

Taxonomic revision of the *Pleione* D. Don in North East India

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Abstract

Pleione is one of the beautiful orchid genera that exhibits diverse shapes, colours and morphological characteristics. This study presents a taxonomic revision of the genus in North East India. The revision is based on the examination of dried specimens from 4 herbaria, together with observations of live plants made during field trips to different regions of the North East. The taxonomic estimate of selected morphological characters is surveyed, as are ecological elements, and occurrence patterns in North East India. Seven species are accepted, whereas the only report of *Pleione* × *lagenaria* Lindley & Paxton from North East India is considered doubtful. Full taxonomic accounts are provided for the genus and species, including key to the species. All accepted species are represented by photograph with line drawings.

Key words: conservation, description, distribution, *Epidendroideae*.

Introduction

Pleione D. Don (1825: 36) is one of the beautiful genera of orchids having large and showy flowers. The genus is closely related to the genus *Coelogyne* Lindley (1821: sub t. 33) (Cribb & Butterfield, 1999). The genus was established in 1825 by David Don in his work *Prodromus Florae Nepalensis*. It is belonging to the subfamily *Epidendroideae* and tribe *Coelogyneae*. About 25 species and 8 natural hybrids (Govaerts *et al.*, 2022) are distributed in North East India, China, Bhutan, Nepal, Burma, Tibet, Vietnam, Bangladesh and Taiwan mostly found at an elevation of 600 to 4200 m. (Cribb & Butterfield, 1999; Chen *et al.*, 2009; Govaerts *et al.*, 2022).

The genus *Pleione* is characterised by epiphytic, lithophytic, or terrestrial herbs. Pseudobulbs annual, ovoid, narrowed toward apex to form a distinct neck, 1 or 2 leaved at apex. Leaves usually papery, plicate, usually deciduous or falling in winter. Inflorescences 1 or 2, arising from base of an old pseudobulb, erect; floral bracts often colorful, persistent. Flowers large, usually showy, opening widely. Sepals usually free, similar. Petals similar to but usually slightly narrower than sepals. Lip conspicuously larger than sepals, entire or obscurely 3-lobed, apical margin erose or lacerate; disk with a callus consisting of 2 to several lamellae or rows of papillae extending along central veins.

In India, there are 8 species and 1 natural hybrid (Misra 2007, 2019; Singh *et al.*, 2019) reported so far, and in the North East 7 species and 1 natural hybrid are reported to occur. But the authors have not seen any herbarium material or any natural population of *Pleione* × *lagenaria* Lindley & Paxton (1851: 5) in the North East but this species was reported from Meghalaya. A brief description of all the species present in North East India along with the key to the identification is provided below.

Material and methods

The present study is based primarily on herbarium material (dried specimens) of *Pleione* studied at CAL, ASSAM, ARUN, and GU. The herbarium studies were combined with the examination of live plants of *Pleione arunachalensis*, *P. hookeriana*, *P. humilis*, *P. maculata*, *P. praecox*, *P. saxicola*, *P. scopulorum* in

natural populations. These 7 species were observed during field trips in different states of North East India - i.e. Assam, Arunachal Pradesh, Nagaland, Meghalaya, Manipur, Mizoram, Tripura, and Sikkim. The plant specimens collected were photographed in the field, press dried, and herbarium material was prepared during each field trip following the standard methods of Jain & Rao (1977) and deposited in ARUN and TOSEHIM, Regional Orchids Germplasm Conservation & Propagation Centre (Assam).

The morphological descriptions were prepared from fresh material, and type specimens for as many names as possible were also studied. When studying dried herbarium specimens, all vegetative structures were examined in a dry state. Based on the morphological data a description was prepared for each accepted species. Finally, a dichotomous key to the species was constructed using morphological information. A line drawing of each species was prepared from fresh material. The ecological, geographic and elevational data from field notes were provided. The distribution of each species was provided based on information from WCSP (2022).

Taxonomic treatment

Key to the species of *Pleione* from North East India

1a. Pseudobulb 2 leaved

2a. Leaves developing at flowering *P. scopulorum*

2b. Leaves deciduous or withered at flowering

3a. Sheaths on pseudobulb warty; pseudobulb mottled

purplish-brown *P. praecox*

3b. Sheaths on pseudobulb smooth; pseudobulb green *P. maculata*

1b. Pseudobulb 1-leaved

4a. Pseudobulb dorsoventrally flattened *P. saxicola*

4b. Pseudobulb ovoid to conic or cylindrical

5a. Pseudobulb ovoid to conic

6a. Flower 5-5.5 cm across, deep pink *P. arunachalensis*

6b. Flower 2-4 cm across, pink to light pink, with lip spotted with yellowish-brown *P. hookeriana*

5b. Pseudobulb narrowly cylindrical with slender beak *P. humilis*

Pleione arunachalensis Hareesh, Kumar & M. Sabu, *Phytotaxa* 291 (4): 294–298. 2017.

Specimen examined: INDIA. Arunachal Pradesh, Lower Dibang Valley district, Mayodia, 2100 m, 06.05.2016, *V.S. Hareesh 143761* holotype: CAL!; isotypes: CAL!.

Description (fig. 1A & 2): Plant a lithophytic herb up to 11–15 cm long. Pseudobulbs 2.8–3.2 × 1.4–1.6 cm, ovoid-conical with an elongated neck, glabrous, green or greenish-black, covered with remaining papery brown sheaths. Leaf solitary, plicate, 4.5–5 × 1.3–1.5 cm, oblanceolate, acuminate, glabrous. Inflorescence erect, 1-flowered; peduncle 5.5–5.7 cm long, slender, glabrous, deep pink. Flower 5–5.5 cm across, deep pink. Dorsal sepal oblanceolate, subacute, glabrous; lateral sepals oblanceolate, acuminate at apex, glabrous. Petals spreading linear-oblanceolate, obtuse or sub-acute at apex, glabrous. Lip obscurely 3-lobed towards the apex, broadly ovate when flattened, obtuse at apex, margin minutely undulate; callus of 4 lines of long papillae 1.4 cm apart from the base and extending towards the apex. Column sub-clavate, 1.5–1.6 cm long.

Flowering: April - May.

Habitat: Lithophytic in the moist rocky areas in association with moss at an elevation of 2000 to 2100 m.

Distribution: INDIA (Lower Dibang Valley district of Arunachal Pradesh).

Pleione hookeriana (Lindley) Rollisson, *Nursery Catalog* (Rollisson) 1875-1876: 39. 1875. *Coelogyne hookeriana* Lindley, *Folia Orchidacea-Coelogyne*: 14. 1854. *Pleione hookeriana* var. *brachyglossa* (Reichenbach f.) Karthikeyan in S. Karthikeyan, S.K. Jain, M.P. Nayar, M. Sanjappa, *Florae Indicae Enumeratio: Monocotyledonae*: 165. 1989.

Specimen examined: INDIA, Arunachal Pradesh, Tawang district, Tawang, 01.09.84, *A.N. Rao 16130* (Orchid Herbarium Tipi!).

Description (fig. 1B & 3): Plants epiphytic or lithophytic. Pseudobulbs ovoid, 1–2.5 × 0.5–0.9 cm, 1-leaved. Leaves 8–10 × 2.5–3 cm, elliptic-lanceolate, acuminate, membranous. Inflorescence synanthous, erect, 1-flowered, ca. 8 cm long, sheathed at base, sheaths appressed. Flowers ca. 5 cm across, light pink. Sepals narrowly ovate to oblong-lanceolate, the laterals slightly shorter than the dorsal sepal. Petals oblanceolate, acute. Lip obscurely 3-lobed, broadly truncate at base, emarginate at apex, white with pale-red-brown blotches, crisped toothed on the margin, disk with 5–7 ciliate lamellae. Column slender 1.5–2 cm long, broadly winged and triangular at apex. Capsules obovoid.

Flowering: April - June.

Habitat: Epiphytic or lithophytic on mossy rocks and trees in deep shade at elevations of 2200 to 4200 m.

Distribution: INDIA (Arunachal Pradesh, Manipur, Nagaland, Sikkim, W. Bengal, Uttarakhand) BHUTAN, CHINA, INDO CHINA, MYANMAR, NEPAL, THAILAND.

Pleione humilis (J.E. Smith) D. Don, *Prodromus florae Nepalensis*: 37. 1825. *Epidendrum humilis* J.E. Smith, *Exotic Botany* 2: 75. 1806. *Pleione humilis* var. *amittii* R. Pal, Dayamma & Medhi, *The Journal of The Orchid Society of India* 25: 73. 2011, nom. inval.

Specimens examined: INDIA, Arunachal Pradesh, Tawang District, Tawang, 18.04.90, *S.K. Majumdar 25667* (Orchid Herbarium Tipi!); West Kameng district, Bampu, 10.03.05, *A.N. Rao 35704* (Orchid Herbarium Tipi!); East Kameng district, Eagle Nest, 18.03.02, *A.N. Rao 30821* (Orchid Herbarium Tipi!); Manipur, Kangpokpi district, Masaklalla, 07.03.14, *Chowlu 00485* (Herbarium of Centre for Orchid Gene Conservation for Eastern Himalayan Region!); Meghalaya, 20.06.11, *Gogoi 00725* (TOSEHIM).

Description (fig. 1C & 4): Plants epiphytic or lithophytic. Pseudobulb olive-green, flask-shaped with a long neck, 2–6 × 0.8–2 cm, apex with 1 leaf. Leaf oblanceolate to elliptic, 18–25 × 2.8–3.5 cm, apex acute. Inflorescence produced before leaf,

with 1 or 2 flowered; peduncle clothed in scarious sheaths. Flowers spreading to nodding; sepals and petals white, lip white, spotted and streaked with crimson or yellow-brown with a central pale-yellow zone. Dorsal sepal linear-oblongate, apex subacute; lateral sepals obliquely oblongate apex subacute. Petals obliquely linear-oblongate, apex rounded. Lip oblong-elliptic, obscurely 3-lobed in front, base saccate, margin lacerate in apical half, apex emarginate, callus consisting of 5–7 barbulate lamellae. Column 2.6–2.8 cm, broadly winged, apex irregularly dentate.

Flowering: March - April.

Habitat: Epiphytic or lithophytic on moss or the smooth trunks of rhododendron trees at elevations of 1100 to 3500 m.

Distribution: INDIA (Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, W. Bengal, Uttarakhand), BHUTAN, CHINA, NEPAL, MYANMAR.

Pleione maculata (Lindley) Lindley & Paxton, *Paxton's Flower Garden*. 2: 5. 1851. *Coelogyne maculata* Lindley, *Genera and Species of Orchidaceous Plants*: 43. 1830. *Pleione maculata* var. *virginica* (Reichenbach f.) Karthikeyan in S. Karthikeyan, S.K. Jain, M.P. Nayar, M. Sanjappa, *Florae Indicae Enumeratio: Monocotyledonae*: 166. 1989.

Specimens examined: INDIA, Meghalaya, Ri-Dhoi district, Barapani, 29.10.84, *A.N. Rao 16695*. (Orchid Herbarium Tipi!); Arunachal Pradesh, Tirap District, Khonsa, 25.03.84, *A.N. Rao 13508*, *A.N. Rao 13507*, *A.N. Rao 13506*, *A.N. Rao 13505*, *A.N. Rao 13504* (Orchid Herbarium Tipi!); Arunachal Pradesh, Roing, 18.10.19. *Gogoi 00810* (TOSEHIM).

Description (fig. 1D & 5): Plants epiphytic or lithophytic. Pseudobulb turbinate to pyriform, 1–3 × 1–1.5 cm, usually with a short, indistinct neck, often enclosed in persistent, smooth sheaths, 2-leaved. Leaves elliptic-lanceolate to oblongate, 10–20 × 1.5–3.5 cm, papery, apex acute. Inflorescence appearing after leaves have fallen, erect; peduncle 5–6 cm long. Flower solitary, suberect or spreading, white or occasionally tinged purplish red, lip with a yellow centre and purple blotches on

apical margin. Dorsal sepal oblong-lanceolate, apex obtuse; lateral sepals broadly lanceolate, falcate, slightly oblique, apex acute. Petals oblanceolate, \pm falcate, apex acute; lip ovate-oblong, conspicuously 3-lobed at or below middle; disk with 5–7 papillate-toothed lamellae. Column 1.7–2.0 cm, apex irregularly erose-toothed.

Flowering: November - December.

Habitat: Epiphytic or lithophytic on tree trunks and mossy rocks in broad-leaved forests at elevations of 600–1600 m.

Distribution: INDIA (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, W. Bengal), BHUTAN, NEPAL, CHINA, MYANMAR, THAILAND.

Pleione praecox (J.E. Smith) D. Don, *Prodromus florae Nepalensis*: 37. 1825.
Epidendrum praecox J.E. Smith, *Exotic Botany* 2: 73. 1806.

Specimens examined: INDIA, Arunachal Pradesh, West Kameng, Jamiri point, 13.10.80, *S.N. Hegde* 3312, Sessa, 19.10.81, *S.N. Hegde* 3878, Nichiphu, 26.10.81, *S.N. Hegde* 3889, Bampo, 20.11.79, *S.N. Hegde* 1814, Jamiri, 13.10.80 *A.N. Rao* 3312, Shergaon, Kalalktang, 17.03.02, *A.N. Rao* 31008, Chaku, 21.04.92 *S.N. Hegde* 26409, Dirang, 10.06.86 *A.N. Rao* 21738, Tenga, 21.03.84, *S.N. Hegde* 4924 (Orchid Herbarium Tipi!); Manipur, Kangpokpi district, Field gene bank Hengbung, 11.11.14, *Chowlu* 00543, *Chowlu* 00535 (Centre for Orchid Gene Conservation for Eastern Himalayan Region!); Arunachal Pradesh, Ziro, 5.02.20, *Gogoi* 00811 (TOSEHIM).

Description (fig. 1E & 6): Plants epiphytic or lithophytic. Pseudobulb usually turbinate, $1.5\text{--}4 \times 1\text{--}2.3$ cm, apex abruptly contracted into a conspicuous neck, outer sheaths warty, 2 or rarely 1 leaved. Leaves elliptic-oblanceolate to elliptic, $9\text{--}20 \times 1.7\text{--}6.7$ cm, papery, acuminate. Inflorescence appearing after leaves have fallen or withered, erect; peduncle 5–10 cm, with 3 papillate sheaths. Flower solitary or rarely 2, large, pink to purplish red, rarely white, with a yellow callus and occasionally with purple spots on lip. Dorsal sepal sub-oblong-lanceolate, apex acute; lateral sepals slightly oblique, slightly wider at base than dorsal sepal, apex

acute. Petals linear-lanceolate, slightly falcate, apex acute; lip obovate-elliptic or elliptic, obscurely 3-lobed; lateral lobes inconspicuous; mid-lobe lacerate on apical margin, apex emarginate; disk with 3–5 rows of papillae extending from base of lip to midway along mid-lobe. Column 3.5–4.5 cm, apex irregularly toothed.

Flowering: November - December.

Habitat: Epiphytic or lithophytic on tree trunks and mossy rocks in forests, cliffs at elevations of 1200–2500(–3400) m.

Distribution: INDIA (Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, W. Bengal, Uttarakhand) BANGLADESH, BHUTAN, NEPAL, CHINA, MYANMAR, THAILAND.

Pleione saxicola T. Tang & F.T. Wang ex S.C. Chen in *Acta Phytotaxonomica Sinica*. 25 (6): 473. 1987.

Specimens examined: INDIA. Arunachal Pradesh, Tawang district, Zemithang, 14.09.17, *K. Chowlu 40940*, *K. Chowlu 40948* (ARUN!).

Description (fig. 1F & 7): Plant epiphytic or terrestrial. Pseudobulb turbinate, dorsiventrally flattened, 0.7–1.1 × 1–2 cm, apex abruptly contracted into a conspicuous neck, 1-leaved. Leaf developing at flowering, suboblong-lanceolate to oblanceolate, 10–18 × 1.7–3.7 cm, papery, apex acute. Inflorescence erect; peduncle 7–10 cm, with 2 or 3 membranous sheaths at base. Flower solitary, large, to 10 cm across, rose-red with a white base and a yellow or white callus on lip. Sepals fused in basal half and forming a tube; dorsal sepal oblanceolate, apex acute; lateral sepals slightly oblique, slightly wider at base than dorsal sepal, apex acute. Petals oblanceolate, slightly shorter and narrower than sepals, apex acute; lip broadly elliptic, base cuneate and with a claw, distinctly 3-lobed above middle; disk with 3 entire or slightly undulate lamellae extending from base of lip to midway along disk. Column 4.0–4.6 cm, apex irregularly toothed.

Flowering: September - October.

Habitat: Epiphytic or terrestrial at elevations of 2400–2500 m.

Distribution: INDIA (Arunachal Pradesh), BHUTAN, CHINA.

Pleione scopulorum W.W. Smith, *Notes from the Royal Botanic Garden, Edinburgh* 13: 218. 1921.

Specimens examined: INDIA. Arunachal Pradesh, Kurung Kumey district, Vadsa hills, undated, *S.S. Dash 32777*; *A.A. Mao & S. S. Dash 31801* (CAL).

Description (fig. 8): Plant terrestrial. Pseudobulb usually ovoid, slightly oblique, 1–2.5 × 0.6–1.5 cm, 2-leaved. Leaves developing at flowering, lanceolate, oblanceolate, or narrowly elliptic, 4–13 × 1–2.3 cm, acute. Inflorescence erect; peduncle 12–18 cm, lacking sheaths. Flowers solitary or rarely 2 or 3, rose-purple or rarely white and tinged pale purplish-blue, usually with a yellow center and dark purple spots on lip. Dorsal sepal elliptic-lanceolate or narrowly ovate, apex acuminate; lateral sepals obliquely elliptic, apex apiculate. Petals oblanceolate or narrowly ovate-oblong, apex subacute or obtuse; lip transversely elliptic or subulate, obscurely 3-lobed, apical margin denticulate, apex obtuse and sometimes emarginate; disk with 5–9 lacerate lamellae. Column 1.5–2.0 cm; column wings very narrow below middle.

Flowering: May to June.

Habitat: Terrestrial in rocky grasslands in coniferous forests, mossy rocks along streams, subalpine scrubby meadows at elevations of 2800–4200 m.

Distribution: INDIA (Arunachal Pradesh, Nagaland) CHINA, MYANMAR.

Conclusion

The growing interest in orchid export, biopiracy, and destruction of forests has cumulatively led to the rapid extinction of *Pleione*'s from this region. Most of the *Pleione*'s vanished due to the mass clearance of forests for other developmental activities like the construction of roads, shifting cultivation, mining etc. Besides, overgrazing, unplanned human activities, and orchid collection for ornamental, medicinal, and commercial purposes have also been considered the main root cause of orchid depletion.

Hence, there is an urgent need for the conservation of these orchids in the forest and the primary concern is the management of ecosystems. Unsustainable harvesting for floriculture is one of the major threats, so reliance on orchids from nature must be avoided.

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Literature Cited

- Chen, X., P.J. Cribb & S.W. Gale, 2009. *Pleione*. In: Wu, Z.Y., Raven, P.H. & Hong, D.Y. (Eds.) *Flora of China* Vol. 25 (Orchidaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis, 325–333 p.
- Cribb, P. & I. Butterfield, 1999. *The genus Pleione*, second edition. Royal Botanic Gardens, Kew 175 p.
- Don, D. 1825. *Prodromus florum Nepalensis*. J. Gale, London 236 p.
- Govaerts, R., M.A. Campacci, D.H. Baptista, P.J. Cribb, A. George, K. Kreutz, & J.J. Wood, 2022. *World Checklist of Orchidaceae*. The Board of Trustees of the Royal Botanic Gardens, Kew. Published on the Internet: <http://apps.kew.org/wcsp/> (Retrieved 6 January 2022).
- Jain, S.K. & R.R. Rao, 1977. *A handbook of field and herbarium methods*. Today & Tomorrow's Printers & Publishers, New Delhi, 107 pp.
- Lindley, J. & J. Paxton, 1851. *Paxton's Flower Garden*, 2: 5. London.
- Lindley, J., 1821. *Collectanea botanica*, London, sub t. 33.
- Misra, S. 2007. *Orchids of India – A glimpse*. Bishen Singh Mahendra Pal Singh, Dehra Dun 402 p.
- Misra, S., 2019. *Orchids of India-A hand book*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India 652 p.
- Singh, S.K., D.K. Agarwala, J.S. Jalal, S.S. Dash, A.A. Mao & P. Singh, 2019. *Orchids of India—a pictorial guide*. Botanical Survey of India 547.



Fig. 1: *Pleione* species of North East India. A – *Pleione arunachalensis*, B – *Pleione hookeriana*, C – *Pleione humilis*, D – *Pleione maculata*, E – *Pleione praecox*, F – *Pleione saxicola*. Photos A, Hareesh; B-E, K. Gogoi; F, K. Chowlu.

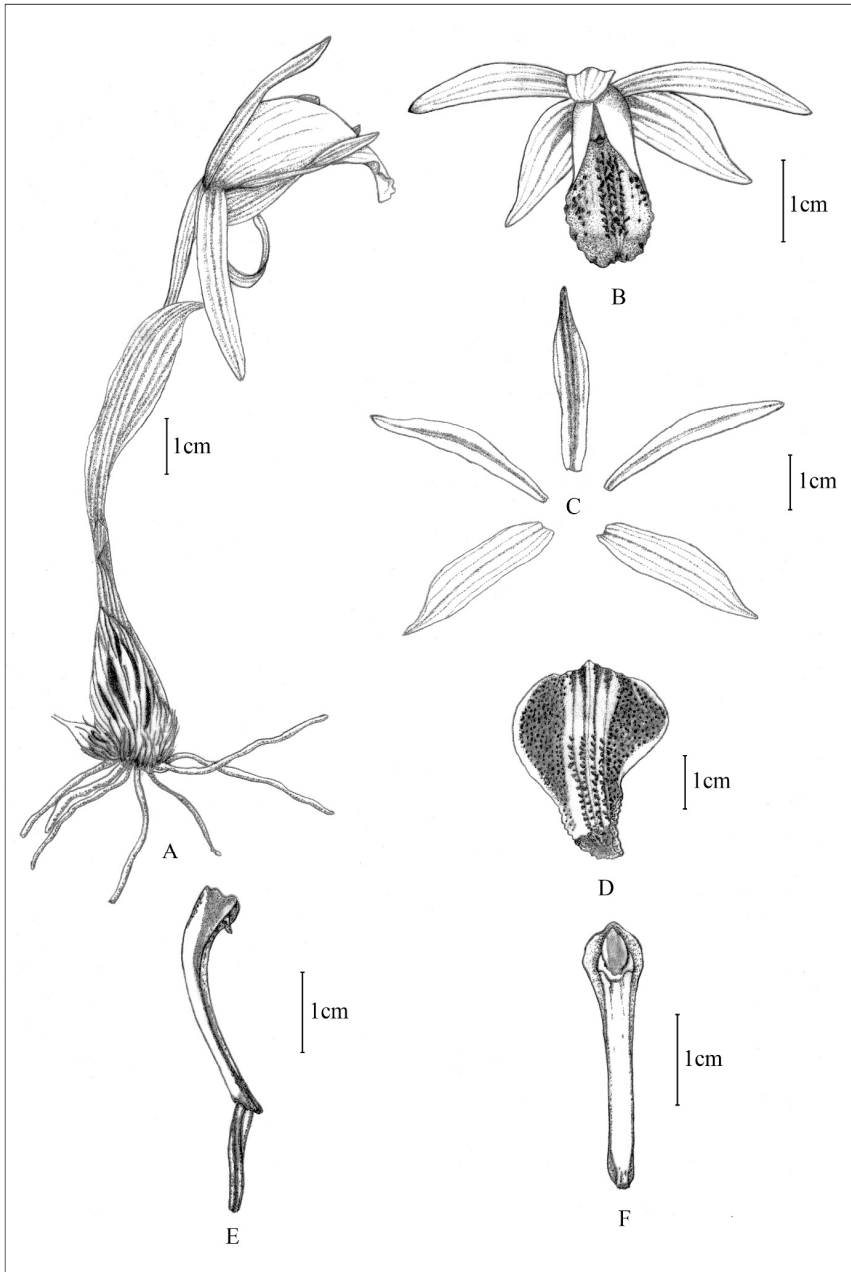


Fig. 2: *Pleione arunachalensis* Hareesh, Kumar & M. Sabu. A – habit, B – front view of flower, C – sepals and petals, D – lip, E – ovary and column, F – front view of column. Drawing K. Gogoi.

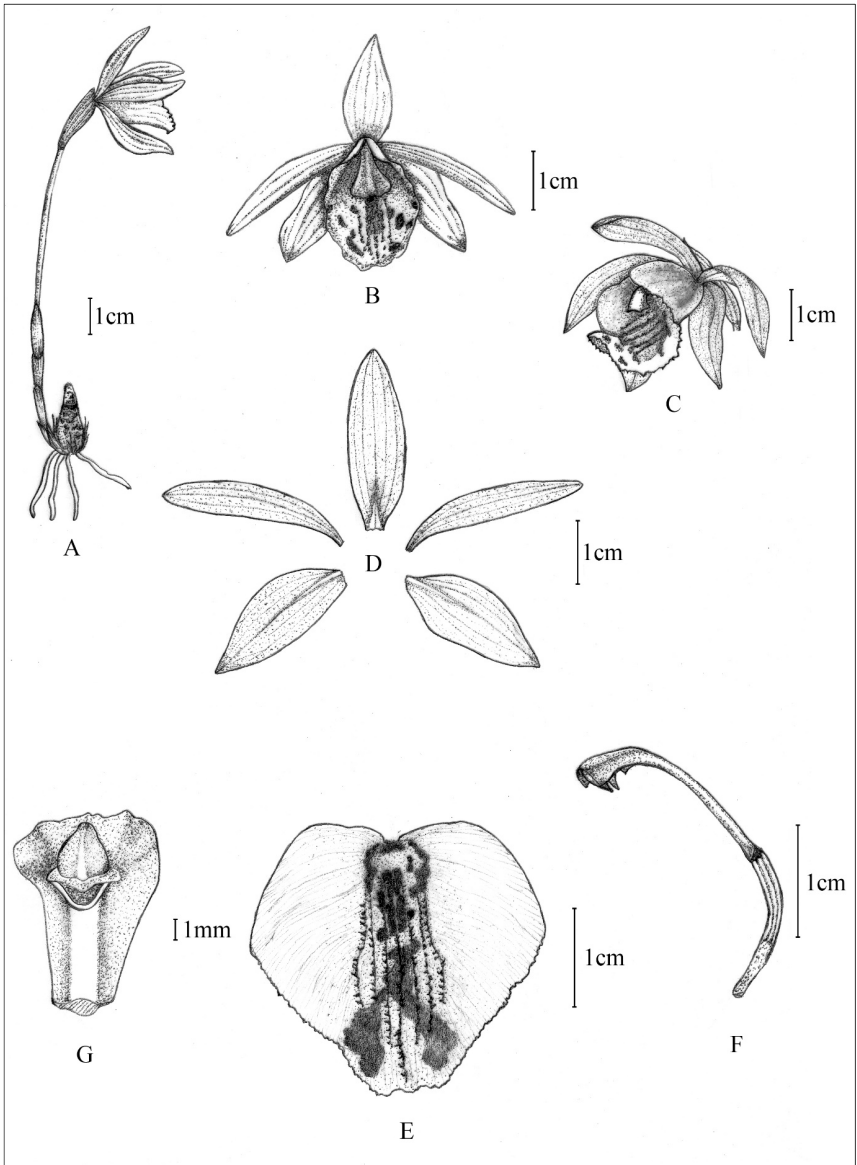


Fig. 3: *Pleione hookeriana* (Lindley) Rollisson. A – habit, B – front view of flower, C – side view of flower, D – perigone, E – lip, F – ovary and column, G – front view of column. Drawing K. Gogoi.

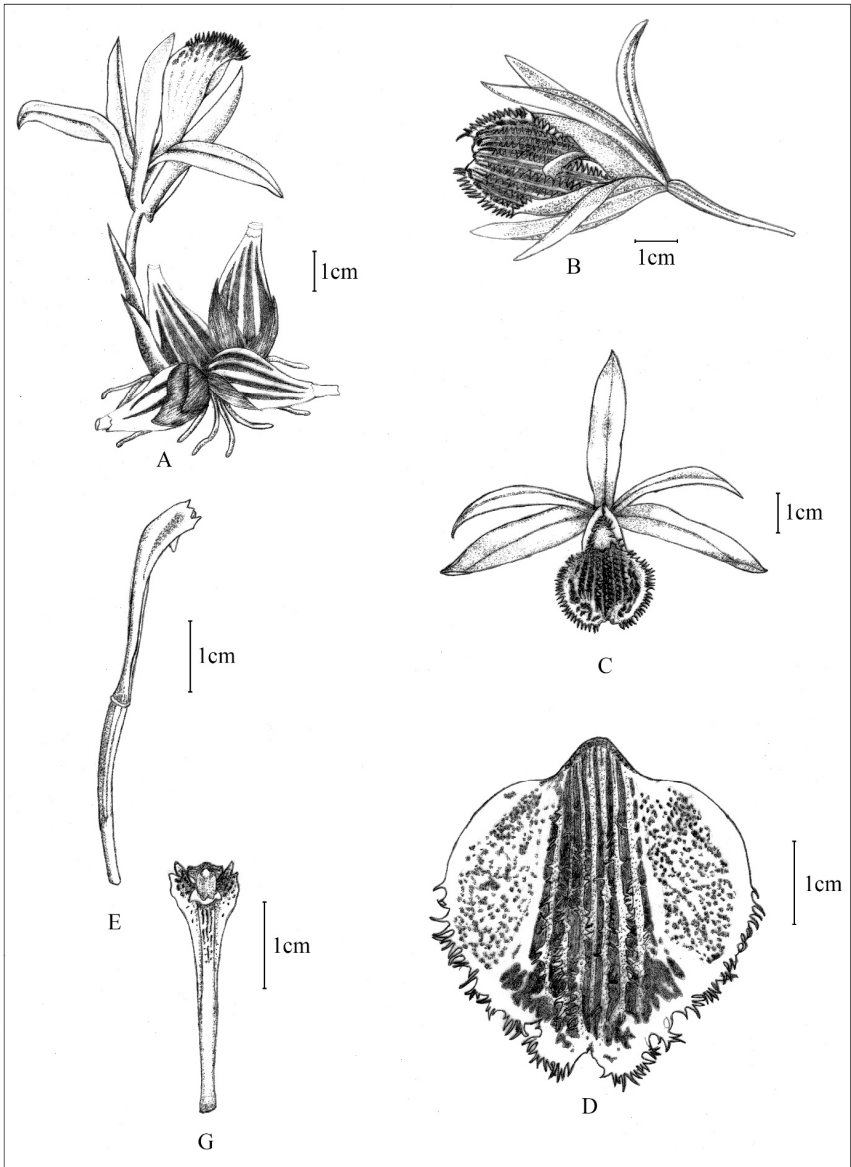


Fig. 4: *Pleione humulis* (J.E. Smith) D. Don. A – habit, B – side view of flower, C – front view of flower, D – lip, E – ovary and column, F – front view of column. Drawing K. Gogoi.

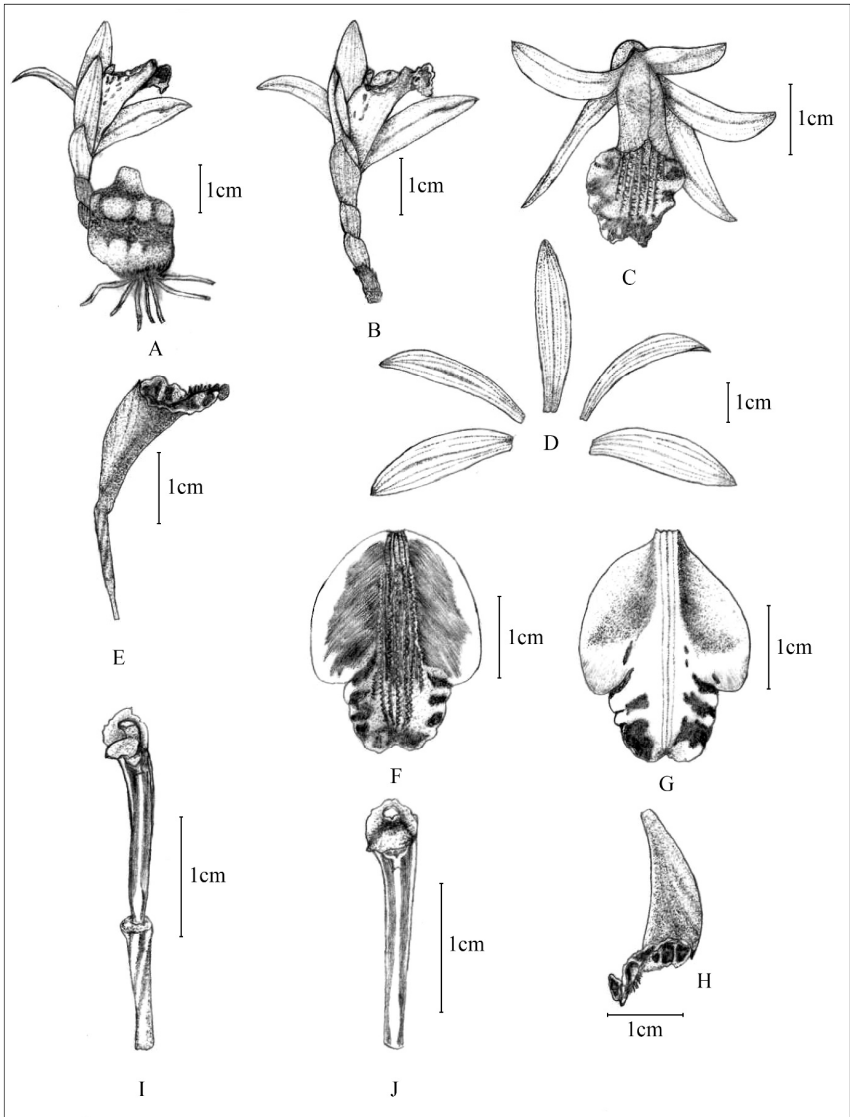


Fig. 5: *Pleione maculata* (Lindley) Lindley & Paxton. A. habit – B. inflorescence, C – front view of flower, D – perigone, E – lip with ovary and column, F; G; H – lip; I – ovary and column, J – front view of column. Drawing K. Gogoi.

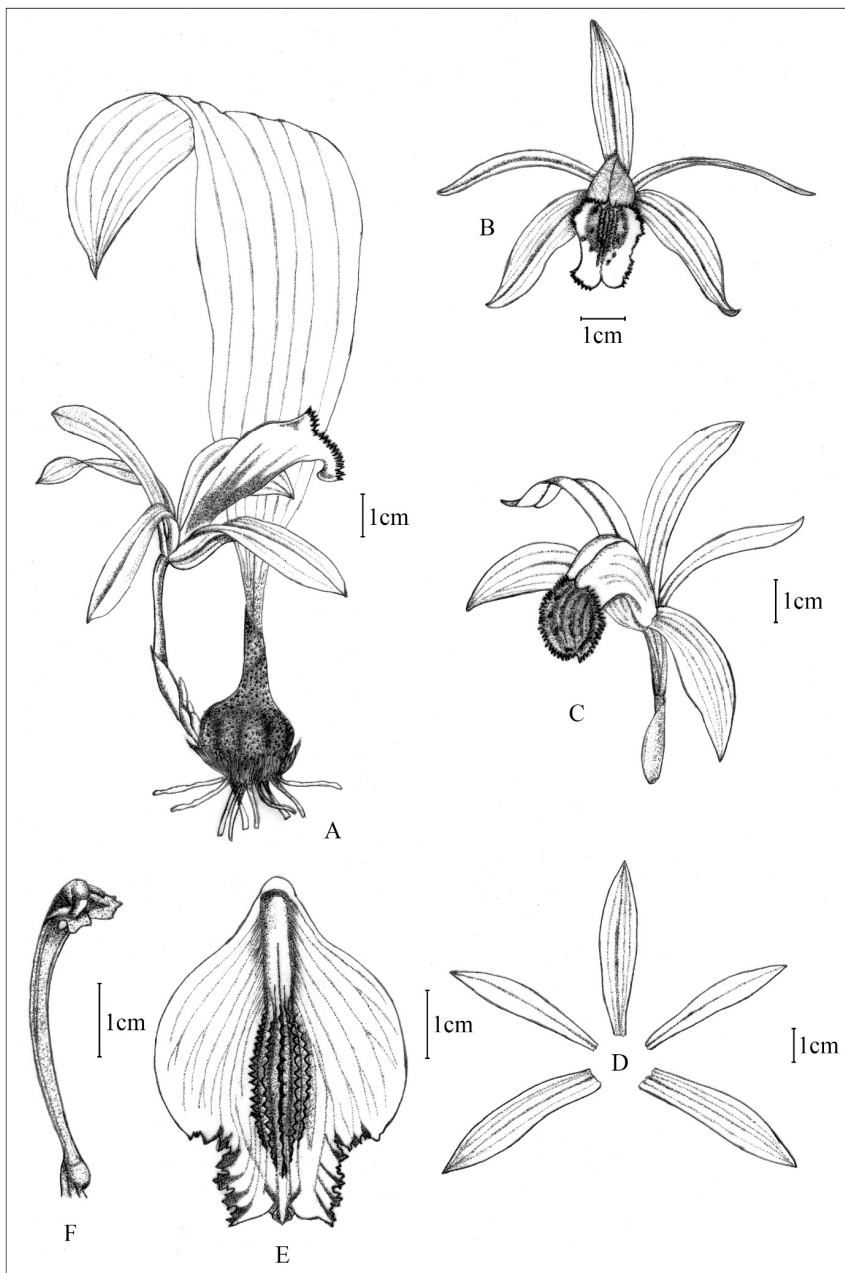


Fig. 6: *Pleione praecox* (J.E. Smith) D. Don. A – habit, B – front view of flower, C – side view of flower, D – perigone, E – lip, F – column. Drawing K. Gogoi.

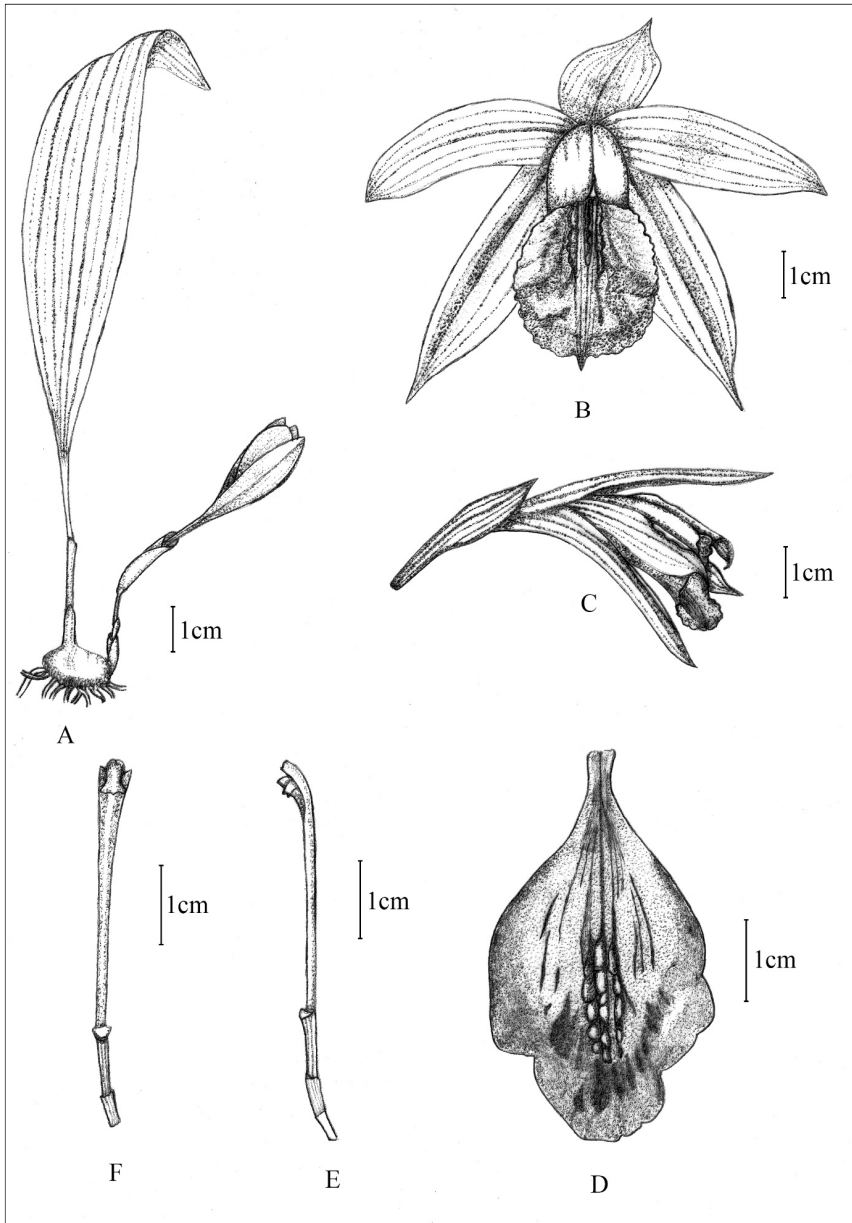


Fig. 7: *Pleione saxicola* T. Tang & F.T. Wang ex S.C. Chen. A – habit, B – front view of flower, C – side view of flower, D – lip, E; F – ovary and column. Drawing K. Gogoi.

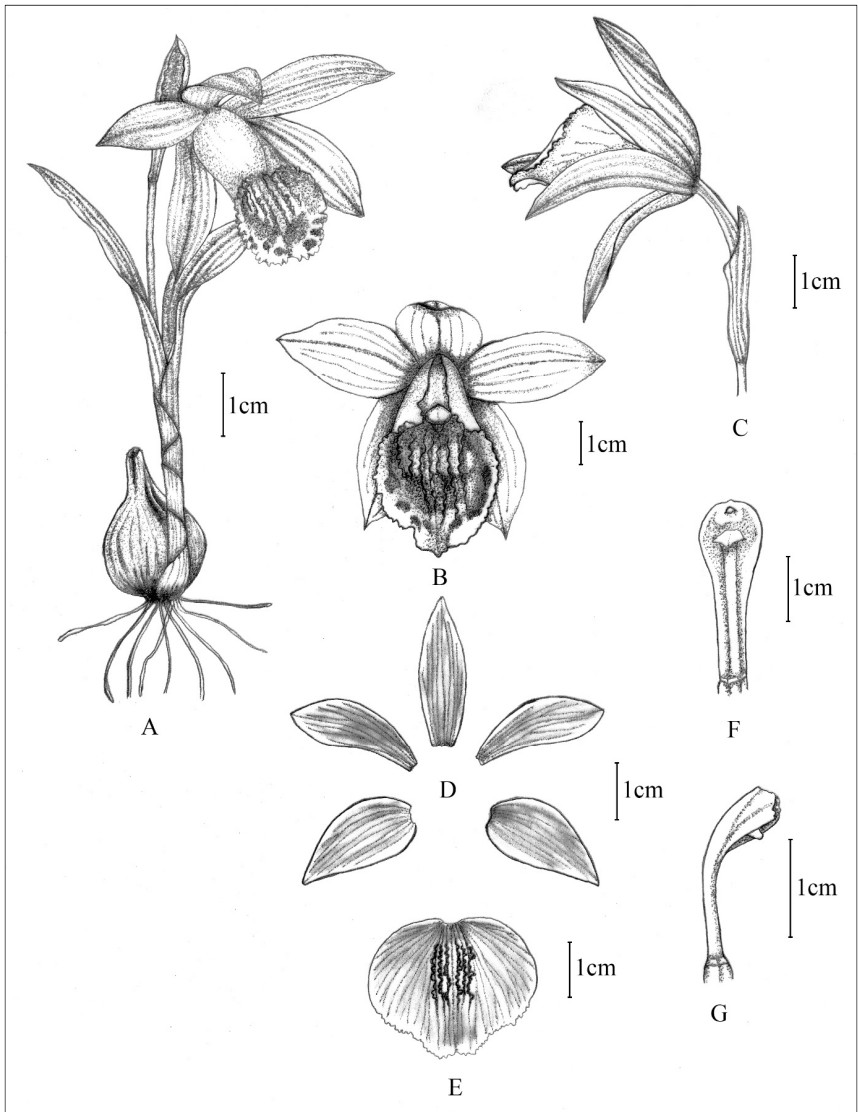


Fig. 8: *Pleione scopulorum* W.W. Smith. A – habit, B – side view of flower, C – front view of flower, D – perigone, E – lip, F; G – column. Drawing K. Gogoi.