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Documentation of orchid diversity in Sarl Hkam Village, Kachin State, Myanmar

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Abstract

Putao Township in northern Kachin State, Myanmar, remains botanically underexplored despite its rugged terrain, high rainfall, evergreen forests and diverse habitats that support a rich orchid flora. This study documented 10 orchid species from Sarl Hkam Village, Putao Township, based on field observations, photographs, georeferenced locality data, morphological descriptions of living plants and documentation of pollinia. The documented species were *Appendicula cornuta* Blume, *Bulbophyllum delitescens* Hance, *Brachycorythis helferi* (Rchb.f.) Summerh., *Calanthe sylvatica* (Thouars) Lindl., *Crepidium orbiculare* (W.W.Sm. & Jeffrey) Seidenf., *Peristylus constrictus* (Lindl.) Lindl., *Coelogyne articulata* (Lindl.) Rchb.f., Robiquetia spathulata (Blume) J.J.Sm., Thunia alba var. bracteata (Roxb.) N.Pearce & P.J.Cribb & P.J.Cribb and *Uncifera obtusifolia* Lindl. Among these, *A. cornuta*, *B. delitescens*, *C. sylvatica*, *P. constrictus*, *C. articulata*, *U. obtusifolia* and *T. alba* var. *bracteata* have previously been reported from Putao or Kachin State. In contrast, *B. helferi*, *C. orbiculare* and R. spathulata are new township-level records for Putao. The study provides baseline taxonomic information on the orchids of Putao and highlights the need for further floristic exploration in northern Kachin.

Keywords: floristic survey; georeferenced observations; new locality records; Orchidaceae diversity; pollinia morphology

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Introduction

Myanmar is among Southeast Asia's most biodiverse yet botanically underexplored countries, with its latitudinal gradients, topographic diversity and monsoonal climate contributing to its exceptional plant richness (1). Recent checklists document more than 14000 vascular plant species, but they also reveal incomplete coverage and spatial bias, with major gaps in taxonomic resolution and sampling across regions and townships (2, 3). Kachin State has yielded numerous new taxa over the past two decades, underscoring both its floristic richness and the remaining knowledge gaps (4, 5). Northern Myanmar, especially Kachin State, is recognised as a global orchid hotspot but remains botanically underexplored. Recent inventories indicate that Putao and nearby protected areas continue to yield new species and records of Orchidaceae, emphasising the importance of regional taxonomic work (3, 6–8).

The orchids of Myanmar represent a significant component of the country's flora (9), with about 1040 orchid species in 151–2 genera (7, 9), making Orchidaceae one of the largest plant families in the country (10, 11). Taxonomic exploration has accelerated since 2000, resulting in the addition of many new species and records; approximately 25 % of all newly discovered vascular taxa are orchids, with 41 % of these orchid novelties originating from Kachin State (11, 12). This highlights the importance of detailed monographic and floristic studies of Orchidaceae (13, 14). Kachin State has the highest plant diversity in Myanmar and accounts for a major share of the country's orchid novelties (15, 16). However, many areas of Putao Township remain poorly documented and much of the available information is still based on checklist records rather than detailed morphological and locality-based studies. This represents a clear research gap in the taxonomic understanding of the orchid flora of northern Kachin, particularly regarding pollinia morphology, distributional data and species-level verification (7, 16).

Appendicula cornuta Blume, *Bulbophyllum delitescens* Hance, *Calanthe sylvatica* (Thouars) Lindl., *Coelogyne articulata* (Lindl.) Rchb.f., *Peristylus constrictus* (Lindl.) Lindl. and *Thunia alba* var. *bracteata* (Roxb.) N.Pearce & P.J.Cribb were previously recorded from Putao, Kachin State (16, 17). In contrast, *Brachycorythis helferi* (Rchb.f.) Summerh., *Crepidium orbiculare* (W.W.Sm. & Jeffrey) Seidenf., *Uncifera obtusifolia* Lindl. and *Robiquetia spatulata* (Blume) J.J.Sm. were not previously reported from Putao in those checklists (12, 17). This study documents 10 species

from Sarl Hkam Village, Putao Township. The study aims to: (1) provide detailed morphological descriptions, including pollinia documentation, of the orchid species recorded from Sarl Hkam Village, Putao Township; (2) present photographic and georeferenced locality records of selected orchid species from northern Kachin State; and (3) contribute baseline taxonomic information to support further studies on Myanmar orchid floristics and the orchid flora of Putao. The study addresses a key taxonomic gap in the orchid flora of northern Kachin State and provides baseline information needed for future floristic, conservation and biodiversity studies (14, 16). The conservation status of many orchid species in Myanmar remains poorly assessed (12, 16).

Materials and Methods

Study area

The study was conducted in Sarl Hkam Village, Putao Township, Kachin State, Myanmar, at the GPS coordinates 26°06′19″ N, 97°31′08″ E (Fig. 1). This area is in northern Myanmar and is characterised by mountainous terrain, high rainfall, evergreen forest and varied microhabitats that support diverse orchid species (9, 16).

Field survey and collection

Fieldwork was carried out between June and September 2025. Flowering orchid species were observed and documented in the field during anthesis. Each plant was photographed in its natural habitat, and field data, including habitat, locality, and collection number, were recorded. Geographic coordinates were obtained using GPS and Map Navigator. The orchid species documented in this study were assigned the collection numbers KN-40 to KN-48.

Morphological observation

Morphological descriptions were prepared from living plants, field observations and photographic records. Diagnostic vegetative and floral characters were recorded, including habit, stem, leaves, inflorescence, floral bracts, sepals, petals, lip, column and ovary (5, 15, 17). Pollinia were collected from fresh flowers and examined under a light microscope for taxonomic documentation (16, 18).

Identification and nomenclature

Family-level identification followed the standard taxonomic references cited in this study. Genus- and species-level determinations were based on relevant floristic and revisionary literature on Myanmar Orchidaceae (8, 19). Scientific names and synonyms were verified using the International Plant Names Index (https://www.ipni.org/) and Plants of the World Online (https://powo.science.kew.org/), which provide nomenclatural and taxonomic information for vascular plants. Distribution records within Myanmar were checked against published literature and checklist sources cited in this study (16, 17, 20).

Specimen deposition

The recorded materials were prepared, assigned collection numbers and deposited in the herbarium of the Department of Botany at the University of Mandalay, Myanmar (MAND).

Taxonomic arrangement

Species were arranged following APG IV (21). Within the family Orchidaceae, genera and species were listed alphabetically. For each species, the accepted name, distribution in Myanmar, collection number and relevant references were provided.

Results

List of species collected from Putao Township

Orchid species occurring in Putao Township and its surrounding areas were collected, identified and studied from July to September 2025. A total of 10 species belonging to 10 genera and one family were recorded and are presented in Table 1.

Table 1. List of the collected species and their distribution in Myanmar

Species	Distribution in Myanmar	Collection number	Reference
Appendicula cornuta Blume	Putao in Kachin State; Tanintharyi	KN-39 (MAND)	(1)
Brachycorythis helferi (Rchb.f.) Summerh.	Mt. ZweKaBin, Kayin; Mon	KN-41 (MAND)	(1)
Bulbophyllum delitescens Hance	Putao, Kachin	KN-40 (MAND)	(1)
Calanthe sylvatica (Thouars) Lindl.	Kachin; Mandalay	KN-42 (MAND)	(1)
Coelogyne articulata (Lindl.) Rchb.f.	Putao, Kachin; Mt. Victoria, Chin; Mt. Popa, Mandalay; Paunglaung Creek, Nay Pyi Taw-Shan Yoma; Taunggyi, Shan; Dawei (Tavoy), Tanintharyi	KN-45 (MAND)	(1)
Crepidium orbiculare (W.W.Sm. & Jeffrey) Seidenf.	Taunggyi & Kengteng, Shan	KN-43 (MAND)	(1)
Peristylus constrictus (Lindl.) Lindl.	Kachin; Chin; Mt. Popa & PyinOoLwin (Maymyo), Mandalay; Sagaing; Shan; Mon; Dawei (Tavoy), Tanintharyi	KN-44 (MAND)	(1)
Robiquetia spathulata (Blume) J.J.Sm.	Mon; YePhyu, Tanintharyi	KN-47 (MAND)	(1)
Thunia alba var. bracteata (Roxb.) N. Pearce & P.J. Cribb	Mt. Victoria & Mindat, Chin; Putao, Kachin; Mt. Popa, Mandalay; Rakhine; Kalaw, Shan; YePhyu, Tanintharyi; Mon	KN-48 (MAND)	(1)
Uncifera obtusifolia Lindl.	Putao, Kachin; YePhyu, Tanintharyi	KN-46 (MAND)	(1)

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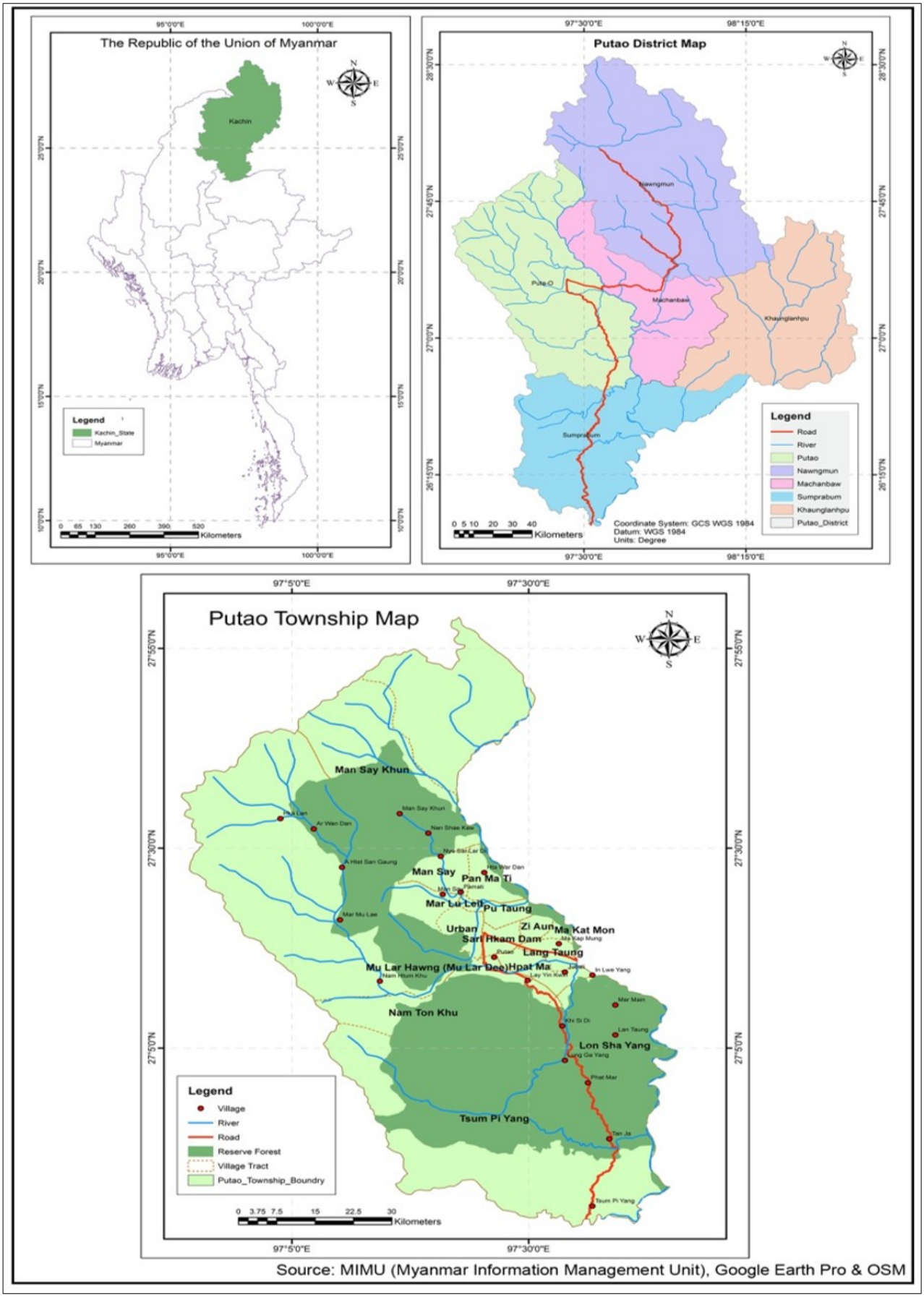


Fig. 1. Location map of the study area in Putao Township, Kachin State, Myanmar. [MIMU (Myanmar Information Management Unit), Google Earth Pro and Open Street Map (OSM)].

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Taxonomic treatment

***Appendicula cornuta* Blume**

Perennial epiphytic herbs, stems ascending, subterete, 21–29 × 2–3 mm, unbranched, sheathed by persistent leaf bases. Leaves alternate, distichous, narrowly ovate-elliptic, 25–35 × 6–12 mm, apex unequally bilobed, base tubular-sheathed; sheaths 5–10 mm long, glabrous. Inflorescence terminal, racemose, 3–7 cm long, shorter than the leaves, 2–6-flowered; floral bracts lanceolate, 4–5 mm long. Flowers white, 3–5 mm in diam., resupinate, zygomorphic. Pedicel and ovary 3–5 mm long. Dorsal sepal elliptic, 3.5 × 1.8–2 mm. Lateral sepals obliquely triangular, 4–6 × 2–2.6 mm; mentum 1 mm long. Lip suboblong, 3.5–4 × 1–1.6 mm, margin crisped, apex obtuse with a thickened lamellate appendage; basal appendage suborbicular, margin incurved. Column 2 mm long; foot 2–2.5 mm long. Pollinia 6, stipitate, narrowly pyriform, pale green to pink, waxy. Ovary oblongoid, 3–7 × 2–5 mm, pale green; capsule ellipsoid, 5–6 × 2.5–3 mm (Fig. 2).

Flowering: August–September.

Distribution: Lithophytic on rocks in humid forests and cliffs, below 800 m. Guangdong, Hainan, Cambodia, northeastern India, Indonesia, Malaysia, Myanmar (Putao, Kachin; Tanintharyi) (1, 7), the Philippines, Thailand and Vietnam.

Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, 359 m alt., 15 Jul 2020, photographic record by Kyaw Nyein, coll. no. KN-39.

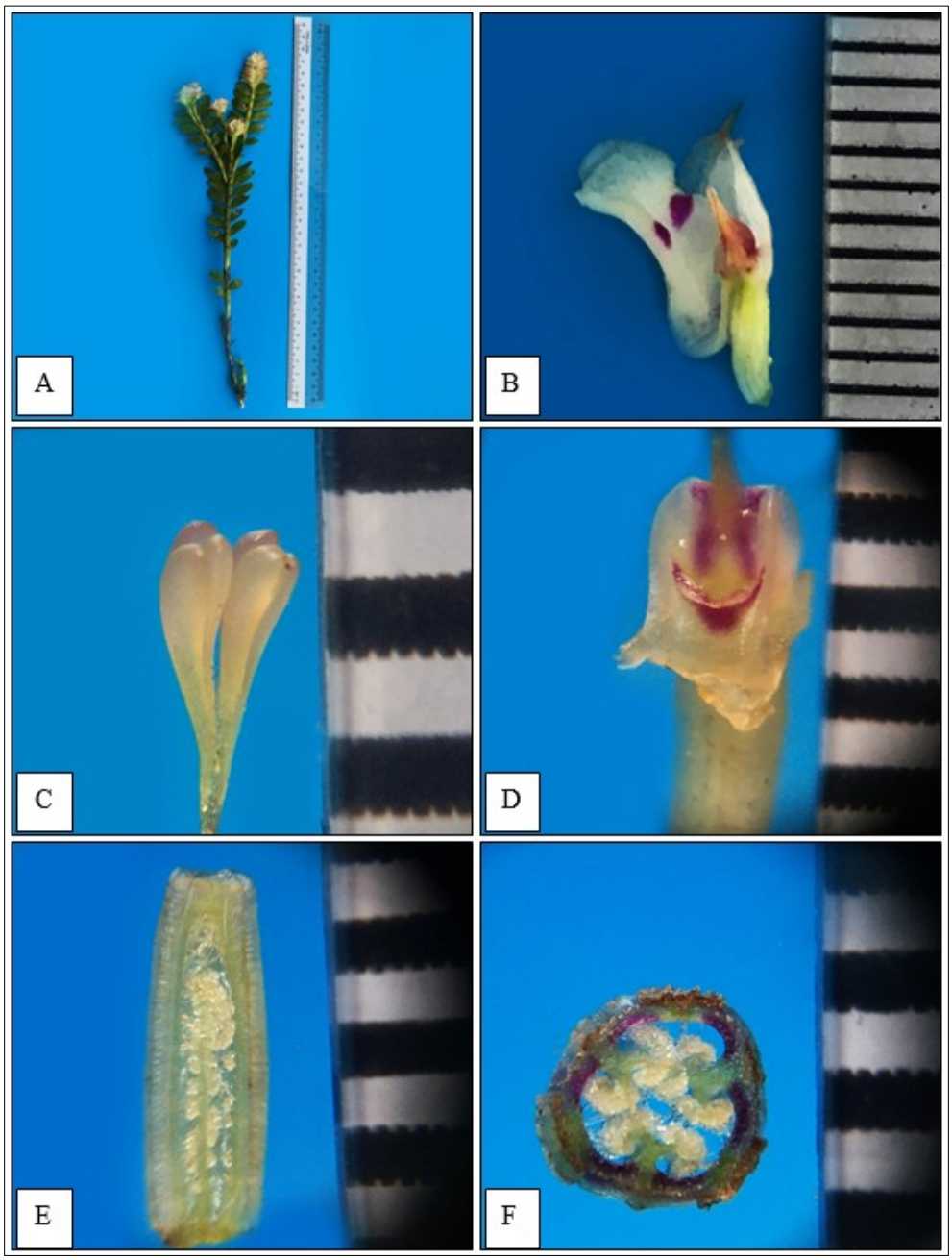


Fig. 2. *Appendicula cornuta*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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***Brachycorythis helferi* (Rchb.f.) Summerh.**

Sympodial terrestrial herb up to 30 cm tall. Roots fibrous-tuberous; tubers ovate-oblong, white. Stem leafy, cylindrical, glabrous, sheathed. Leaves simple, alternate, exstipulate, glabrous, sessile; blade ovate-oblong to lanceolate, 1–4 × 0.5–0.8 cm, base narrow, margin entire, apex acute; sheath 1–2 cm long, reddish green. Inflorescence axillary, 1-flowered; pedicel 2–3 mm long, glabrous; floral bracts linear-oblong, 3–5 mm long. Flowers green, about 1.3 cm in diam., zygomorphic, epigynous. Dorsal sepal oblong, 8–15 mm long, glabrous; lateral sepals falcate-lanceolate, 8–9 mm long, recurved, glabrous. Petals linear-lanceolate, 5–6 × 1–2 mm, glabrous. Labellum orbicular, 1.5–1.8 × 1.4–1.6 cm, with a saccate spur 1–2 mm long, glabrous, bilobed; column foot absent. Anther cap oblong, 2–3 mm long; pollinia 2, clavate, about 1.5 mm in diam., black, waxy, with caudicles and viscidium; rostellum truncate. Ovary inferior, oblong, 1–2 mm long, with parietal placentation (Fig. 3).

Flowering: August–October.

Distribution: Rocks, streamside and forest tree trunks, 300–1600 m. Myanmar (Kayin, Mon State) (1, 7), India, Bangladesh, Laos, Thailand and southwestern China.

Specimen examined: MYANMAR. Kachin State: Putao Township, main road Sarl Hkam–Putao, 26°06′19″ N, 97°31′08″ E, 359 m alt., 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-41.

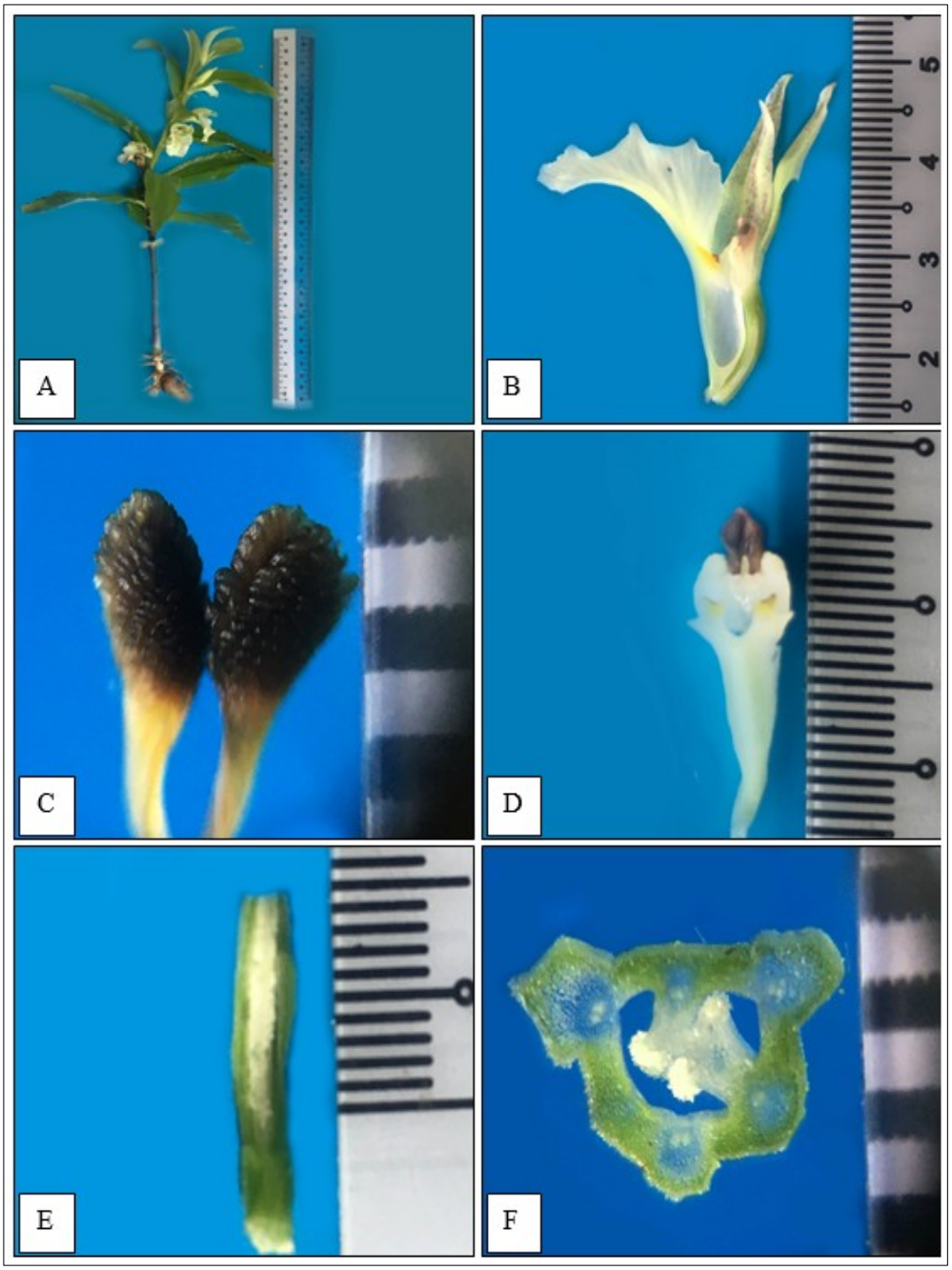


Fig. 3. *Brachycorythis helferi*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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***Bulbophyllum delitescens* Hance**

Perennial epiphytic herb, up to 25 cm tall. Rhizome creeping, stout, 4 mm in diam., branched, rooting. Pseudobulbs 3–11 cm apart, ovoid or subcylindric, 1.7–3.5 × 0.5–1 cm, 1-leaved. Petiole 2–3 cm long; leaf blade oblong, elliptic or obovate-oblong, 16–25 × 3.5–6 cm, leathery, apex obtuse or shortly acute. Scape arising from the base of the pseudobulb, erect, 10–22 cm long, with a 2–4-flowered umbel; peduncle 1.5 mm in diam., with 3 tubular sheaths, about 1 cm long; floral bracts lanceolate, 4–6 mm long, aristate. Pedicel and ovary 1 mm long. Flowers purple. Dorsal sepal ovate-cymbiform, 10 × 3 mm, apex truncate-emarginate with a 7 mm awn. Lateral sepals narrowly lanceolate, 60 × 2 mm, base adnate to the column foot, twisted and connate, forming a tube, apex long acuminate. Petals falcate-lanceolate, 5–7 × 1.5–2 mm, apex truncate-emarginate with a central thread. Lip recurved, ligulate, 5 mm long, fleshy, base grooved, apex obtuse. Column 3 mm long, with basal wings; foot 5 mm long, free part 3 mm; pollinia 4; stelidia 3 mm long, sharply bidentate (Fig. 4).

Flowering: April–November.

Distribution: Rocks along streams and valleys, tree trunks in forests; 1000–2000 m. S Fujian, E and S Guangdong, Hainan, SE Xizang, NE, S and W Yunnan, NE India, Vietnam (7), Myanmar (Putao, Kachin) (1, 7).

Specimen examined: MYANMAR. Kachin State: Putao Township, main road Sarl Hkam–Putao, 26°06′19″ N, 97°31′08″ E, 359 m alt., 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-40.

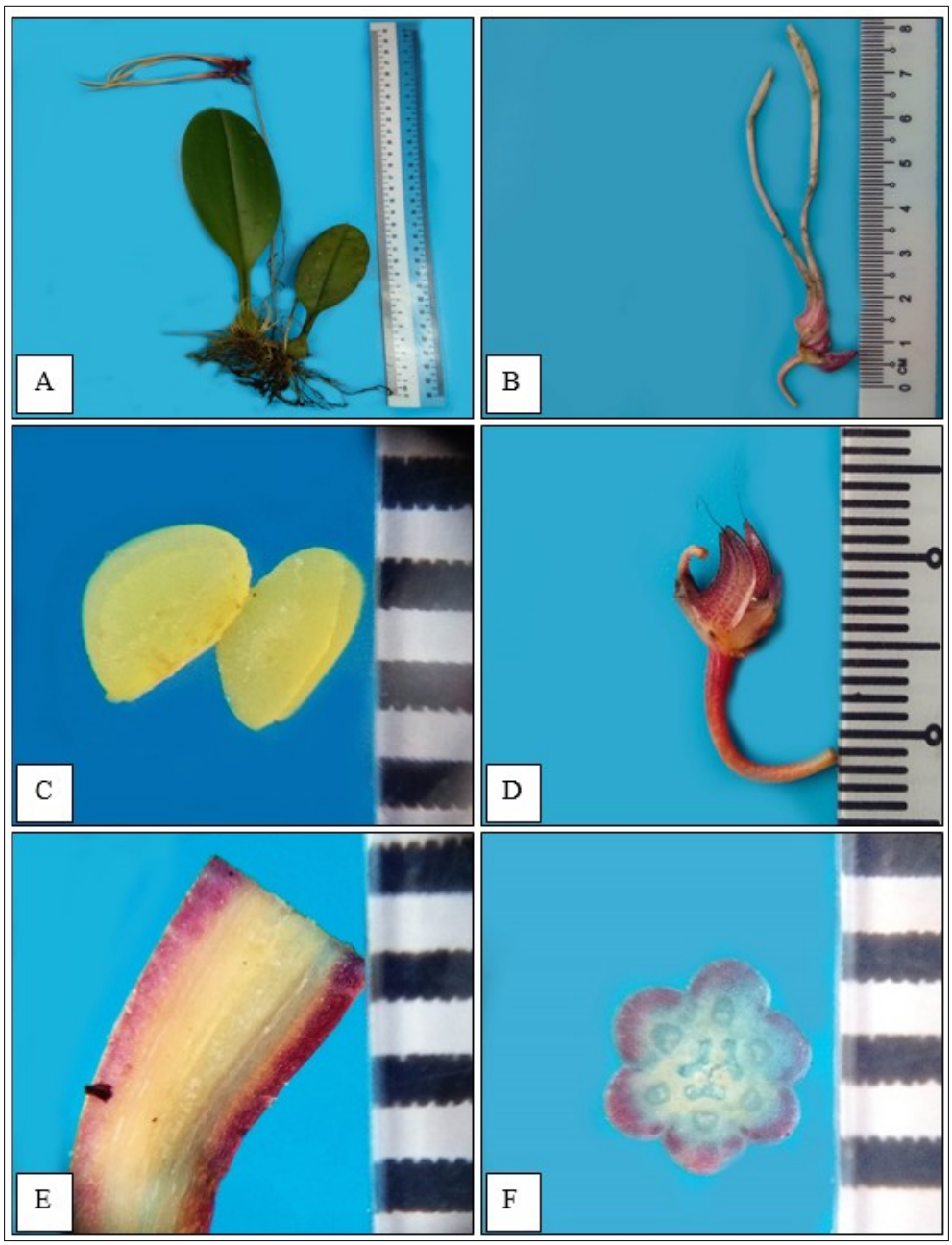


Fig. 4. *Bulbophyllum delitescens.* A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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***Calanthe sylvatica* (Thouars) Lindl.**

Sympodial terrestrial herb. Roots fibrous, vermiform, arising from a stout rootstock; tuberous roots ovoid with ridges. Stem erect, annulate, 1.5–1.7 cm long, 0.5–0.8 cm in diam., glabrous, green. Leaves alternate, elliptic-lanceolate, 10–26 × 5–8 cm, coriaceous, glabrous, green above and paler beneath; margins entire, apex acute; sheaths membranous, 3.0–5.2 × 1.0–2.6 cm, glabrous, pale green. Inflorescence basal, an erect solitary raceme, 11–20 cm long, 0.8–1.6 cm in diam., 10–15-flowered; peduncular bracts 3, 1.0–1.3 × 0.5 cm, deciduous; peduncle cylindrical, stout, pubescent, 0.7–1.6 mm in diam., pale green; floral bracts lanceolate, 1.3–1.7 × 0.4–0.64 cm, subcoriaceous, deciduous. Flowers 2.5–3.6 cm across, membranous, bright or pinkish purple; pedicels 1.8–2.1 cm long, about 2.0 mm in diam., purple. Dorsal sepal oblong-lanceolate, 1.3 × 0.5 cm; lateral sepals' oblong-lanceolate, 1.6 × 0.4 cm; petals oblong-lanceolate, 1.2 × 0.5 cm, sparsely pubescent. Labellum 3-lobed, 5.6 × 2.0 mm, membranous; lateral lobes oblong, obtuse, plicate; midlobe broad, 2-lobed, lobules crenulate, disc wanted at base. Column obliquely truncate, 4.6 × 2.7 mm, pale purple; spur slender, 2.5 × 0.3 cm long, pale purplish pink, pubescent, apex obtuse. Pollinia 8, stipitate, narrowly pyriform, in two bundles, yellow, waxy; rostellum bifid, purple; stigmatic surfaces oblong, 5.0 × 2.0 mm. Ovary oblongoid, 3.7 × 2.5 mm, pale green (Fig. 5).

Flowering: April–June.

Distribution: Thailand, Java; Myanmar (Kachin State) (3, 7). Commonly found in humid forest habitats.

Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, 359 m, 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-42.

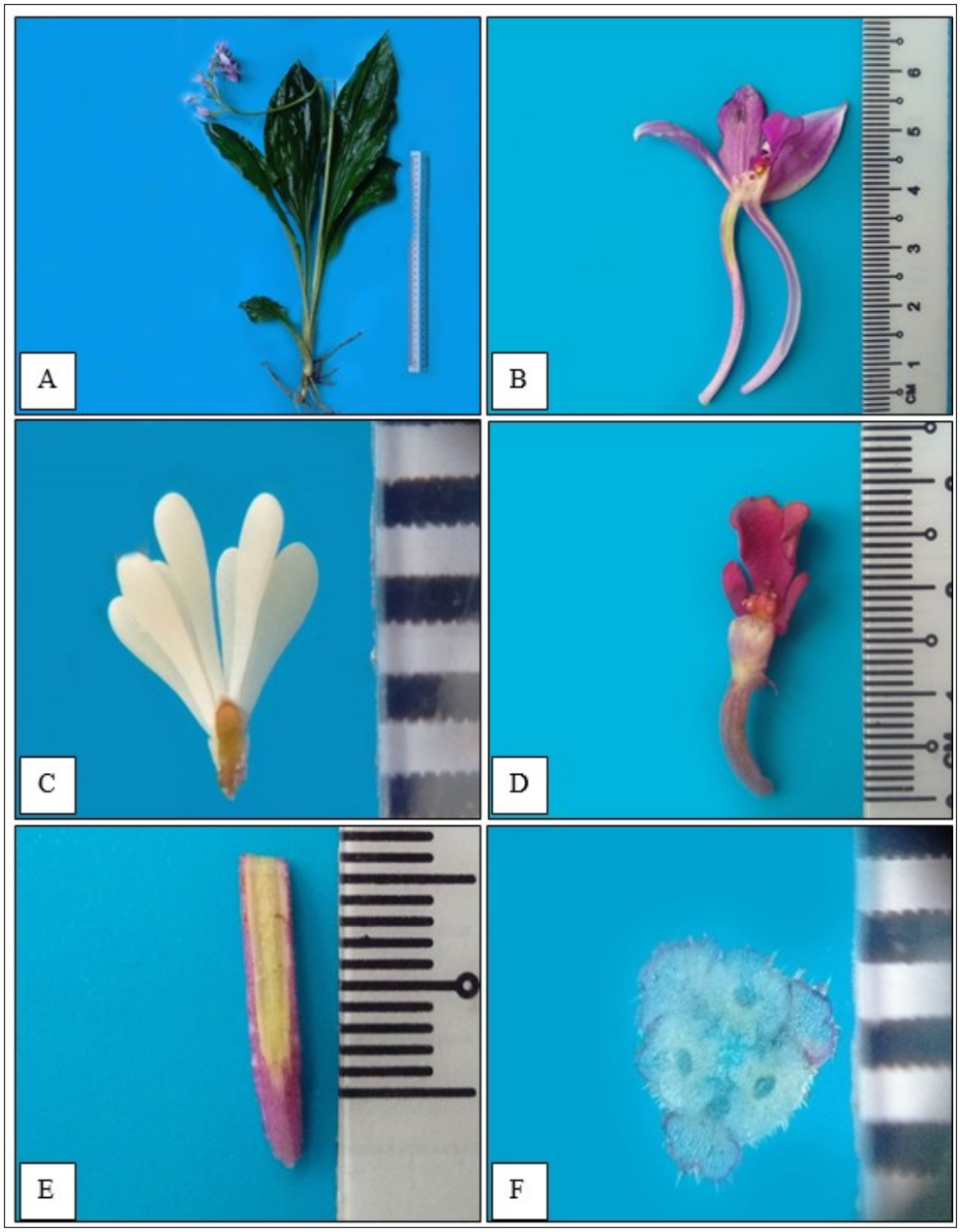


Fig. 5. *Calanthe sylvatica*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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***Coelogyne articulata* (Lindl.) Rchb.f.**

Sympodial epiphyte or lithophyte. Roots fibrous, clinging, cylindrical, glabrous, brownish-white, ca. 1.0 mm in diam. Pseudobulbs many-jointed, two-leaved, subterete, elongated-oblong, erect, 10.0–15.0 × 0.5–1.0 cm, yellowish green; internodes 5.0–10.5 cm long, superposed. Leaves alternate, distichous, elliptic-lanceolate, 7.0–10.0 × 2.0–3.0 cm, subcoriaceous, green, persistent, margins entire, apex acute, glabrous; leaves present at anthesis; sheath membranous, 2.0 × 1.5 cm. Inflorescence terminal, 2-seriate raceme, drooping, 2 per stem, 8.0–15.0 cm long, ca. 1.0 mm wide, 20–23-flowered; peduncular bracts ca. 6, oblong, 1.5 × 0.5 cm, membranous, deciduous, pale green, glabrous; peduncle cylindrical, stout, 3.5 × 0.1 cm, light green; floral bracts rhombic-ovate, 1.0–1.1 × 0.5 cm, membranous, deciduous, pale brownish white, glabrous. Flowers 0.6–0.8 cm across, membranous, white with a light pink tint; pedicel short, 2.0 × 1.0 mm, pinkish white. Dorsal sepal suborbicular, 5.0–7.0 × 3.0–4.0 mm, white with light pink, margins entire, apex acute, glabrous; lateral sepals ovate-keeled, 7.0 × 3.0 mm, similarly colored, glabrous. Petals elliptic-oblong, 6.0 × 3.0 mm, white with light pink, glabrous. Labellum cymbiform, attached to column base, distinctly 3-lobed; lateral lobes saccate, erect, 5.0 × 3.0 mm, membranous, glabrous, basally 5-veined, margins subentire, apex retuse; midlobe reniform-triangular, 1.0 × 3.0 mm, basally yellow with a blotch, glabrous, margins emarginate; lip base obovate-orbicular, 5.0 × 3.0 mm, concave, inner side with 5 longitudinal reddish ribs, margins entire, apex obtuse; lip tip bifid, with transverse plaits, kidney-shaped with a yellow blotch, 2.0 × 1.8 mm, membranous, glabrous. Column very short, hooded, 2.0 × 1.0 mm, brownish; column foot absent; spur absent. Anther cap subglobose, 1.0 × 1.5 mm, glabrous, reddish; pollinia 4, subglobose, in a single group, yellow, waxy; caudicle and viscidium very minute; rostellum 2.0 × 1.7 mm; stigmatic surface oblong, 2.0 × 1.0 mm, pale pink. Ovary oblong, 3.0 × 1.0 mm, light green, glabrous (Fig. 6).

Flowering: June–August.

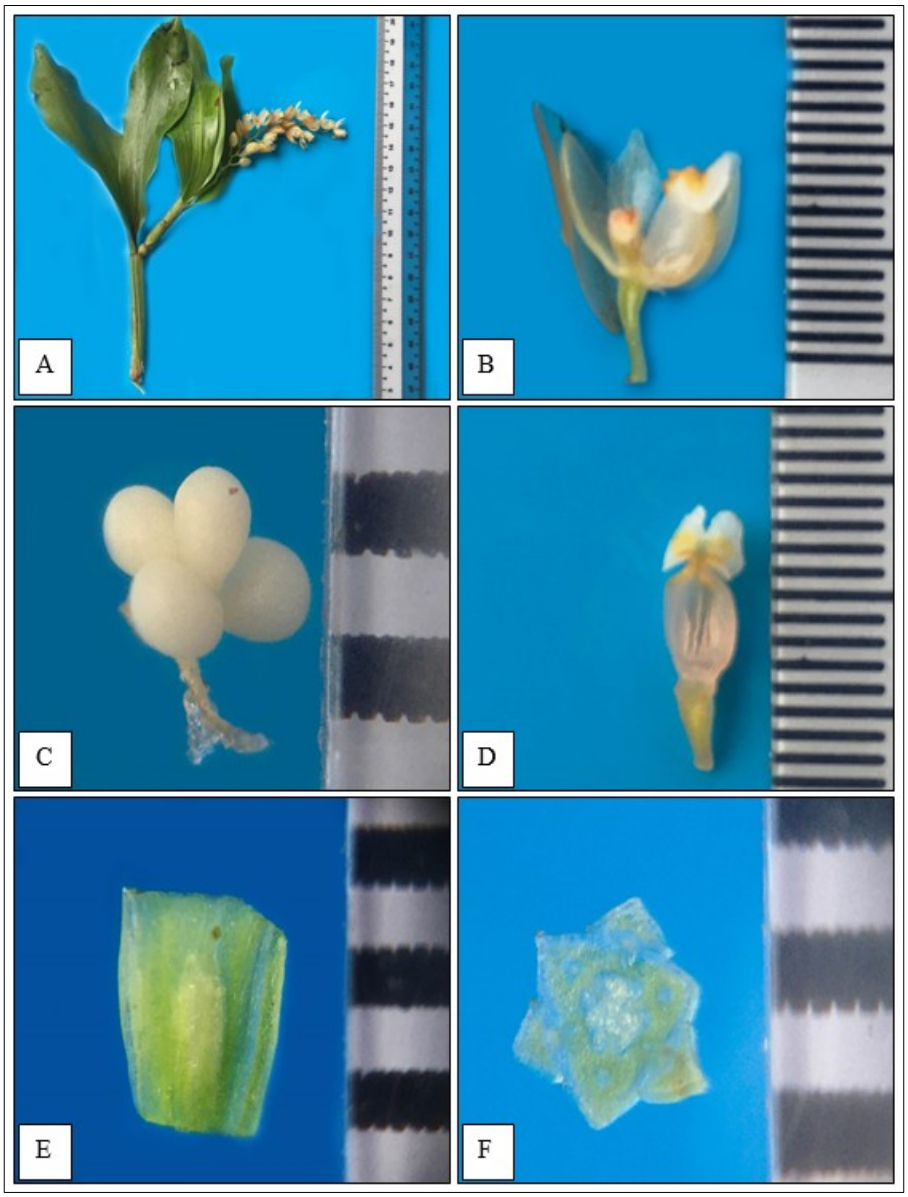


Fig. 6. *Coelogyne articulata*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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Distribution: From northwestern India eastwards to Yunnan, south through Thailand to Malaya and Indonesia (7); in Myanmar: Bago Region, Kachin, Kayin, Mon, Chin and Shan States (1, 7).

Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, elevation 359 m, 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-45.

***Crepidium orbiculare* (W.W.Sm. & Jeffrey) Seidenf.**

Terrestrial plant. Stem cylindrical, 2–2.5 cm long, simple, fleshy, with white nodes, enclosed in membranous sheaths. Leaves usually 3, ovate, oblong-ovate, or subelliptic, 5–10 × 1.8–5 cm, base contracted into a sheath-like structure, margins entire, apex acute, pubescent on both surfaces; lateral veins parallel. Inflorescence terminal, cymose, 15–20-flowered; peduncle 18.0–19.0 cm long, green, pubescent. Flowers bisexual, zygomorphic; floral bracts purplish red to green, narrowly lanceolate, 4.5–6.0 mm long; pedicel short, 3.0–4.0 mm long, purplish red to green. Dorsal sepal sub oblong or oblong-lanceolate, 6–6.5 × 1.5–2 mm, margins revolute, apex obtuse; lateral sepals narrowly oblong-ovate, 4–5 × 1.5–2 mm, base oblique, apex obtuse. Petals narrowly linear, 5.0 × 0.3 mm. Lip superior, rhombic-elliptic in outline, 4–5.5 × 3–3.5 mm, base with a pair of auricles decurrent backwards, embracing the column apex, unlobed; auricles ovate or narrowly ovate, 2–3 mm long. Ovary trigonous, with two short lamellae in the central part and a longitudinal groove between them. Anther cap movable, dorsal, dorsiventrally flattened, attached by a slender filament; locules opening ventrally; pollinia 4, pale yellow, nearly equal in size, in pairs, clavate, waxy, with a delicate viscidium or lacking a viscidium; stigma elliptic to transversely elliptic; rostellum often obtuse or rounded at apex (Fig. 7).

Flowering: August–October.

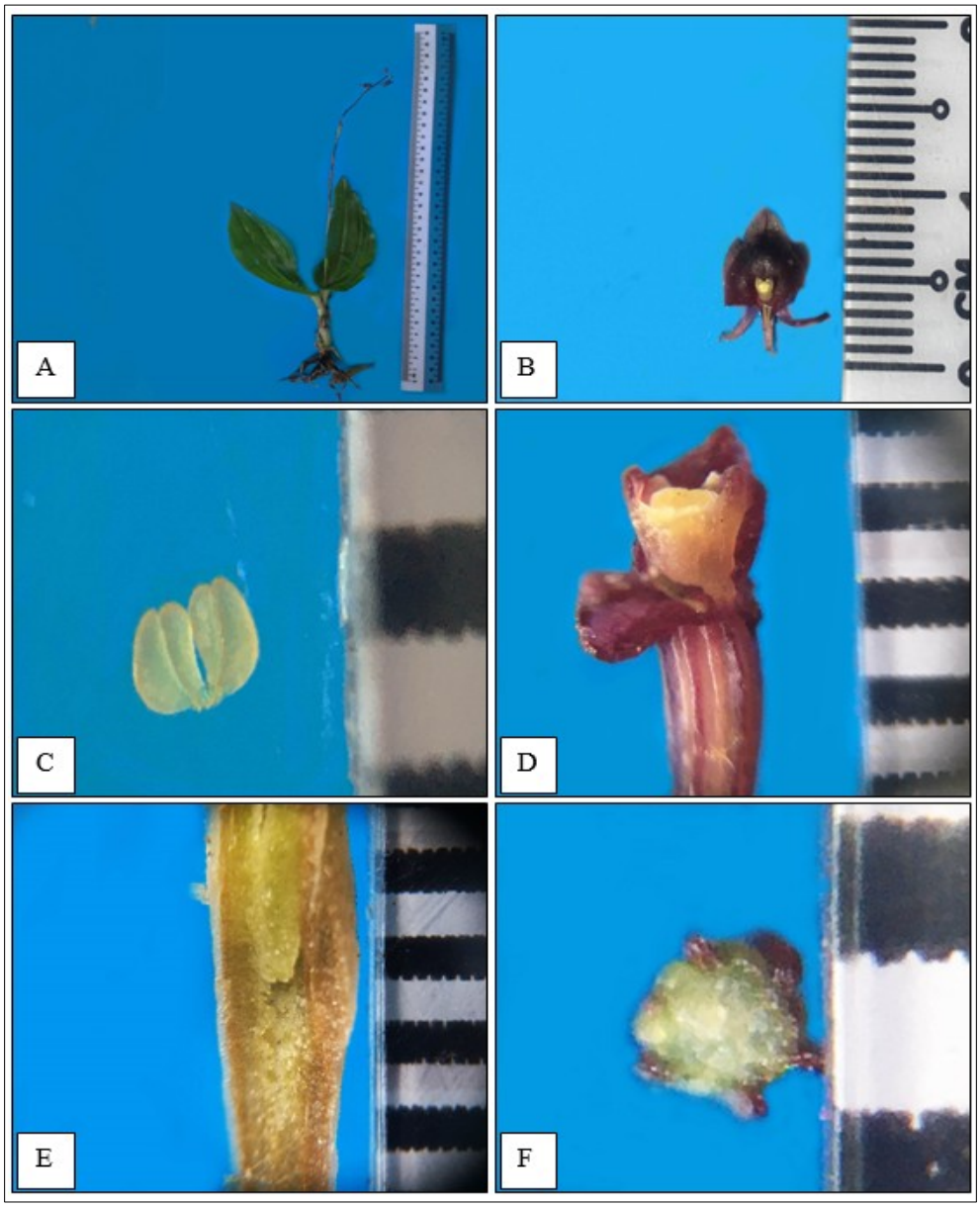


Fig. 7. *Crepidium orbiculare*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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Distribution: Myanmar (Taunggyi and Kengteng, Shan), Yunnan (China) and Vietnam (1, 7); in shaded areas and open grasslands of primary hill evergreen forests, on forested slopes and valleys.

Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, 359 m, photograph by Kyaw Nyein, coll. no. KN-43.

***Peristylus constrictus* (Lindl.) Lindl.**

Sympodial terrestrial herb with tuberous roots; stems slender, erect, 25–31 cm tall, glabrous, partially covered by leaf sheaths. Leaves simple, alternate, ovate-lanceolate, 10–18 × 4.6–6.5 cm, sheathing at base, margins entire, apex obtuse, glabrous on both surfaces. Inflorescence terminal, a many-flowered spike; peduncle erect, terete, 10–16 cm long; peduncular bracts ovate-lanceolate, 2.5–2.8 cm long, glabrous; floral bracts ovate-lanceolate, 1.5–2.5 cm long, coriaceous, glabrous. Flowers bisexual, zygomorphic, trimerous, hypogynous, white, fragrant, 1.2–1.6 cm in diam. Pedicel slender, 0.7–1.0 cm long. Dorsal sepal ovate, cup-shaped, 8–9 mm long, margins entire, apex acuminate, glabrous; lateral sepals ovate-lanceolate, 1.0–1.3 cm long, rolled, entire, acuminate, glabrous. Petal oblong-lanceolate, margins slightly undulate, apex obtuse, glabrous. Labellum tripartite, filiform, attached to the column base; side lobes oblong-lanceolate, 1.1–1.5 cm long, entire, acute; midlobe linear-lanceolate, 1.2–1.4 cm long, entire, acute; spur globose, 1.7–2.0 mm long. Column short, 1.7–2.5 mm long, foot absent; anther cells minute, adnate to the column; pollinia 2, pale yellow, clavate; caudicle short, directed toward the anther base; viscidium minute; stigmatic surface on lip claw; rostellum truncate. Ovary trigonous, 1.5 cm long, with 2 ridges, glabrous (Fig. 8).

Flowering: July–August.

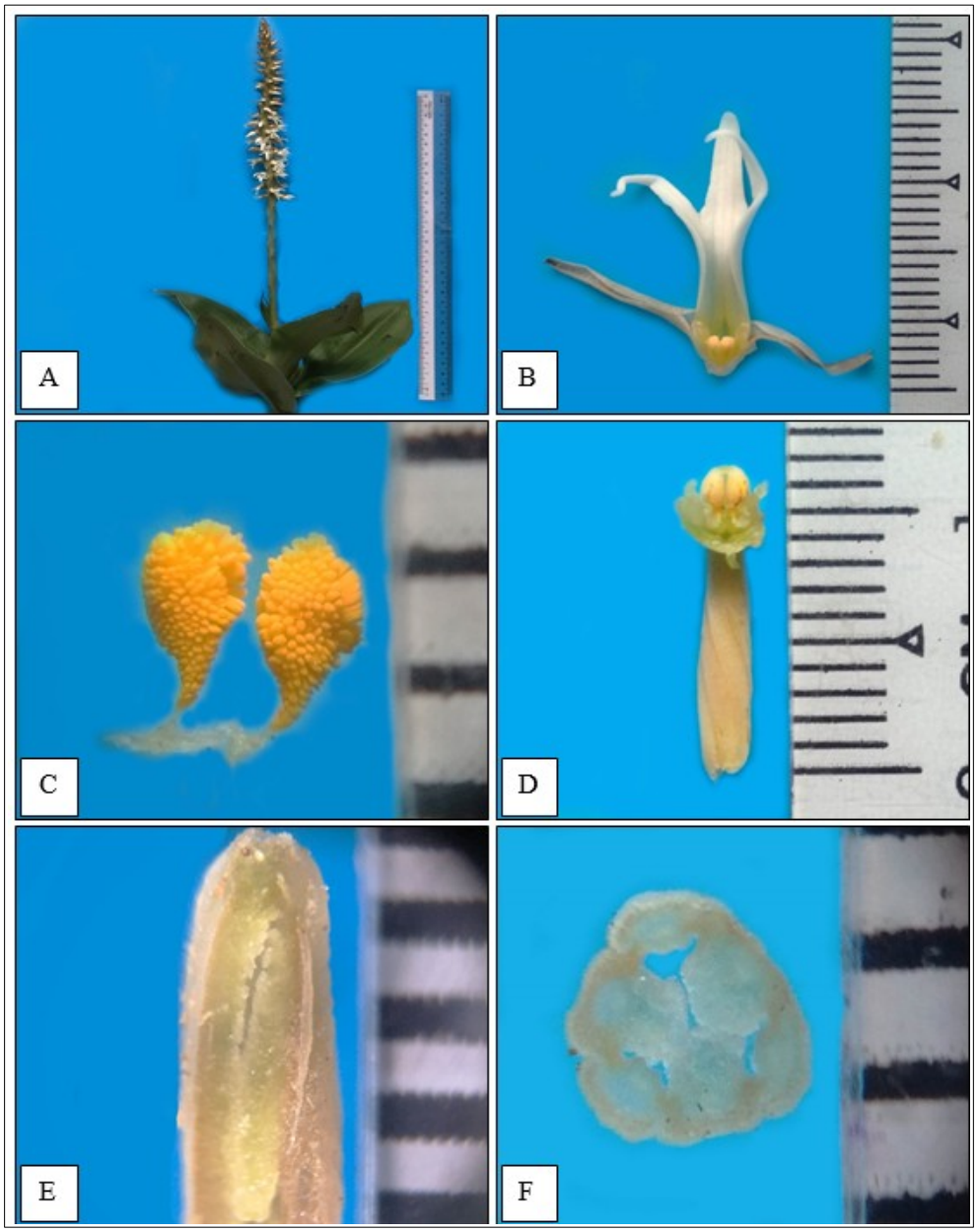


Fig. 8. *Peristylus constrictus*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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Distribution: Myanmar (Kachin, Chin, Mandalay, Sagaing, Shan, Mon) (1, 7), also found along roadsides in the study area.

Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, 359 m, 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-44.

***Robiquetia spathulata* (Blume) J.J.Sm.**

Epiphytic herb, up to 30 cm tall; stem often pendulous, slightly compressed-terete, to 50 cm long, stout, 7–11 mm in diam., internodes 1–3 cm long. Leaves simple, alternate, sessile, thick, oblong, 10–20 × 2.5–5.5 cm; blades linear-lanceolate, 15–18 × 2–3 cm, margins entire, apex unequally bilobed, coriaceous, upper surface glabrous. Inflorescence terminal, densely arranged in large pendulous clusters, racemose, about 10–20 cm long; flowers yellowish white, bisexual, epigynous, trimerous; floral bracts narrowly lanceolate, 4–5 mm long; pedicel slender, 5 mm long, straight. Dorsal sepal ovate, 4–5 × 2.5 mm, concave, obtuse; lateral sepals obliquely ovate, 4–5 × 2.5–3.0 mm, obtuse. Petals ovate, 3 × 2 mm, obtuse. Lip 3-lobed; lateral lobes erect, subovate-triangular, 2.5–3 mm long; midlobe incurved, fleshy, obtuse, adaxially with fused lamellae. Spur perpendicular to the ovary, globose, 5–7 mm long, contracted at the middle, apex dilated; upper adaxial surface with a bifid appendage on the back wall and a small callus on the front wall. Column 3 mm long; anther cap narrowed and beaked at apex; pollinia 2, globose, waxy. Ovary inferior, unilocular. Fruit a capsule (Fig. 9).

Flowering: July–August.

Distribution: Epiphytic on tree trunks in forests, lithophytic on rocks along streamsides; below 1700 m. Hainan, Bhutan, Cambodia, northeastern India, Indonesia, Laos, Malaysia, Myanmar (Mon; Ye Phyu, Tanintharyi) (3, 7), Singapore, Thailand and Vietnam.

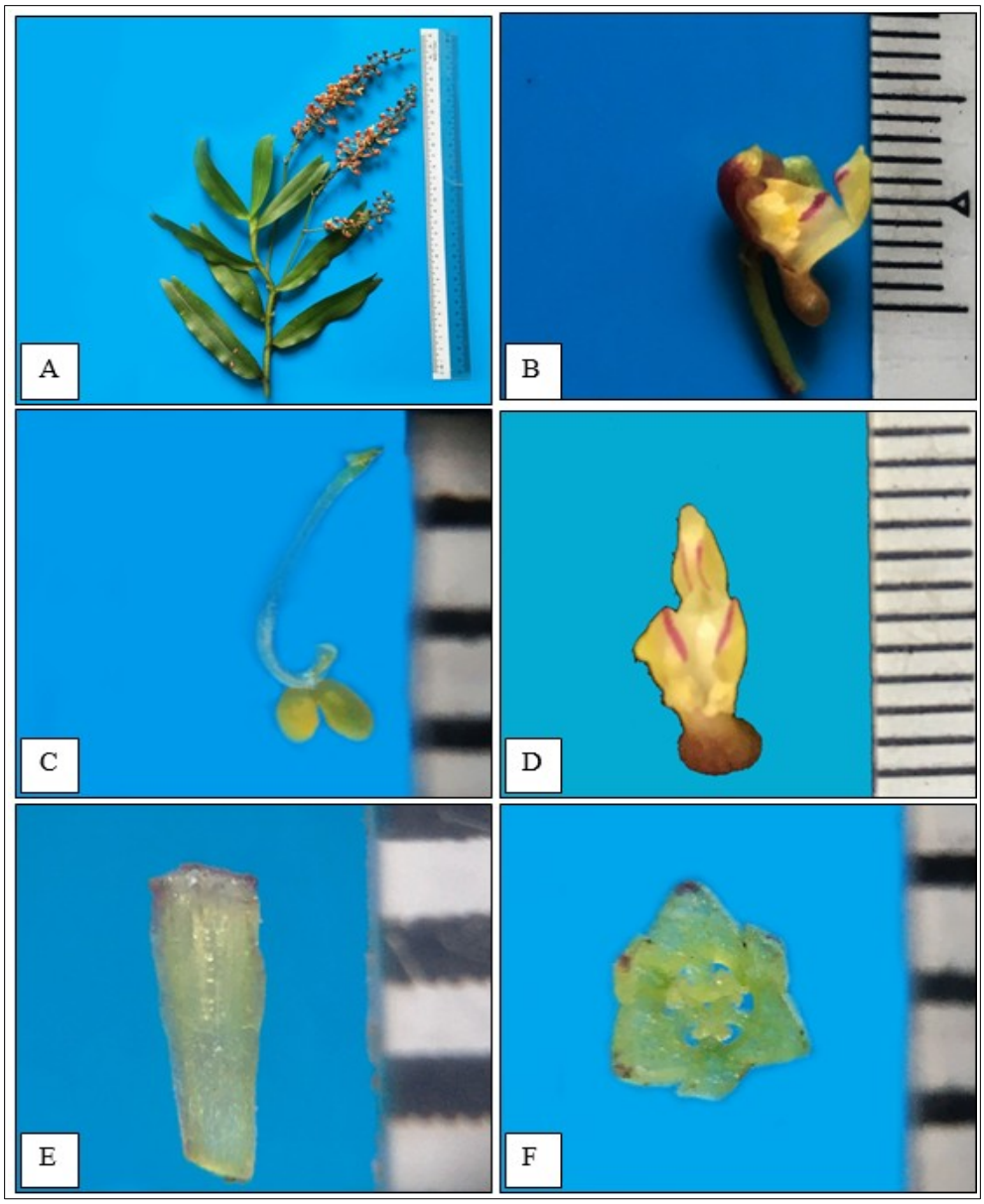


Fig. 9. *Robiquetia spathulata*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, 359 m, 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-47.

***Thunia alba* var. *bracteata* (Roxb.) N. Pearce & P.J. Cribb**

Sympodial, lithophytic herb. Roots fibrous, cylindrical, white, glabrous. Stems leafy, erect, cylindrical, slightly thickened at base, narrowing toward apex, pale green, glabrous; internodes ca. 0.6 cm long. Leaves simple, alternate, distichous; blades oblong-lanceolate, 15.0–21.0 × 2.0–2.6 cm, green above, pale green beneath, glabrous, sheathing at base, margins entire, apex acuminate. Inflorescence terminal, racemose; peduncle cylindrical, 8.0–12.0 cm long, 2–6-flowered; flowers white, ca. 4.5 cm in diam.; peduncular bracts 2, linear-lanceolate, 3.0–4.6 cm long, membranous, pale green, glabrous; floral bracts ovate-lanceolate, 4.0–4.6 cm long, pale green, glabrous. Flowers bisexual, zygomorphic, epigynous, trimerous, white, 5.0–6.0 cm across at anthesis; pedicel 1.6–1.7 cm long, pale green to whitish green, glabrous. Dorsal sepal oblong-lanceolate, 3.5–4.0 × 0.3–0.6 cm, slightly concave, white; lateral sepals' oblong-lanceolate, 4.5–5.6 cm long, white. Petals elliptic-lanceolate to linear-lanceolate, 5.0–5.6 cm long, 4.0–5.0 mm wide, white. Labellum 3-lobed, 5.0–5.6 × 1.5–2.0 cm; side lobes oblong, 2.6–4.5 × 0.5–0.9 cm, white with reddish-brown streaks; midlobe broadly obovate-orbicular, 1.0–1.6 cm long, recurved, margins fimbriate, white with reddish-brown streaks, pubescent within, glabrous without; spur 5.0–6.0 mm long, emarginate, white, glabrous. Column 1.6–2.0 cm long, connate with the lip base, white, with columnar wings; column foot absent. Anther cap subglobose, 3.0–3.4 mm, white with black spots inside, glabrous; pollinia 8, obovate, each 1.7–2.0 mm, waxy, yellow; caudicles and viscidium obscure; stigmatic surface suborbicular, 1.6–2.0 mm, white. Ovary inferior, oblongoid, 6.6–8.0 × 2.5–3.0 mm, pale green, glabrous. Fruit: a capsule (Fig. 10).

Flowering: April–July.

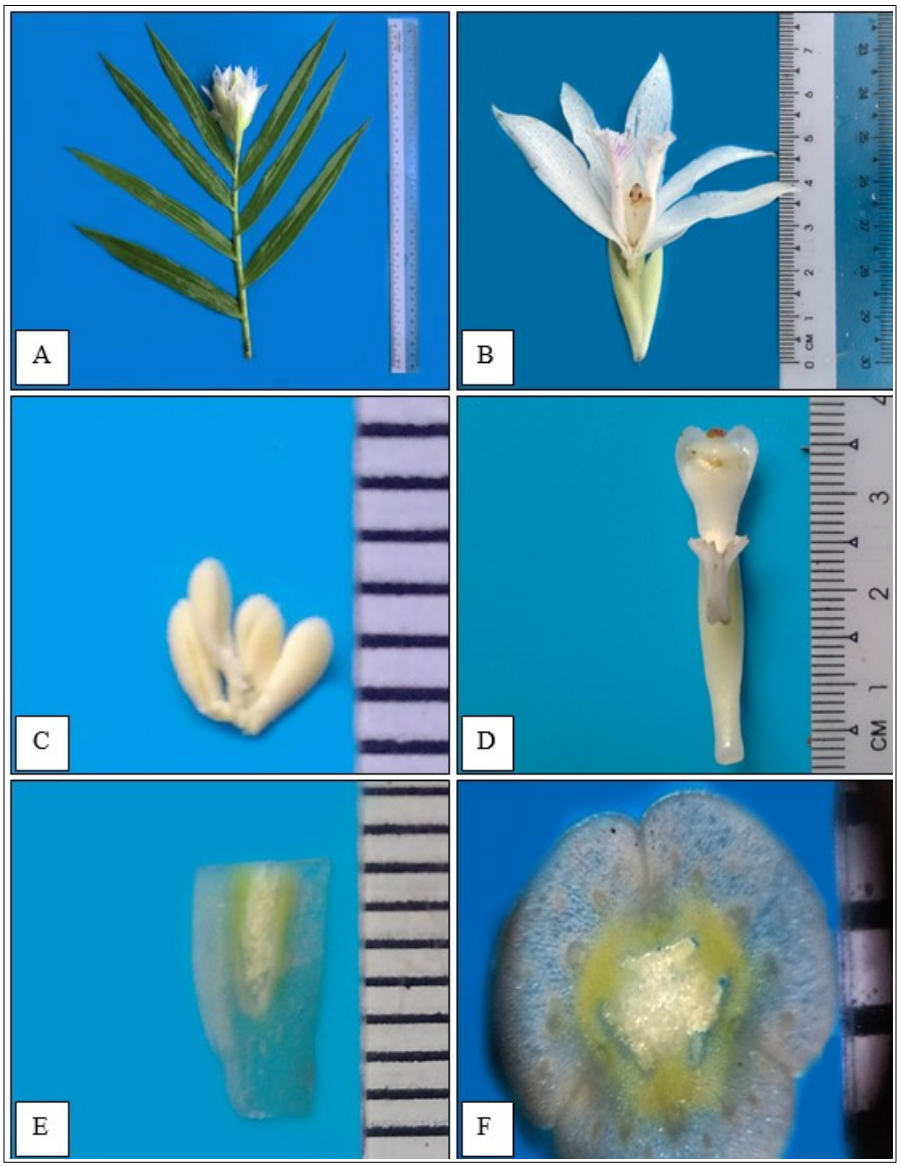


Fig. 10. *Thunia alba* var. *bracteata*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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Distribution: Sichuan, Xizang (south and southeast), western Yunnan, Bhutan, India, Indonesia, Malaysia, Myanmar (Mt. Victoria and Mindat, Chin; Putao, Kachin; Mt. Popa, Mandalay; Rakhine; Kalaw, Shan; Ye Phyu, Tanintharyi; Mon) (1, 7), Nepal, Thailand and Vietnam.

Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, 359 m, 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-48.

***Uncifera obtusifolia* Lindl.**

Perennial epiphytic herb; monopodial. Stems are usually pendulous, elongate, slender and leafy. Leaves overlapping, simple, opposite-distichous, flat, oblong to acuminate, slightly fleshy; base amplexicaul, sheathing, jointed; apex unequally bilobed; blade lanceolate, 4–10.5 cm long, acute and slightly praemorse. Inflorescence axillary, racemose, densely few- to many-flowered; peduncle 3.5–55 cm long, glabrous. Flowers bisexual, zygomorphic, hypogynous, yellowish green, 1.0–2.5 cm in diam., thick-textured; floral bracts ovate, 3–6 mm long, slightly fleshy; pedicel 1.5–2.0 cm long, glabrous. Sepals cymbiform, broadly ovate, 6 × 4 mm. Lip with a long basal spur, 3-lobed; lateral lobes erect, suborbicular, fleshy, adaxially shallowly concave, apex obtuse; spur funnel-shaped, strongly curved forward and hooked, about 15 mm long. Column subconic, stipe 3 mm long; viscidium oblong, 3 mm long; pollinia 2, waxy, globose, deeply cleft, separated by a hyaline flap, attached by a common stipe. Ovary inferior, slender, 4 mm long, monolocular, with many ovules on parietal placentation. Capsule glabrous, 2.5–3 cm long (Fig. 11).

Flowering: June–August.

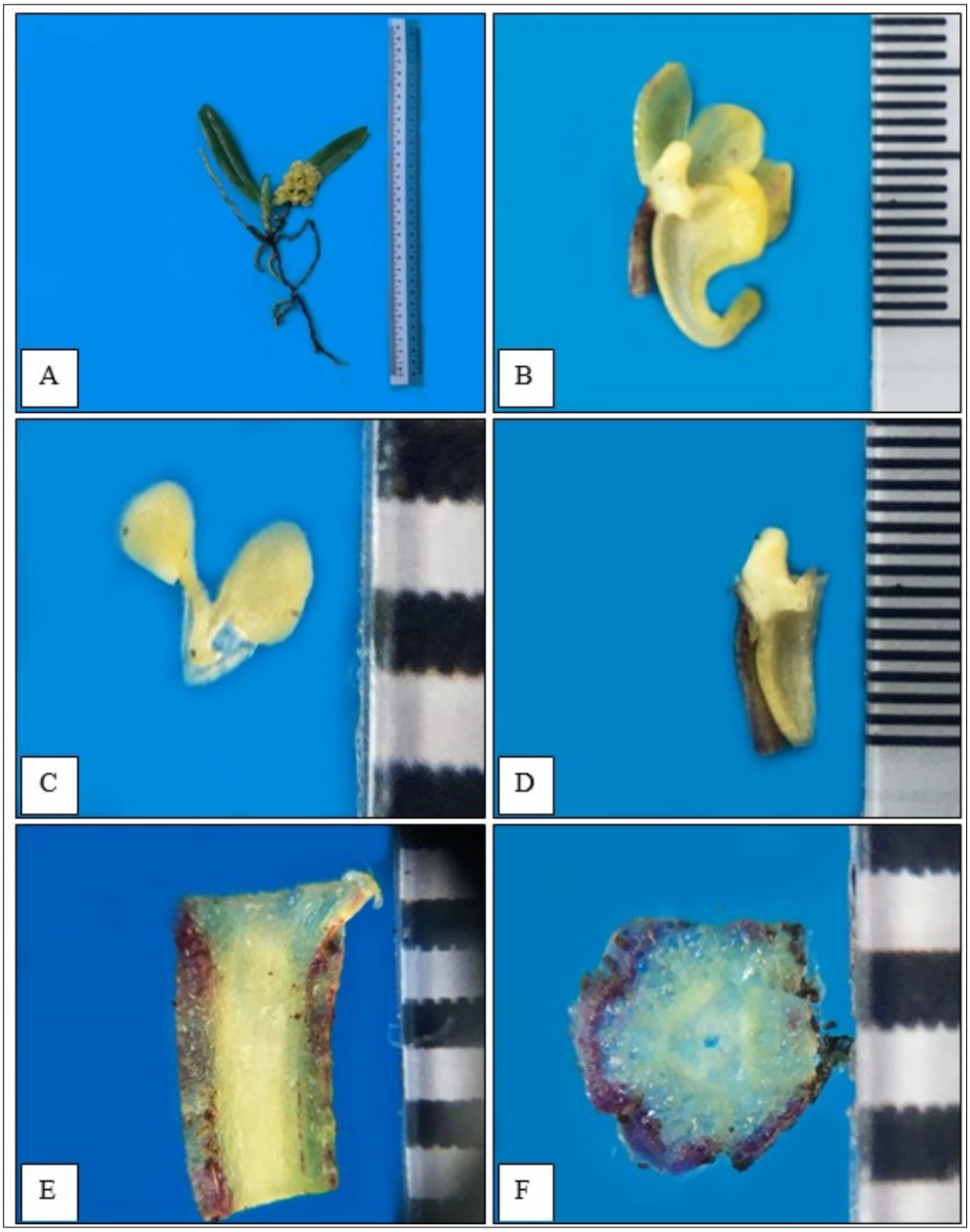


Fig. 11. *Uncifera obtusifolia*. A: Inflorescence; B: L.S. of flower; C: Pollinia; D: Pistil; E: L.S. of ovary; F: T.S. of ovary.

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Distribution: Epiphytic on tree trunks in dense forests; 1300–1900 m. Guizhou, southern Yunnan, Bhutan, northeastern India, Nepal (7). Myanmar (Putao, Kachin; Ye Phyu, Tanintharyi) (1, 7); record to be treated cautiously if based only on photographs and field observations.

Specimen examined: MYANMAR. Kachin State: Putao Township, main road between Sarl Hkam Village and Putao, 26°06′19″ N, 97°31′08″ E, 359 m, 15 Jul 2020, photograph by Kyaw Nyein, coll. no. KN-46.

Discussion

This study provides a taxonomic account of angiosperms, with emphasis on Orchidaceae, in Putao Township, northern Kachin State, Myanmar (1, 4, 22). The study area is predominantly mountainous and covered by evergreen forests, with a mosaic of habitats comprising highlands, lowlands and surrounding mountain ranges. High rainfall and humidity, particularly during the rainy season, create favourable conditions for orchid diversity and support a rich vascular plant flora (22, 23).

Orchidaceae is one of the largest families of flowering plants (9, 24) and is particularly diverse in tropical regions such as Southeast Asia (7, 25). Although previous studies have documented a high number of orchid taxa in Myanmar, the flora remains incompletely explored in many parts of the country (1, 26). In the present study, ten orchid species were recorded from Sarl Hkam Village, namely *A. cornuta*, *B. delitescens*, *B. helferi*, *C. sylvatica*, *C. orbiculare*, *P. constrictus*, *C. articulata*, *R. spathulata*, *T. alba* var. *bracteata* and *U. obtusifolia* (4, 27).

Several species, including *A. cornuta*, *B. delitescens*, *C. sylvatica*, *P. constrictus*, *C. articulata*, *U. obtusifolia* and *T. alba* var. *bracteata*, have previously been reported by Putao or other localities in Kachin State (27, 28). The present study provides additional fine-scale locality information based on photographic records, field observations and georeferenced data from Sarl Hkam Village. In contrast, *B. helferi*, *C. orbiculare* and *R. spatulata* are treated here as new township-level records because they were not previously reported from Putao in the consulted floristic sources (27–29). These findings suggest that the orchid flora of Putao Township remains incompletely documented. The evergreen forests surrounding Sarl Hkam Village, which support both epiphytic and terrestrial orchids, are therefore important habitats for plant diversity (28, 30).

The pollinia morphology documented in this study provides useful taxonomic characters for species identification and phylogenetic studies (15, 30). Detailed descriptions of pollinia number, shape, colour and texture can aid in distinguishing closely related species and contribute to understanding orchid reproductive biology (16, 24).

Conservation implications are significant, as many orchid species in Myanmar face threats from habitat loss, deforestation and illegal collection. The documentation of species distributions and population status is essential for developing effective conservation strategies (25, 30). The findings of this study highlight the importance of protecting the remaining evergreen forests in Putao Township (30, 31) and conducting further surveys to document the region's rich orchid diversity before further habitat degradation occurs (32). Overall, this study provides baseline taxonomic and distributional data that will be useful for future research on orchid diversity, biogeography and conservation in northern Myanmar (2, 7, 19, 32).

Species identification in this study was based mainly on field photographs, georeferenced observations and morphological assessment of living plants. Therefore, some identifications should be regarded as provisional. In addition, the survey was conducted over a limited period and seasonal flowering patterns may have restricted the number of species recorded. Future studies should include repeated surveys during different seasons, voucher specimen collection and molecular analyses where possible. Expanding surveys to adjacent habitats in Putao Township would also improve understanding of species distributions, habitat preferences and conservation priorities.

Conclusion

This study documents ten orchid species from Sarl Hkam Village, Putao Township, based on photographic and field observations. Three species, namely *Brachycorythis helferi* (Rchb.f.) Summerh., *Crepidium orbiculare* (W.W.Sm. & Jeffrey) Seidenf. and *Robiquetia spathulate* (Blume) J.J.Sm., are reported as new township-level records. Although these records require confirmation through herbarium specimens and, where possible, molecular analyses, the findings provide useful baseline information for future studies of orchid diversity, biogeography and conservation in northern Kachin State, Myanmar.

Dichotomous Key to Orchids of Putao, Kachin, Myanmar

1a. Plants epiphytic or lithophytic, with aerial roots or creeping stems; not tuberous rooted ……2

1b. Plants terrestrial, with fibrous or tuberous roots……5

2a. Pseudobulbs present and distinct ……3

2b. Pseudobulbs absent or poorly developed; stems elongate or leafy .....……4

3a. Pseudobulbs 1-leaved; flowers purple; pollinia 4 ..... *Bulbophyllum delitescens*

3b. Pseudobulbs many-jointed or elongated; flowers white or pale pink; pollinia 4–8 4

4a. Leaves distichous, elliptic-lanceolate; inflorescence drooping, many-flowered; flowers white with a light pink tint .....*Coelogyne articulata*

4b. Leaves sessile, thick, oblong to linear-lanceolate; inflorescence terminal or axillary; flowers yellowish white .....*Robiquetia* spathulata

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5a. Roots tuberous or tuberous-fibrous; flowers produced in a 1-flowered axillary inflorescence ……...6

5b. Roots fibrous only; flowers produced in a raceme or spike .....…7

6a. Flowers green; dorsal sepal 8–15 mm long; labellum orbicular; spur present …….*Brachycorythis helferi*

6b. Flowers not as above; inflorescence not 1-flowered .....…… 7

7a. Inflorescence basal, erect raceme; flowers large, bright or pinkish purple ..... *Calanthe sylvatica*

7b. Inflorescence not basal raceme; flowers white, pale yellow or green .....……8

8a. Flowers white; plants robust, lithophytic; labellum 3-lobed with broad side lobes ..... *Thunia alba* var. *bracteata*

8b. Flowers smaller, not as above; plants slender or herbaceous 9

9a. Leaves ovate-lanceolate; flowers white, fragrant; spur globose and short .....*Peristylus constrictus*

9b. Leaves ovate or subelliptic; flowers small, greenish or yellowish; lip with auricles or basal lobes ……...10

10a. Lip rhombic-elliptic with auricles at base; flowers greenish; terrestrial orchid .....*Crepidium orbiculare*

10b. Lip not as above; plants epiphytic with pendulous stems and opposite-distichous leaves .....…11

11a. Leaves linear-lanceolate to oblong, apex unequally bilobed; spur long and curved .....…*Uncifera obtusifolia*

11b. Leaves alternate, distichous, narrowly ovate-elliptic; flowers small, white, with a lamellate appendage on the lip ..... *Appendicula cornuta*

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Authors' contributions

KN conceived and designed the study and performed the experiments. KN contributed to data analysis and interpretation. SU performed statistical analysis and prepared the figures. All authors read and approved the final version of the manuscript.

Compliance with ethical standards

Conflict of interest

Authors do not have any conflict of interests to declare.

Ethical issues

None

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used OpenAI ChatGPT and Grammarly solely for language improvement, editing and proofreading purposes. The authors have carefully reviewed and edited all AI-assisted content and take full responsibility for the accuracy, originality and integrity of the final manuscript.

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