4 cm long; sepals and petals white flushed with pink; pedicel and ovary 2-4 mm long. Sepals and petals subsimilar, linear-lanceolate, acute to acuminate; dorsal sepal 2.5-3.3 x 0.2-0.4 cm, white suffused with purple; lateral sepals 2.8-3 x 0.2-0.4 cm, connate at base. Petals 2.5-2.8 x 0.2-0.3 cm, 1-nerved, pale-white. Lip 2.4-3.5 x 0.5-0.8 cm, obscurely 3-lobed, narrowly oblong in outline; side lobes small, bifid; apical lobe lanceolate, apex subacute, margins weakly undulate, softly pubescent, slender, veined. Column 0.5-1.3 cm long, slender, apex clavate. Anther *ca* 3 x 3 mm. **[Figure 4]**

Habitat: Terrestrial; **Altitudinal ranges:** 600 – 1800 m; **Flowering:** May-June.

Exsiccatae: Samalbong busty, Nimbong, Godok, Kumsi, Pedong, Seokbir Khani – Kalimpong sub–division; Mungpoo – Kurseong Sub – Division; Rajendra *et al* 1801; dated 22 May 2012;

Geographical distribution: Nepal, N.E. India, Bhutan and Myanmar.

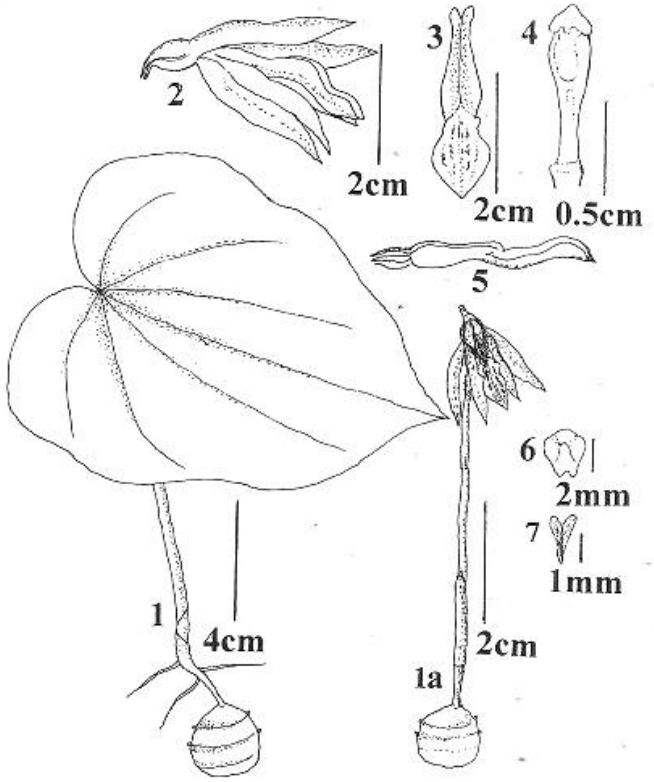

Figure 4. ***Nervilia macroglossa*** (Hooker f.) Schlechter **1.** Habit (with leaf and tuber); **1a.** Habit (with young inflorescence and tuber); **2.** Side view of flower; **3.** Top view of lip; **4.** Column with anther *in situ*; **5.** Side view of lip; **6.** Anther; 7. Pollinia.

Nervilia plicata (Andrews) Schlechter in Bot. Jahrb. Syst. 45: 403. 1911; *Arethusa plicata* Andrews in Bot. Repos. 5: t.321. 1803; *Cordyla discolor* Blume, Bijdr.: 417 1825; *Epipactis plicata* (Andrews) Roxburgh, Hort. Bengal.: 63. 1814; Fl. Ind. Ed.1832, 3: 454. 1832; *Pogonia plicata* (Roxburgh) Lindley, Gen. Sp. Orchid. Pl.: 415. 1840; *P. discolor* (Blume) Blume,

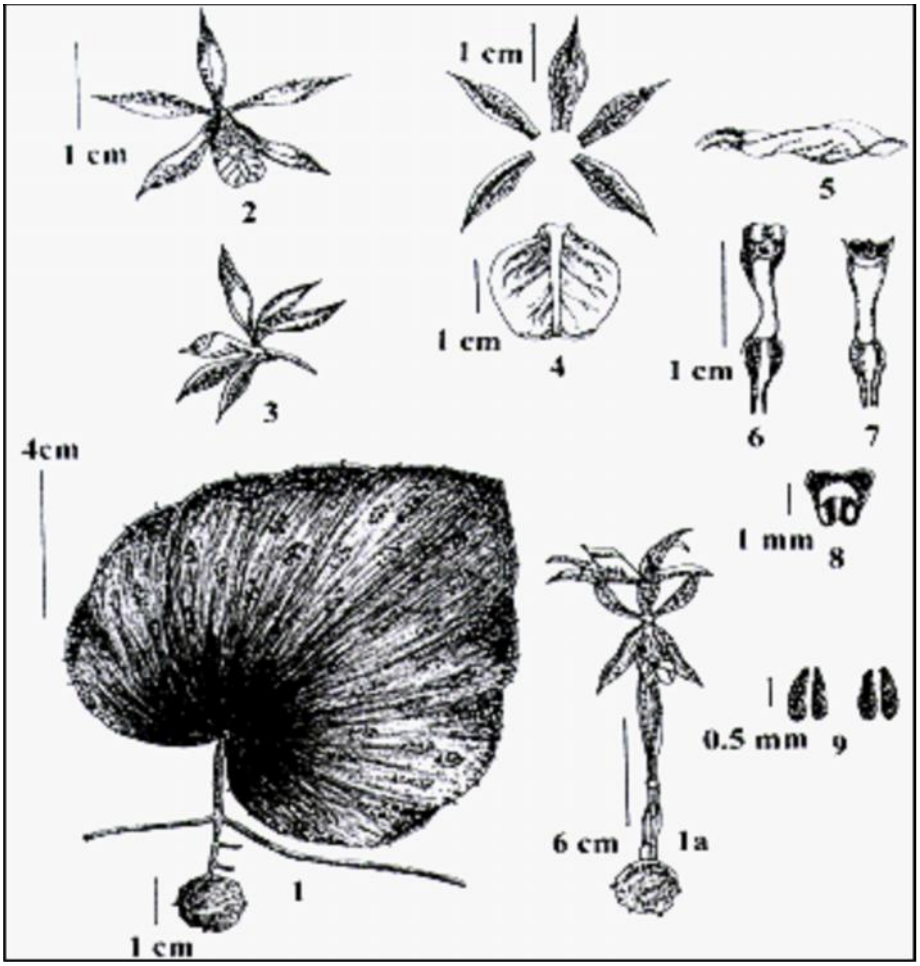

Figure 4. ***Nervilia plicata*** (Andrews)) Schlechter, **1.** Habit with leaf and tuber; **1a.** Habit with inflorescence and tuber; **2.** Front view of single flower; **3.** Side view of flower; **4.** Floral perigone, **a.** dorsal sepal, **b.** lateral sepals, **c.** petals, **d.** Lip; **5.** Side view of ovary, column enclosed in lip; **6.** Tip of ovary, column with anther *in situ* and stigma, **7.** Front view of column without anther; **8.** Anther; **9.** Pollinia.

Mus. Bot. 1: 32. 1849; *P. biflora* Wight, Icon. Pl. Ind. Orient. 5(1): t.1758, f.2. 1851; *P. dallachyana* f. Mueller ex Bentham, Fl. Austral. 6: 310. 1873; *P. velutina* Paris & Reichenbach f. in Trans. Linn. Soc. London 30: 142. 1874; *P. pulchella* Paris in Mason, Burmah: 186. 1883; *P. pulchella* Hooker f. in Bot. Mag. 111: t.6851. 1885; *Pogonia pudica* Ames in Orchidaceae 2: 44. 1908; *Nervilia velutina* (Parish & Reichenbach f.) Schlechter in Bot. Jahrb. Syst. 45: 403. 1911; *N. biflora* (Wight) Schlechter, loc. cit. 1911; *N. discolor* (Blume) Schlechter, loc. cit. 1911; *Aplostellis velutina* (Parish & Reichenbach f.) Ridley, Fl. Malay. Penins. 4: 204. 1924.

Plant terrestrial, 11 – 28 cm tall; tuber 1.2 – 1.5 cm across, globose, fleshy. Leaf 3 – 7.6 x 3.7 – 8.5 cm, prostrate, cordate – orbicular, acute, margins denticulate, sometimes blotched with purple; petiole 1 – 2 cm long. Inflorescence 2 or 3 – flowered; peduncle 16 – 23 cm long; floral bracts 0.2 – 1.2 cm long, ovate – lanceolate, acute to apiculate. Flowers subpendent; sepals and petals creamy white to greenish – brown, lip with violet streaks and a purple marginal band; pedicellate – ovary 0.8 – 1.2 cm long. Sepals and petals 1.6 – 2 x 0.3 – 0.5

cm, spreading, oblong – lanceolate, acute, sparsely dotted with tiny glands. Lip 1.4 – 2 cm long, porrect, glabrous, ovate – oblong; Column straight, 1 – 1.4 cm long. **[Figure 5]**

Habitat: Terrestrial; **Altitudinal ranges:** 300 – 850 m; **Flowering:** April – June.

Exsiccatae: Forest areas in Kalijhora – Kurseong; Nimbong – Kalimpong Sub–Division; Pareng, Rongo, Teesta River Valley; Rajendra *et al* 1598; dated 13 May 2011.

Geographical distribution: India, Myanmar, Thailand, S. China, Laos, Vietnam, Malaysia, the Malay Archipelago to New Guinea, the Philippines and Australia.

RESULTS AND DISCUSSION

During recent field studies in the Darjeeling Himalaya of India, four fleshy tuberous terrestrial species of *Nervilia* Commerson *ex* Gaudichaud were recorded. Flowering time of each species varies from each other. *N. aragoana* Gaudichaud generally flower in the beginning of April and persist till the month of May, *N. macroglossa* (Hooker f.) Schlechter flower in the month of May and persist till June but *N. gammieana* (Hooker f.) Schlechter and *N. plicata* (Andrews) Schlechter flower in the month of April and persists till the end of June. *N. aragoana* available within altitudinal range 400 to 1000m, *N. plicata* available within 300 to 850m and *N. gammieana* is available within altitudinal range 800 to 1300m and *N. macroglossa* available within altitudinal range 600 to 1800m in the study regions.

The rapid and regular diminution of natural habit by extension of agricultural lands, urbanization, deforestation for firewood and timber harvesting, developmental schemes, frequent landslides, erosion of top layer soil surface, accumulation of pesticide and herbicide residues, premature cutting and uprooting of grasses, overgrazing of cattle, indiscriminate collection of Orchids by the agents of floral nurserymen and ignorance cause greater harm to all the Orchid species in the study region (Yonzone *et al* 2012). Present investigation observed that all the species of Orchidaceae facing high risk of vanishing in the study area. Therefore, it is necessary to frame and implement strict conserve measures to save our precious Orchids in their natural habitat.

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