



## NOTE

## Additions to Orchid Flora of Bhutan-II

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**ABSTRACT:** Nine orchid species from seven genera, namely, *Bulbophyllum andersonii* (Hook.f.) J.J.Sm., *Bulbophyllum roxburghii* (Lindl.) Rchb.f., *Dendrobium farmeri* Paxton, *Dendrobium nathanielis* Rchb.f., *Panisea panchaseensis* Subedi, *Odontochilus brevistylis* Hook.f., *Platanthera dulongensis* X.H.Jin & Efimov, *Porpax ehwesii* (Rchb.f.) Rolfe and *Thelasis longifolia* Hook.f., are reported for the first time from Bhutan. Detailed description along with information on type, updated global distribution, phenology, ecology and colour plates of the recorded species are provided.

**KEY WORDS:** Distribution, Himalaya, new record, Orchidaceae, taxonomy.

### INTRODUCTION

The family Orchidaceae is the largest and most diverse among angiosperms (Pearce and Cribb, 2002; Gurung, 2006, Chase *et al.*, 2015) comprising over 28,000 species from 736 genera with new species increasing every year (Christenhusz and Byng, 2016). Orchids grow in almost all habitats on the earth except the glaciers (Gyeltshen *et al.* 2019) and distributed worldwide except for Antarctica, depicting higher diversity in the tropical regions (Gurung, 2006). Bhutan, the eastern part of Himalaya Biodiversity Hotspot is home to rich flora and fauna (CEPF 2005). One of the milestone for the country with respect to orchids in the recent times was the publication of the account of orchid flora of Bhutan where Pearce and Cribb (2002) reported 579 species from the country, however, of these, only 369 species were actually known to exist here, while the rest were assumed to occur in the country on the basis of their distribution in adjacent areas in India and Nepal. A century of new orchid records of Bhutan by Dalstrom *et al.* (2017) enumerated 100 species of orchids to Orchids of Bhutan excluding one mistaken identity which is later investigated and reported as a new species, *Bulbophyllum trongsaense* P.Gyeltshen, D.B.Gurung & Kumar (Gyeltshen *et al.* 2020). During the same time, Gyeltshen *et al.* (2017, 2019) reported *Spathoglottis jetsuniae* N.Gyeltshen, K.Tobgyel & Dalström and *Chiloschista gelephuense* C.Gyeltshen & Dalström followed by *Chilochista densiflora* Gyeltshen, C. Gyeltshen & Dalström and *Chilochista himalaica* Tobgay, C.

Gyeltshen, Dalström by Gyeltshen *et al.* (2020). And, gradually more new records are being added on yearly basis now, for example, *Crepidium aphyllum* (King & Pantl.) A.N.Rao by Rabgay and Kumar (2019), *Herminium longilobatum* S.N.Hegde & A.N.Rao (Dechen *et al.* 2020), *Bulbophyllum spathulatum* (Zangpo *et al.* 2021). These new species discoveries and new distribution records of species are clear indication that many parts of the country are still under-surveyed and hence, emphasizes the need for thorough explorations and in-depth studies. Based on these new findings and recent updates, we presume that more than 520 species of orchids currently occur in Bhutan. The current manuscript is one such effort which adds nine more orchid species, hitherto not known from the country.

During field surveys and explorations during 2018 to 2019, these nine orchid species were observed growing on rocks and on the trees at various localities. Authors collected field notes and voucher specimens for further examination in 2019 and systematically identified them after critical morphological study, consultation of existing relevant literature in the region (Hooker, 1896; King & Pantling, 1898; Seidenfaden, 1986; Pearce & Cribb, 2002; Chen, 2009; Subedi *et al.*, 2011; Jin & Efimov, 2012) and various online herbarium specimens available online at AMES, E, K, NY, P and RENZ. Detailed morphological description, phenology, distribution, ecology and analytical photo plates are provided for each newly recorded species. The voucher specimens are deposited at the National Herbarium (THIM), National Biodiversity Centre, Thimphu, Bhutan.



**Fig. 1.** *Bulbophyllum andersonii* (Hook.f.) J.J. Smith: **A.** Plant in habitat with flowers; **B.** Inflorescence; **C.** Flowers (ventral view); **D.** Flower (top view); **E.** Flower (back view); **F.** Flower (front view without ovary and pedicel); **G.** Flower (side view).

## ENUMERATION OF THE SPECIES

*Bulbophyllum andersonii* (Hook.f.) J.J.Sm., Bull. Jard. Bot. Buitenzorg, sér. 2, 8: 22. 1912; *Cirrhopetalum andersonii* Hook.f., Fl. Brit. India 5: 777. 1890; *Phyllorkis andersonii* (Hook.f.) Kuntze, Revis. Gen. Pl. 2:

677. 1891. **Type:** India, Sikkim Himalaya, near Darjeeling, *T. Anderson s.n.* (holotype - CAL icon.).

### Fig. 1

*Cirrhopetalum henryi* Rolfe, J. Linn. Soc., Bot. 36: 15. 1903; *Bulbophyllum henryi* (Rolfe) J.J.Sm., Bull. Jard. Bot. Buitenzorg, sér. 2, 8: 25. 1912. *Cirrhopetalum rivesii* Gagnep., Bull. Soc. Bot. France 78: 7. 1931.



Epiphytic herb. Rhizome creeping, 2.6–5.2 mm in diam., brown; roots clustered at the base of pseudobulb. Pseudobulbs ovoid to ovoid-conic, 2–6 × 0.6–2 cm, placed of 3–13 cm apart on rhizome, slightly angular with longitudinal furrows during dry seasons, glabrous, pale green. Scape emerging from base of pseudobulb, erect, yellowish green with purplish red stripes, ca. 18 cm long. Leaf single per pseudobulb; petiole 1–2 cm long, glabrous, pale green; lamina oblong to linear-oblong or oblong-elliptic, 6–20 × 1.5–4.5 cm, thick, coriaceous, base attenuate, margin entire, apex obtuse or retuse, glabrous, green. Inflorescence an umbel, 5–12-flowered; peduncle slender, 10–19 cm long, glabrous, yellowish-green with purple streaks, with several tubular sheaths; sheaths tubular-oblong to oblong-lanceolate, 0.7–1.2 cm long. Flowers resupinate, 1.2–2.0 cm long, sepals and petals pinkish-white, surface purplish pink spotted, lip purple; floral bracts lanceolate, 3.5–5.2 × 1–1.5 mm, apex acute or acuminate, glabrous, pale yellow, surface pale purple spotted, 1-veined; pedicel and ovary slender, 0.8–1.2 cm long, glabrous, yellowish green; dorsal sepal concave, oblong-ovate, 4.5–5.5 × 2.2–3 mm, apical margins minutely dentate, apex with extended to short awn, 5-veined; lateral sepals falcate, oblong-obovate, 1.5–2.1 × 0.4–0.7 cm, base adnate to column foot, twisted, upper margin connate, apex obtuse, 5-veined; petals slightly falcate, oblong or oblong-ovate, 3–3.5 × 1.5–2 mm, margins with irregular erose, apex acuminate extended to awn, both surfaces minutely papillose. Labellum recurved, narrowly oblong-ovate, 4.1–4.8 × 2 mm, mobile, fleshy, base grooved, margins entire, apex obtuse, attached to end of column foot. Column stout, thick, oblong, 1.8–2 mm long, glabrous, yellowish green; forwarded and incurved foot, rectangular with broad apex, 2.5–2.8 mm long, white, spotted with purplish red; stelidia deltoid, ca. 1 mm long, apex acute; anther cap yellow, apical margins ciliated.

**Phenology:** Flowering and fruiting from November to December.

**Habitat & ecology:** The plant was growing as epiphyte on *Quercus griffithii* Hook.f. in the warm broad-leaved forest at 1580m elevation.

**Distribution:** Bhutan (Zhemgang), China, India, Laos, Myanmar, Nepal and Vietnam.

**Specimens examined:** BHUTAN, Zhemgang District, Phangkhar Block, Buli forest area, 1580 m, 19 November 2019, *Phub Gyeltshen & S. Jamtsho* 37 (THIM!). INDOCHINA, *s.loc.*, November 1931, *P.A. Petelot*, 5431 (AMES!); VIETNAM, Chapa, 1450 m, September 1931, *P.A. Petelot* 5431 (P!); Cao Bang Province, Bao Lac District, DinhPhung, Ban O, 1200–1300 m, 24 November 2014, *L. Averyanov et al.*, CPC 7615 (P!). CHINA, September 1904, *J. Cavalerie* 1798 (P!); Yunnan, 1524 m, 1898, *A. Henry* 11264 (Isotype-MO!); Yunnan, *A. Henry* 11264 (NY!); Yunnan, Mengzi, 1524 m, *A. Henry* 11264 (Isotype-AMES!); *G. Forrest s.n.* (E!); Yunnan, 1524 m, *A. Henry* 11264 (Isotype-E!); *s.loc.* 1524 m, *A. Henry* 11264 (K!).

**Bulbophyllum roxburghii** (Lindl.) Rchb.f. in W.G. Walpers, *Ann. Bot. Syst.* 6: 263. 1861; *Cirrhopetalum roxburghii* Lindl., *Gen. Sp. Orchid. Pl.*: 58.

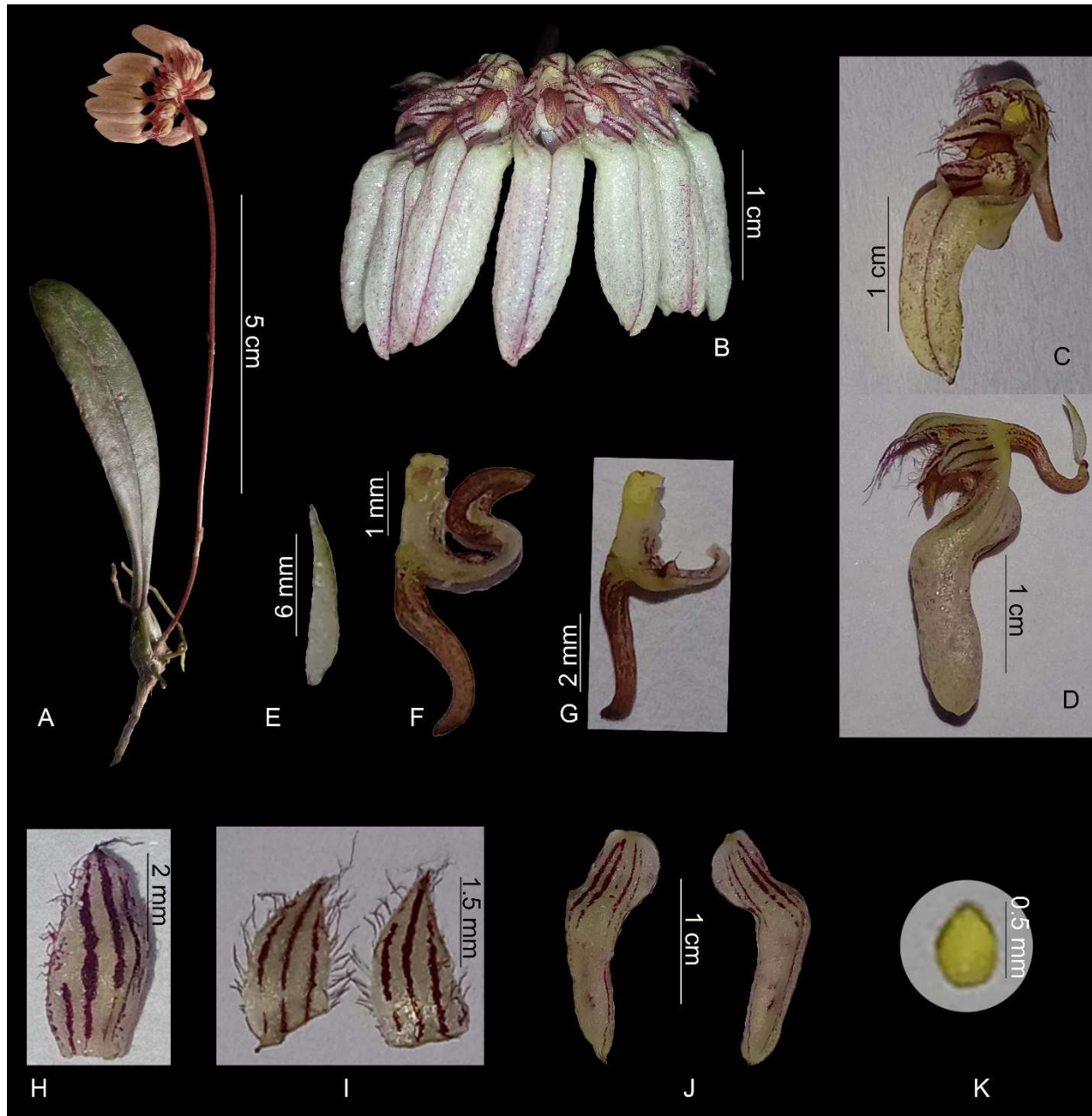
1830; *Aerides radiata* Roxb., *Fl. Ind. ed.* 1832, 3: 476 (1832); *Phyllorkis roxburghii* (Lindl.) Kuntze, *Revis. Gen. Pl.* 2: 677. 1891. **Type:** India, Gangetic Delta, *Roxburgh 2351* (holotype - K icon.).

### Fig. 2

*Cirrhopetalum sikkimense* King & Pantl., *Ann. Roy. Bot. Gard. (Calcutta)* 8: 90. 1898; *Bulbophyllum sikkimense* (King & Pantl.) J.J.Sm., *Bull. Jard. Bot. Buitenzorg, sér. 2*, 8: 28 (1912).

Epiphytic herbs, semi-erect, 7–8 cm tall. Rhizomes creeping, cylindrical, terete, 1.5–2.5 cm long, 1–2 mm wide, slightly swollen at nodes, woody, covered by membranous sheaths, persistent, brown, a few roots arise from the base of pseudobulb. Pseudobulbs ovoid, 0.7–1.0 cm long, 0.5–0.6 cm wide, placed 2–11 cm apart on the rhizome, glabrous, green, slightly angular with longitudinal furrows during dry seasons. Leaf 1, petiolate, petiole 3.5–5 mm long, longitudinally channeled, glabrous, green; lamina oblong-elliptic or oblanceolate, 4–6.2 × 1.4–2.0 cm, coriaceous, base slightly attenuate, margins entire, apex obtuse, obliquely emarginate, glabrous, pale green abaxially, dark green adaxially. Inflorescence erect or sub-erect, umbellate, 6–14 flowered, slightly exceeding leaves in length; peduncle slender, up to 10 cm long, up to 3-noded, glabrous, maroon, bearing 2–3 bracts like sheaths; sheaths oblong-ovate or tubular-oblong, 4–5.5 × 1–2 mm, membranous, acute at apex, pale brown. Floral bracts lanceolate, 10–12 × 4–6.5 mm, margin entire, acuminate at apex, glabrous, pale white. Flowers non-resupinate, pale greenish-white with reddish purple stripes on veins; pedicel and ovary slender, 3–4 mm long, glabrous, pale reddish-brown; dorsal sepal oblong-ovate, 2–3 × 1–2 mm, concave, covering the column, margins ciliated, glabrous, pale purplish-white with 4-prominent reddish-brown stripes like veins, apex acute with setae, 1–2 mm long; lateral sepals oblong, 10–20 × 2–3 mm, slightly falcate, connate on the inner margins except at base, base obliquely attached to column foot, margins entire, apex broadly acute, glabrous, pale whitish-purple with 4-prominent reddish brown veins; petals oblong-ovate or narrowly ovate, 2–2.8 × 1–1.5 mm, margins ciliated, slightly falcate, apex sub-acute with setae, setae, ca. 2 mm long, glabrous, purplish-white with 3-prominent reddish-brown veins; labellum recurved, thick and fleshy, ovate, much narrower towards apex, 2–2.5 × 1.5–2 mm, side lobes absent, immobile, margins entire, apex obtuse, glabrous, reddish-brown. Column oblong, 1.5–2 × ca. 1 mm, glabrous, pale whitish-purple, forwarded and incurved foot, rectangular, 2–2.5 × ca. 1 mm, margins entire, abaxially pale yellowish at base and pale whitish-purple towards distal portions, adaxially reddish-brown; callus 2 with acute apex extended to awn; anther-cap 2-lobed; lobes, broadly ovate, ca. 1.0 × 1.3 mm, yellow; stelidia 2, triangular, ac. 1 mm long. Pollinia 2 in one pair, ovoid ca. 1.2 × 1 mm, glabrous, yellow.

**Phenology:** Flowering and fruiting from late April to June.



**Fig. 2.** *Bulbophyllum roxburghii* (Lindl.) Rchb.f.: **A.** Habit; **B.** Inflorescence (front view); **C.** Flower (front view); **D.** Flower (side view); **E.** Floral bract; **F.** Labellum-pedicel, ovary and column (side view); **G.** Pedicel, ovary-column and foot (side view); **H.** Dorsal sepal; **I.** Petals; **J.** Lateral sepals; **K.** Pollinia.

**Habitat & ecology:** The plant is epiphytic on *Terminalia* sp. in the subtropical forest at 200–400 m elevation.

**Distribution:** Bhutan (Sarpang & Zhemgang), Bangladesh, India and Nepal.

**Specimens examined:** BHUTAN, Zhemgang, Phangkhar, Pantang, 200–400 m, 26 May 2019, P. Gyeltshen & P. Zangpo38 (THIM!). INDIA, Sikkim, June 1893, R. Panling148 (P-Isotype!); *Ibid.*, Valley of Teesta, 305 m, June 1891, R. Panling 148(GH-Isotype!); *Ibid.*, June 1893, R. Panling 148 (BM-Isotype!); *Ibid.*, s.d., June 1893, R. Panling 148 (K!).

*Dendrobium farmeri* Paxton. Paxton's Mag. Bot. 15 (179): 241. 1848; *Dendrobium densiflorum* var. *farmeri* 418

(Paxton) Regel, Gartenflora 23: 67. 1874; *Callista farmeri* (Paxton) Kuntze, Revis. Gen. Pl. 2: 654. 1891. **Type:** India, Mag. Bot. 15 (179): 241. 1848 (Icon.).

**Fig. 3**

*Dendrobium farmeri* var. *albiflorum* C.Morren, Belgique Hort. 10: 322. 1860. *Dendrobium farmeri* var. *aureoflavum* Hook.f., Bot. Mag. 90: t. 5451. 1864.

Epiphytic herbs, erect up to 30 cm tall. Stem clavate-fusiform, 10–24 × 1–2.2 cm at broadest portion, narrow towards base, ridged, with several nodes, glabrous, green. Leaves 2–5, alternative, elliptic-lanceolate to elliptic,



**Fig. 3.** *Dendrobium farmeri* Paxton. Plant in habit with close-up of flower.

9.5–14 × 3.2–6 cm, coriaceous, concentrated at distal portion, sessile or subsessile at base, margins entire, apex acute, veins numerous. Inflorescence racemose, axillary, up to 20 cm long, pendent; peduncle, 3.2–4 cm long, curve, glabrous, sheathed; sheaths obovate, 5–11 × 4–6 mm, overlapping at base, laxly arranged above, apex obtuse; rachis, 9–16 cm long, glabrous; floral bracts lanceolate, 7–12 × 2.1–3.2 mm, margins revolute, apex acute, 3-veined. Flowers mauve-white, labellum yellowish-orange with pale yellowish white margins; pedicel and ovary slender, 2.5–4 cm long, slightly pubescent; dorsal sepal narrowly ovate to ovate-oblong, 15–20 × 6–9 mm, apex subacute to acute, weakly 5-veined; lateral sepals ovate-oblong, 16–22 × 7–11 mm, base adnate to forming short mentum with the column foot; petals suborbicular, 16–21 × 9–14 mm, shortly clawed at base, apex obtuse to rounded. Labellum orbicular, 15.5–24 × 15–16 mm, margin erose, apex rounded, pubescent. Column 5–6 mm long. Fruit ca. 6 cm long.

**Phenology:** Flowering and fruiting from April to May.

**Habitat & ecology:** The plant was found growing as epiphyte on *Lagerstroemia hirsuta* (Lam.) Willd. in the subtropical forest at 325m elevation.

**Distribution:** Bhutan (Sarpang), Bangladesh, India, Laos, Malaya, Myanmar, Nepal and Thailand.

**Specimens examined:** BHUTAN, Sarpang, Singye, 325 m, *T. Phuntsho01* (THIM!). INDIA, Sikkim, April 1893, *R. Pantling 116* (P!); 1891, *R. Pantling 116* (NL!); *s.coll. s.n.* (NL!). THAILAND, Kanchanaburi Province, KhaoYa, 30 March 1968, *C.F. van Beusekom & C. Phenklai 231* (NL!); *s.loc.*, *C.F. van Beusekom & C. Phenklai 166* (NL!); *s.loc.*, 900 m, 28 March 1968, *C.F. van Beusekom & C. Phenklai 166* (P!); Siam, Chanthabun, 05 February 1925, *A.F.G. Kerr 244* (NL!); *s.loc.*, 16 March 1905, *C.C. Hosseus 434* (M!); VIETNAM, Dalat, 1958, *Hach69* (P!).

*Dendrobium nathanielis* Rchb.f., Cat. Orch.-Samml. Schiller, ed. 3: 26. 1857; *Callista nathanielis* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 655. 1891; *Aporum nathanielis* (Rchb.f.) M.A.Clem., *Telopea* 10: 296. 2003. **Type:** Myanmar, *Schiller cult. s.n.* (holotype - W).

**Fig. 4**

*Aporum cuspidatum* Wall. ex Lindl., Edwards's Bot. Reg. 27(Misc.): 2. 1841; *Dendrobium cuspidatum* (Wall. ex Lindl.) Lindl., J. Proc. Linn. Soc., Bot. 3: 4. 1858, *nom. illeg. Dendrobium multiflorum* C.S.P. Parish & Rchb.f., Trans. Linn. Soc. London 30: 149. 1874.

Epiphytic herbs, 17–28 cm tall, roots fasciculate, slender. Stem straight or curved, stout, covered by leaf sheaths, unbranched, narrow towards base and broad towards distal portion. Leaf sheaths numerous. Leaves



**Fig. 4.** *Dendrobium nathanielis* Rchb.f. Plant in habit with close-up flower (inset).

distichous, overlapping, terminal leaves larger than preceding ones, fleshy, lanceolate, 3.5–7 × 0.8–1.2 cm, margins entire, acute, glabrous, green. Inflorescences axillary or terminal, 1–5 flowered; peduncle attenuate, sheathed, ca. 2.5–3.5 mm long. Flowers 0.6–1.1 cm across, erect or pendent, greenish-white, lip white with yellow blotch in the midlobe; pedicel & ovary, slender, 0.6–0.8 cm long, glabrous; dorsal sepal ovate-elliptic, 4–5.5 × 2.5–3 mm, apex subacute; lateral sepals ovate, 5–6 × 3–4 mm, base adnate to mentum, mentum shorter than the dorsal sepal, margins entire, apex acute to obtuse; petals oblong, 5–5.5 × 2 mm, apex obtuse. Labellum obovate or spatulate, 5–6 × 3.5–4.5 mm, hypochile and mesochile narrower, epichile broad with flat thickening on the disk, membranous, margins entire, side lobes minute, midlobe, 2-lobed. Column ca. 1.5 mm long.

**Phenology:** Flowering and fruiting from April to July.

**Habitat & ecology:** The plant was found growing as an epiphyte on *Lagerstroemia speciosa* (L.) Pers. in the subtropical forest at 320m elevation.

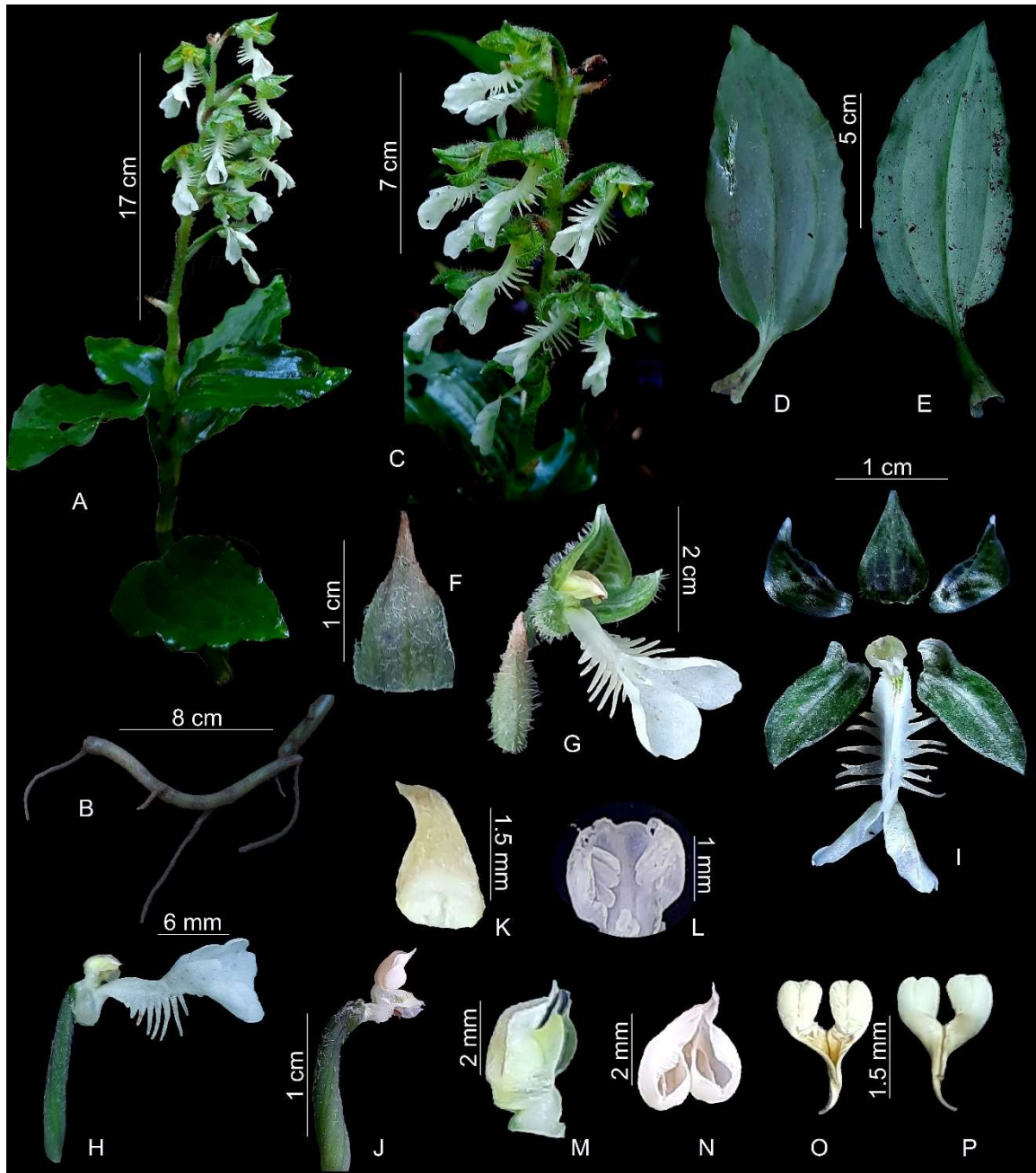
**Distribution:** Bhutan (Sarpang), Cambodia, India, Laos, Malaysia, Myanmar, Thailand and Vietnam.

**Specimens examined:** BHUTAN, Sarpang, Singye, 320 m, *T. Phuntsho* 02 (THIM!). CAMBODIA, ad arbores in monte Cherreo, April 1870, *L. Pierre* 6555 (P!). LAOS, Lakh Ôn, 1866, *C. Thorel* 3061 (P!). VIETNAM, de Dalat, 1955, *C.R.S.T.* 182 (P!). THAILAND, Trat province, SaphanHin, 03 May 1974, *R. Geesink, T. Hattink & C. Phengkklai* 6524 (NL!); Threepagodas, 06 May 1946, *A.J.G.H. Kostermans* 514 (NL!); Kwaenoi river basin, 280 m, 06 May 1946, *A.J.G.H. Kostermans* 514 (P!); Wanfan, Kanburi, 200 m, *A.F.G. Kerr* 292 (P!); Chaiyaburi, Nung Kai, 200 m, 20 February 1924, *A.F.G. Kerr* 154 (P!).

*Odontochilus brevistylis* Hook.f. Fl. Brit. India 6: 100.1890. *Anoectochilus brevistylis* (Hook.f.) Ridl., Mat. Fl. Malay. Penins. 1: 214. 1907; *Cystopus brevistylis* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 658. 1891. **Type:** Malaysia, Perak, lower camp, Gunung Batu Patch, 3400 ft., 16 August 1888, L. Wray 1210 (Holotype – K!).

**Fig. 5**

Terrestrial herbs, erect, up to 31–35 cm tall. Stem ascending, terete, fleshy, 4–6 mm wide, glabrous. Rhizomes creeping, terete, up to ca. 15 cm long, 3–5 mm dia., bearing hairy roots. Leaves 5–6, slightly clustered at the middle of the plant, alternate; petiole sheathing, 1.5–2.0 × 1.2–1.3 cm, glabrous, green; lamina narrowly ovate to ovate-lanceolate, 6–8 × 3–4 cm, slightly falcate, subcoriaceous, margins undulate, apex acute, glabrous, adaxially dark green, abaxially pale green, 3-veined. Inflorescences racemose, up to 14 cm long; peduncle erect, terete, slender, 4–5 × 0.2–0.3 cm, hairy, green, bearing 1–2 sterile bracts; rachis 6–8 cm long, bearing up to 13 sub-densely arranged flowered, pubescent. Floral bracts ovate-lanceolate to lanceolate, 1.2–1.4 × 0.8–1.0 cm shorter than ovary, margins hirsute, acuminate at apex, hairy on the adaxial surface, abaxially glabrous, pale greenish-brown. Flowers resupinate, sepals and petals pale green, labellum white; ovary and pedicel twisted, cylindrical-fusiform, 1.3–1.6 × 2–2.3 mm, hairy, green; dorsal sepal ovate, 0.9–1.0 × 0.5–0.6 cm, cucullate, forming a hood with the petals above the column, margins entire with pale white edges, apex acute, glabrous and silver-white nerves ventrally, hairy on dorsal surface, 1-veined; lateral sepals lanceolate to oblong-lanceolate, 1.0–1.4 × 0.4–0.5 cm, base oblique, margins entire with pale white edges, acute at apex, adaxial surface hairy, abaxial surface glabrous; petals obliquely elliptic, falcate, appressed to the margins of the dorsal sepal, 0.8–1.0 × 0.3–0.4 cm, slight incurved, inner margin with small broad teeth in the middle, apex acute, margins and apex with pale white edges, glaucous, 1-veined. Labellum tripartite, adnate to the base of the column, Y-shaped, up to 2.5 cm long, including the spur; hypochile globose 1.7–2 mm long, whole margins attached to column, bisaccate, containing a central longitudinal septum and pair of 3–4 fleshy hooked papillae on inner walls of each side, papillae ca. 1 mm long; mesochile canaliculate, 0.9–1 cm long, curved upward, margins slightly down curved, with the pectinate flanges along each margin; flanges fleshy, up to 9, 2–5 mm long; epichile 2-lobed, lobes obovate or flabellate, falcate, 1.0–1.2 × 0.7–0.9 cm, not fully open, margin undulate, apex rounded; spur oblong, ca. 2 mm long, pointing downwards, conspicuously longitudinally channeled along the external surface. Column twisted, 4–5 mm long, stout, with 2 lamellate wings; anther ovoid-lanceolate, 2–3 mm long, acuminate. Pollinarium Y-shaped; lobes obovate, arched inwards, ca. 2 mm long; caudicle bifurcated into two lanceolate lobes, 1.8–2.0 mm long; viscidium elliptic ca. 1 mm long. Anther-cap 2-lobed;



**Fig. 5.** *Odontochilus brevistylis* Hook.f.: **A.** Habit; **B.** Rhizome; **C.** Inflorescence; **D.** Leaf (ventral view); **E.** Leaf (dorsal view); **F.** Floral bract; **G.** Flower (side view); **H.** Flower without petals and sepals (side view); **I.** Dissected flower parts; **J.** Pedicel and ovary (side view); **K.** Anther cap (dorsal view); **L.** Hypochile showing papillae; **M.** Column (side view); **N.** Anther cap; **O.** Pollinarium (ventral view); **P.** Pollinarium (dorsal view).

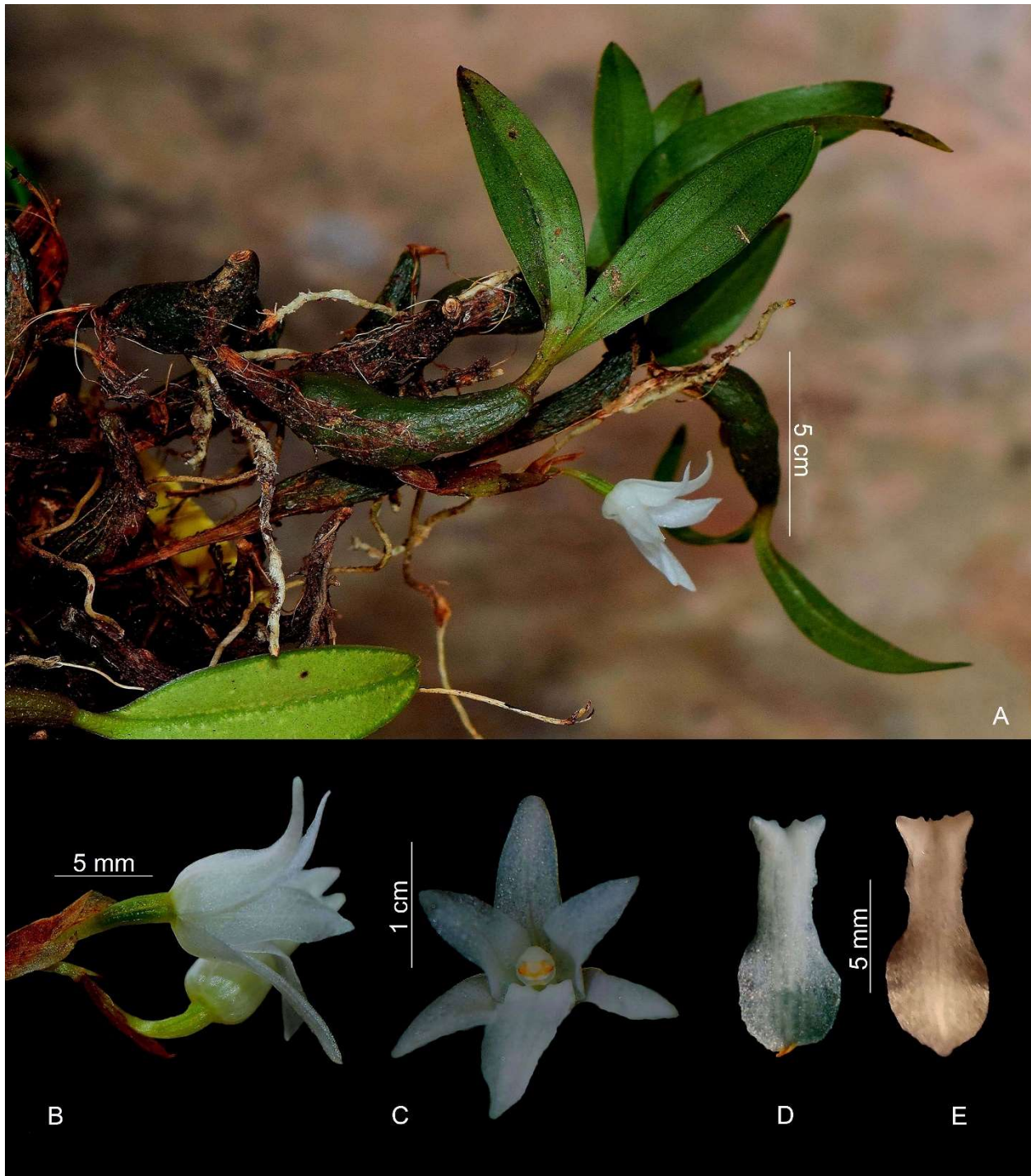
lobes obovate, 3–4 × 3 mm, semi-transparent, base cordate, silver yellow at adaxial surface, pale white at abaxial surface.

**Phenology:** Flowering and fruiting from mid-August to December.

**Habitat:** The plant grows in damp and shady areas in subtropical forest at 1090–1300 m elevation. The associated species includes *Boehmeria cylindrica* (L.) Sw. [?? this is road side weed], *Elatostema* spp. and *Piper* spp.

**Distribution:** Bhutan (Zhemgang), China, Laos, Malaya, Taiwan, Thailand and Vietnam.

**Species examined:** BHUTAN, Zhemgang, Phangkhar, Tashibe, Salapong locality, 1090–1300 m, 13 September 2020, *P. Gyeltshen & P. Zangpo* 39 (THIM!). CHINA, 10 August 1921, *E.E. Maire* s.n. (P!); *Ibid.*, 23 August 2020, *Jody Hsieh*, s.n. (iNaturalist-Image!); *Ibid.*, 03 September 2020, *H. Meiman* s.n. (iNaturalist-Image!); *Ibid.*, 05 June 2020, *Ihnglan* s.n. (iNaturalist-Image!); *Ibid.*, 29 August 2020, *Z. Yewei* s.n. (iNaturalist-Image!). VIETNAM, Sentier forestier, Chapa, 1500 m, July 1928, *P.A. Pételot* s.n. (P!); MALAYSIA, Lower camp Gunong Batu Patch, 1036 m, 16 August 1888, *Jr. L. Wray* 1210 (K!).



**Fig. 6.** *Panisea panchaseensis* Subedi: **A.** Plant in habitat; **B.** Inflorescence; **C.** Flower (front view); **D & E.** Labellum showing keels on the epichile.

*Panisea panchaseensis* Subedi, Nordic J. Bot. 29: 362. 2011. **Type:** Nepal, Kaski district, Panchase forest, 2200–2450 m, 2 November 2007, *A. Subedi 1780* (holotype – KATH, isotype – TUCH).

**Fig. 6**

Epiphytic herb. Roots few, arising from the base of pseudobulb. Rhizome short, creeping, 5 cm long, with

several imbricate scales on the young shoots. Pseudobulbs clustered together or distant, up to 5.2 cm apart along the rhizome, oblique, narrowly ovoid to ellipsoid, 12–18 × 4–10 mm, glabrous, green, becoming brown and wrinkled with the age. Leaf 2, apical; petiole up to 2.8 mm long, glabrous, green; lamina elliptic, 20–30 × 5–8 mm, sub-coriaceous, margins entire, apex acute





to sub-acute, surfaces glabrous, 3-veined. Inflorescence racemose, 1-3-flowered, erect or sub-erect, arising from the base of the pseudobulb; peduncle 5-10 mm long, covered by the scale like bracts during anthesis, bracts ovate, 3.5-6 × 0.5-1.0 mm. Floral bract lanceolate to narrowly ovate, 4.5-5.8 × 3.6-4 mm, apex acute, glabrous, pale brownish-white, several veined. Flowers white, glabrous; pedicel and ovary, 6.5-9 mm long, pedicel slight curved, ovary straight, ridged; dorsal sepal narrowly ovate, 10-12 × 3-3.7 mm, apex sub-obtuse to obtuse, 3-veined; lateral sepals ovate to narrowly ovate, 10-11 × 2.8-3.2 mm, apex broadly acute, 5-veined; petals oblong-ovate, 9-11 × 2.7-3.1 mm, apex acute, 3-veined; labellum obovate, 11-12 × 3-3.4 mm, margins undulated, apex sub-acute to obtuse, 3-veined; hypochile and mesochile margins recurved; lateral veins branching towards epichile, keels 3, at the base of hypochile, rod-shaped, middle one shorter than the lateral keels. Column curved, oblong, 3.5-4 × 1.5-2.0 mm, median margins widely emarginated, glabrous, white; stigma semi-circular; rostellum broadly elliptic; anther flattened, 8.5-9 × 1 mm, yellowish-brown. Pollinia 4, in 2 pairs, oblong-obovate or sub-elliptic, 0.6-7.2 × 0.4-0.5 mm, golden yellow.

**Phenology:** Flowering and fruiting is from November to December.

**Habitat and ecology:** Epiphytic on *Quercus lamellosa* Sm. at 2485 m elevation in cool broadleaved forests.

**Distribution:** Bhutan (Zhemgang), India and Nepal.

**Specimen examined:** BHUTAN, Zhemgang district, Nangkhor block, Malaya forest area, 2553 m, 11 January 2019, *P. Gyeltshen & S. Jamtsho* 40 (THIM!).

***Platanthera dulongensis*** X.H.Jin & Efimov, *Nordic J. Bot.* 30: 294. 2012. **Type:** China, Yunnan Province, Gongshan County, Dulong river, 2800 m, 18 August 2006, *X. H. Jin 8386* (PE-Holotype).

#### Fig. 7

*Platanthera fugongensis* Ormerod, *Taiwania* 58: 29. 2013.

Epiphytic herb on the rotten log, erect stem 15-30 cm tall. Tuberosities narrowly fusiform to cylindrical, densely pubescent, and adventitious roots absent. Leaves alternate, 2-3, petiolate; petiole sheathing stem; lamina narrowly lanceolate to oblong-lanceolate 9-18 × 1.4-3.8 cm, situated in the middle of the stem, apex acute to sub-acute, midrib depressed adaxially, 4-8 veined. Inflorescence 6-14 cm long, sub-densely 15-38-flowered, rachis 0.2-1 cm long, ribbed. Lowermost bract like leaf narrowly lanceolate 6-7.5 cm long. Bracts like sheath 2-3, situated on the stem beneath the first leaf, underground sheath 1.4-1.6 × 1.5-1.7 cm, white, apex broadly acute, upper sheath 3.5-5 × 2-2.2 cm, green, and apex sub-acute. Flowers resupinate, green, glabrous; dorsal sepal broadly ovate, 2.8-3 × 3.1-3.2 mm, slightly concave, base truncate, margin entire, apex sub-acute, one veined; lateral sepals oblong-ovate to narrowly ovate 3.5-4 ×

2.5-3 mm, slightly oblique, margin entire, apex sub-obtuse, recurved, 1-veined; petals ovate-lanceolate, 3-3.5 × 1.8-2 mm, falcate, incurved, base oblique, margin entire, apex sub-acute, 1-veined; pedicel and ovary fusiform 12-15 × 2.5-3 mm, ridged, twisted, glabrous. Labellum oblong-ovate 3.6-4 × 1.8-2 mm, fleshy, base truncate, margin entire, apex obtuse, glabrous, obscurely 5-veined; spur cylindrical, 5-7 × 1.4-1.6 mm, curved, hollow, not swollen at apex, apex rounded, glabrous. Column 1.3-1.4 × 1.0 mm. Pollinia yellow, 0.5 × 0.25 mm; stipe up to 0.5 mm long; viscidium concave, 0.25 mm long.

**Phenology:** Flowering and fruiting from July to October.

**Habitat & ecology:** The plant grows on dead tree logs in cool broadleaved forests at 2400 m elevation.

**Distribution:** Bhutan (Zhemgang), China and India.

**Specimens examined:** BHUTAN, Zhemgang, Nangkhor, Malaya, 2462 m, 26 May 2019, *S. Jamtsho 01* (THIM!).

***Porpax elwesii*** (Rchb.f.) Rolfe, *Orchid Rev.* 16: 8. 1908; *Eria elwesii* Rchb.f., *Gard. Chron.*, n.s., 19: 402. 1883; *Porpax meirax* var. *elwesii* (Rchb.f.) R.C.Srivast., *Natl. Acad. Sci. Lett.* 18: 61. 1995. **Type:** India, Sikkim, Himalaya Mountains, *Elwes, s.n.* (K!-Holotype).

#### Figs. 8

*Eria nummularia* Kraenzl., *Bot. Tidsskr.* 24: 9. 1901; *Porpax nummularia* (Kraenzl.) Smitinand, *Nat. Hist. Bull. Siam Soc.* 19: 12. 1958. *Eria semiconnata* Kraenzl., *Bot. Tidsskr.* 24: 8. 1901; *Porpax semiconnata* (Kraenzl.) Smitinand, *Nat. Hist. Bull. Siam Soc.* 19: 12. 1958.

Epiphytic or lithophytic herb. Pseudobulbs flattened, globose to sub-globose, 0.8-1.5 × 0.6-1.2 cm, covered with radiating fibres, roots inconspicuous. Leaf 2, obliquely notched on the pseudobulbs; petioles subsessile, up to 2 mm long, green, glabrous; lamina elliptic to oblanceolate, 5-6.5 × 0.6-1.0 cm, base attenuate, margins entire, acute at apex, glabrous, green, 1-veined. Inflorescence single, arising from the apex of pseudobulb, 1-flowered. Bracts triangular-ovate to oblong-ovate, pale brown, 4-7 × 3-4.5 mm, soft, thin, oblique at base, margins entire, apex caudate; peduncle cylindrical, ca. 1.5 mm long, glabrous, green. Flowers tubular, 10-15 mm long, glabrous, maroon-red; pedicel and ovary 1.5-2.5 mm, glabrous, green; sepals 2/3 portions connate, lobed, lobes margins entire, mucronate at apex, glabrous; dorsal sepal 5.5-6 mm long, lobe triangular-ovate, 2-2.5 × 1.8-2.3 mm, margins slightly revolute, 3-veined; lateral sepals connate nearly to apex, 10-12 mm long, lobes triangular-ovate, 1.5-2 × 1.2-1.6 mm, base spurred; petals oblong, 4.5-5.5 × 1.8-2.5 mm, shorter than sepals, entirely enclosed in the tube, margins entire, acute at apex, glabrous, 3-veined. Labellum ovate-lanceolate, 3-4 × 2-3 mm; spur oblong, ca. 2 mm long, retuse at apex. Column oblong, ca. 1 mm long; column foot, oblong, 2-2.5 mm long, incurved. Anther cap ca. 1 × 0.5 mm; pollinia 8, in 4 pairs, obovate to spatulate, ca. 0.5 mm long.



Fig.7. *Plantanthera dulongensis* Jin & Efimov: **A.** Plant in habitat; **B.** Inflorescence; **C.** Section of inflorescence; **D.** Tubers; **E. & F.** Flower (front view); **G.** Flower (side view).

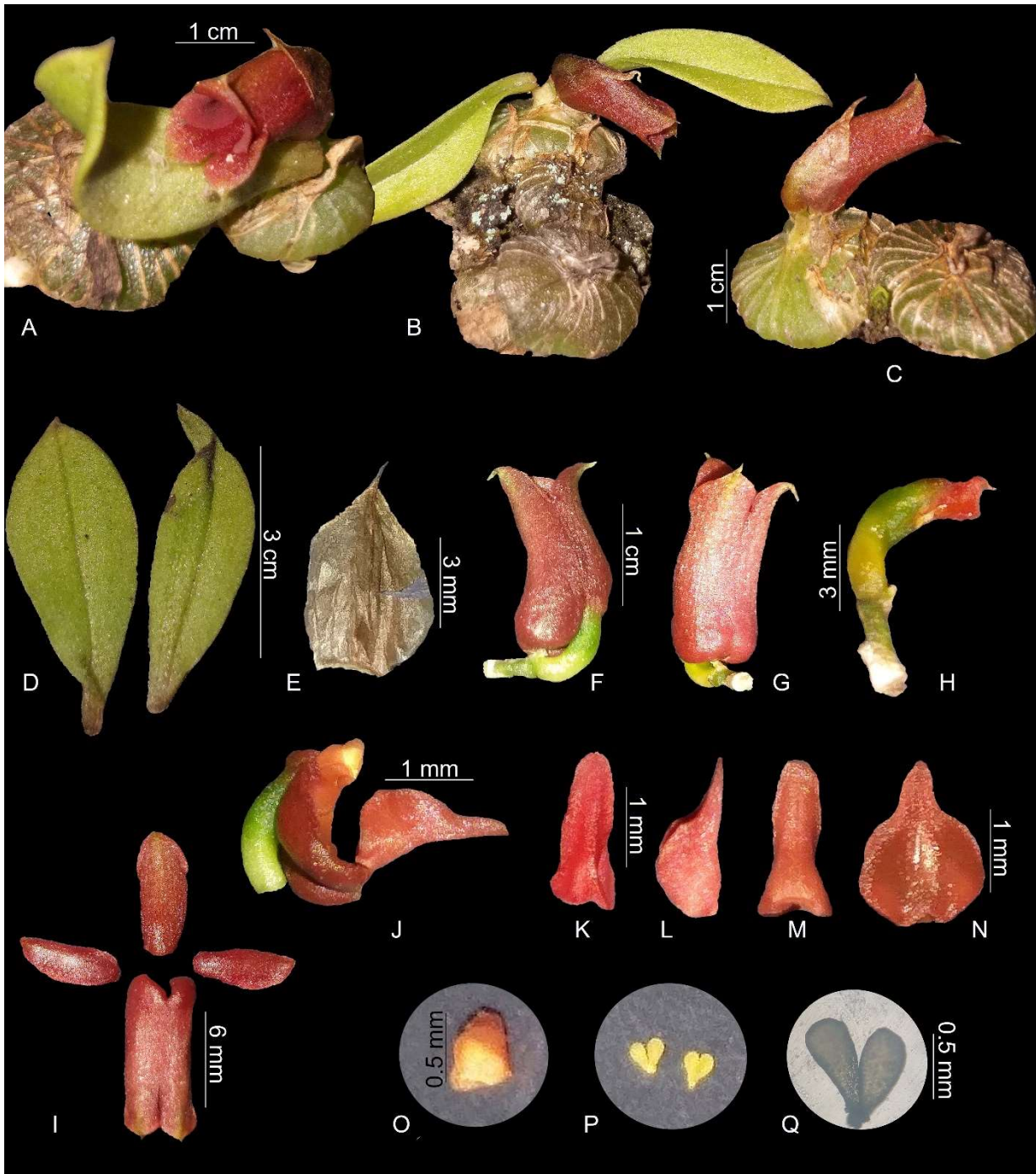
**Phenology:** Flowering and fruiting from October to November.

**Habitat & ecology:** The plant grows on *Schima wallichii* (DC.) Korth. and lithophytic on a rock in the subtropical forest at 900–2070 m elevation.

**Distribution:** Bhutan (Trashigang, Trongsa & Samtse), Cambodia, China, India, Laos, Malaysia, Nepal,

Thailand and Vietnam.

**Specimen examined:** BHUTAN, Trongsa, Dzongkhalum, 2000 m, 13 September 2020, *P. Gyeltshen 41* (THIM!). INDIA, Sikkim, 1891, *H.J. Ehwes s.n.* (K!); *s.loc.*, 1895, *s.coll. s.n.* (K!); Mungpoo, 2500 m, July 1895, *R. Pantling 249* (P!); Mungpoo, 2500 m, October 1895, *R. Pantling 249* (P!); *s.loc.* 30 January 1891, *C. Strickland s.n.* (K!). LAOS, Bassac, 1866, *C. Thorel s.n.* (P!).



**Fig. 8.** *Porpax elwesii* Rolfe: **A & B.** Habit; **C.** Pseudobulbs with solitary flower; **D.** Leaves; **E.** Floral bract; **F.** Flower (side view); **G.** Flower (ventral view); **H.** Flower without sepals and petals (side view); **I.** Dissected flower parts; **J.** Pedicel, ovary-labellum and column (side view); **K.** Labellum (ventral view); **L.** Labellum (side view); **M.** Labellum (dorsal view); **N.** Labellum flattened (top view); **O.** Anther cap; **P & Q.** Pollinarium.

***Thelasis longifolia*** Hook.f., Fl. Brit. India 6(1): 87. 1890.  
**Type:** India, Khasia Mountains, *Hooker & Thomson 29B*  
 (K-LINDL!-Holotype, K!-Isotype).

**Fig. 9**

Epiphytic herbs, sub-erect up to 15–20 cm tall.  
 Pseudobulbs conical, 14–16 × 13–20 mm. leaf single,

notching on the apex of pseudobulb, narrowly oblong to oblanceolate, 8–18 × 1–2.7 cm, base attenuated and sessile, margins entire, apex acute, glabrous, green. Inflorescence arising from new pseudobulb, up to 25 cm long, many-flowered; peduncle, 13–17 cm long, with several sheaths, glabrous; sheath lanceolate, 4–5 × 1–2



mm, membranous, apex subacute; rachis, 2–3 mm, glabrous, green; floral bracts minute, broadly ovate-triangular, 2–3 × 1–2 mm, apex acute to broadly acuminate. Flowers greenish white; pedicel and ovary, up to 1.2 mm long; dorsal sepal ovate-elliptic, 2.8–3.2 × 0.7–2 mm; lateral sepals ovate, 3–3.3–0.7–1 mm, apex obtuse; petals narrowly ovate, 2.3–2.8 × 0.6–0.8 mm, apex acute. Labellum elliptic-ovate, 2–3 × 0.8–1.3 mm, margins entire, apex emarginate, ecallose. Column ca. 1 mm long; rostellum oblong, narrowly acute or acuminate at apex. Fruits not seen.

**Phenology:** Flowering from April to July.

**Habitat & ecology:** The plant grows on *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet in the subtropical forest at 300 m elevation.

**Distribution:** Bhutan (Sarpang), India and Nepal.

**Specimen examined:** BHUTAN, Sarpang, Singye, 300 m, 13 September 2020, *T. Phuntscho 03* (THIM!). INDIA, Khasi Hills, 4000 feet, 14 July 1952, *W.N. Koelz 30545* (MICH!); *Ibid.*, 914 m, 27 March 1984, *J.D. Hooker 29* (K!); *Ibid.*, 1219 m, 27 March 1984, *J.D. Hooker & T. Thomson 29* (K!); *Ibid.*, 12 August 1954, *T.R. Chand 6379* (MICH!); *Ibid.*, *J.D. Hooker & T. Thomson 296* (K!); Sikkim, 01 April 1892, *R. Pantling 223* (NL!); *Ibid.*, 01 April 1892, *R. Pantling 223* (P!).

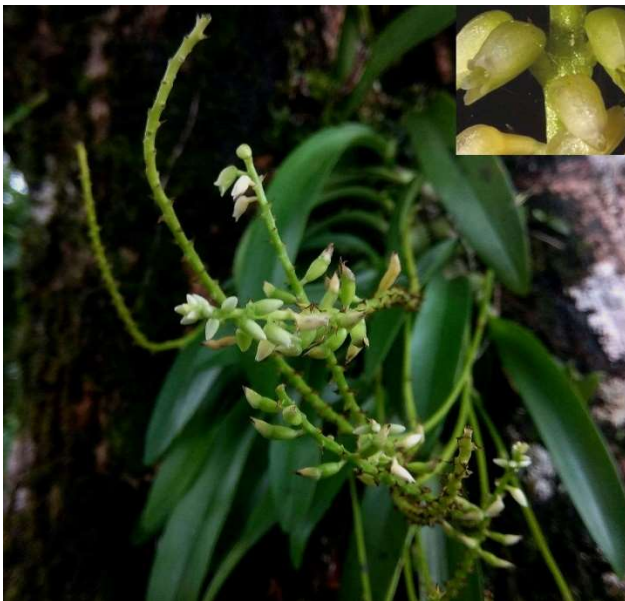


Fig. 9. *Thelasis longifolia* Hook.f. Plant with close-up flowers (inset).

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