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ADDITION OF FIVE ORCHID SPECIES TO THE FLORA OF BHUTAN

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Abstract. Bhutan, situated in the eastern part of the Himalaya Biodiversity Hotspot, is renowned for its rich flora and fauna. This biodiversity is attributed to the country's multiple biogeographic origins, diverse topography, ecological complexity, and varied climatic and soil conditions. However, much of the flora remains under-collected, with many taxa yet to be discovered. From June 2022 to March 2024, floristic studies were conducted in Bhutan, leading to the discovery of five orchid species not previously recorded in the country: *Bulbophyllum crabro*, *B. rigidum, Cymbidium tortisepalum* var. *longibracteatum*, *Galeola cathcartii*, and *Liparis kumokiri*. These species are scientifically documented for the first time in Bhutan. Detailed descriptions, type information, updated global distribution, ecology, and colour plates of the recorded species are provided.

Keywords / Palabras clave: Biodiversidad, biodiversity, distribución, distribution, Orchidaceae, Punakha, taxonomía, taxonomy, Trongsa

Introduction. Bhutan, nestled in the eastern part of the Himalaya Biodiversity Hotspot, harbours a rich flora and fauna. Due to its multiple biogeographic origins, diverse topography, ecological complexity, and a wide range of climatic and soil conditions, it supports a diverse range of floristic complexes (Gyeltshen *et al*. 2023). However, the Bhutanese flora remains under-collected, and many species have yet to be discovered. Numerous plants found in neighbouring regions are not yet recorded in Bhutan, highlighting a significant gap in our knowledge of the country's diverse flora (Gyeltshen *et al*. 2023). Recent advancements in plant systematics call for further investigation into Bhutan's flora.

The checklist of Orchids of Bhutan initially included 369 species, incorporating records from the neighbouring states of Darjeeling and Sikkim in India (Pearce & Cribb 2002). Subsequently, Gurung (2006) published "An Illustrated Guide to the Orchids of Bhutan", listing 419 species. Recent publications, such as "A Century of New Orchid Records in Bhutan" by Dalstrom *et al.* (2017, 2021), have increased the count to 462 species, excluding five uncertain locations and two cases of mistaken identity. There has also been a notable increase in the number of orchid species due to recent discoveries of species new to science and new records for Bhutan. For instance, eight new species (C.Gyeltshen *et al*. 2019, N.Gyeltshen *et al.* 2017, 2020, P.Gyeltshen *et al.* 2020, 2023, Ghalley *et al.* 2022) and 26 new records (Chaida & Tashi 2020, Dechen *et al.* 2020, Dorji *et al*. 2023, P.Gyeltshen *et al.* 2021, Rabgay & Kumar 2019, Rabgay *et al.* 2021, Tobgay *et al*. 2024, Zangpo *et al.* 2021) have increased Bhutan's orchid species count to 493. With the addition of five more species from the current study, the total now stands at 498 orchid species in Bhutan.

Materials and methods. This paper results from floristic assessments conducted in Bhutan between June 2022 and March 2024. While identifying the material, we consulted literature on the regional orchid flora (Averyanov 2011, Chen & Liu 2003, Chen *et al.* 2009, Clayton 2017, Dorji 2008, Gurung 2006, Hooker 1894, King & Pantling 1898, Lucksom 2007, Maekawa 1936, Pearce & Cribb 2002, Seidenfaden 1986, Shankar 2021, Tetsana *et al*. 2019, Vermeulen *et al*. 2014), and we found five orchid species not previously reported from Bhutan. The abbreviation of the author's citation followed the International Plant Names Index

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(IPNI 2024), and the circumscription and terminology adopted for the morphological descriptions followed Pearce & Cribb (2002) and Beentje (2024).

Measurements of the vegetative and reproductive parts were taken *in situ* from at least 5 to 10 randomly chosen flowers of the species. Geographical details such as elevation and geo-coordinates were collected using a Garmin GPS (eTrex 40), and photographs were taken using a digital camera. Micro images were photographed using a Z-stacking microscope at the National Biodiversity Centre in Thimphu, Bhutan. The coloured plates were prepared and edited using Adobe Photoshop software. Distribution data were plotted on a map using QGIS software version 3.16.2 (QGIS Development Team, 2022), and the collected specimens were deposited at the Bhutan National Herbarium (THIM). Descriptions, distribution maps, habitat characteristics of all five species, and colour photographs are provided to aid in accurate species identification and practical conservation efforts.

Taxonomic treatment

Bulbophyllum crabro (C.S.P.Parish & Rchb.f.) J.J.Verm., Schuit. & de Vogel, Phytotaxa 166: 106. 2014. *Monomeria crabro* C.S.P.Parish & Rchb.f., Trans. Linn. Soc. London 30(1): 143 (1874). Lectotype, (designated by Clayton 2017): Fig. 1.
Monomeria barbata Lindl., Gen. Sp. Orch. 61. 1830. *Epicranthes barbata* Rchb.f., Ann. Bot. Syst. (Walpers) 6(2): 265. 1861. Lectotype, (designated by Shankar, 2021): Nepal. Toka, 1821, *Wallich 1978* (K [K000974273 digital image!]: Isolectotype, K [K000974243, K001114839 digital images!]; G [G00434759 digital image!]).

Plant epiphytic or lithophytic, up to 45 cm long. *Rhizome* creeping, stout, woody, 5–7 mm in diam., sympodial, rooting from both current pseudobulbs and rhizomes. *Pseudobulbs* spaced on rhizome by 4–10 cm, ovoid, lemon green, c. 3–5 cm in height, 2.0–3.5 cm in diam., green, shiny when new, moderately shrivelled after flowering, getting flaccid with age. *Leaf* single at apex; petiole, 6–8 cm long; lamina oblong, 16–24 × 3.2–4.0 cm, leathery, glabrous, apex emarginate (mostly symmetrical), base attenuated into petiole. *Inflorescence* racemose, 30–35 cm long, up to 10-flowered, arising laterally from base of pseudobulbs, stout, ascending, dark purple; peduncle, 9–15 cm long, with 2–3 sheaths, 8–10 × 5.5–6.0 mm; floral bracts lanceolate, 4.5–5.0 × 2.0–2.5 mm, glabrous, persistent; pedicel and ovary, 1–2 cm long, ovary grooved, flushed with dark purple colour. *Flower* laxly arranged on inflorescence, 1–2 cm apart; *dorsal sepal* lanceolate, 10–12 × 5.4–5.0 mm, cucullate, adaxially surface brownish colour, abaxial surface yellowish, margin recurved, apex narrowly acute or acuminate, incurved or recurved, 7-veined; *lateral sepals* connate at base, oblong, 15–20 × 6.8–7.5 mm, pineapple-yellow, tinged with brown dots, veined, adaxially densely hispid, abaxially glabrous, margins recurved, apex acute or acuminate, yellow without tinge, base oblique; *petals* oblanceolate, 6–10 × 5–7 mm, adnate to base of column and extended other half adnation to posterior side of foot, margin fimbriate, yellowish with maroon spots or flushed with dark purple. *labellum* panduriform, *ca.* 8 × 5 mm, 3-lobed, deflexed about middle; lateral lobes narrowly falcate (horn-like), *ca.* 3 mm long, yellowish or dark purple; mid-lobe oblong when flattened, *ca.* 5 × 4 mm, glaucous, adaxial surface 4-keeled, base of outer keels merged with lateral lobes and apex with mid lobe, base of inner keels visible at base of labellum, apex converge and connate on mid lobe forming warty structure, flushed with maroon or dark purple, abaxial surface with prominent midrib impression, yellowish-white with pink spots, apex retuse. *Column* rectangular, *ca.* 5 × 4 mm, dilated at the base, obtuse, wings yellow spotted with maroon; column foot rectangular, *ca.* 9 × 4 mm, yellow spotted with maroon; stelidia triangular, *ca.* 2.5 mm long, yellow. *Anther cap* subglobose, *ca.* 2 × 2 mm, abaxially papillose, yellow, apex rounded. *Pollinia* 4, in 2 pairs; stipe terete, *ca.* 0.5 mm long, reddish-orange; viscidium ovoid, *ca.* 0.5 mm long, yellow; pollinarium ovoid, *ca.* 1 mm long, golden yellow.

Phenology: Flowering from September to November.

Habitat: *Bulbophyllum crabro* grows on boulders and as an epiphyte on the main trunks of *Lyonia ovalifolia* (Wall.) Drude, *Rhododendron arboreum* Sm. (Ericaceae), *Quercus griffithii* Hook.f. & Thom-

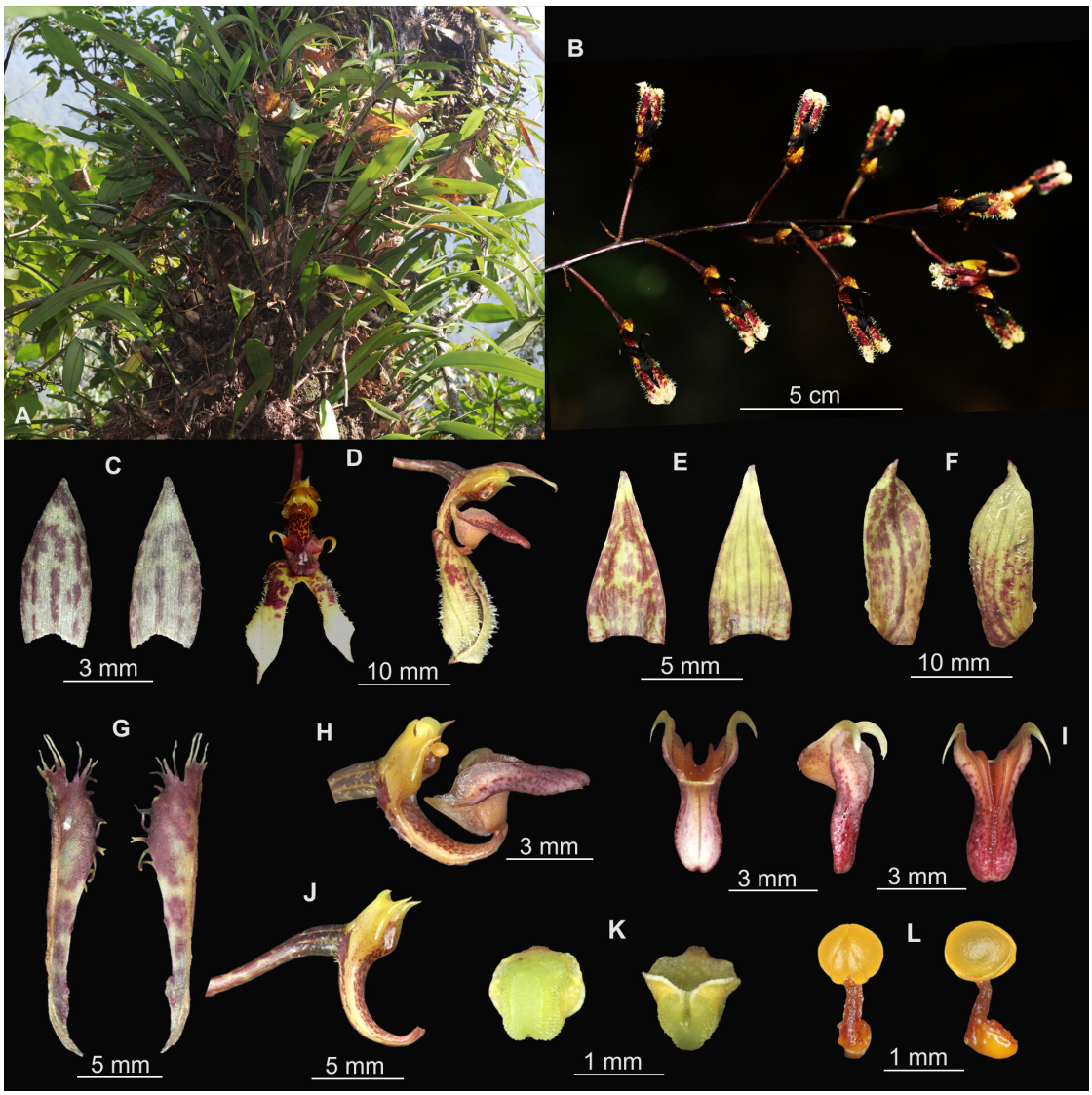

Figure 1. *Bulbophyllum crabro* (C.S.P.Parish & Rchb.f.) J.J.Verm., Schuit. & de Vogel. **A**. Habit. **B**. Inflorescence. **C**. Bracts (abaxial and adaxial view). **D**. Flower (front & lateral view). **E**. Dorsal sepal (abaxial and adaxial view). **F**. Lateral sepals (abaxial and adaxial view). **G**. Petals (abaxial and adaxial view). **H**. Column with labellum and gynoecium attached. **I**. Labellum (abaxial, lateral & adaxial view). **J**. Column. **K**. Anther caps (abaxial and adaxial view). **L**. Pollinia with stipe and viscidium (abaxial and lateral view). Photographs by Kinley Rabgay (A & B) and Phub Gyeltshen (C–L). Illustration assembled by Phub Gyeltshen.

son ex Miq., and *Quercus lanata* Sm. (Fagaceae) in warm broadleaved forests at elevations around 1500–1700 m.

Distribution: The species is distributed in India, China, Malaysia, Myanmar, Nepal, Thailand, Vietnam, and Bhutan (Punakha, Woku-Damchi) (Fig. 6).

Specimen examined: Bhutan. Punakha District: Kabesa Gewog, Woku-Damchi, 17 November 2023, *P. Gyeltshen, D.D. Lama & K. Rabgay 121* (THIM22552!, THIM22553!, THIM22554!, THIM22555!).

Notes: According to Vermeulen (2014), *Bulbophyllum crabro* belongs to *Bulbophyllum* sect. *Monome-*

ria, which is characterized by a creeping rhizome, pseudobulbs that become longitudinally wrinkled with age, racemose inflorescences, flowers with a long column-foot to which the sepals are attached in the apical half, 1-veined, ciliate to erose-fimbriate petals, a mobile and auriculate labellum, stelidia with a winged upper margin, and pollinia attached to a stipe. *Bulbophyllum crabro* differs from other known *Bulbophyllum* species by having spotted petals that are longer than wide, twisted lateral sepals, and long triangular stelidia resembling horns on the column.

Bulbophyllum rigidum King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 169. 1898. *Bulbophyllum conchiferum* auct. non Rchb.f.: Hooker, Fl. Br. Ind. 1894. TYPE: India. Sikkim, *W.Griffith 5291* (holotype: K-Dist.-image not seen). Fig. 2.

Plant epiphytic, 18–20 cm tall. *Rhizome* thick, covered with fibrous sheaths, 10–13 × 4–5 mm. *Roots* inserted along the rhizome. *Pseudobulbs* small, conical, attenuate. *Leaf* 1; petiole 3–6 cm long; lamina oblong–elliptic, 10–20 × 2.0–3.2 cm, thick, leathery, margin entire, base slightly attenuate, apex subacute. *Inflorescence* erect, arising from the rhizome at the base of the inconspicuous pseudobulbs, laxly 10 to 17 flowered; peduncle slender, 10–13 cm long, deflexed at distal portion while blooming; sheathed, glabrous; sheath lanceolate, 10–14 × 4–5 mm; rachis glabrous, 6–8 cm long. *Flowers* opening from base; *floral bracts* lanceolate, 5–6 × 2–3 mm, pale green, apex narrowly acuminate, glabrous; pedicel and ovary, 2–3 mm long; *dorsal sepal* lanceolate, 5–6 × 4–5 mm, cucullate, broadly acuminate, glabrous, 3-veined*; lateral sepals* oblong, 5.5–7.0 × 2.5–3.0 mm, lower margin connate towards the base, 3-veined, base oblique, apex obtuse; *petals* oblong-lanceolate, 3–4 × 1.0–1.5 mm, margin obscurely denticulate, apex broadly acuminate, 1-veined, 1-lateral short vein. *Labellum* simple, ovate-elliptic, 3.5–4.0 × 2.5–3.0 mm, deflexed in the middle, glabrous, base grooved, apex obtuse. *Column* stout, 1.0–1.3 mm long, pale yellowish-green; *stelidia* 2, unevenly bilobed; column foot, rectangular, *ca*. 2 × 2 mm, adaxially maroon, abaxially pale yellowish-green; anther cap bilobulate 1.0 × 1.4 mm long, depressed. *Pollinia* 2, ovoid, 0.5 mm long. *Seed capsules* unknown.

Phenology: Flowering from September to November.

Habitat: *Bulbophyllum rigidum* is found in warm broadleaved forests at an elevation of 1640 m.

Distribution: The species is distributed in India, Nepal, and Bhutan (Punakha, Rimchu) (Fig. 6).

Specimen examined: Bhutan. Punakha District: Goenshari Gewog, Rimchu,1640 m, 20 November 2023, *P. Gyeltshen, D.D. Lama & K. Rabgay 129* (THIM22564!).

Notes: Pearce & Cribb (2002) included this species in the Orchids of Bhutan based on its occurrence in the neighbouring states of India. The occurrence of the species in Bhutan was highlighted following the publication of *A Century of New Orchid Records in Bhutan* by Dalstrom *et al.* (2017, 2021), but without voucher specimens. Our field survey and specimen collection now provide a detailed description and habitat information for this species in Bhutan.

Bulbophyllum rigidum is most similar to *Bulbophyllum cornu-cervi* King & Pantl. but differs by having a larger habit, ≥ 18 cm tall (*vs*. ≤ 6.5 cm), larger leaves, 8.5–22 × 2–3.4 cm (*vs*. smaller leaves 2–3 × 1–2 cm), lanceolate dorsal sepal (*vs*. oblong), oblong petals (*vs*. lanceolate), and column 1.0–1.9 mm long (*vs*. 0.3–0.4 mm long).

Cymbidium tortisepalum var. ***longibracteatum*** (Y.S.Wu & S.C.Chen) S.C.Chen & Z.J.Liu, Acta Phytotax. Sin. 41(1): 81. 2003. *Cymbidium longibracteatum* Y.S.Wu & S.C.Chen, Acta Phytotax. Sin. 11(1): 31. 1966. *Cymbidium goeringii* var. *longibracteatum* (Y.S.Wu & S.C.Chen) Y.S.Wu & S.C.Chen, Acta Phytotax. Sin. 18(3): 300. 1980. TYPE: China. Sichuan: Cult. Pt., *Y. L. Fee* 2064 (holotype: PE, destroyed). Neotype (designated by Chen & Liu, 2003): China. W. Sichuan, Dujiangyan, *Z.J. Liu 22318* (PE, not seen). Fig. 3.

Plant terrestrial, 30–85 cm tall. *Pseudobulbs* ovoid, 1.5–2.5 × 1.0–1.3 cm, enclosed in leaf bases, and bladeless sheaths. *Roots* thick, 4–8 mm in diam. *Leaves* 5–7, young flexuous, old stiff, lorate, 26–63 × 0.7–1.2 cm, not articulate at the base, margin ser-

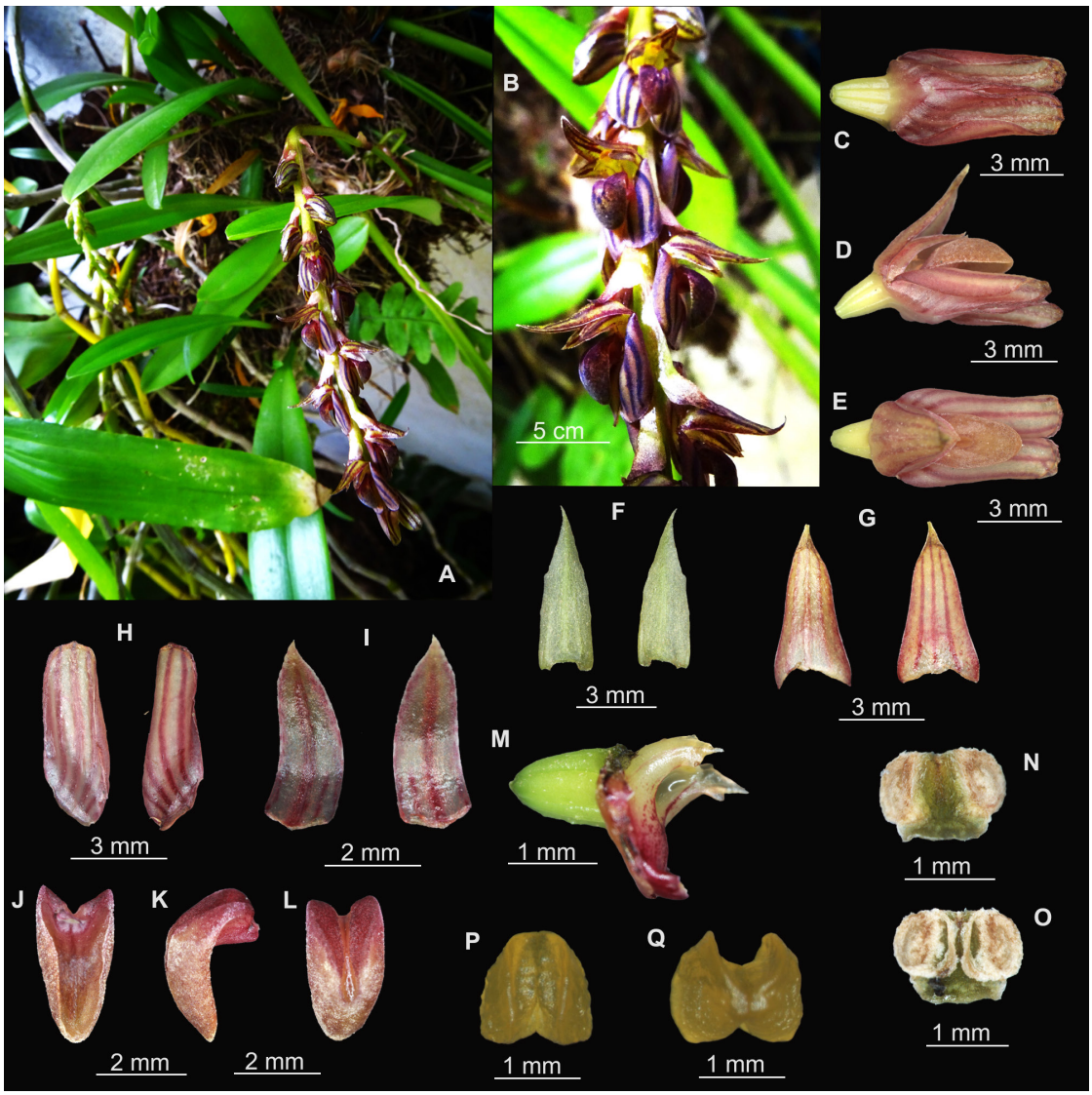

FIGURE 2. *Bulbophyllum rigidum* King & Pantl. **A**. Habit. **B**. Section of inflorescence. **C–E**. Flower (abaxial, lateral & adaxial view). **F**. Floral bract (abaxial & adaxial view). **G**. Dorsal sepal (abaxial & adaxial view). **H**. Lateral sepal (abaxial & adaxial view). **I**. Petal (abaxial & adaxial view). **J–L**. Labellum (abaxial, lateral & adaxial view). **M**. Column and pedicel (diagonal view). **N** & **O**. Anther cap (abaxial & adaxial view). **P** & **Q**. Pollinia (abaxial & adaxial view). Photographs by Kezang Tobgay (A & B) and Phub Gyeltshen (C–Q). Illustration assembled by Phub Gyeltshen.

rulate, apex acuminate. *Inflorescence* arising from near base of pseudobulb, erect, 21–25 cm long; peduncle 12–18 cm long, with several sheaths; rachis 5–8 cm long, 2–5-flowered. *Floral bracts* linear-lanceolate, 28–45 × 4–7 mm, exceeding ovary. *Flowers* scented sepals and petals light pink, labellum creamy with orange-red spots adaxially, glabrous; pedicel and ovary 2.0–2.5 cm long. *Dorsal sepal*, elliptic-lanceolate, 30–35 × 7–8 mm, margin entire, apex acuminate, 7-veined. *Lateral sepals* oblong-lanceolate, 32–35 × 5–6 mm, apex acuminate, 7-veined. *Petals* lanceolate, 23–26 × 8–9 mm, sometimes slightly twisted, apex broadly acuminate or acute, 7–9 veined. *Labellum* not fused to basal

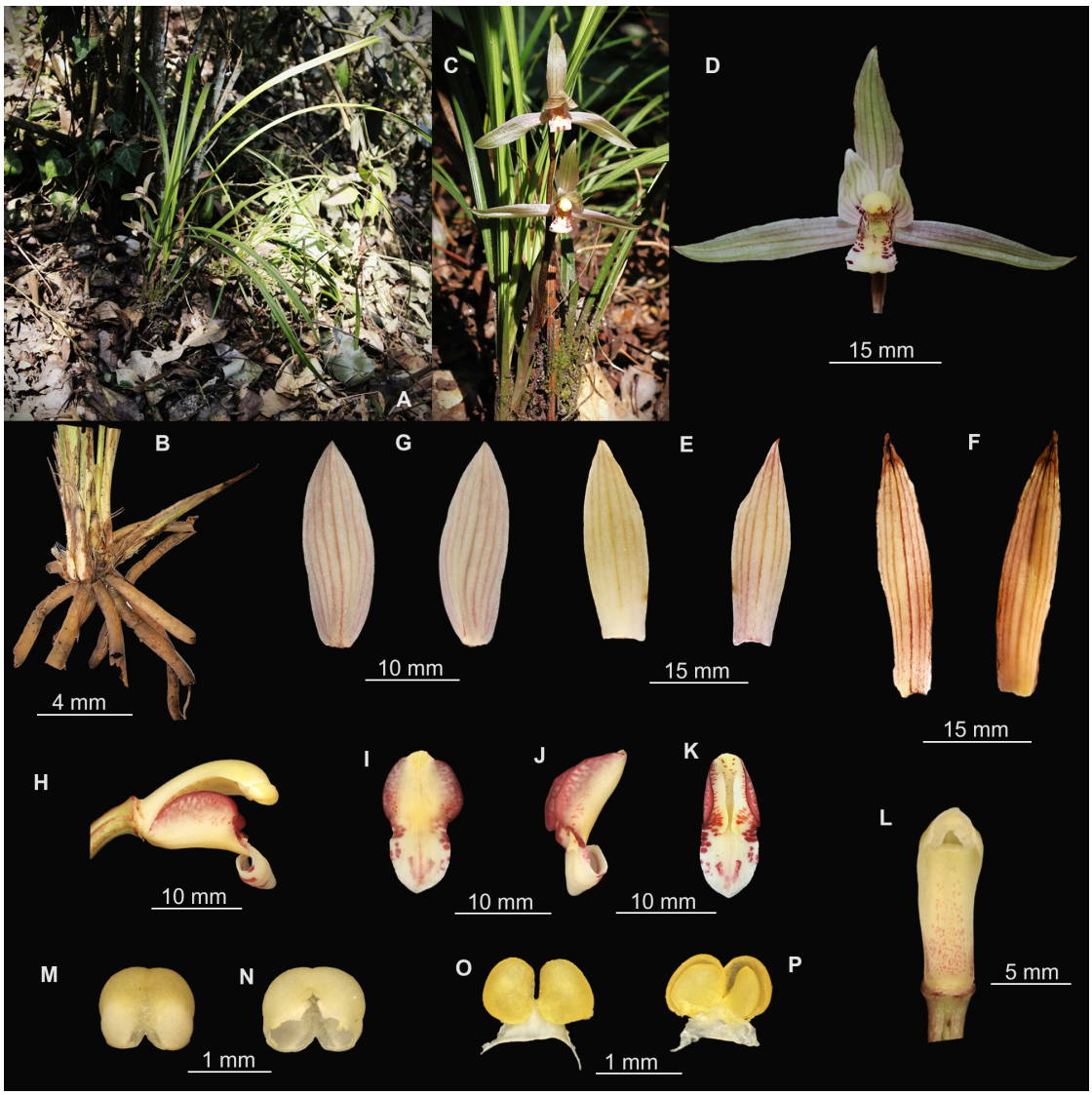

FIGURE 3. *Cymbidium tortisepalum* var. *longibracteatum* (Y.S.Wu & S.C.Chen) S.C.Chen & Z.J.Liu. **A**. Habitat. **B**. Roots. **C**. Inflorescence. **D**. Flower (front view). **E**. Dorsal sepal (abaxial & adaxial view). **F**. Lateral sepals (abaxial & adaxial view). **G**. Petals (abaxial & adaxial view). **H**. Column with labellum and gynoecium attached. **I–K**. Labellum (abaxial, lateral & adaxial view). **L**. Colum (front view). **M** & **N**. Anther cap (abaxial & adaxial view). **O** & **P**. Pollinia (abaxial & adaxial view). Photographs by Kezang Tobgay (A), Kinley Rabgay (C & D) and Phub Gyeltshen (B & E–P). Illustration assembled by Phub Gyeltshen.

margins of column, 3-lobed; mid-lobe broadly ovate or elliptic, 17.0–18.6 × 10–12 mm, recurved in the middle, apex obtuse; lateral lobes small, rounded, incurved; disk with 2 longitudinal callus extending from near the base of lip to the base of mid-lobe. *Column* sub-rectangular and incurved, 13–15 × 3–5 mm, ventrally flat, with minute purplish striations on abaxial surface, apex slightly broadened, with 2 small wings. *Anther cap* suborbicular, 2 × 3 mm, surface colliculate, light yellow. *Pollinia* 4, in 2 pairs, pollinium ovoid, 1.0–1.5 × 1 mm, attached to short and triangular viscidium with elastic caudicles.

Phenology: Flowering occurs from September to November.

Habitat: *Cymbidium tortisepalum* var. *longibracteatum* grows in association with *Cymbidium lancifolium* Hook. in warm broadleaved forests at an elevation of 1920 m.

Distribution: The species is distributed in China and Bhutan (Punakha, Gangtharmo). Fig. 6.

Specimen examined: Bhutan. Punakha District: Talo Gewog, Gangtharmo, 1920 m, 15 March 2024, *P. Gyeltshen, K. Tobgay & K. Rabgay 255* (THIM22866!, THIM22867!).

Notes: *Cymbidium tortisepalum* var. *longibracteatum* is most similar to *Cymbidium cyperifolium* var. *szechuanicum* (Y.S.Wu & S.C.Chen) S.C.Chen & Z.J.Liu but differs in several morphological characteristics. The leaves of *C. tortisepalum* var. *longibracteatum* are not articulate towards the base, whereas those of *C. cyperifolium* var. *szechuanicum* are articulate towards the base. Additionally, the floral bracts of *C. tortisepalum* var. *longibracteatum* exceed the ovary, in contrast to usually exceeding only half the length of the ovary in *C. cyperifolium* var. *szechuanicum*. The sepals and petals of *C. tortisepalum* var. *longibracteatum* are light pink, unlike the dull greenish-yellow or grey-green sepals and petals of *C. cyperifolium* var. *szechuanicum*. It should be noted that *Cymbidium faberi* var. *szechuanicum* is considered a synonym of *C. cyperifolium* var. *szechuanicum* (Chen & Liu 2003)

Galeola cathcartii Hook.f., Fl. Brit. India [J. D. Hooker] 6(17): 89. 1890. *Galeola kerrii* Rolfe ex Downie, Bull. Misc. Inform. Kew 1925(10): 409. 1925. *Galeola siamensis* Rolfe ex Downie, Bull. Misc. Inform. Kew 1925(10): 410. 1925. TYPE: India. Sikkim, icon. *Cathcart s.n.* (holotype: CAL; image of type, K, not seen). Fig. 4.

Plant climbing vine, up to 6 m long. *Stem* fibrous, 0.9–1.5 cm in diameter, rooting at nodes with triangular stem scales, fleshy, 2–3 × 2.0–3.5 cm. *Rhizome* woody; scales ovate to ovate-oblong or triangular scales 2 × 1.5–2.5 cm. *Inflorescence* branching, with branches 16–60 cm long, laxly bearing many flowers, flowering in succession from lowest to the tip, flower buds rusty hairy. *Pedicel and ovary* 1.5–5.0 cm long, rusty hairy. *Floral bracts* fleshy, triangular, 9–12 mm long, apex acute. *Flowers* do not open widely, *ca*. 2.5 cm across, yellow, lip with orange-red veins on sidewalls inside, petals and sepals recurved, apex obtuse, adaxial surface yellow, glaucous, abaxial surface fainted with rusty hairs, petals glaucous. *Floral bracts* triangular, 0.5–1.5 × 0.7–2.5 cm, apex acute. *Dorsal sepal* oblong to oblong-elliptic, *ca*. 20 × 4 mm, apex obtuse. *Lateral sepals*, similar to dorsal sepals, larger, 2.0–2.6 cm long, 0.4–0.6 cm wide. *Petals* oblanceolate, *ca*. 23 × 4 mm, slightly undulate along the upper margin or entire apex obtuse. *Labellum* broadly obovate, 1.6–1.8 × 0.8–1.0 cm, strongly concave, adaxial surface hairy, abaxial surface glabrous, margin irregularly incised and undulate upper half portions, with somewhat rounded or obtuse apex and without short callus near the base. *Column* clavate, 8–10 mm long, nearly straight. *Anther cap* 2 mm wide, reddish-orange. *Pollinia* 2, *ca*. 1 mm long, grooved. *Seed capsules* unknown.

Phenology: Flowering occurs from June to July.

Habitat: In Bhutan, *Galeola cathcartii* is found in the semi-shaded area of warm broadleaved forest at elevations between 1400 and 2000 m. Associated include *Ageratina adenophora* (Spreng.) R.M.King & H.Rob. (Asteraceae), *Acer oblongum* Wall. ex DC. (Sapindaceae), *Casearia glomerata* Roxb. (Salicaceae), *Chloranthus erectus* Sweet (Chloranthaceae), *Daphne sureil* W.W.Sm. & Cave (Thymelaeaceae), *Elatostema lineolatum* Wight, *Elatostema platyphyllum* Wedd. (Urticaceae), *Eriobotrya hookeriana* Decne. (Rosaceae), *Neolitsea cuipala* (D.Don) Kosterm. (Lauraceae), *Oplismenus compositus* (L.) P.Beauv. (Poaceae), *Persicaria chinensis* (L.) H.Gross (Polygonaceae), *Piper betleoides* C.DC., *Piper pedicellatum* C.DC. (Piperaceae), as well as *Blumea* sp. (Asteraceae), *Boehmeria* sp. (Urticaceae), *Diplazium* sp. (Athyriaceae) and *Pteris* sp. (Pteridaceae).

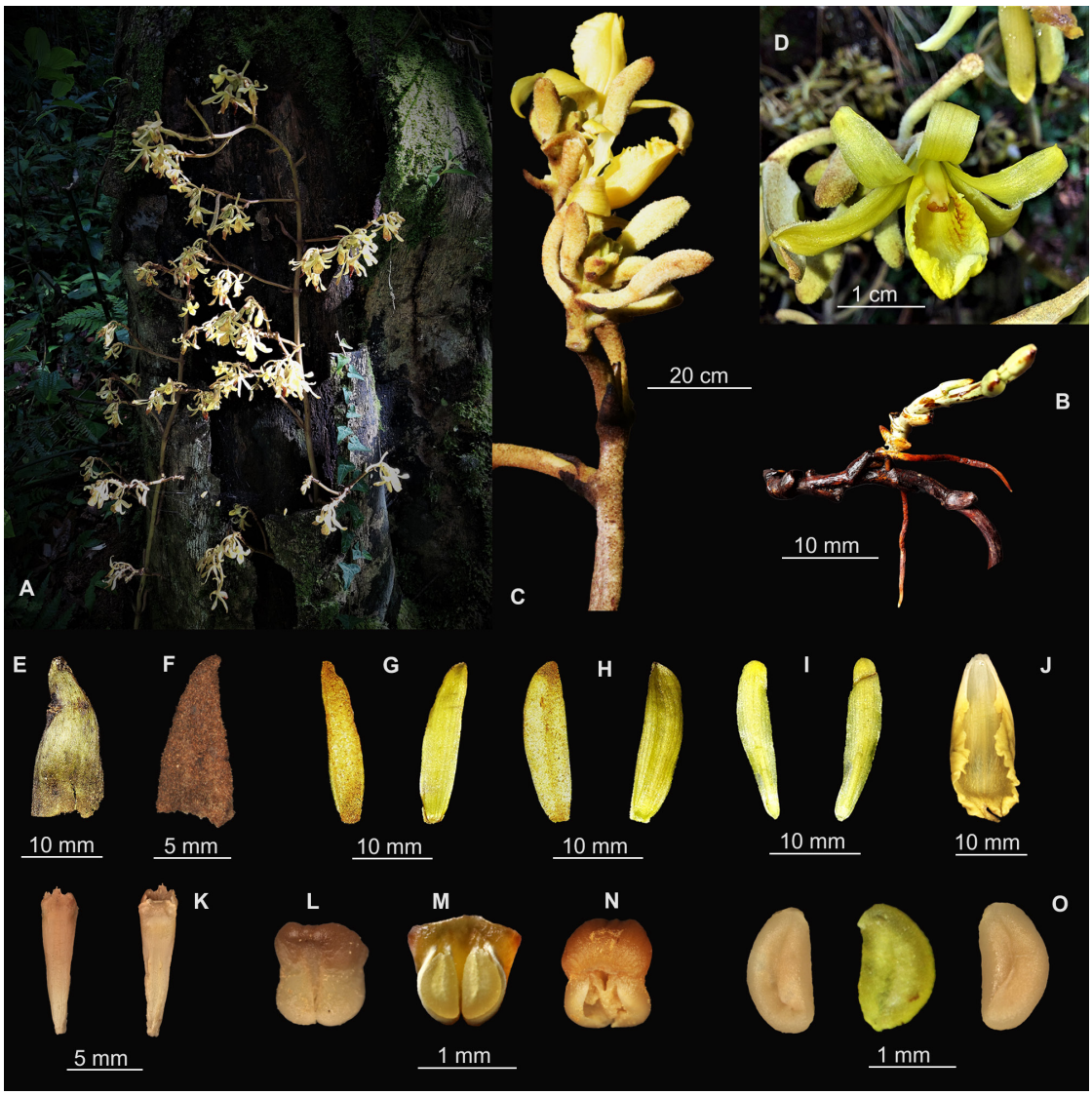

FIGURE 4. *Galeola cathcartii* Hook.f. **A**. Habit. **B**. Rhizome with inflorescence shoot and roots. **C**. Inflorescence. **D**. Flower (front view). **E**. Stem bract (dorsal view). **F**. Floral bracts (Dorsal view). **G**. Dorsal sepal (abaxial and adaxial view). **H**. Lateral sepals (abaxial and adaxial view). **I**. Petals (adaxial view). **J**. Labellum (adaxial view). **K**. Column (Abaxial and adaxial view). **L–N**. Anther cap (abaxial, adaxial with pollinia attached and adaxial view). **O**. Pollinia. Photographs by Phuentsho (A–E, G–J, M, O-middle) and Kezang Tobgay (F, K, L, N & O). Illustration assembled by Phub Gyeltshen.

DISTRIBUTION: *Galeola cathcartii* is distributed in India, Thailand, and Bhutan (Trongsa, Wangling). Fig. 6.

SPECIMEN EXAMINED: Bhutan. Trongsa Distrct: Langthel, Wangling, 1662 m, 20 July 2022, *Phuentsho & P. Namgyal BTN682* (THIM15891!, THIM15892!, THIM15893!, THIM15894!, THIM15895!, THIM15896!, THIM15897!, THIM15898!, THIM15899!).

NOTES: *Galeola cathcartii* is similar to *Galeola nudifolia* Lour. but differs in having oblong sepals (*vs.* lanceolate sepals) and an obovate labellum with a cuneate base (*vs*. suborbicular, cordate).

FIGURE 5. *Liparis kumokiri* F.Maek. **A**. Habitat. **B**. Pseudobulb. **C**. Inflorescence. **D**. Inflorescence (top view). **E** & **F**. Flower (dorsal & lateral view). **G**. Dorsal sepal (Ventral view). **H**. Lateral sepals (dorsal view). **I**. Petals (lateral view). **J**. Labellum (dorsal view). **K**. Column (lateral view). **L**. Anther caps (dorsal and ventral view). **M**. Pollinia (lateral view). Photographs and illustration assembled Phub Gyeltshen.

Liparis kumokiri F.Maek., J. Jap. Bot. 12(2): 95. 1936. *Liparis auriculata* var. *kumokiri* (F.Maek.) M.Hiroe, Orchid Flowers 2: 78 (1971). TYPE: Japan. Hondo: Hitachi Province, Mount Tsukuba, 13 July 1895, *C. Owatari s.n.* (holotype: TI- not seen). Fig. 5.

Plant terrestrial, up to 15 cm tall. *Pseudobulbs* aggregated, ovoid, 2–3 × 2 cm, distally 2-leafed, enclosed several membranaceous sheaths; sheaths ovate-lanceolate, 1–3 cm long, apex shortly subacute. *Leaf* 2; petiole base sheathing, enclosing peduncle, winged, 3–9 cm long; lamina elliptic or ovate-elliptic, 8.5–10.0 × 4.5–5.6 cm, conduplicate, plicate, green, apex obtuse, margin undulate, glabrous. *Inflorescence* terminal, racemose, 5–9 flowered; peduncle slender, 15–18 cm long, green, glabrous. *Floral bracts* trian-

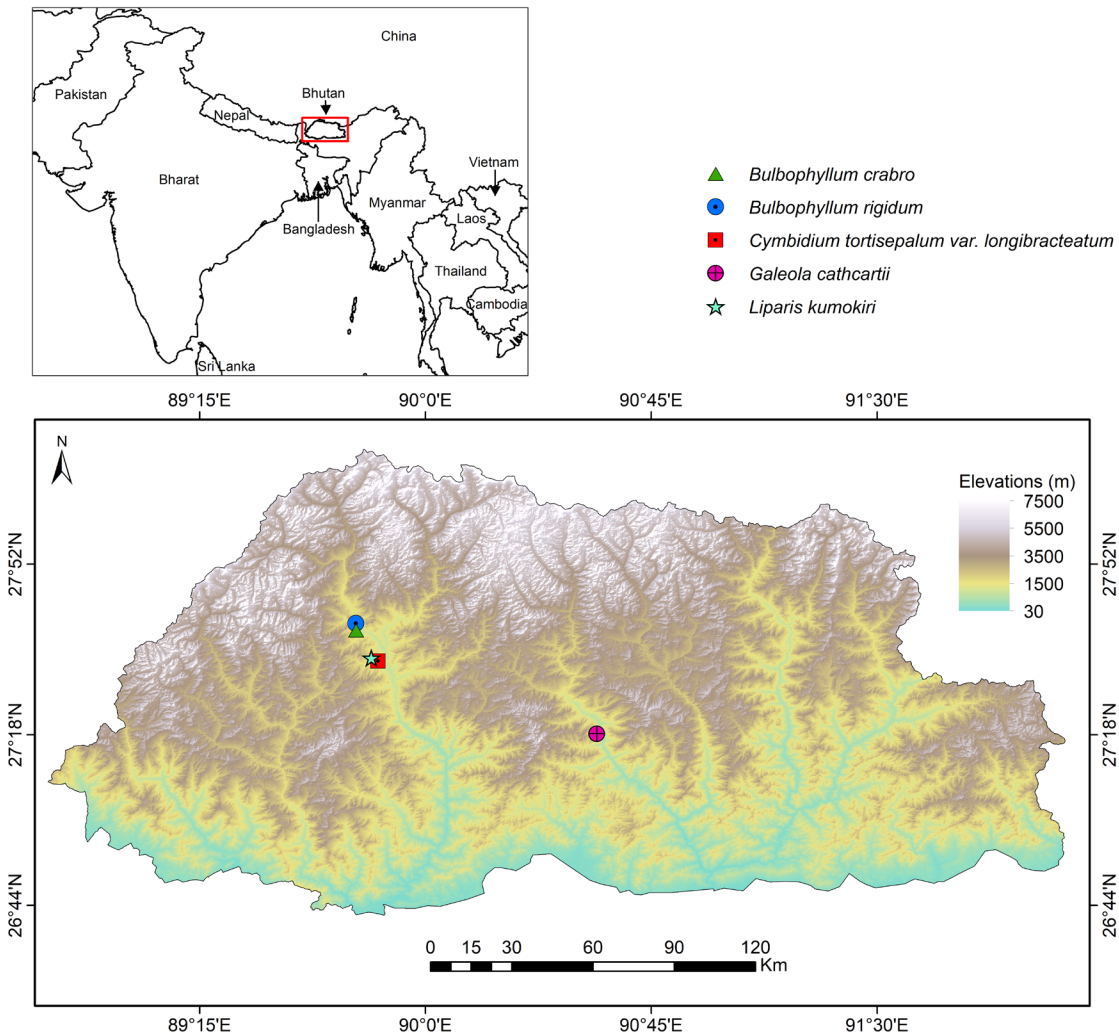

FIGURE 6. Distribution map of *Bulbophyllum crabro*, *Bulbophyllum rigidum, Cymbidium tortisepalum* var. *longibracteatum*, *Galeola cathcartii* and *Liparis kumokiri* in Bhutan. Illustration by Phub Gyeltshen.

gular, *ca.* 2 mm long, apex acute or narrowly acute, green. *Pedicel and ovary* twisted at base, 1.0–1.7 cm long, green. *Flowers* yellowish-green, widely open, labellum green or purple especially in middle. *Dorsal sepal* oblong-lanceolate, *ca.* 10 × 3 mm, apex subacute or obtuse, strongly revolute, yellowish-green. *Lateral sepals* oblong-lanceolate, *ca.* 10 × 3 mm, yellowish-green, slightly oblique, apex subacute, strongly revolute. *Petals* falcate, obscurely oblanceolate when flattened, 9–10 × 1.0–1.5 mm, greenish, apex obtuse, margin strongly revolute, pendulous. *Labellum* obovate, *ca.* 8 × 7 mm, narrowed toward base, apex roundly truncate and mucronate, inconspicuously clawed, strongly recurved from the middle, green. *Column ca.* 5 mm long, incurved, with obtuse wings at apex, much dilated at base, pale-green to white towards the base. *Anther cap* suborbicular, 1.3 × 1.6 mm, 2-celled, cells surrounded by a whitish rim, apex obtuse, not beaked, pale green. *Pollinia* 4 in 2 pairs, ovoid, waxy, yellow. *Seed capsules* clavate, 10–15 × 4–5 mm.

PHENOLOGY: Flowering occurs from June to July, and fruiting from July to September.

Habitat: *Liparis kumokiri* is found in shaded areas of cool broadleaved forests at an elevation of 2400 m.

Distribution: The species is distributed in Russia, Korea, Japan, and Bhutan (Punakha, Pangkarpo) (Fig. 6).

Specimen examined: Punakha District: Talo Gewog, Pangkarpo, 2400 m, 20 June 2022, *P.Gyeltshen & K.Rabgay 136* (THIM22575!).

Notes: *Liparis kumokiri* is most similar to *Liparis cathcartii* Hook.f. but differs by having longer floral bracts *ca.* 2 mm long (*vs*. *ca.* 0.5 mm long), lateral sepals not appressed to lower surface of the labellum (*vs*. appressed to lower surface of the labellum), and a green labellum that is strongly recurved in the middle (*vs.* purple, not curved or slightly curved at the base). It is also similar to *Liparis deflexa* Hook.f. but differs by having an obtuse or subacute leaf apex (*vs.* acuminate) and small erect triangular floral bracts (*vs.* deflexed, lanceolate floral bracts).

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Literature cited

Averyanov, L. V. (2011). The orchids of Vietnam. Illustrated survey. Part 3. Subfamily Epidendroideae (primitive tribes – Neottieae, Vanilleae, Gastrodieae, Nervilieae). *Turczaninowia*, 14(2), 15–100.

Beentje, H. (2024). *The Kew Plant Glossary an illustrated dictionary of plant terms*. 2nd Ed. Royal Botanic Gardens, Kew.

Chaida, L. & Tashi. (2020). *A Pictorial Record of Orchids of Jomotsangkha Wildlife Sanctuary*. Jomotsangkha Wildlife Sanctuary, Department of Forests and Park Services.

Chen, S. C. & Liu, Z. J. (2003). Critical notes on some taxa of *Cymbidium*. *Acta Phytotaxonomica Sinica*, 41(1), 79–84.

Chen, S. C., Liu, Z. J., Zhu, G. H., Lang, K. Y., Tsi, Z. H., Luo, Y. B., Jin, X. H., Cribb, P. J., Wood, J. J., Gale, S. W., Ormerod, P., Vermeulen, J. J., Wood, H. P., Clayton, D. & Bell, A. (2009) Orchidaceae. In: Z. Y. Wu, P. H. Raven & D. Y. Hong (Eds.), *Flora of China*, vol. 25. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis. 570 pp.

Clayton, D. (2017). *Charles Parish—Plant Hunter and Botanical Artist in Burma*. The Ray Society, London, in association with Royal Botanic Gardens, Kew.

Dalstrom, S., Gyeltshen, C. & Gyeltshen, N. (2017). *A Century of New Orchid Records of Bhutan*. Bhutan: National Biodiversity Centre, BICMA.

Dalstrom, S., Gyeltshen, C. & Gyeltshen, N. (2021). *A Century of New Orchid Records of Bhutan*. Bhutan: National Biodiversity Centre, BICMA.

Dechen, U., Wangchuk, T. & Norbu, L. (2020). *Herminium longilobatum* (Orchidaceae), a new record for Bhutan. *Journal of Threatened Taxa*, 12(10), 16396–16398. doi: https://doi.org/10.11609/jott.5887.12.10.16396-16398

Dorji, P., Gyeltshen, P., Tobgay, K., Dorji, S., Dorji, U., Doya, S. K. & Kumar, P. (2023). Additions to the Orchid Flora of Bhutan III: *Paphiopedilum* × *pradhanii. Lankesteriana*, 23(3), 425–432. doi: http://dx.doi.org/10.15517/lank.v23i3.57038

Dorji, S. (2008). *The Field guide to the Orchids of Bhutan*. Thimphu: DSB Publication

Ghalley, B. B., Dalström, S., Sagar, L. & Gurung, M. M. (2022). New Early-Flowering Spotted *Chiloschista* (Aeridinae) from Bhutan. *Lankesteriana*, 22(2), 117–122. doi: http://dx.doi.org/10.15517/lank.v22i2.51751

Gyeltshen, C., Dalström, S., Gyeltshen, N. & Tobgay, K. (2019). A New Spotted *Chiloschista* (Orchidaceae: Aeridinae) from Bhutan. *Lankesteriana*, 19(1), 23—29. doi: http://dx.doi.org/10.15517/lank.v19i1.37030

Gyeltshen, N., Tobgay, K. & Dalström, S. (2017). A New Striking *Spathoglottis* (Orchidaceae: Collabiinae), Honoring Her Majesty The Queen of Bhutan. *Lankesteriana*, 17(3), 395–401. doi: http://dx.doi.org/10.15517/lank.v17i3.31575

Gyeltshen, N., Gyeltshen, C., Tobgay, K., Dalström, S., Gurung, D. B., Gyeltshen, N. & Ghalley, B. B. (2020). Two New Spotted *Chiloschista* Species (Orchidaceae: Aeridinae) from Bhutan. *Lankesteriana*, 20(3), 281–299. doi: http://dx.doi.org/10.15517/lank.v20i3.44149

Gyeltshen, P., Gurung, D. B. & Kumar, P. (2020). *Bulbophyllum trongsaense* (Orchidaceae: Epidendroideae: Dendrobieae), a new species from Bhutan. *Phytotaxa*, 436(1), 085–091. doi: https://doi.org/10.11646/phytotaxa.436.1.9

Gyeltshen, P., Jamtsho, S., Phuntsho, T., Zangpo, P., Gurung, D. B. & Kumar, P. (2021). Additions to Orchid Flora of Bhutan-II. *Taiwania,* 66(3), 415–426. doi: https://doi.org/10.6165/tai.2021.66.415

Gyeltshen, P., Rabgay, K., Tobgay, K., Gyeltshen, C., Sangay, K., Chencho, Tenzin, K., Phuentsho & Kumar, P. (2023). Two New Species of *Bulbophyllum* from Bhutan. *Lankesteriana*, 23(1), 109–120. doi: http://dx.doi.org/10.15517/lank.v23i1.54911

Gurung, D. B. (2006). *An Illustrated Guide to the orchids of Bhutan*. Thimphu, Bhutan: DSB Publication.

Hooker, J.D. (1894). *Flora of British India Volume VI*. London: Missouri Botanical Garden.

IPNI. (2024). *International Plant Names Index*. The Royal Botanic Gardens, Kew, Harvard University Herbaria & Libraries and Australian National Herbarium. Retrieved from http://www.ipni.org [assessed 11 March 2024].

King, G. & Pantling, R. (1898). *The Orchids of Sikkim Himalaya*. Royal Botanic Garden, Calcutta. pp. 90–91.

Lucksom, S. Z. (2007). *The orchids of Sikkim and Northeast Himalaya*. Sikkim, India: S.Z.Lucksom.

Maekawa, F. (1936). Studia Monocotyledonearum Japonicarum (VI). *Journal of Japanese Botany*, 12(2), 95.

Pearce, N. R. & Cribb, P. J. (2002). *The orchids of Bhutan*. Volume 3, Part 3. Royal Botanic Garden Edinburgh, Kew and Royal Government of Bhutan.

Rabgay, K. & Kumar, P. (2019). *Crepidium aphyllum* (Orchidaceae), a new record from Bhutan. *Journal of Threatened Taxa*, 11(14), 14914–14916. doi: https://doi.org/10.11609/jott.5017.11.14.14914-14916

Rabgay, K., Qazi, S., Nidup, T., Gurung, D. B., Penjor, L., Lhendup, S. & Kumar, P. (2021). Additions to Orchid Flora of Bhutan-I. *Taiwania,* 66(3), 408–414. doi: https://doi.org/10.6165/tai.2021.66.408

Seidenfaden, G. (1986). *Orchid Genera in Thailand XIII*. Thirty-three epidendroid Genera. *Opera Botanica*, 89, 169–170.

Shankar, U. (2021). Lectotypification and recollection of *Bulbophyllum crabro* in Meghalaya after 125 years. *Rheedea*, 31(3), 211–217. doi: https://dx.doi.org/10.22244/rheedea.2021.31.03.13

Tobgay, S., Nidup, T., Dalström, S., Tobgay (A), S., Tobgay (B), S. & Tshering, D. (2024). Orchids of Bhutan: *Cyrtosia javanica*, a new orchid record for Bhutan. *Orchids (The Bulletin of the American Orchid Society)*, 93(1), 31–35.

Tetsana, N., Sridith, K., Watthana, S. & Pedersen, H. E. (2019). A taxonomic revision of *Liparis* (Orchidaceae: Epidendroideae: Malaxideae) in Thailand. *Phytotaxa*, 421(1), 1–65. doi: https://doi.org/10.11646/phytotaxa.421.1.1

Vermeulen, J. J. (2014). Artificial key to the Asian sections of *Bulbophyllum*. In: A. M. Pridgeon, P. J. Cribb, M. W. Chase & F. N. Rasmussen (eds.), *Genera Orchidacearum, vol. 6 Epidendroideae (Part three)*. UK: Oxford University Press.

Vermeulen, J. J., Fischer, G., Smidt, E. de C., Stern, W. L., Pridgeon, A. M., Veitch, C., Sieder, A., van Vugt, R. & Gravendeel, B. (2014). *Bulbophyllum*. In: A. M. Pridgeon, P. J. Cribb, M. W. Chase & F. N. Ramussen (eds.), *Genera Orchidacearum vol. 6, Epidendroideae (Part three)*. UK: Oxford University Press.

Zangpo, P., Gyeltshen, P. & Kumar, P. (2021). *Bulbophyllum spathulatum* (Orchidaceae), a new record for Bhutan. *Journal of Threatened Taxa*, 13(1), 17592–17596. doi: https://doi.org/10.11609/jott.6393.13.1.17592-17596