

A review of the *Calanthe* group (Orchidaceae) in Myanmar

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ABSTRACT

A review of the *Calanthe* group in Myanmar is presented, comprising the representatives of the genera *Calanthe*, *Cephalantheropsis* and *Phaius*. Currently there are 28 *Calanthe* species, 2 *Cephalantheropsis* species and 6 *Phaius* species known in the country. An identification key to the species, short descriptions as well as brief notes on distribution and ecology are given, and colour photographs of several species are also provided. *Calanthe lamellosa* is newly reported for Myanmar.

KEYWORDS: Orchidaceae, *Calanthe*, *Cephalantheropsis*, *Phaius*, taxonomic review.

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INTRODUCTION

The orchid flora of Myanmar is among the most poorly known on the Asian continent, which is largely a consequence of the past political situation in the country and the remoteness of many areas. The vast size of Myanmar and the many different habitat types, ranging from tropical rainforests in the south to alpine conditions in the ‘Myanmar Himalayas’ in the far north, have resulted in a remarkable diversity in this plant group. More than 940 orchid species have been recorded in the country (according to an unpublished checklist draft; Ormerod, Kurzweil & Watthana, in prep.), and it can be expected that a number of new discoveries will be made in the course of future botanical inventory work, both species new to science and new records of species known from other countries. Biodiversity studies based on field-work, undertaken by both Myanmar botanists and foreign nationals, are now increasing and will eventually form the basis for the new project ‘Flora of Myanmar’.

In the present review we provide a complete list of species in the *Calanthe* group which are found in Myanmar. The *Calanthe* group, comprising the genera *Calanthe* R.Br., *Cephalantheropsis* Guillaumin and *Phaius* Lour. as well as *Gastrorchis* Schltr. (which does not occur in Asia) is a well-defined group of orchids in tribe Collabieae of subfam. Epidendroideae

(Pridgeon *et al.*, 2005), characterised by plicate leaves; simple, free and spreading sepals and petals; a tendency towards the fusion of the lip base and the column; and eight waxy pollinia in two groups of four. Molecular studies have been undertaken in order to try and clarify the phylogeny of the group, and these have shown that *Calanthe* is not monophyletic as both *Cephalantheropsis* and *Phaius* are nested in it (Yukawa, 2013; Xiang *et al.*, 2014; Zhai *et al.*, 2014). *Preptanthe* Rchb.f. and *Styloglossum* Breda, two of the lineages of the traditional *Calanthe*, were treated as separate genera by Yukawa & Cribb (2014) and Kurzweil & Cribb (2016). However, we suggest that the recognition of these genera, though in line with the available molecular evidence, appears premature as more research needs to be done to resolve the phylogeny satisfactorily. In the meantime, we are here treating the genera *Calanthe*, *Cephalantheropsis* and *Phaius* in their traditional delimitation.

The species of the *Calanthe* group are rather uncommon plants seldom encountered by collectors, and in Myanmar the number of the available collections is therefore generally low. All Myanmar specimens held in the herbaria AMES, BM, E, K, MBK, NY, RAF, TNS, SING and W are cited, and almost all of these have been seen by us. A few literature reports are also included, namely citations

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in: chapter 'An enumeration of Burmese orchids' in Parish, 1883 (vouchered list); Saw Lwin, 2003 (illustrated guide); Saw Lwin, 2007 (partly illustrated article); Kress *et al.*, 2003 (unvouchered checklist); Nyan Tun, 2014 (pictorial book); and Tanaka *et al.*, 2015 (vouchered checklist). Detailed localities are here not given for conservation reasons. We provide

short descriptions based on our own measurements and the floristic literature of surrounding countries (particularly Pearce & Cribb, 2002; Chen *et al.*, 2009; Kurzweil, 2014). Habitat information given on herbarium labels is often scanty, and the ecological and elevation information is therefore often also obtained from flora treatments of surrounding areas.

TAXONOMIC TREATMENT

KEY TO THE GENERA OF THE *CALANTHE* GROUP

1. Stems with prominent swollen pseudobulbs; leaves annual, jointed; flowering stems and sepals with long and soft hairs
Calanthe in part (subgenus *Preptanthe*), p. 197
1. Stems pseudobulbous or cane-like; pseudobulbs, if present, inconspicuous and largely obscured by the bases of the foliage leaves; leaves evergreen, not jointed; flowering stems either glabrous or with short hairs
2. Column extensively fused with the lip base, usually this fusion involves the entire column up to the anther-stigma-complex, very rarely the lip base is only fused with the basal one or two thirds of the column and the upper portion is free (*Calanthe clavata*, *C. densiflora*, *C. biloba*); stems always pseudobulbous, pseudobulbs adjacent or rarely spaced on a creeping rhizome
Calanthe in part, p. 197
2. Column not or only basally fused with the lip base
3. Lip spurred; stems either pseudobulbous or cane-like; flowers large
Phaius, p. 217
3. Lip not spurred or saccate; stems cane-like; flowers medium-sized
Cephalantheropsis, p. 215

CALANTHE

R.Br., Bot. Reg. 7: t. 573 [as 578]. 1821, **nom. cons.**; Hook.f., Fl. Brit. India 5: 847. 1890; Holttum, Orch. Malaya: 146. 1953; Seidenfaden, Dansk Bot. Ark. 29(2): 9. 1975; Seidenfaden, Opera Bot. 114: 88. 1992; Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 163. 1992; Pearce & Cribb, Orch. Bhutan: 281. 2002; Pridgeon *et al.* (eds), Gen. Orchid. 4: 122. 2005; Chen *et al.*, Fl. China 25: 292. 2009; Kurzweil, Adansonia, sér. 3, 32: 61. 2010; Barretto *et al.*, Wild Orch. Hong Kong: 435. 2011; Kurzweil in Fl. Thailand: 341. 2014. Type species: *Calanthe veratrifolia* R.Br. ex Ker Gawl., **nom. superfl.** (= *Calanthe triplicata* (Willemet) Ames).

— *Alismorkis* Thouars, Nouv. Bull. Sci. Soc. Philom. Paris 19: 318. 1809, **nom. rej.** pro *Calanthe* R.Br.

— *Amblyglottis* Blume, Bijdr. Fl. Ned. Ind.: 369. 1825. Type species not designated.

— *Styloglossum* Breda, Gen. Sp. Orchid. Asclep. 2: t. 7. 1829. Type species: *Styloglossum nervosum* Breda (= *Calanthe pulchra* (Blume) Lindl.).

— *Preptanthe* Rchb.f., Fl. Serres Jard. Eur. 8: 245. 1853. Type species: *Preptanthe vestita* (Wall. ex Lindl.) Rchb.f. (= *Calanthe vestita* Wall. ex Lindl.).

Plants mostly terrestrial, rarely lithophytic or epiphytic, 12–80(–150) cm tall, deciduous or evergreen.

Stems pseudobulbous, adjacent or rarely spaced at intervals on a creeping rhizome. *Pseudobulbs* either insignificant and largely obscured by the bases of the leaves, or less commonly large and swollen. *Leaves* perennial or deciduous, few, plicate, variously lanceolate, petiolate, glabrous or hairy. *Inflorescences* arising from a basal leaf axil, erect, sometimes apically nodding, few- to many-flowered, unbranched, glabrous or pubescent; floral bracts persistent or caducous, glabrous or hairy. *Flowers* small, medium-sized or large, resupinate, mostly opening widely, usually white, yellow or pink, often turning dark blue after damage or while senescing; ovary usually indistinguishable from the pedicel, glabrous or hairy. *Sepals* free, subsimilar, often hairy on the outside. *Petals* similar to the sepals but almost always glabrous. *Lip* unlobed, two-lobed or three-lobed, most commonly united with the column base, spurred or not, free part normally glabrous but base (which is united with the column) often hairy on the outside; mid-lobe often bilobulate or apically emarginate; disk usually with papillate or lamellate ornaments. *Column* usually short and thick, without or rarely with column-foot, glabrous or rarely hairy; anther incumbent, with 8 waxy clavate pollinia; rostellum lobed or unlobed; stigma in a cavity below the rostellum.

A large genus of about 200 species found primarily in Asia, northern Australia and the Pacific

Ocean islands. In addition, several species occur in Africa and Madagascar, and one in central America. Twenty-eight species are found in Myanmar.

Notes.— Traditionally characterised by the

extensive fusion of the lip base to the column. However, there are exceptions as this fusion is absent in a few species (*Calanthe labrosa* and related species).

KEY TO *CALANTHE* SPECIES

1. Stems with prominently swollen ovoid or conical pseudobulbs; leaves annual, jointed; flowering stems and sepals with long and soft hairs (subgen. *Preptanthe*)
 2. Lip unlobed
 3. Flowers medium-sized, median sepal 10–14 mm long; column with a distinct foot **2. *C. labrosa***
 3. Flowers large, median sepal longer than 16 mm; column without a distinct foot, lip base rolled around the column **4. *C. rosea***
 2. Lip 3-lobed
 4. Column-foot absent; lip extensively fused with the column **5. *C. vestita***
 4. Column-foot distinct; lip not fused with the column
 5. Flowers with green sepals and petals, and a whitish lip with pink flush; petals and lip side lobes with red dots; petals pointing straight up **3. *C. punctata***
 5. Flowers pink to lilac or white with red dots, lip with red markings; petals not like this **1. *C. cardioglossa***
1. Pseudobulbs not prominently swollen, largely hidden by the bases of the foliage leaves; leaves perennial, not jointed; stems and sepals either glabrous or short-hairy (subgen. *Calanthe*)
 6. Floral bracts caducous (sect. *Styloglossum*)
 7. Pseudobulbs adjacent; flowers small, sepals and petals 6–11.5 mm long; lip spur under 6 mm long **8. *C. lyroglossa***
 7. Pseudobulbs spaced on an elongate rhizome, intervals 3 cm or more; flowers larger, sepals and petals 9–16 mm long; lip spurs longer than 8 mm
 8. Inflorescence cylindric, rachis usually 10 cm long or longer, peduncle 20 cm or longer; lip spur clavate **6. *C. clavata***
 8. Inflorescence globose, rachis to 5 cm long, peduncle under 20 cm long; lip spur usually cylindric **7. *C. densiflora***
 6. Floral bracts persistent
 9. Lip spur absent
 10. Lip with 3–5 prominent keels on the disk; flowers with green sepals and petals, and orange-red to brown lip **25. *C. tricarinata***
 10. Lip without lamellae, keels or calli on the disk; flowers lavender, mauve or lilac **23. *C. puberula***
 9. Lip spurred
 11. Lip unlobed
 12. Lip margins fimbriate **10. *C. alpina***
 12. Lip margins not fimbriate
 13. Floral bracts narrowly lanceolate to linear, sharply deflexed; sepals reflexed; column puberulent **28. *C. whiteana***
 13. Floral bracts ovate-lanceolate, not deflexed; sepals not reflexed; column densely hirsute **24. *C. simplex***
 11. Lip 2- or 3-lobed
 14. Lip 2-lobed **12. *C. biloba***
 14. Lip 3-lobed
 15. Lip calli wart-like
 16. Lip spur pointing upwards, 30–52 mm long **14. *C. ceciliae***
 16. Lip spur not like this
 17. Lip mid-lobe usually flabellate to reniform, emarginate; lip spur 21–50 mm long **21. *C. masuca***
 17. Lip mid-lobe distinctly bilobulate; lip spur normally shorter than 30 mm
 18. Sepals and petals green, lip white **17. *C. herbacea***
 18. Flowers white
 19. Pedicel and ovary 10–20 mm long; lip side lobes subrhombic, 5–6 mm wide **9. *C. alismifolia***
 19. Pedicel and ovary 29–60 mm long; lip side lobes oblong **27. *C. triplicata***
 15. Lip calli as keels, lamellae or ridges
 20. Lip spur cylindric, 17–30 mm long **22. *C. plantaginea***
 20. Lip spur cylindric or conical, under 7 mm long
 21. Flowers small, brown or green; sepals 6–9 mm long **20. *C. mannii***
 21. Flowers larger; sepals longer than 10 mm
 22. Lip side lobes broader than mid-lobe **26. *C. trifida***
 22. Lip side lobes narrower than mid-lobe
 23. Lip callus confined to the lip disk, no callus on the mid-lobe; leaves 0.7–3 cm wide **11. *C. arcuata***
 23. Lip callus extending to, or only developed, on the mid-lobe; leaves mostly wider
 24. Lip callus very indistinct; lip mid-lobe with a prominent basal claw 3.5–4 mm long; spur 4–6 mm long **18. *C. kermodei***
 24. Not this combination of characters
 25. Lip mid-lobe with a single lamella-like keel **15. *C. griffithii***
 25. Lip mid-lobe with three keels

26. Flowers large, yellowish brown; sepals 25–35 mm long

26. Flowers smaller; sepals 15–23 mm long

27. Flowers red to purple with pale markings; lip mid-lobe with three keels

27. Sepals and petals white or light green, lip white and purple with a prominent yellow callus made up of three high lamellae

16. *C. hancockii*

13. *C. brevicornu*

19. *C. lamellosa*

1. *Calanthe cardioglossa* Schltr., Repert. Spec. Nov. Regni Veg. 2: 85. 1906; Seidenfaden, Dansk Bot. Ark. 29(2): 35, fig. 12, pl. VI. 1975; Seidenfaden, Opera Bot. 114: 89. 1992; Kurzweil, Adansonia, sér. 3, 32: 69, fig. 3. 2010; Clayton & Cribb, Gen. *Calanthe*: 35, figs. 9.1 & 10, pl. 1A–B. 2013; Kurzweil in Fl. Thailand: 348, fig. 193, pl. XXVII: 4. 2014.—*Preptanthe cardioglossa* (Schltr.) T. Yukawa & P.J. Cribb, Bull. Natl. Mus. Nat. Sci., Tokyo, ser. B, 40: 146. 2014. Type: Thailand, Chiang Mai Province, Doi Suthep, 1,500 m, 14 Dec. 1904, *Hosseus* 249 (lectotype **M!**, designated here; isolectotypes **P!**, **K!**). Fig. 1A.

—*Calanthe succedanea* Gagnep., Bull. Mus. Natl. Hist. Nat., sér. 2, 3: 324. 1931; Seidenfaden, Dansk Bot. Ark. 29(2): 32, fig. 11, pl. VI. 1975.—*Preptanthe succedanea* (Gagnep.) T. Yukawa & P.J. Cribb, Bull. Natl. Mus. Nat. Sci., Tokyo, ser. B, 40: 146. 2014. Types: Laos, Bassac, *Thorel* 2629 (syntype **P!**); Cambodia, Kompot, *Geoffray* 354 (syntype **P!**).

Terrestrial, lithophytic or very rarely epiphytic plants, 30–70 cm tall. *Pseudobulbs* prominent, to 8.5 by 3 cm. *Leaves* (1–)2–4, deciduous, blade lanceolate-oblong, acute or acuminate, 22–47 by 4–7 cm, glabrous; petioles short. *Inflorescences* from the base of the plant, erect, softly pubescent, nodding; racemes mostly 5–15 cm long, flowers 5 to 20, subdensely or laxly arranged; bracts persistent, ovate-lanceolate, acute or acuminate, usually 9–20 by 5–8 mm long, long- and soft-hairy. *Flowers* pink to lilac or white with red dots, lip with red markings, flowers turning orange when old; pedicel and ovary 23–50 mm long, softly pubescent. *Sepals* ovate-lanceolate, acuminate, 9–14 by 3–8 mm, softly pubescent. *Petals* ovate-elliptic, obtuse, 9.3–14 by 2.9–4.5 mm, glabrous. *Lip* 3-lobed, 9–15 by 13–22 mm, attached to the end of the column-foot but not united with the sides of the column; side lobes ovate-oblong or ovate, obtuse; mid-lobe flabellate, obtuse, truncate or emarginate; callus as 3 fleshy keels in the proximal lip portion, the middle one continuing onto the lip blade as an obscure ridge or a lamella; spur cylindric, 15–25 mm long, hairy. *Column* 3–5 mm long, subglabrous or pubescent, with a prominent

column-foot. *Capsule* ellipsoid, to 20 by 8 mm.

Myanmar.—Shan State [Taunggyi District, *vide* Nyan Tun, 2014: 84].

Distribution.—E Myanmar, Thailand, Laos, Vietnam and Cambodia.

Ecology and phenology.—The habitat has not been recorded in Myanmar, but elsewhere this species is found in evergreen and deciduous forest, often in rather dry conditions; at 300–1,700 m elev. Flowering in Myanmar has been recorded from December to February.

Notes.—The type specimen at M could be the holotype, as suggested by a hand-written note “Original” on this sheet. However, in the protologue Schlechter gave no indication that he studied Munich specimens (Schlechter, 1906: 85). Because of the ambiguity we prefer to choose this specimen as the lectotype. In this species there is considerable variation in flower colour, and the shape of the lip midlobe and its keel.

We consider *Calanthe succedanea* a form of *C. cardioglossa*. Seidenfaden (1975: 32) originally regarded the keel on the lip midlobe of *C. succedanea* a character to distinguish between the two species. However, after studying a large number of collections of the two species we find that the keel on the lip midlobe is variable in *C. succedanea*, ranging from a thickened midvein to a prominent lamella.

2. *Calanthe labrosa* (Rchb.f.) Hook.f., Fl. Brit. India 5: 856. 1890; Seidenfaden, Dansk Bot. Ark. 29(2): 41, fig. 15. 1975; Chen *et al.*, Fl. China 25: 309. 2009; Kurzweil, Adansonia, sér. 3, 32: 72. 2010; Clayton & Cribb, Gen. *Calanthe*: 38, fig. 9.4. 2013; Kurzweil in Fl. Thailand: 356, fig. 198, pl. XXVIII: 3. 2014.—*Limatodis labrosa* Rchb.f., Gard. Chron., n.s., 11: 202. 1879.—*Alismorkis labrosa* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 650. 1891.—*Preptanthe labrosa* (Rchb.f.) T. Yukawa & P.J. Cribb, Bull. Natl. Mus. Nat. Sci., Tokyo, ser. B, 40: 146. 2014. Type: Myanmar, Mon State, Mawlamyine, Jan. 1879, *Veitch's collector* s.n. (holotype **W!**, drawing).

Terrestrial, lithophytic or very rarely epiphytic plants, 25–30 cm tall. *Pseudobulbs* prominent, ovoid, 2–8 by 1.5–4 cm. *Leaves* 2 or 3, deciduous in the dry season, fully developed during flowering, blade lanceolate-oblong, acute or acuminate, 15–34 by 8.9–10.4 cm, glabrous; petioles 10–12 cm long. *Inflorescences* from the base of the plant, erect but apically nodding, softly long-pubescent; racemes 8–10 cm long, flowers 3 to 10, laxly arranged; bracts persistent, ovate-lanceolate, acuminate, 10–20 by 7–14.2 mm, softly pubescent. *Flowers* whitish pink or violet, lip often with pink dots, becoming yellow at age; pedicel and ovary 22–30 mm long, softly pubescent. *Sepals* ovate-lanceolate, acuminate, 10–14 by 4–6.8 mm, softly pubescent. *Petals* ovate-elliptic, subacute, 11–15 by 4.5–5.5 mm, glabrous. *Lip* unlobed, flabellate or triangular, 11–15 by 12–20 mm, attached to the end of the column-foot but not united with the sides of the column; callus as 3 fleshy keels; spur cylindric, 22–29 mm long, densely villous. *Column* 4–6.5 mm long, glandular-hairy or glabrous; column-foot 3–3.5 mm long; rostellum 2-lobed.

Myanmar.— Sagaing Region [Patkai Range, 2017, *JRA27951* (NY!)]. Shan State [Taunggyi District, *vide* Nyan Tun, 2014: 90, as *Calanthe succedanea* Gagnep.]. Mon State [Mawlamyine District, Jan. 1879, *Veitch's collector s.n.* (W!); same locality, 1889, *Veitch s.n.* (K!); same locality, *Alsterlund 383* (C!)].

Distribution.— NW, E and S Myanmar, Thailand and SW China.

Ecology and phenology.— Found in deciduous and evergreen broad-leaved forest; at 800–1,950 m elev. Flowering in Myanmar has been recorded from November to January.

Notes.— There are also unverified reports from Tanintharyi Region (Kress *et al.*, 2003: 68).

3. *Calanthe punctata* Kurzweil, Gard. Bull. Singapore 65: 163. 2013.— *Preptanthe punctata* (Kurzweil) T.Yukawa & P.J.Cribb, Bull. Natl. Mus. Nat. Sci., Tokyo, ser. B, 40: 146. 2014. Type: Myanmar, Tanintharyi Region, Dawei District, 700 m, 22 Nov. 2012, *Saw Lwin et al. TNRO 153* (holotype SING!; isotype Myanmar Floriculturist Association!).

Terrestrial or lithophytic plants, 24–43 cm tall. *Pseudobulbs* prominent, ovoid or conical, 5.4–13.5 by 2.5–3.8 cm. *Leaves* deciduous, not present at the

flowering time, apparently 4, lanceolate-oblong, acute or acuminate, 24–29 by 6.9–9.6 cm; petioles 2–3 cm long, forming a pseudostem. *Inflorescences* from the base of the pseudobulb, erect, apically nodding, softly pubescent; racemes with 3 to 7 laxly arranged flowers; bracts persistent, ovate-lanceolate, long-acuminate, ca 15 by 8 mm, softly pubescent. *Flowers* with green sepals and petals, and whitish lip with pink flush, petals and lip side lobes with red dots; pedicel and ovary 28–32 mm long, softly pubescent. *Sepals* ovate-lanceolate, acuminate, softly pubescent, reflexed; median sepal 9–10 by 4.9–5.4 mm; lateral sepals 9.5–10 by 5.2–6 mm. *Petals* ovate-elliptic, acute or subacute, 12.5–14 by 4.4–5.1 mm, pointing straight up, glabrous. *Lip* 3-lobed, 10–11.5 by 12.8–14 mm, attached to the column-foot but not united with the sides of the column; side lobes oblong, obtuse; mid-lobe ovate, obtuse; callus as 3 obscure ridges; spur cylindric, 15–16 mm long, softly pubescent. *Column* 3–3.5 mm long, glabrous; column-foot prominent, 2–3 mm long.

Myanmar.— Tanintharyi Region [Dawei District, 700 m, 22 Nov. 2012, *Saw Lwin et al. TNRO 153* (SING!, Myanmar Floriculturist Association!)]. Without locality [cult. *RBG Kew s.n.* (leg. *Rule 5358*), spirit coll. 29390.000 (K!)].

Distribution.— Endemic.

Ecology and phenology.— Found on rocks in forest; ca 700 m elev. Flowering occurs in November.

4. *Calanthe rosea* (Lindl.) Benth. ex Hook.f., Fl. Brit. Ind. 5: 856. 1890; Seidenfaden, Dansk Bot. Ark. 29(2): 39, fig. 14. 1975; Kurzweil, Adansonia, sér. 3, 32: 73, fig. 4. 2010; Clayton & Cribb, Gen. *Calanthe*: 40, fig. 9.6, pl. 2A. 2013; Kurzweil in Fl. Thailand: 366, fig. 204, pl. XXIX: 1. 2014.— *Limatodis rosea* Lindl., Paxton's Fl. Gard. 3: 35. 1852.— *Alismorkis rosea* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891.— *Preptanthe rosea* (Lindl.) T.Yukawa & P.J.Cribb, Bull. Natl. Mus. Nat. Sci., Tokyo, ser. B, 40: 146. 2014. Type: Myanmar, Mon State, Mawlamyine District, *Lobb s.n.* (holotype K-LINDL!). Fig. 1B.

Lithophytic or rarely epiphytic plants, 22–66 cm tall. *Pseudobulbs* prominent, ovoid or oblong, 2.4–14 by 1–3.5 cm. *Leaves* 4, deciduous, blade elliptic-oblong, acute, to 38 by 11 cm but often much smaller, glabrous; petioles 3.5–6 cm long. *Inflorescences* from the base of the pseudobulb,

erect, softly pubescent; racemes 10–20 cm long, flowers 5 to many, subdensely or laxly arranged; bracts persistent, ovate-lanceolate, acuminate, 12–25 mm long, softly pubescent. *Flowers* pink, lip with white base; pedicel and ovary 20–29 mm long. *Sepals* softly pubescent: Median sepal ovate-lanceolate, acute, 16–30 by 6–8 mm, softly pubescent; lateral sepals similar, 17–30 by 4.5–7 mm. *Petals* obovate-elliptic, acuminate, 17–30 by 5.3–9 mm, largely glabrous. *Lip* unlobed, rounded-rectangular, emarginate, 18–35 by 11–16 mm, base not united with the column; no prominent callus present; spur cylindric, 11–16 mm long, softly pubescent. *Column* 4–6 mm long, pubescent.

Myanmar.— Mon State [Thaton District, 2007 or 2008, *Saw Lwin SL s.n.*, photographic record; Mawlamyine District, *Lobb s.n.* (**K-LINDL!**); same locality, *Hundley s.n.* (**K!**); ? same locality, *Parish II* (not located), *fide* Parish, 1883: 196, as *Limatodis rosea*].

Distribution.— S Myanmar, Thailand and Philippines.

Ecology and phenology.— The habitat in Myanmar has not been recorded, but in neighbouring Thailand the species is found on rocks in forest; at 200–900 m elev. In Thailand flowering occurs mainly in December and January.

Notes.— There are also unverified reports from Tanintharyi Region (Kress *et al.*, 2003: 68).

5. *Calanthe vestita* Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 250. 1833; Hook.f., Fl. Brit. India 5: 852. 1890; Holttum, Orch. Malaya: 149. 1953; Seidenfaden, Dansk Bot. Ark. 29(2): 26, fig. 9, pl. IV. 1975; Seidenfaden, Opera Bot. 114: 89. 1992; Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 165, fig. 71a–b, pl. 9a. 1992; Pridgeon *et al.* (eds), Gen. Orchid. 4: fig. 264.2. 2005; Kurzweil, Adansonia, sér. 3, 32: 63. 2010; Clayton & Cribb, Gen. *Calanthe*: 42, figs. 9.10 & 12, pl. 3A–F. 2013; Kurzweil in Fl. Thailand: 375, fig. 210, pl. XXIX: 4. 2014.— *Preptanthe vestita* (Wall. ex Lindl.) Rchb.f., Fl. Serres Jard. Eur. 8: 245. 1853; Kurzweil & Cribb, Males. Orchid J. 17: 66, figs. 4–5. 2016.— *Phaius vestitus* (Wall. ex Lindl.) Rchb.f., Gard. Chron. 1867: 264. 1867.— *Alismorkis vestita* (Wall. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: Myanmar, Tanintharyi Region, Dawei District, 1827, *Gomez 1176* in Wall. Cat. 7345 (holotype **K-W!**). Fig. 1C.

— *Cytheris griffithii* Wight, Icon. Pl. Ind. Orient. 5(1): 21, t. 1751–1752. 1851. Type: Myanmar, Tanintharyi Region, Myeik District, *Griffith s.n.* (holotype **K!**).

— *Calanthe vestita* Wall. ex Lindl. var. *rubra-oculta* B.S. Williams, Orch.-Grow. Man., ed. 2: 65. 1862. Type: Myanmar, Mon State, Mawlamyine District, *without collector s.n.* (not found).

— *Calanthe vestita* Wall. ex Lindl. var. *luteo-oculata* H.J. Veitch ex B.S. Williams, Orch.-Grow. Man., ed. 4: 106. 1871. Type: Myanmar, Mon State, Mawlamyine District, cult. *Williams s.n.* (not found).

Epiphytic, lithophytic or rarely terrestrial plants, 43–100 cm tall. *Pseudobulbs* prominent, ovoid or conical, to 12.5 by 2.5 cm. *Leaves* 2–4, deciduous, mostly appearing after flowering, blade elliptic-lanceolate, acute or acuminate, to 45 by 12 cm, glabrous; petioles 4–5 cm long. *Inflorescences* from the pseudobulb base, erect, nodding, softly pubescent; racemes to 40 cm long, flowers 5–20, laxly arranged; bracts persistent, ovate-lanceolate, acuminate, 17–32 by 5–12 mm, softly pubescent. *Flowers* white or cream, often with yellow or red blotch at the lip base; pedicel and ovary 35–54 mm long, softly pubescent. *Sepals*: Median sepal ovate-elliptic, acuminate, 20–30 by 7–12 mm, softly pubescent; lateral sepals similar, 21–30 by 7–9.3 mm. *Petals* ovate-elliptic, obtuse, apiculate, 20–27 by 7.4–11 mm, glabrous. *Lip* 3-lobed, 24–32 by 19–36 mm, base extensively united with the column; side lobes ovate or broadly oblong, obtuse; mid-lobe bilobulate, lobules oblong; callus as 3 obscure ridges; spur cylindric, 20–30 mm long, softly pubescent. *Column* 10–12 mm long, glabrous or pubescent; rostellum 2-lobed.

Myanmar.— ‘Tenasserim’ [*Helper s.n.*, *Kew Distr.* 5275 (**K!**); *Parish 20* (not located), *fide* Parish, 1883: 196]. Mon State [unlocalised, *fide* Nyan Tun, 2014: 89, as *Calanthe rubens* Ridl.; Mawlamyine District, *without collector s.n.*; same locality, cult. *Williams s.n.*; same locality, 1839, *Parish 217* (**K!**); same locality, *Curtis s.n.* (**SING!**); same locality, Feb. 1898, *Machado s.n.* (**SING!**), det. P.J. Cribb]. Tanintharyi Region [unlocalised, *fide* Nyan Tun, 2014: 89, as *Calanthe rubens* Ridl.; Dawei District, 1827, *Gomez 1176* in Wall. Cat. 7345 (**K-W!**); Myeik District, *Griffith s.n.* (**K!**)].

Distribution.— Widespread in tropical and subtropical Asia as far east as New Guinea; recorded

from S Myanmar, Thailand, Laos, Vietnam, Philippines, Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi, Lesser Sunda Islands, Moluccas and New Guinea.

Ecology and phenology.— Found in limestone forest at low elevations. Flowering in Myanmar has been recorded in February.

6. *Calanthe clavata* Lindl., Gen. Sp. Orchid. Pl.: 251. 1833; Hook.f., Fl. Brit. India 5: 854. 1890; Seidenfaden, Dansk Bot. Ark. 29(2): 22, fig. 7. 1975; Seidenfaden, Opera Bot. 114: 99. 1992; Pearce & Cribb, Orch. Bhutan: 295. 2002; Chen *et al.*, Fl. China 25: 296. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 422.6. 2010; Kurzweil, Adansonia, sér. 3, 32: 79. 2010; Nakajima & Ohba, Males. Orchid J. 7: 17, fig. 4.7a–c. 2011; Clayton & Cribb, Gen. *Calanthe*: 69, fig. 20.2a–b. 2013; Kurzweil in Fl. Thailand: 351, fig. 195. 2014.— *Alismorkis clavata* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891.— *Styloglossum clavatum* (Lindl.) T.Yukawa & P.J.Cribb, Bull. Natl. Mus. Nat. Sci., Tokyo, ser. B, 40: 148. 2014. Type: Bangladesh, Sylhet, *De Silva s.n.* in Wall. Cat. 7343 (holotype **K-W!**).

Terrestrial plants, 40–80 cm tall, glabrous. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves, spaced on an elongate rhizome. *Leaves* 2 or 3, evergreen, fully developed during flowering, blade lanceolate-oblong or narrowly elliptic, acute, 40–65 by 4–10 cm; petioles sheathing, forming a pseudostem. *Inflorescences* from the rhizome next to the leafy shoot, erect; peduncle 20 cm long or longer; rachis (2–)10–14 cm long, flowers 10 to many, subdensely or densely arranged; bracts caducous, lanceolate, acuminate, 1–3.5 cm long. *Flowers* yellow; pedicel and ovary ca 15 mm long. *Sepals*: Median sepal elliptic, acute, 9–14 by 4–6.7 mm; lateral sepals similar but slightly narrower. *Petals* obovate-elliptic, acute or acuminate, 9–14 by 3–6.5 mm. *Lip* 3-lobed, 6–8 by 4–5 mm, base united with the lower half or two thirds of the column; side lobes auriculate or subovate; mid-lobe orbicular, emarginate; callus as 2 triangular lamellae at the base of the disk; spur clavate, 8–10 mm long. *Column* 6–7 mm long, with a short rostellum beak. *Capsule* ellipsoid, 10–13 by 5–6 mm.

Myanmar.— Upper Myanmar [*Griffith s.n.* (**K!**)]. Kachin State [Nogmung Township, 455 m, 4 Jan. 1931, *Kingdon-Ward* 9088 (**BM!**); same locality,

Dec. 2015, *Saw Lwin KSL* 1077 & 1081 (**RAF!**); Putao Township, 915 m, 23 Dec. 1931, *Kingdon-Ward* 10222 (**BM!**); Kachin Hills, 915 m, 4 Jan. 1923, *Kingdon-Ward* 5574 (**E!**); Tanai Township, 1,080 m, 7 Dec. 2005, *Murata et al.* 041255 (**MBK!**, **TI!**)].

Distribution.— E Himalayas, NE India, Upper Myanmar, Thailand, Vietnam, SW & S China and Taiwan.

Ecology and phenology.— Found in dense evergreen and deciduous forest, sometimes in rocky places and on fallen trees; at 700–1,660 m elev. Flowering in Myanmar has been recorded in December and January.

7. *Calanthe densiflora* Lindl., Gen. Sp. Orchid. Pl.: 250. 1833; Hook.f., Fl. Brit. India 5: 855. 1890; Seidenfaden, Opera Bot. 114: 99, fig. 52. 1992; Pearce & Cribb, Orch. Bhutan: 295. 2002; Chen *et al.*, Fl. China 25: 295. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 422.7. 2010; Kurzweil, Adansonia, sér. 3, 32: 80. 2010; Nakajima & Ohba, Males. Orchid J. 7: 18, fig. 4.8a–b. 2011; Clayton & Cribb, Gen. *Calanthe*: 71, fig. 20.3a–b, pl. 9A–B. 2013; Kurzweil in Fl. Thailand: 352, fig. 196, pl. XXVIII: 1. 2014.— *Alismorkis densiflora* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891.— *Styloglossum densiflorum* (Lindl.) T.Yukawa & P.J.Cribb, Bull. Natl. Mus. Nat. Sci., Tokyo, ser. B, 40: 148. 2014. Type: Bangladesh, Sylhet, *De Silva s.n.* in Wall. Cat. 7344 (syntypes **K-LINDL!**, **K-W!**). Fig. 1D.

Terrestrial plants, 40–60 cm tall, glabrous. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves, spaced 5–6 cm apart on an elongate rhizome. *Leaves* 2–4, evergreen, fully developed during flowering, blade narrowly elliptic, acute or acuminate, 30–40 by 2–6 cm; petioles to 22 cm long. *Inflorescences* 1 or 2, from the rhizome next to the leafy shoot, erect; peduncle under 20 cm long; racemes 1–5 cm long, densely globose to subcylindric, flowers 12 to 25; bracts caducous, narrowly lanceolate, acuminate, 10–20 mm long. *Flowers* yellow; pedicel and ovary 14–20 mm long. *Sepals* oblong or elliptic-lanceolate, aristate; median sepal 13–16 by 4–6.5 mm; lateral sepals similar but narrower. *Petals* spatulate-oblong, acute, 12–15 by 4–5 mm. *Lip* 3-lobed, 7–13 by 5–13 mm, base united with the column for 3–4.5 mm; side lobes ovate-triangular, obtuse; mid-lobe subquadrate, truncate or emarginate; callus as 2 fleshy lamellae

between the side lobes; spur cylindric, 8.5–16 mm long. *Column* 12–13 mm long, with a short rostellum beak. *Capsule* ellipsoid-globose, 10–13 by 5–8 mm.

Myanmar.— Upper Myanmar [*Toppin* 4302 (CAL)]. Kachin State [Kachin Hills, 8 Apr. 1897, *Pottinger s.n.* (CAL); Triangle, 1,065 m, 21 Sept. 1953, *Kingdon-Ward* 21351 (BM!)]. ? Shan State [Taunggyi District, a photograph in Nyan Tun, 2014: 85 which is called *Calanthe lyroglossa* probably shows *C. densiflora*].

Distribution.— Himalayas, NE India, Bangladesh, Upper Myanmar, Thailand, Vietnam, SW & S China, Taiwan and S Japan.

Ecology and phenology.— Found in broad-leaved and mixed forest; at 1,000–3,000 m elev. Flowering in Myanmar has been recorded in September and April.

8. *Calanthe lyroglossa* Rchb.f., *Otia Bot. Hamburg.*: 53. 1878; Seidenfaden, *Dansk Bot. Ark.* 29(2): 22, fig. 8, pl. III. 1975; Seidenfaden, *Opera Bot.* 114: 99.

1992; Seidenfaden & Wood, *Orchids Penins. Malays.* Singap.: 175, fig. 74g–k, pl. 10b. 1992; Chen *et al.*, *Fl. China* 25: 295. 2009; Chen *et al.*, *Fl. China* 25, Illustrations: fig. 422.1–4. 2010; Kurzweil, *Adansonia*, sér. 3, 32: 75, fig. 5. 2010; Nakajima & Ohba, *Males. Orchid J.* 7: 20, figs. 5.3a–b & 13. 2011; Clayton & Cribb, *Gen. Calanthe*: 83, fig. 25, pl. 12A–C. 2013; Kurzweil in *Fl. Thailand*: 358, fig. 199. 2014.— *Alismorkis lyroglossa* (Rchb.f.) Kuntze, *Revis. Gen. Pl.* 2: 650. 1891.— *Styloglossum lyroglossum* (Rchb.f.) T.Yukawa & P.J.Cribb, *Bull. Natl. Mus. Nat. Sci., Tokyo*, Ser. B, 40: 149. 2014; Kurzweil & Cribb, *Males. Orchid J.* 17: 82, figs. 20–22. 2016. Type: Philippines, Luzon, *Wilkes s.n.* (holotype W; possible isotypes GH!, AMES! [drawing]). Fig. 1E.

— *Calanthe foerstermannii* Rchb.f., *Gard. Chron.*, n.s., 19: 814. 1883; Hook.f., *Fl. Brit. India* 5: 854. 1890; Holttum, *Orch. Malaya*: 155. 1953.— *Alismorkis foerstermannii* (Rchb.f.) Kuntze, *Revis. Gen. Pl.* 2: 650. 1891. Type: ‘Eastern Burma’, *Foerstermann s.n.* (W-R! 15393).

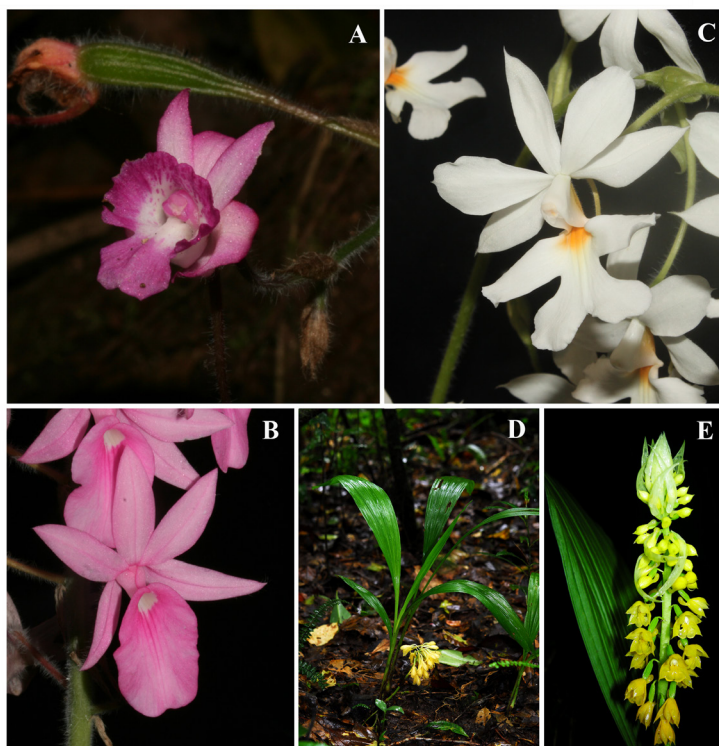


Figure 1. *Calanthe* species in Myanmar – subgen. *Preptanthe* and subgen. *Calanthe* sect. *Styloglossum*. A. *C. cardioglossa* Schltr.; B. *C. rosea* (Lindl.) Benth. ex Hook.f.; C. *C. vestita* Wall. ex Lindl.; D. *C. densiflora* Lindl.; E. *C. lyroglossa* Rchb.f. Photos: A–C by Hubert Kurzweil; D–E by Petch Tripetch.

Terrestrial plants, 37–74 cm tall, glabrous. *Pseudobulbs* adjacent, insignificant, largely obscured by the bases of the leaves. *Leaves* 3–7, evergreen, blade lanceolate-oblong, acuminate, 16–64 by 3–8.5 cm; petioles mostly 9–28 cm long. *Inflorescences* from the base of the plant, erect; racemes 8–19 cm long, flowers many, subdensely or densely arranged; bracts caducous, ovate-lanceolate, acute to acuminate, 22–52 by 4–12 mm, white or pale green. *Flowers* yellow, small, sometimes hardly or not at all opening; pedicel 3.5–7 mm long, clearly differentiated from the 5–9 mm long ovary. *Sepals*: Median sepal elliptic-lanceolate, acute or acuminate, 6–11.5 by 3–5.7 mm; lateral sepals similar but slightly narrower. *Petals* elliptic, cuspidate, 6.5–9 by 3–5.8 mm. *Lip* weakly 3-lobed, 7–10.5 by 5–8 mm, fused with the column; side lobes minutely auriculate; mid-lobe ovate or reniform, emarginate; callus as 2 triangular keels at the lip base; spur clavate, 4–6 mm long. *Column* 3–5 mm long; stigma comparatively wide. *Capsule* ellipsoid, 10–13 by 5–6.5 mm.

Myanmar.— Eastern Myanmar [*Foerstermann s.n.* (W-R!)]. Locality illegible [*Griffith s.n.*, Kew Distr. 5391 (K!)].

Distribution.— India, Bangladesh, Myanmar, Thailand, Laos, Cambodia, Vietnam, S China, Taiwan, Japan, Philippines, Peninsular Malaysia and Borneo.

Ecology and phenology.— Found in primary or secondary evergreen forest; at 725–1,830 m elev. In neighbouring China flowering has been recorded between December and February.

Notes.— There are also unverified reports from Kachin State, Sagaing Region, Chin State, Magwe and Mandalay regions, and Shan State (Kress *et al.*, 2003: 68).

A specimen at GH and a drawing at AMES are possible isotypes as they were collected on the same expedition as the holotype at W.

9. *Calanthe alismifolia* Lindl., Fol. Orchid. 6: 8. 1855 ('*alismaeifolia*'); Hook.f., Fl. Brit. India 5: 849. 1890; Seidenfaden, Opera Bot. 114: 94, fig. 47. 1992; Pearce & Cribb, Orch. Bhutan: 283, pl. 10 (top right). 2002; Pridgeon *et al.* (eds), Gen. Orchid. 4: fig. 264.1. 2005; Chen *et al.*, Fl. China 25: 302. 2009; Chen *et al.*, Fl. China 25, Illustrations:

figs. 431.1–2 & 432.1–17. 2010; Clayton & Cribb, Gen. *Calanthe*: 166, fig. 52, pl. 22C–E. 2013.— *Alismorkis alismifolia* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Types: India, Sikkim, *Hooker 239A* (syntype K-LINDL); India, Khasia Hills, *Hooker & Thompson 239B* (syntype K-LINDL) [*vide* Pearce & Cribb, 2002].

Terrestrial plants, 20–45 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–3, evergreen, fully developed during flowering, blade elliptic to ovate-elliptic, acute, 10–23 by 4–12 cm, glabrous or subglabrous; petioles 6–20 cm long. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 3–10 cm long, flowers 3 to more than 10, subdensely or densely arranged; bracts persistent, broadly ovate-lanceolate, acuminate, 5–10 mm long, sparsely puberulent. *Flowers* white, occasionally tinged purple; pedicel and ovary 10–20 mm long, puberulent. *Sepals* subobovate, ca 10 by 6 mm, pubescent. *Petals* subrhombic, obtuse, 7–10 by ca 4 mm, glabrous. *Lip* 3-lobed, base united with the column; side lobes subrhombic, obtuse; mid-lobe flabellate, deeply two-lobed; callus at lip base wart-like; spur cylindric, 8–10 mm long, glabrous. *Column* ca 3 mm long, glabrous. *Capsule* ellipsoid, ca 20 by 6 mm.

Myanmar.— Kachin State [Putao Township, 1,115 m, 23 Mar. 2009 (sterile), *Kurzweil & Saw Lwin KL 2693* (SING! [s]), prepared from a cultivated plant].

Distribution.— Himalayas, NE India, N Myanmar, Laos, Vietnam, China, Taiwan and Japan.

Ecology and phenology.— Found in evergreen broad-leaved forest, often among grass at the base of rocks; at 700–2,100 m elev. Flowering in adjacent China has been recorded in June and July (Chen *et al.*, 2009).

10. *Calanthe alpina* Hook.f. ex Lindl., Fol. Orchid. 6: 4. 1855; Hook.f., Fl. Brit. India 5: 850. 1890; Pearce & Cribb, Orch. Bhutan: 283. 2002; Chen *et al.*, Fl. China 25: 298. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 424.4. 2010; Clayton & Cribb, Gen. *Calanthe*: 114, fig. 37. 2013.— *Alismorkis alpina* (Hook.f. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: India, Sikkim, *Hooker 245* (holotype K-LINDL; possible isotypes AMES!, P!).

Terrestrial plants, 25–50 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 3–5, evergreen, fully developed during flowering, blade elliptic or elliptic-ovate, acute or obtuse, 11–26 by 3–6(–9) cm, glabrous; petioles sheathing. *Inflorescences* 1 or rarely 2, from leaf axils at the base of the plant, erect, puberulent; racemes 3–12 cm long, flowers 3 to more than 10, subdensely or laxly arranged; bracts persistent, lanceolate, acuminate, to 18 mm long, glabrous. *Flowers* pale greenish-yellow heavily marked with purple; pedicel and ovary to 26 mm long, puberulent. *Sepals*: Median sepal elliptic or subelliptic, aristate, 15–21 by 5–7.5 mm; lateral sepals lanceolate or ovate-lanceolate, aristate, 15–20 by 6–7 mm. *Petals* oblong to lanceolate, acute or acuminate, 12–13 by 4–4.5 mm. *Lip* unlobed, suborbicular or flabellate, fimbriate, emarginate at the apex, to 10 by 17 mm, base united with the column, ecallose; spur cylindric, 15–35 mm long, straight. *Column* ca 8 mm long, glabrous. *Capsule* elliptic to obovoid-elliptic, about 20 by 15 mm.

Myanmar.—Upper Myanmar [2,440 m, 8 June 1914, *Kingdon-Ward 1653* (E!)]. Kachin State [Triangle, 2,895 m, 3 July 1953, *Kingdon-Ward 21170* (AMES!, BM!)].

Distribution.—Himalayas, NE India, Upper Myanmar, SW & C China, Taiwan and Japan.

Ecology and phenology.—Found in montane forest dominated by spruce, fir and bamboo, also in grassy areas; at 1,500–3,655 m elev. Flowering in Myanmar has been recorded in June and July.

11. *Calanthe arcuata* Rolfe, Bull. Misc. Inform. Kew 1896: 196. 1896; Chen *et al.*, Fl. China 25: 305. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 435.1–2. 2010; Clayton & Cribb, Gen. *Calanthe*: 117, fig. 33.2, pl. 16G–H. 2013. Type: China, Hubei, *Henry 6514* (holotype **K!**; isotype **AMES!**).

Terrestrial plants, 18–45 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 3 or 4, evergreen, fully developed during flowering, blade narrowly elliptic-lanceolate or narrowly lanceolate, acute or acuminate, 15–28 by 0.7–3 cm; petioles sheathing. *Inflorescences* 1 or 2, from leaf axils at the base of the plant, erect, glabrous or puberulent; racemes 10–25 cm long, flowers up to 10; bracts persistent, lanceolate, 10–18

mm long, glabrous. *Flowers* yellow-green to white; pedicel and ovary 14–20 mm long, puberulent. *Sepals* similar, lanceolate, acuminate, 17–22 by ca 4 mm, glabrous. *Petals* linear, acuminate, 17–22 by 2–3 mm, glabrous. *Lip* prominently or shallowly 3-lobed, 11–18 by 4–6 mm, base united with the column; side lobes ovate-triangular or suboblong, acute; mid-lobe elliptic-rhombic, aristate; callus as 3–5 keels on the disk; spur cylindric, obtuse, ca 5 mm long, glabrous or sparsely puberulent. *Column* thick, 4–5 mm long, glabrous or sparsely puberulent. *Capsule* ellipsoid, ca 20 by 8 mm.

Myanmar.—Kachin State [Chipwi Township, 2,440 m, July 1914, *Kingdon-Ward 1654* (E!); same locality, *Kingdon-Ward 1696 & 1721B* (E!)].

Distribution.—N Myanmar, China and Taiwan.

Ecology and phenology.—Found in forest, thicket and scrub; at 1,400–3,100 m elev. Flowering in Myanmar has been recorded in July.

12. *Calanthe biloba* Lindl., Fol. Orchid. 6: 3. 1855; Hook.f., Fl. Brit. India 5: 848. 1890; Seidenfaden, Dansk Bot. Ark. 29(2): 12, fig. 1. 1975; Pearce & Cribb, Orch. Bhutan: 284. 2002; Chen *et al.*, Fl. China 25: 299. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 427.5. 2010; Kurzweil, *Adansonia*, sér. 3, 32: 82. 2010; Clayton & Cribb, Gen. *Calanthe*: 174, figs. 48.1 & 49.1, pl. 24A. 2013; Kurzweil in Fl. Thailand: 346, fig. 192. 2014.—*Alismorkis biloba* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: India, Sikkim, 4,000 ft, *Hooker 246* (holotype **K-LINDL**; isotype **K**) [*vide* Pearce & Cribb, 2002].

—*Calanthe biloba* Lindl. var. *obtusata* C.S.P. Parish & Rehb.f., Trans. Linn. Soc. London 30: 144. 1874; Hook.f., Fl. Brit. India 5: 848. 1890. Type: Myanmar, ‘Tenasserim’, *Parish 254* (holotype **W-R!** 26239).

Terrestrial plants, 40–70 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2 or 3, evergreen, fully developed during flowering, blade elliptic, acute or acuminate, 12–40 by 4.6–10 cm, glabrous; petioles sheathing. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 11–22 cm long, flowers few to many, laxly arranged; bracts persistent, lanceolate, acuminate, 10–17 mm long, glabrous. *Flowers* red to brown with a yellowish lip; pedicel and ovary 19–25 mm long, puberulent. *Sepals*: Median

sepal broadly ovate, aristate, 15–18 by 6–7.5 mm, puberulent or subglabrous; lateral sepals similar, 15–18 by 7–8 mm. *Petals* oblong-lanceolate, acuminate, 15–16 by 3–6 mm, glabrous. *Lip* 2-lobed, subreniform, 19–25 by 20–26 mm, clawed, united with the column at the base only; callus as 2 prominent or obscure keels on the blade; spur narrowly conic, 2–4 mm long. *Column* 4.5–7 mm long, glabrous. *Capsule* ellipsoid, to 30 by 15 mm.

Myanmar.—Kachin State [Nogmung Township, 1,220 m, 16 Dec. 1926, *Kingdon-Ward 7412* (**K!**); same locality, Dec. 2015, *Saw Lwin KSL 1049* (**RAF!**); border area Nogmung and Putao townships, 1,260 m, 3 Mar. 2007 (fruiting), *Kurzweil & Saw Lwin KL 2343* (**RAF!**, **SING!** [s]), prepared from a cultivated plant; Putao Township, 1,220 m, 29 Dec. 1930, *Kingdon-Ward 9075* (**BM!**), ident. uncertain (flowers firmly glued onto sheet)]. ‘Tenasserim’ [*Parish 254* (**K!**)].

Distribution.—Himalayas, NE India, Bangladesh, N & S Myanmar, Thailand and SW China.

Ecology and phenology.—Found in mountain forest and thicket; at 1,220–1,550 m elev. Flowering in Myanmar has been recorded in December.

Notes.—There are also unverified reports from Sagaing Region, Chin State, Magwe and Mandalay regions, and Shan State (Kress *et al.*, 2003: 68).

13. *Calanthe brevicornu* Lindl., Gen. Sp. Orchid. Pl.: 251. 1833; Hook.f., Fl. Brit. India 5: 848. 1890; Pearce & Cribb, Orch. Bhutan: 284, pl. 10 (bottom left). 2002; Chen *et al.*, Fl. China 25: 303. 2009; Clayton & Cribb, Gen. *Calanthe*: 119, fig. 36.1, pl. 17D. 2013.—*Alismorkis brevicornu* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: Nepal, Sheopore, May 1821, *Wallich s.n.* in Wall. Cat. 7338 (syntypes **K-LINDL**, **K-W!**).

Terrestrial plants, 30–55 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 3 or 4, evergreen, not fully developed at anthesis, blade elliptic-ovate, acute or acuminate, 18–30 by 5–11 cm; petioles sheathing, usually forming a short pseudostem. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes to 30 cm long, flowers 5 to 15, laxly arranged; bracts persistent, lanceolate, acute or acuminate, 5–13 mm long, subglabrous. *Flowers* red to purple with yellow

or white markings; pedicel and ovary 16–23 mm long, puberulent. *Sepals* oblong-lanceolate, acute, 15–23 by 4–6 mm, puberulent. *Petals* oblong-lanceolate, acute, 11–20 by 4–5 mm, glabrous. *Lip* 3-lobed, 11–20 by 6–10 mm, base united with the column; side lobes oblong, obtuse; mid-lobe ovate, apically emarginate with an apiculus in the sinus; callus as 3 keels; spur 1.5–3 mm long, puberulent. *Column* 3–4 mm long. *Capsule* ellipsoid, to 25 by 15 mm.

Myanmar.—Kachin State [Nogmung Township, 1,830–2,130 m, 16 May 1926, *Kingdon-Ward 6717* (**K!**); Triangle, 2,135 m, 13 May 1953, *Kingdon-Ward 20819* (**BM!**); Chipwi Township, 2,440 m, May 1914, *Kingdon-Ward 1606* (**E!**); same locality, 1,525 m, May 1919, *Cox 1010* (**E!**)]. Without detailed locality [Ayeyarwady Valley, 26 June 1897, *without collector s.n.* (**CAL**)].

Distribution.—Himalayas, NE India, Myanmar and SW & C China.

Ecology and phenology.—Found in dense montane forest; at 1,525–3,100 m elev. Flowering in Myanmar has been recorded in May and June.

14. *Calanthe ceciliae* Rchb.f., Gard. Chron., n.s., 19: 432. 1883; Holttum, Orch. Malaya: 151. 1953; Seidenfaden, Dansk Bot. Ark. 29(2): 19, fig. 5. 1975; Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 169, fig. 72b–c. 1992; Kurzweil, Adansonia, sér. 3, 32: 84. 2010; Clayton & Cribb, Gen. *Calanthe*: 252, fig. 79.1a–b, pl. 35E–F. 2013; Kurzweil in Fl. Thailand: 349, fig. 194. 2014; Kurzweil & Cribb, Males. Orchid J. 17: 92, figs. 27–29. 2016. Type: Peninsular Malaysia, Perak, *Low s.n.* (holotype **W**).

—*Calanthe burmanica* Rolfe, Bull. Misc. Inform. Kew 1907: 129. 1907. Type: Myanmar, Shan State, Sept. 1896, cult. *van Imschoot s.n.* (holotype **K!**).

Terrestrial or less often lithophytic plants, mostly 35–54 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–5, evergreen, fully developed during flowering, blade broadly elliptic or elliptic-lanceolate, acuminate, to 52 by 12 cm, upper surface subglabrous, lower surface sparsely hairy; petioles 3–18 cm long. *Inflorescences* from leaf axils at the base of the plant, erect, sparsely hairy; racemes 3–9 cm long, flowers 6 to 25, subdensely or densely arranged; bracts

persistent, ovate-lanceolate, acute or subacute, 7–15 by 5–8 mm, sparsely or densely hairy. *Flowers* purple or white and turning yellow when old, callus yellow; pedicel and ovary 20–35 mm long, hairy. *Sepals*: Median sepal elliptic or ovate-elliptic, cuspidate, 12–19 by 7.5–11.5 mm, glabrous or subglabrous; lateral sepals similar, 14.5–19 by 8.5–11.2 mm. *Petals* spatulate obovate-elliptic, obtuse, subacute or apiculate, 10.6–18 by 4.5–10.1 mm, glabrous. *Lip* 3-lobed, mostly 19–23 mm long, base united with the column; side lobes oblong or oblong-elliptic, obtuse; mid-lobe deeply bilobed; callus as a group of finger-like warts at the lip base; spur cylindric, 30–52 mm long, upwards-pointing, subglabrous or sparsely hairy. *Column* 5–9 mm long, glabrous. *Capsule* ellipsoid, 32–43 by 8–11 mm.

Myanmar.—Shan State [Sept. 1896, cult. *van Imschoot s.n.* (K!); southern part, Aug. 1902, cult. *RBG Kew s.n.* (K!)].

Distribution.—E Myanmar, Thailand and western Malasia.

Ecology and phenology.—Found in evergreen rainforest at an elevation of 75–1,000 m. The two specimens from Myanmar were found in flower in August and September.

15. *Calanthe griffithii* Lindl., Paxton's Fl. Gard. 3: 37. 1852; Hook.f., Fl. Brit. India 5: 852. 1890; Pearce & Cribb, Orch. Bhutan: 286. 2002; Chen *et al.*, Fl. China 25: 304. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 433.1. 2010; Clayton & Cribb, Gen. *Calanthe*: 131, fig. 36.3, pl. 18D. 2013.—*Alismorkis griffithii* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Types: Bhutan, Chuka, Griffith 33 (syntype K-LINDL); Bhutan, Telagong, Griffith *s.n.* (syntype K-LINDL) [*vide* Clayton & Cribb, 2013].

Terrestrial plants, 30–60 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 3 or 4, evergreen, fully developed during flowering, blade oblong or oblong-lanceolate, acute or acuminate, 29–34 by 5–7 cm; petioles sheathing, forming a pseudostem. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 13–30 cm long, flowers many, laxly arranged; bracts persistent, lanceolate, acute to acuminate, 4–5 mm long, sparsely puberulent. *Flowers* yellowish green to greenish brown; pedicel

and ovary 17–25 mm long, puberulent. *Sepals* similar, oblong, acute, to 20 by 10 mm, puberulent. *Petals* oblong-elliptic, acute, 12–17 by 4–6 mm, glabrous. *Lip* 3-lobed, base united with the column; side lobes oblong, truncate; mid-lobe flabellate-elliptic; callus a tooth-like, triangular lamella; spur cylindric, 4–6 mm long, sparsely puberulent. *Column* 5–9 mm long, subglabrous.

Myanmar.—Kachin State [Chipwi Township, 2,135 m, May 1925, *Forrest 26671* (K!)].

Distribution.—Himalayas, NE India, N Myanmar and SW China.

Ecology and phenology.—Found in evergreen broad-leaved forest; at 2,000–3,000 m elev. Flowering in Myanmar has been recorded in May.

16. *Calanthe hancockii* Rolfe, Bull. Misc. Inform. Kew 1896: 197. 1896; Chen *et al.*, Fl. China 25: 304. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 431.7. 2010; Clayton & Cribb, Gen. *Calanthe*: 132, fig. 34.2, pl. 18E–F. 2013. Type: China, Yunnan, 6,600 ft, Apr. 1893, *Hancock 78* (holotype K!).

Terrestrial plants, 32–85 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–3, evergreen, not well developed at flowering, blade elliptic or elliptic-lanceolate, acute, 20–40 by 5–12 cm, puberulent; petioles sheathing, usually forming a pseudostem. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes to 30 cm long, flowers 7 to 20, laxly arranged; bracts persistent, narrowly lanceolate, 7–16 mm, subglabrous. *Flowers* yellowish brown, large; pedicel and ovary 15–20 mm long, puberulent. *Sepals*: Median sepal oblong-lanceolate, acute or acuminate, 25–35 by 6–10 mm, puberulent; lateral sepals similar but slightly narrower. *Petals* subelliptic, acute or acuminate, to 32 by 7.7 mm. *Lip* 3-lobed, 18–25 by 14–16 mm, base united with the column; side lobes falcate-oblong, truncate; mid-lobe obovate-oblong, acute or obtuse; callus as 3 undulate lamellae on the disk; spur slender, 2–3.5 mm long, puberulent. *Column* 5–6 mm long, sparsely puberulent.

Myanmar.—Kachin State [Chipwi Township, 1,765 m, 7 May 1929, *Sue Koe 9862* (K!)].

Distribution.—NE India, N Myanmar and SW China.

Ecology and phenology.— Found in evergreen broad-leaved forest; at 1,000–3,600 m elev. Flowering in Myanmar has been recorded in May.

17. *Calanthe herbacea* Lindl., *Fol. Orchid.* 6: 10. 1855; Hook.f., *Fl. Brit. India* 5: 852. 1890; Seidenfaden, *Opera Bot.* 114: 94, pl. 5d. 1992; Pearce & Cribb, *Orch. Bhutan*: 287. 2002; Chen *et al.*, *Fl. China* 25: 301. 2009; Chen *et al.*, *Fl. China* 25, Illustrations: fig. 431.4. 2010; Clayton & Cribb, *Gen. Calanthe*: 194, fig. 63, pl. 26G–H. 2013; Kurzweil in *Fl. Thailand*: 354, pl. XXVIII: 2. 2014. — *Alismorkis herbacea* (Lindl.) Kuntze, *Revis. Gen. Pl.* 2: 650. 1891. Type: India, Sikkim, *Hooker s.n.* (holotype **K-LINDL!**). Fig. 2A.

Terrestrial plants, 30–70 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 3–5, evergreen, fully developed during flowering, blade elliptic or elliptic-lanceolate, acute or acuminate, 18–30 by 7.3–12.2 cm, sparsely puberulent; petioles 10–25 cm long, sheathing. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 23–27 cm long, flowers 11 to 20, laxly arranged; bracts persistent, lanceolate, acute, to 15 mm long, puberulent. *Flowers* with green sepals and petals, lip white; pedicel and ovary 30–40 mm long, puberulent. *Sepals* elliptic-lanceolate, acute, 16–18 by 6–8.2 mm, puberulent, reflexed. *Petals* subspathulate, subacute or obtuse, 13–16 by 2–4 mm, glabrous, reflexed. *Lip* 3-lobed, 10–20 mm long, base united with the column; side lobes ovate, obtuse; mid-lobe bilobulate; callus as wart-like papillae at the lip base; spur cylindric, 20–30 mm long, pubescent. *Column* 7–8 mm long, subglabrous; rostellum 2-lobed.

Myanmar.— Kachin State [Nogmung Township, 1,525 m, 18 Sept. 1926, *Kingdon-Ward 7420* (**K!**)]. Without locality [*Toppin 2736* (**E!**)].

Distribution.— E Himalayas, NE India, Myanmar, Thailand, Vietnam and SW China.

Ecology and phenology.— Found in dense forest; at 1,500–2,100 m elev. Flowering in Myanmar has been recorded in September.

18. *Calanthe kermodei* Ormerod & Kurzweil, *Rhedeia* 28: 1. 2018. Type: Myanmar, Kachin State, Chipwi Township, 2,440 m, 22 Apr. 1938, *Kermode 17210* (holotype **AMES!**; isotype **K!**).

Terrestrial plants, 47–58 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2 or 3, evergreen, in early stage of development during flowering, blade apparently narrowly elliptic, acute or subacuminate, subglabrous. *Inflorescences* from leaf axils at the base of the plant, erect, hairy; racemes 15–24 cm long, flowers 20 or more, subaxly to laxly arranged; bracts persistent, ovate-lanceolate, acute or acuminate, 9–18 by ca 4 mm, sparsely hairy. *Flowers* green, lip yellow-green; pedicel and ovary narrowly cylindric-clavate, ca 22 mm long, shortly pubescent. *Sepals*: Median sepal broadly oblong, acute or acuminate, 18–19 by 7–7.9 mm, sparsely hairy; lateral sepals broadly oblong-lanceolate, acute, 18–19 by 6–7.9 mm, sparsely hairy. *Petals* oblong-lanceolate, acute, 14–17 by ca 5 mm, glabrous or subglabrous. *Lip* 3-lobed, base united with the column for ca 6 mm; side lobes cuneate, obtuse; mid-lobe unguiculate, subquadrate-reniform with acute apex; callus as a low ridge; spur narrowly conical, obtuse, 4–6 mm long, sparsely hairy, weakly curved. *Column* 7–9 mm long, glabrous.

Myanmar.— Kachin State [Chipwi Township, 2,440 m, 22 Apr. 1938, *Kermode 17210* (**AMES!**, **K!**)].

Distribution.— Currently only known from the type collection.

Ecology and phenology.— Not recorded, but at this elevation and in this area this would probably be montane forest; at ca 2,440 m elev. Flowering in Myanmar has been recorded in April.

19. *Calanthe lamellosa* Rolfe, *Bull. Misc. Inform. Kew* 1896: 197. 1896; Clayton & Cribb, *Gen. Calanthe*: 135, fig. 36, pl. 19E–F. 2013. Type: China, Hubei, *Henry 5958* (holotype **K!**; isotypes **AMES!**, **P!**). Fig. 2B.

— *Calanthe yunnanensis* Rolfe, *J. Linn. Soc., Bot.* 36: 27. 1903. Types: China, Yunnan, 2,440 m, 9 May 1896, *Henry 11107* (syntype **K!**); China, Yunnan, 2,440–2,740 m, *Hancock 589* (syntype **K!**).

Very similar to *Calanthe brevicornu* Lindl. and in the past considered conspecific with it (see Notes). It differs in its flower colour with white or light green sepals and petals, and a white lip with some purple on it and a prominent yellow callus (as opposed to *C. brevicornu* which has red to purple floral segments

with yellow or white markings). Further differences are the shape of the sepals and petals which are elliptic or oblong-elliptic in *C. lamellosa* but oblong-lanceolate in *C. brevicornu*. The lip callus is much more pronounced in *C. lamellosa* and takes the shape of 3 high lamellae or teeth (as opposed to 3 keels or ridges in *C. brevicornu*).

Myanmar.— Kachin State [Nogmung Township, 1,830 m, 9 Apr. 1931, *Kingdon-Ward 9379* (BM!)]. Sagaing Region [Hkampti District, 2,300 m, 6–8 May 2016, *Davidson s.n.*, photographic record].

Distribution.— N Myanmar and SW & S China.

Ecology and phenology.— Found in shady and moist forest and thicket; at 1,830 m elev. Flowering in Myanmar has been recorded in April and May.

Notes.— In the past the species was considered conspecific with *Calanthe brevicornu* Lindl. (Pearce & Cribb, 2002; Chen *et al.*, 2009), but was resurrected as a distinct species endemic to China by Clayton & Cribb (2013) because of its flower colour and the sepal and petal shape. It is here newly recorded for Myanmar.

20. *Calanthe mannii* Hook.f., Fl. Brit. India 5: 850. 1890; Pearce & Cribb, Orch. Bhutan: 288, pl. 10 (bottom right). 2002; Chen *et al.*, Fl. China 25: 303. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 435.3–4. 2010; Clayton & Cribb, Gen. *Calanthe*: 137, fig. 36.7, 43, pl. 19J. 2013.— *Alismorkis mannii* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Types: India, Kumaon, 30 May 1886, *Duthie 5996* (syntype K!); India, Khasia Hills, 5,000 ft, May 1890, *Mann s.n.* (syntype K!); India, Khasia Hills, 4,000 ft, Apr. 1882, *Mann 62/1884* (syntype K!); India, eastern Khasia Hills, 18 May 1886, *Clarke 49321* (syntype K!).

Terrestrial plants, 30–45 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–5, evergreen, not fully developed during flowering, blade oblanceolate or oblong, acute, 18–35 by 3–4.5 cm, subglabrous or puberulent; petioles 5–10 cm long, forming a pseudostem. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 4–10 cm long, flowers 10 to 20, laxly or semi-densely arranged; bracts persistent, lanceolate, acute, 2–4 mm long, glabrous.

Flowers pale green to brown with yellow lip, small; pedicel and ovary 5–8 mm long, puberulent. *Sepals* similar, ovate-lanceolate or oblong, acute or sub-acute, 6–9 by 2–4.5 mm, puberulent. *Petals* obovate-lanceolate or oblong, acute, 5–8.5 by 1.2–2 mm, subglabrous. *Lip* 3-lobed, 3–5 by 2–4.5 mm, base united with the column; side lobes ovate or oblong, obtuse; mid-lobe reniform, emarginate; callus as 3 lamellae; spur 1–3 mm long, puberulent. *Column* ca 3 mm long, rostellum 2-lobed.

Myanmar.— Kachin State [Nogmung Township, 1,830 m, 7 May 1931, *Kingdon-Ward 9456* (BM!); same locality, 1,220–1,525 m, 6 May 1926, *Kingdon-Ward 6691* (K!); Triangle, 1,525 m, 10 Apr. 1953, *Kingdon-Ward 20645* (AMES!, BM!, E!); Chipwi Township, 1,830 m, 12 Apr. 1938, *Kermode 17024* (K!); greater Myitkyina area, 1,525 m, 6 May 1938, *Kermode 17325* (K!)].

Distribution.— Himalayas, NE India, N Myanmar, Vietnam and SW & S China.

Ecology and phenology.— Found in forest and alpine pasture; at 1,220–2,400 m elev. Flowering in Myanmar has been recorded in April and May.

21. *Calanthe masuca* (D.Don) Lindl., Gen. Sp. Orchid. Pl.: 249. 1833; Hook.f., Fl. Brit. India 5: 850. 1890; Holttum, Orch. Malaya: 151. 1953; Seidenfaden, Dansk Bot. Ark. 29(2): 19, fig. 6, pl. II. 1975; Barretto *et al.*, Wild Orch. Hong Kong: 441. 2011; Clayton & Cribb, Gen. *Calanthe*: 235, fig. 77, pl. 33A–D. 2013; Kurzweil in Fl. Thailand: 360, fig. 200. 2014; Kurzweil & Cribb, Males. Orchid J. 17: 94, figs. 30–31. 2016.— *Bletia masuca* D.Don, Prodr. Fl. Nepal.: 30. 1825.— *Alismorkis masuca* (D.Don) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: Nepal, *Buchanan-Hamilton s.n.* (holotype BM!; isotype LINN!). Fig. 2C.

— *Calanthe sylvatica* auct. non (Thouars) Lindl.: Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 167, fig. 72a, non pl. 9c [*C. ceciliae*]. 1992; Pearce & Cribb, Orch. Bhutan: 290. 2002; Chen *et al.*, Fl. China 25: 300. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 429.1–7. 2010; Kurzweil, Adansonia, sér. 3, 32: 89. 2010.

Terrestrial plants, 30–80 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–6, evergreen, fully developed during flowering, blade lanceolate-elliptic, acute, 19–40 by

4.5–15 cm, glabrous or pubescent above, pubescent below; petioles 5–20 cm long. *Inflorescences* from leaf axils at the base of the plant, erect, pubescent; racemes 5–17 cm long, flowers 10 to 30, laxly or subdensely arranged; bracts persistent, ovate-lanceolate, acute or subacute, 10–17 by 3–5 mm, pubescent. *Flowers* pink to mauve, sometimes white, large; pedicel and ovary 17–35 mm long, pubescent. *Sepals* ovate-elliptic, acuminate, mostly pubescent; median sepal 20–36 by 7–12 mm; lateral sepals 21–28 by 6–11 mm. *Petals* obovate-elliptic, obtuse or subacute, 17.5–30 by 7–15 mm, glabrous. *Lip* 3-lobed, 17–26 mm long, variable in its lobing, base united with the column; side lobes oblong or auriculate, obtuse; mid-lobe flabellate to reniform, emarginate or very rarely somewhat bilobulate; callus as a cluster of warts at the lip base; spur cylindric, 21–50 mm long. *Column* 5–6 mm long, glabrous or subglabrous, rostellum 2-lobed. *Capsule* ellipsoid, 20–30 by 5–10 mm.

Myanmar.—Kachin State [Putao Township, 24 Mar. 2009, *Kurzweil & Saw Lwin* KL 2696 (**SING!**); Triangle, 1,220 m, 28 Aug. 1953, *Kingdon-Ward* 21292 (**AMES!**, **BM!**); same locality, 455 m, 11 July 1939, *Kaulback* 263 (**BM!**); Tanai Township, 250 m, 17 Sept. 2005, *Tanaka et al.* 040307 (**MBK!**); same locality, 250 m, 17 Sept. 2005, *Tanaka et al.* 040308 (**MBK!**); same locality, 250 m, 18 Sept. 2005, *Tanaka et al.* 040364 (**MBK!**)]. Mandalay Region [Pyinoolwin District, 5 Sept. 1938, *Po Khant* 16379 (**K!**)].

Distribution.—Widespread in tropical and subtropical Asia as far east as the Lesser Sunda Islands; recorded from India, Sri Lanka, the Himalayas, N & C Myanmar, Thailand, Laos, Vietnam, SW & S China, Taiwan, Japan, Borneo, Peninsular Malaysia, Sumatra, Java, Sulawesi and the Sunda Islands.

Ecology and phenology.—Found in evergreen and mixed hill forest and lower montane forest; at 150–1,500 m elev. Flowering in Myanmar has been recorded in March, and between July and September.

Notes.—In the past this species was often treated as conspecific with the African *Calanthe sylvatica* (Thouars) Lindl. (references are given above), but is now considered as distinct based on the colour patterns of the flowers.

22. *Calanthe plantaginea* Lindl., Gen. Sp. Orchid. Pl.: 250. 1833; Hook.f., Fl. Brit. India 5: 853. 1890; Pearce & Cribb, Orch. Bhutan: 289. 2002; Chen *et al.*, Fl. China 25: 306. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 415.8. 2010; Clayton & Cribb, Gen. *Calanthe*: 141, fig. 34.6, pl. 20B. 2013.—*Alismorkis lindleyana* Kuntze, Revis. Gen. Pl. 2: 650. 1891. Types: Nepal, 1821, *Wallich s.n.* in Wall. Cat. 7346A (syntypes **K-LINDL!**, **K-W!**); India, Kumaon, *Blinkworth s.n.* in Wall. Cat. 7346B (syntypes **K-LINDL!**, **K-W!**, **P**). Fig. 2D.

Terrestrial plants, 30–65 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–4, evergreen, not fully developed during flowering, blade elliptic, acute, 25–28 by 4–10 cm; petioles ca 20 cm long, forming a pseudostem. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 13–22 cm long, flowers 12 to many, subdensely or laxly arranged; bracts persistent, lanceolate, acute, 5–10 mm long, glabrous. *Flowers* pinkish or white; pedicel and ovary 20–33 cm long, puberulent. *Sepals* similar, ovate-lanceolate, acuminate, 13–17 by 6–7 mm, puberulent. *Petals* oblong, acute, 14–15 by 4–5 mm, glabrous. *Lip* 3-lobed, 10–12 by 8–13 mm, base united with the column; side lobes obovate, truncate; mid-lobe spatulate, apiculate; callus as 3 inconspicuous ridges; spur cylindric, 17–30 mm long, puberulent. *Column* 7–8 mm long, subglabrous, rostellum 2-lobed.

Myanmar.—Kachin State [Putao Township, 1,515–1,700 m, 21 Mar. 2009, *Kurzweil & Saw Lwin* KL 2629 (**RAF!** [s], **SING!** [s]); Chipwi Township, 2,285 m, Apr. 1919, *Farrer* 827 (**E!**); same locality, 1,220 m, 27 Feb. 1939, *Kingdon-Ward* 351 (**AMES!**, **NY!**)].

Distribution.—Himalayas, NE India, N Myanmar and SW China.

Ecology and phenology.—Found in evergreen broad-leaved forest and thicket; at 1,800–2,500 m elev. Flowering in Myanmar has been recorded between February and April.

23. *Calanthe puberula* Lindl., Gen. Sp. Orchid. Pl.: 252. 1833; Hook.f., Fl. Brit. India 5: 848. 1890; Seidenfaden, Opera Bot. 114: 94, fig. 50. 1992; Pearce & Cribb, Orch. Bhutan: 289. 2002; Chen *et al.*, Fl. China 25: 298. 2009; Kurzweil, Adansonia,

sér. 3, 32: 81. 2010; Clayton & Cribb, Gen. *Calanthe*: 142, figs. 35.3 & 45, pl. 20D. 2013; Kurzweil in Fl. Thailand: 363, fig. 202. 2014.—*Alismorkis puberula* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: Bangladesh, Sylhet, *De Silva s.n.* in Wall. Cat. 7342 (holotype **K-W!**).

Terrestrial plants, 25–60 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 4–7, evergreen, fully developed during flowering, blade elliptic or elliptic-oblong, acuminate, 12–22 by 3–7 cm, glabrous or subglabrous; petioles to 13 cm long. *Inflorescences* 1 or 2, from leaf axils at the base of the plant, erect, puberulent; racemes 6–14 cm long, flowers 4 to 10, laxly arranged; bracts persistent, lanceolate, acuminate, 15–25 by 3–5 mm, puberulent. *Flowers* lavender, mauve or lilac; pedicel and ovary 15–30 mm long, puberulent. *Sepals* similar, ovate-lanceolate, cuspidate, 9–16 by 4–6.2 mm, puberulent. *Petals* linear-oblong, acuminate, 9–13 by 1–2 mm, puberulent. *Lip* 3-lobed, 10–15 by 6–11 mm, spurless, base united with the column; side lobes oblong-falcate, obtuse; mid-lobe obovate-cuneate to rhombic-elliptic, acute, margin dentate or fringed; disk without lamellae or calli. *Column* 4–6.5 mm long, glabrous; rostellum 3-lobed. *Capsule* ellipsoid, ca 30 by 14 mm.

Myanmar.—Kachin State [Chipwi Township, 17 July 1938, *Naw Mu Pa 17436* (**K!**)]. Magwe Region [Minbu District, Mar. 1903, *Gage s.n.* (**CAL**)].

Distribution.—Himalayas, NE India, Bangladesh, N & W Myanmar, Thailand, Vietnam, SW China, Taiwan and Japan.

Ecology and phenology.—Found in hill evergreen forest; at 1,300–2,100 m elev. Flowering in Myanmar has been recorded in March and July.

24. *Calanthe simplex* Seidenf., Dansk Bot. Ark. 29(2): 42, fig. 16a–b. 1975; Chen *et al.*, Fl. China 25: 299. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 427.3. 2010; Kurzweil, *Adansonia*, sér. 3, 32: 82. 2010; Clayton & Cribb, Gen. *Calanthe*: 41, fig. 9.8. 2013; Kurzweil in Fl. Thailand: 369, fig. 206, pl. XXIX: 3. 2014. Type: Thailand, Chiang Mai Province, Doi Chiang Dao, *Put 4470* (holotype **K!**). Fig. 2E.

Terrestrial plants, 30–55(–94) cm tall. *Pseudobulbs* insignificant, largely obscured by the

bases of the leaves. *Leaves* 2–3, perennial, fully developed during flowering, blade oblong, acute, 15–50 by 3.2–10.5 cm, glabrous; petioles sheathing, 7–15 cm long. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 20–37 cm long, flowers up to 30, laxly arranged; bracts persistent, ovate-lanceolate, acute or acuminate, 10–27 mm long, puberulent. *Flowers* yellow-green; pedicel and ovary ca 15 mm long, densely puberulent. *Sepals* ovate-lanceolate, acute or acuminate, 8–14 by 5–7.8 mm, densely villous. *Petals* spatulate, obovate-elliptic, acute or acuminate, 8–12 by 3.5–5.3 mm, densely villous. *Lip* unlobed, reniform, emarginate, 7–15 by 8–16 mm, base united with the column; callus as 3 basal ridges; spur cylindric, 8–14 mm long. *Column* 4–8 mm long, densely hirsute.

Myanmar.—Chin State [unlocalised, 1,645 m, 9 Oct. 1923, *Daun 101* (**K!**)]; Falam District, 2,135 m, 13 Dec. 1909, *Venning 1* (**K!**).

Distribution.—NE India, W Myanmar, N Thailand and SW China.

Ecology and phenology.—No habitat information in Myanmar is available but in China and Thailand the species is found in savanna or forest (Chen *et al.*, 2009; Kurzweil, 2014); at 1,645–2,600 m elev. Flowering in Myanmar has been recorded in October and December.

25. *Calanthe tricarinata* Lindl., Gen. Sp. Orchid. Pl.: 252. 1833; Hook.f., Fl. Brit. India 5: 847. 1890; Pearce & Cribb, Orch. Bhutan: 291, fig. 65, pl. 11 (top left). 2002; Chen *et al.*, Fl. China 25: 297. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 426.1–11. 2010; Clayton & Cribb, Gen. *Calanthe*: 148, figs. 35.4 & 47, pl. 21A–B. 2013.—*Alismorkis tricarinata* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: Nepal, *Wallich s.n.* in Wall. Cat. 7339 (syntypes **K**, **K-LINDL**, **K-W!**).

Terrestrial plants, 35–50 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–4, evergreen, not fully developed during flowering, blade elliptic or obovate-lanceolate, acute or acuminate, 20–30 by 5–11 cm, glabrous or sparsely hairy; petioles sheathing, forming a pseudostem. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 3–21 cm long, flowers few to many, laxly arranged; bracts persistent, ovate-lanceolate, acute, 5–13 mm long, subglabrous.

Flowers pale yellow or green, lip orange to brown; pedicel and ovary 10–24 mm long, puberulent. *Sepals* similar, lanceolate, acuminate, 16–19 by 5–8 mm, basally puberulent. *Petals* lanceolate, acute, 15–18 by 5–8 mm. *Lip* 3-lobed, 10–18 by 5–15 mm, spurless, base united with the column; side lobes auriculate, small; mid-lobe reniform, emarginate, mucronate; callus as 3–5 crenulate ridges. *Column* 5–6.2 mm long, sparsely puberulent; rostellum 2-lobed. *Capsule* ellipsoid, 3–4 by 1.5–2 mm.

Myanmar.— Kachin State [Nogmung Township, 3,050 m, 1 June 1926, *Kingdon-Ward 6817* (K!); Chipwi Township, 2,135–2,440 m, 24 July 1914, *Kingdon-Ward 1825* (E!)].

Distribution.— Himalayas, NE India, N Myanmar, SW & C China, Taiwan and Japan.

Ecology and phenology.— On steep grass and fern-clad slopes where the snow has recently melted, also under trees and bushes; at 1,300–3,500 m elev. Flowering in Myanmar has been recorded in June and July.

26. *Calanthe trifida* Tang & F.T. Wang, *Acta Phytotax. Sin.* 1: 87. 1951; Chen *et al.*, *Fl. China* 25: 305. 2009; Clayton & Cribb, *Gen. Calanthe*: 150. 2013. Type: China, Yunnan, 1,700 m, 17 Mar. 1934, *Tsai 55503* (holotype PE; isotype AMES!).

Terrestrial plants, 36–75 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–3, evergreen, fully developed during flowering, blade elliptic, acute or acuminate, ca 22 by 7–10 cm, glabrous; petioles 14–37 cm, forming a pseudostem. *Inflorescences* from leaf axils at the base of the plant, puberulent; racemes 7–30 cm long, flowers few to many, laxly arranged; bracts persistent, lanceolate, acute, 5–7 mm long. *Flowers* pink; pedicel and ovary 15–20 mm long. *Sepals* similar, elliptic, acuminate, ca 10 by 3–4.7 mm, puberulent. *Petals* narrowly elliptic, acute or obtuse, ca 7 by 2.2 mm, puberulent. *Lip* 3-lobed, ca 5.5 mm long, base united with the column; side lobes oblong, subtruncate, broader than the mid-lobe; mid-lobe suboblong, acute; callus as 3 ridges; spur cylindric, ca 6.5 mm long, puberulent. *Column* ca 4 mm long, sparsely puberulent; rostellum 2-lobed.

Myanmar.— Sagaing Region [Mawlaik District, 1,800 m, 23 Feb. 1929, *native collector 9045* (K!)].

Distribution.— N Myanmar and SW China.

Ecology and phenology.— Found in evergreen broad-leaved forest; ca 1,700 m elev. Flowering in Myanmar has been recorded in February.

Notes.— The above-cited collection from Myanmar, '*native collector 9045*', is listed in the protologue must be considered a paratype.

27. *Calanthe triplicata* (Willemet) Ames, *Philipp. J. Sci.*, C 2: 326. 1907; Seidenfaden, *Dansk Bot. Ark.* 29(2): 15, fig. 3, pl. I. 1975; Seidenfaden, *Opera Bot.* 114: 94. 1992; Seidenfaden & Wood, *Orchids Penins. Malays. Singap.*: 169, fig. 73a–b, pl. 9d. 1992; Pearce & Cribb, *Orch. Bhutan*: 293, pl. 11 (top right). 2002; Chen *et al.*, *Fl. China* 25: 302. 2009; Chen *et al.*, *Fl. China* 25, *Illustrations*: fig. 431.3. 2010; Kurzweil, *Adansonia*, sér. 3, 32: 85, fig. 6–7. 2010; Barretto *et al.*, *Wild Orch. Hong Kong*: 446, figs. 365–368. 2011; Clayton & Cribb, *Gen. Calanthe*: 275, fig. 92, pl. 38C–H. 2013; Kurzweil in *Fl. Thailand*: 373, fig. 209. 2014; Kurzweil & Cribb, *Males. Orchid J.* 17: 96, figs. 32–35. 2016.— *Orchis triplicata* Willemet, *Ann. Bot. (Usteri)* 18: 52. 1796. Lectotype: Rumphius, *Herb. Amboin.* 6: 115, fig. 2, t. 52. 1750, designated by Kores, 1989: 124. Fig. 2F.

— *Limodorum veratrifolium* Willd., *Sp. Pl.* 4: 122. 1805, **nom. superfl.**— *Calanthe veratrifolia* (Willd.) R.Br. ex Ker Gawl., *Bot. Reg.* 9: t. 720. 1823; Hook.f., *Fl. Brit. India* 5: 851. 1890; Holttum, *Orch. Malaya*: 152, fig. 26a–e. 1953.— ? *Amblyglottis veratrifolia* Blume, *Bijdr. Fl. Ned. Ind.*: 370. 1825.— *Alismorkis veratrifolia* (Willd.) Kuntze, *Revis. Gen. Pl.* 2: 650. 1891. Type: Indonesia, Moluccas, Ambon, *Rumphius s.n.* (holotype L, lost) [*fide* Clayton & Cribb, 2013].

Terrestrial or lithophytic plants, 40–100 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 2–6, evergreen, fully developed during flowering, blade elliptic or elliptic-lanceolate, acute, 20–60 by 5–17 cm, subglabrous above and glabrous or pubescent below; petioles 6.5–25 cm long. *Inflorescences* from leaf axils at the base of the plant, erect, pubescent; racemes 4–20 cm long, flowers many, subdensely or densely arranged; bracts persistent, lanceolate, acute or acuminate, mostly 10–30 by 5–11 mm, pubescent, recurved or not. *Flowers* white, callus yellow, orange or red;

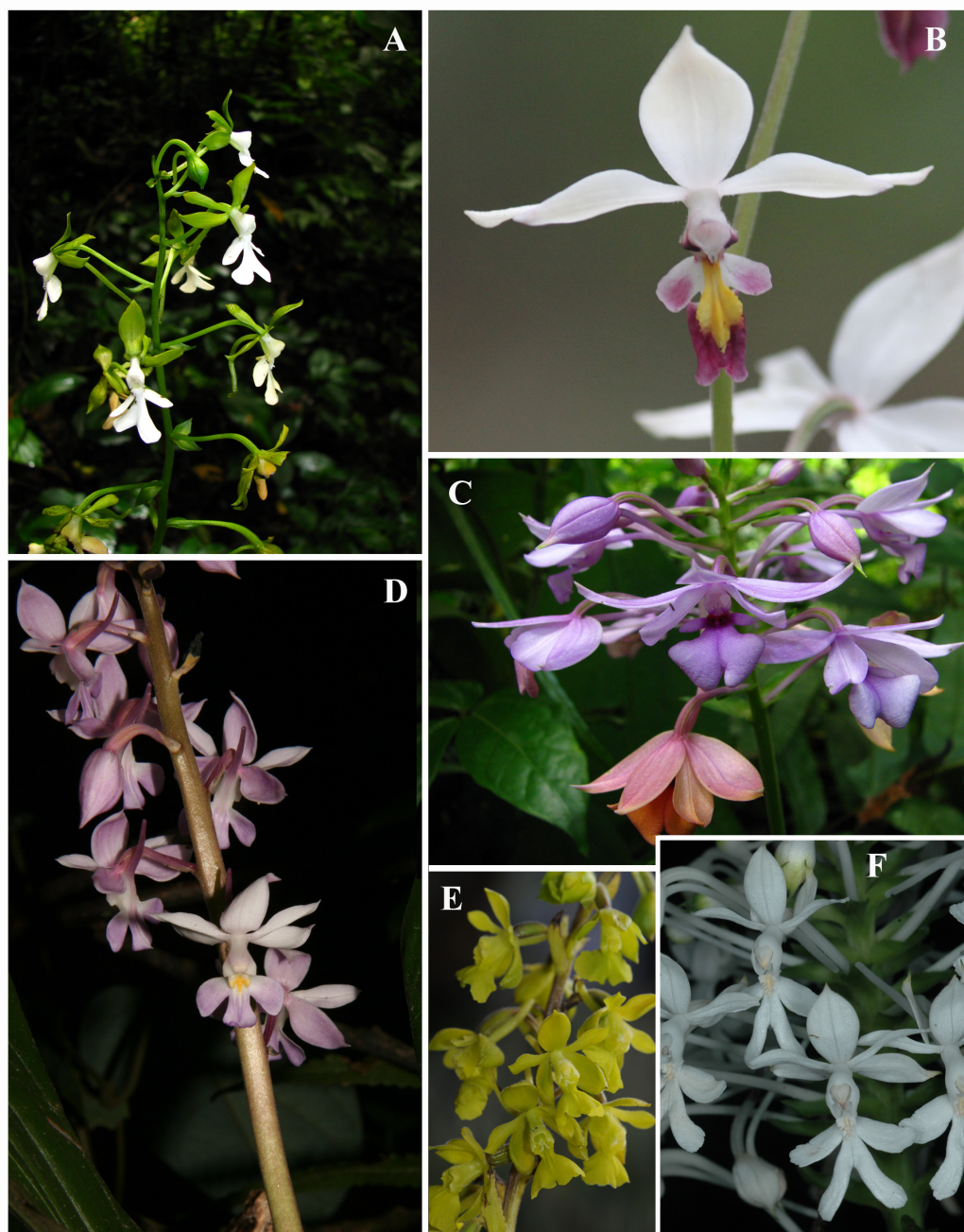


Figure 2. *Calanthe* species in Myanmar – subgen. *Calanthe*. A. *C. herbacea* Lindl.; B. *C. lamellosa* Rolfe; C. *C. masuca* (D. Don) Lindl.; D. *C. plantaginea* Lindl.; E. *C. simplex* Seidenf.; F. *C. triplicata* (Willemet) Ames. Photos: A, C by Piyakaset Suksathan, B by Geoffrey Davison, D by Hubert Kurzweil, E by Pramote Triboun, F by Sahut Chantanaorrapint.

pedicel and ovary 29–60 mm long, pubescent. *Sepals* elliptic, apiculate, 10–18 by 3–9 mm, pubescent; lateral sepals sometimes slightly longer than the median sepal. *Petals* oblong to oblanceolate, apiculate, 8.5–15 by 3.5–7.7 mm, subglabrous. *Lip* 3-lobed, 14–23 by 7–24 mm, base united with the column; side lobes oblong, obtuse; mid-lobe bilobulate, lobules oblong; callus as a cluster of warts at the lip base; spur cylindric, mostly 12–25 mm long, pubescent. *Column* 4–7 mm long, subglabrous or sparsely pubescent. *Capsule* ellipsoid, 25–35 by 8–15 mm, pubescent.

Myanmar.—Kachin State [Triangle, 1,295 m, 13 July 1953, *Kingdon-Ward 21144* (**BM!**)]. Mandalay Region [Pyinoolwin District, 1,065 m, 14 July 1925, *Forest Botanist 1554* (**K!**); same locality, 1,220 m, *Mg Sein 13501* (**K!**); same locality, 1,065 m, July 1912, *Lace s.n.* (**E!**), det. R.A. Rolfe; same locality, 23 Mar. 2003, *Kuroiwa 20030132* (**TNS!** [s]); Myingyan District, 12 May 2005, *Khin Myo Htwe 28* (**MBK!** [s], **TNS!**), *fide* Tanaka *et al.*, 2015: 73]. Shan State [unlocalised, Sept. 1896, imp. *Low s.n.*, cult. *Hildebrand s.n.* (**K!**); Taunggyi District, 1893, *Abdul Khalil s.n.* (**CAL**); southern part, 8 Aug. 1897, *Hildebrand s.n.* (**CAL**)]. Tanintharyi Region [Dawei District, Feb. 1920, *Russell 1839* (**CAL**)].

Distribution.—Widespread from the islands of the western Indian Ocean throughout tropical and subtropical Asia to the Pacific; recorded from Mauritius, Seychelles, Sri Lanka, India, Bhutan, Myanmar, Thailand, Cambodia, Laos, Vietnam, SW & S China, Taiwan, Japan, the Philippines, Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi, Lesser Sunda Islands, Maluku, New Guinea, E Australia, New Caledonia, Vanuatu, Fiji, Samoa, Marquesas, Society Islands, Caroline Islands and Marianas.

Ecology and phenology.—In primary and secondary forest; at 200–1,400 m elev. Flowering in Myanmar has been recorded between February and September.

28. *Calanthe whiteana* King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65: 121. 1896; Pearce & Cribb, Orch. Bhutan: 294. 2002; Chen *et al.*, Fl. China 25: 298. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 427.1–2. 2010; Clayton & Cribb, Gen. *Calanthe*: 221, figs. 48.8 & 49.8, pl. 31B–C. 2013. Type: India, Sikkim, Choongthang, 6,000 ft,

June 1895, *Pantling 365* (holotype **CAL**; isotypes **BM!**, **K!**, **P!**).

—*Calanthe wardii* W.W.Sm., Notes Roy. Bot. Gard. Edinburgh 13: 194. 1921. Types: Myanmar, Kachin State, Chipwi Township, 11 June 1914, *Kingdon-Ward 1734* (syntype **E!**); same locality, 2,135 m, June 1914, *Kingdon-Ward 1661* (syntype **E!**); same locality, 2,135 m, June 1919, *Farrer 1040* (syntype **E!**).

Terrestrial plants, 80–130 cm tall. *Pseudobulbs* insignificant, largely obscured by the bases of the leaves. *Leaves* 3–6, evergreen, not fully developed during flowering, blade ensiform or linear-lanceolate, acute, 60–100 by 6–9 cm; petioles forming a pseudostem. *Inflorescences* from leaf axils at the base of the plant, erect, puberulent; racemes 20–54 cm long, flowers 10 to 20, laxly arranged; bracts persistent, deflexed, linear-lanceolate, acuminate, 10–40 mm long, sparsely puberulent. *Flowers* yellow to yellowish green; pedicel and ovary 10–15 mm long, puberulent. *Sepals*: Median sepal reflexed, ovate-lanceolate, obtuse, 7–10 by 3.5–5 mm, slightly puberulent; lateral sepals similar but slightly wider. *Petals* elliptic or ovate-lanceolate, acute or obtuse, 8–12 by 3–4.5 mm. *Lip* unlobed, reniform, emarginate, ca 5 by 9–13 mm, base united with the column; callus as 3 papillose lamellae; spur cylindric, 10–24 mm long, puberulent. *Column* 3–4 mm long, puberulent; rostellum 2-lobed.

Myanmar.—Kachin State [Chipwi Township, 3,050 m, 11 June 1914, *Kingdon-Ward 1734* (**E!**, **BM!**); same locality, 2,135 m, 11 June 1914, *Kingdon-Ward 1661* (**E!**); same locality, 2,135 m, June 1919, *Farrer 1040* (**E!**); same locality, 13 June 1938, *Naw Mu Pa 17417* (**AMES!**, **K!**)]. Chin State [Mindat District, 2,135 m, 18 Nov. 1956, *Kingdon-Ward 22873* (**BM!**), ident. uncertain].

Distribution.—E Himalayas and NE India to Upper Myanmar, Indochina and SW China.

Ecology and phenology.—Found in forest and on shrubby slopes, often in open areas; at 2,135–3,050 m elev. Flowering in Myanmar has been recorded in June; a specimen which was doubtfully identified as belonging to this species was flowering in November.

Notes.—There are also unverified reports from Sagaing Region, Magwe and Mandalay regions, and Shan State (Kress *et al.*, 2003: 68) [as *Calanthe wardii*].

CEPHALANTHEROPSIS

Guillaumin, Bull. Mus. Hist. Nat. (Paris), sér. 2, 32: 188. 1960; Seidenfaden, Opera Bot. 89: 38. 1986; Seidenfaden, Opera Bot. 114: 101. 1992; Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 179. 1992; Ormerod, Orchid Digest 62: 155. 1998; Pearce & Cribb, Orch. Bhutan: 296. 2002; Pridgeon *et al.* (eds), Gen. Orchid. 4: 127. 2005; Chen *et al.*, Fl. China 25: 288. 2009; Kurzweil, Adansonia, sér. 3, 32: 101. 2010; Barretto *et al.*, Wild Orch. Hong Kong: 417. 2011; Kurzweil in Fl. Thailand: 378. 2014; Kurzweil & Cribb, Males. Orchid J. 17: 110. 2016. Type species: *Cephalantheropsis lateriscapa* Guillaumin (= *C. longipes* (Hook.f.) Ormerod).

Plants mostly terrestrial or rarely lithophytic, with several-noded cane-like leafy stems, 25–59 cm tall, subglabrous or hirsute. *Leaves* perennial, few, plicate, elliptic-lanceolate, acuminate, petiolate. *Inflorescences* arising in lateral position on the stem,

erect, few- to many-flowered, mostly unbranched, glabrous or pubescent; floral bracts caducous. *Flowers* medium-sized, resupinate, in Myanmar usually white or yellow; ovary mostly indistinguishable from the pedicel, variously hairy. *Sepals* free, ovate-lanceolate, acuminate, pubescent or not. *Petals* similar but glabrous. *Lip* 3-lobed, largely free from the column and united with it only at the very base, spurless; callus as 2 keels. *Column* without column-foot, hairy; anther incumbent, with 8 waxy clavate pollinia.

A small genus of four species, distributed from the E Himalayas and NE India through tropical and subtropical Asia as far east as the Moluccas. Two species are found in Myanmar.

Notes.—Molecular studies have shown that this small genus is monophyletic (Yukawa, 2013; Xiang *et al.*, 2014; Zhai *et al.*, 2014).

KEY TO CEPHALANTHEROPSIS SPECIES

Flowers white, becoming orange when ageing; lip side lobes truncate; sepals ovate-lanceolate
Flowers yellow; lip side lobes falcate, tips pointing forwards; sepals linear or oblong

1. *C. longipes*
2. *C. obcordata*

1. *Cephalantheropsis longipes* (Hook.f.) Ormerod, Orchid Digest 62: 156, figs. 1a–b & 2d–e. 1998; Pearce & Cribb, Orch. Bhutan: 298, fig. 66. 2002; Pridgeon *et al.* (eds), Gen. Orchid. 4: fig. 265.1. 2005; Chen *et al.*, Fl. China 25: 289. 2009; Kurzweil in Fl. Thailand: 378, fig. 211. 2014; Kurzweil & Cribb, Males. Orchid J. 17: 111, figs. 46–47. 2016.—*Calanthe longipes* Hook.f., Fl. Brit. India 6: 195. 1890.—*Alismorkis longipes* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 650. 1891.—*Phaius longipes* (Hook.f.) Holttum, Gard. Bull. Singapore 11: 286. 1947. Type: India, Sikkim, *King s.n.* (holotype **BM**).

Terrestrial plants, 25–65 cm tall. *Stems* several-noded, leafy in the upper part. *Leaves* 4–8, evergreen, blade elliptic-lanceolate, acuminate, 7–20 by 2.5–5.5 cm, glabrous; petioles short. *Inflorescences* to 3, laterally half-way up the stem, 10–20 cm long, hairy; racemes 3–9 cm long, flowers 5 to 15, laxly arranged; bracts caducous, narrowly lanceolate, long-acuminate, 15–17 by 5–7 mm. *Flowers* white, lip with some yellow, flowers ageing to orange, sepals and petals shortly pubescent on the outside; pedicel and ovary 8–23 mm long, pubescent. *Sepals* ovate-lanceolate, acute or acuminate, 6–10 by 2.5–3.8 mm; lateral

sepals sometimes narrower. *Petals* ovate-lanceolate, acute or subacute, 5–9 by 2–3.3 mm. *Lip* 3-lobed, unspurred, to 8.5 by 7.3 mm; side lobes flabellate, irregularly dentate, truncate; mid-lobe reniform, irregularly dentate, with insignificant claw; callus as 2 lamellate keels. *Column* 3–4 mm long, hairy.

Myanmar.—Kachin State [Nogmung Township, 1,220–1,525 m, 7 Nov. 1937, *Kingdon-Ward 13443* (**AMES!**, **BM!**, **E!**); Putao Township, 655 m, 8 Nov. 2016, *Armstrong et al.* 2347 (**NY!**, **SING!**); Kachin Hills, 1898, *Mokim s.n.* (**K!**)].

Distribution.—NE India, N Myanmar, Thailand, Vietnam, SW & S China, Taiwan, Philippines, Peninsular Malaysia and Sumatra.

Ecology and phenology.—Found in primary montane forest; at 655–2,525 m elev. Flowering in Myanmar has been recorded in November.

2. *Cephalantheropsis obcordata* (Lindl.) Ormerod, Orchid Digest 62: 157, figs. 1c–e & 2g–i. 1998; Seidenfaden, Contrib. Orchid Fl. Thai. XIII: 16. 1997, in sched.; Chen *et al.*, Fl. China 25: 289. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig.

417.7. 2010; Kurzweil, *Adansonia*, sér. 3, 32: 102, fig. 11. 2010; Barretto *et al.*, Wild Orch. Hong Kong: 417, figs. 343–346. 2011; Kurzweil in Fl. Thailand: 379, fig. 212. 2014.— *Bletia obcordata* Lindl., Gen. Sp. Orchid. Pl.: 123. 1831. Type: Bangladesh, Sylhet, icon. *Wallich s.n.* (holotype not located, possibly lost). Fig. 3A–B.

— *Calanthe gracilis* Lindl., Gen. Sp. Orchid. Pl.: 251. 1833; Hook.f., Fl. Brit. India 5: 855. 1890. *Limatodis gracilis* (Lindl.) Lindl., Fol. Orchid. 6: 1. 1855.— *Alismorkis gracilis* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 650. 1891.— *Cephalantheropsis gracilis* (Lindl.) S.Y.Hu, Quart. J. Taiwan Mus. 25: 213. 1972; Seidenfaden, Opera Bot. 89: 38, fig. 17, pl. IIIb. 1986; Seidenfaden, Opera Bot. 114: 102. 1992; Seidenfaden & Wood, Orchid. Penins. Malays. Singap.: 180, fig. 77. 1992. Type: Bangladesh, Sylhet, *De Silva s.n.* in Wall. Cat. 7341 (holotype **K-W!**).

— *Calanthe tubifera* Hook.f., Fl. Brit. India 5: 855. 1890.— *Alismorkis tubifera* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. Type: Myanmar, Mandalay Region, Ava, *Griffith s.n.*, Kew Distr. 5279 (holotype **K-LINDL!**).

— *Phaius longipes* auct. non (Hook.f.) Holttum: Seidenfaden & Smitinand, Orchids Thail.: 329, 792, fig. 251. 1961–1965; Seidenfaden, Bull. Mus. Hist. Nat. (Paris), sér. 3, 71, Bot. 5: 141. 1972 (publ. 1973).

Terrestrial or lithophytic plants, 35–100 cm tall. *Stems* several-noded, leafy in the upper part.

Leaves 3–9, evergreen, blade elliptic-lanceolate, acute or acuminate, mostly 18–47 by 3–8 cm, glabrous; petioles usually 3–11 cm long. *Inflorescences* to 3, arising laterally half-way up the stem, erect, 30–66 cm long, hirsute; racemes 5–20 cm long, flowers 15 to many, laxly arranged; bracts caducous, lanceolate, acuminate, 20–40 mm long, glabrous. *Flowers* yellowish green, turning orange with age; pedicel and ovary 10–26 mm, puberulent. *Sepals* reflexed, linear or oblong-elliptic, aristate, 10–19 by 3–6.8 mm, puberulent. *Petals* reflexed, obovate-lanceolate, acute, 10–18 by 2–4.5 mm, puberulent. *Lip* 3-lobed, unspurred, 8–15 by 5–10 mm; side lobes subtriangular-falcate with forwards-pointing tips; mid-lobe flabellate, emarginate; callus as 2 ridges. *Column* 3–6 mm long, pubescent. *Capsule* cylindric, 15–20 by 8–10 mm.

Myanmar.— Kachin State [Nogmung Township, 1,525 m, 15 Jan. 1931, *Kingdon-Ward 9141* (**BM!**); Triangle, 1,220 m, 30 Nov. 1953, *Kingdon-Ward 21635* (**AMES!**, **BM!**)].— Mandalay Region [Kyaukse District, *Griffith s.n.*, Kew Distr. 5279 (**K-LINDL!**)].

Distribution.— NE India, Bangladesh, N & C Myanmar, Thailand, Laos, Vietnam, SW & S China, Taiwan, S Japan, Philippines and Moluccas.

Ecology and phenology.— Found in dry evergreen forest; at 1,220–1,525 m elev. Flowering in Myanmar has been recorded in November and January.

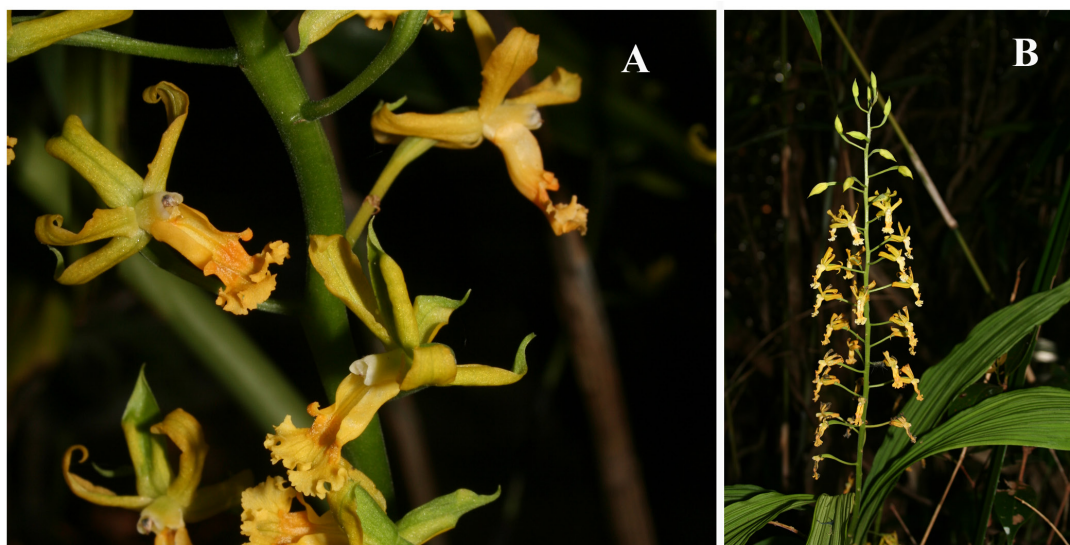


Figure 3. *Cephalantheropsis obcordata* (Lindl.) Ormerod in Myanmar. A. flowers; B. inflorescence. Photos: Hubert Kurzweil.

Notes.— There are also unverified reports from Sagaing Region, Chin State, Magwe Region, and Shan State (Kress *et al.*, 2003: 68).

PHAIUS

Lour., Fl. Cochinch.: 529. 1790; Hook.f., Fl. Brit. India 5: 816. 1890 [as *Phajus*]; Holttum, Orch. Malaya: 169. 1953; Seidenfaden, Opera Bot. 89: 41. 1986; Seidenfaden, Opera Bot. 114: 99. 1992; Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 176. 1992; Pearce & Cribb, Orch. Bhutan: 302. 2002; Pridgeon *et al.* (eds), Gen. Orchid. 4: 149. 2005; Chen *et al.*, Fl. China 25: 290. 2009; Kurzweil, Adansonia, sér. 3, 32: 92. 2010; Barretto *et al.*, Wild Orch. Hong Kong: 423. 2011; Kurzweil in Fl. Thailand: 584. 2014; Kurzweil & Cribb, Males. Orchid J. 17: 100. 2016; Stone & Cribb, Histor. Monogr. Rev. *Phaius* and *Gastrophys*: 24. 2017. Type species: *Phaius grandifolius* Lour. (= *P. tankervilleae* (Banks) Blume).

— *Limatodis* Blume, Bijdr. Fl. Ned. Ind.: 375. 1825. Type species: *Limatodis pauciflora* Blume (= *Phaius pauciflorus* (Blume) Blume).

Plants mostly terrestrial, rarely lithophytic, 40–200 cm tall, evergreen, largely glabrous. *Stems* adjacent, either pseudobulbous or cane-like. *Pseudobulbs*, if present, largely hidden by the leaf bases. *Leaves* perennial, few, plicate, variously

lanceolate, petiolate. *Inflorescences* basal or lateral, few-flowered; floral bracts persistent or caducous. *Flowers* mostly few, usually large, resupinate, in Myanmar mostly yellow, pink or white, often turning dark blue after damage or while senescing; ovary usually indistinguishable from the pedicel. *Sepals* and petals similar, campanulate or spreading, free. *Lip* deeply or shallowly 3-lobed, usually spurred, free from the column or united with it only basally, glabrous or hairy; side lobes often wrapped around the column; callus as obscure ridges, sometimes hairy. *Column* long, without a foot, mostly pubescent on the front side; anther incumbent, with 8 waxy pollinia; rostellum entire; stigma in a cavity below the rostellum.

A genus of about 40 species which are mainly found in Asia, N Australia and the Pacific Ocean Islands. In addition, a few species are also found in Africa. Six species are native to Myanmar.

Notes.— Often characterised by having a free lip, but on closer examination the lip is sometimes united with the column at the base (up to several millimetres).

Preliminary molecular studies have been undertaken which suggest that this genus consists of at least two separate lineages and is nested in the genus *Calanthe* (Yukawa, 2013; Xiang *et al.*, 2014; Zhai *et al.*, 2014).

KEY TO PHAIUS SPECIES

1. Stems with conical to ovoid or cylindric-ovoid pseudobulbs 1–10(–15) cm long
 2. Inflorescences to 25 cm long; flowers two to three **3. P. nanus**
 2. Inflorescences longer than this; flowers usually more than three
 3. Inflorescences shorter than the leaves; leaves green with yellow spots; flowers bright yellow, lip with red or brown markings **1. P. flavus**
 3. Inflorescences longer than the leaves; leaves green
 4. Sepals and petals brown-red on the inside and white on the outside; flowers nodding; lip spur usually 12 mm long or less **5. P. tankervilleae**
 4. Sepals and petals greenish-yellow on both sides; flowers spreading; spur mostly longer than 12 mm **6. P. wallichii**
1. Stems either with elongate-clavate pseudobulbs 20–40 cm long, or stems cane-like
 5. Stems with elongate-clavate pseudobulbs; flowers yellowish-green **4. P. takeoi**
 5. Stems cane-like, 30–80 cm long; flowers pink **2. P. mishmensis**

1. Phaius flavus (Blume) Lindl., Gen. Sp. Orchid. Pl.: 128. 1831; Holttum, Orch. Malaya: 172. 1953; Seidenfaden, Opera Bot. 89: 41, fig. 18, pl. IIIc. 1986; Seidenfaden, Opera Bot. 114: 99. 1992; Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 177, fig. 76c–d, pl. 10d. 1992; Pearce & Cribb, Orch. Bhutan: 303, fig. 69a–l. 2002;

Pridgeon *et al.* (eds), Gen. Orchid. 4: fig. 275.1. 2005; Chen *et al.*, Fl. China 25: 290. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 414.1–12, 417.6. 2010; Kurzweil, Adansonia, sér. 3, 32: 93, fig. 9. 2010; Kurzweil in Fl. Thailand: 585, fig. 316, pl. LI-1. 2014; Kurzweil & Cribb, Males. Orchid J. 17: 101, fig. 36. 2016; Stone & Cribb, Histor.

Monogr. Rev. *Phaius* and *Gastrorchis*: 48, figs. 34–42, map 8, pl. 8. 2017.— *Limodorum flavum* Blume, Bijdr. Fl. Ned. Ind.: 375. 1825.— *Bletia flava* (Blume) Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 127. 1831.— *Paraphaius flavus* (Blume) J.W. Zhai, Z.J. Liu & F.W. Xing, Molec. Phylogen. Evol. 77: 221. 2014. Type: Indonesia, Java, Mt. Gede, *Blume's collectors s.n.* (holotype **L!**). Fig. 4A.

— *Phaius maculatus* Lindl., Gen. Sp. Orchid. Pl.: 127. 1831, **nom. superfl.**; Hook.f., Fl. Brit. India 5: 817. 1890 [as *Phajus*]. Type: Nepal, 1826, *Wallich s.n.* in Wall. Cat. 3748 (holotype **K-LINDL!**).

Terrestrial or rarely lithophytic plants, 40–100 cm tall, glabrous except for the column. *Pseudobulbs* ovoid or conical, mostly 5–14 by 1.5–4 cm. *Leaves* 4–8, blade oblong-elliptic or ovate-elliptic, acute, 25–60 by 3.7–15 cm, usually with pale blotches; petioles forming a pseudostem. *Inflorescences* from the base or middle of the pseudobulb, erect; racemes 5–40 cm long, flowers 8 to 25, subdensely or laxly arranged; bracts persistent, ovate-lanceolate, acute or subacute, 8–40 by 5–10.7 mm. *Flowers* yellow or greenish-yellow, marked with orange or brown; pedicel and ovary 20–32 mm long. *Sepals*: Median sepal obovate-lanceolate, acute or obtuse, 23–43 by 6–17 mm; lateral sepals similar but slightly wider. *Petals* obovate-elliptic, obtuse, 25–42 by 8–15.5 mm. *Lip* shallowly 3-lobed, 23–45 by 22–45 mm, margins crisped, united with the column base, without prominent callus; spur cylindric, 4.5–8 mm long. *Column* 15–20 mm long, sparsely hairy on the front side. *Capsule* ellipsoid, ca 25 by 5 mm.

Myanmar.— Kachin State [Putao Township, 2018, *Armstrong et al.* 3941 (**NY!**); Chipwi Township, 1,830–2,135 m, 6 July 1914, *Kingdon-Ward* 1739 (**E!**)]. Shan State [unlocalised, *fide* Saw Lwin, 2003: 24; Taunggyi District, 1,330 m, 11 Jan. 2016, *Saw Lwin SL 218 (RAF!)*, fruiting].

Distribution.— Widespread from subtropical and tropical Asia to the islands of the Pacific Ocean; recorded from Nepal, Bhutan, NE India, N & E Myanmar, Thailand, Laos, Vietnam, SW & S China, Taiwan, Japan, Philippines, Peninsular Malaysia, Sumatra, Java, Sulawesi, Moluccas, New Guinea, New Caledonia, Samoa and Vanuatu.

Ecology and phenology.— Found in evergreen forest, sometimes in marshy situations; at 1,330–2,135 m elev. Flowering in Myanmar has been recorded in July.

Notes.— There is also an unverified report from Nogmung Township in Kachin State (Saw Lwin 2007: 256).

2. *Phaius mishmensis* (Lindl. & Paxton) Rchb.f., Bonplandia 5: 43. 1857 [as *Phajus*]; Hook.f., Fl. Brit. India 5: 817. 1890 [as *Phajus*]; Seidenfaden, Opera Bot. 89: 47, fig. 21. 1986; Seidenfaden, Opera Bot. 114: 101. 1992; Pearce & Cribb, Orch. Bhutan: 303, fig. 69m–n. 2002; Chen *et al.*, Fl. China 25: 291. 2009; Chen *et al.*, Fl. China 25, Illustrations: figs. 414.13–14, 417.1–4 & 419.1–15. 2010; Kurzweil, Adansonia, sér. 3, 32: 100. 2010; Kurzweil in Fl. Thailand: 588, fig. 318, pl. LI: 3. 2014; Stone & Cribb, Histor. Monogr. Rev. *Phaius* and *Gastrorchis*: 164, figs. 156–161, map 41, pl. 16. 2017.— *Limatodis mishmensis* Lindl. & Paxton, Paxton's Fl. Gard. 3: 36. 1852. Type: India, Mishmee Hills, *Griffith s.n.* (holotype **K-LINDL!**). Fig. 4B.

— *Phaius roseus* Rolfe, Bull. Misc. Inform. Kew 1893: 6. 1893. Type: " ? West Tropical Africa" [certainly incorrect], Dec. 1892, cult. *Lord Scarborough s.n.* (holotype **K!**).

Terrestrial plants, 40–140 cm tall, glabrous except for the lip and column. *Stems* cane-like, 30–80 by 0.6–1.9 cm. *Leaves* 4–8, elliptic-lanceolate, acute, 15–50 by 3.5–7.8 cm; petioles forming a pseudostem. *Inflorescences* 1 or 2, from the upper part of the stem, 30–45 cm long; racemes 17–32 cm long, flowers 2 to 15, laxly arranged; bracts caducous, ovate-lanceolate, acute, 3–4 cm long. *Flowers* rose-coloured to red, ageing yellow, not widely opening; pedicel and ovary 15–30 mm long. *Sepals* similar, obovate-lanceolate, subacute, mostly 25–37 by 5–12 mm. *Petals* linear-oblongate, obtuse or acute, 20–30 by 4–8.3 mm. *Lip* 3-lobed, 20–35 by 15–31 mm, united with the column base; side lobes flabellate, obtuse; mid-lobe oblong or subquadrate, truncate or emarginate; callus as 3 or 4 hairy ridges; spur cylindric, 10–18 mm long. *Column* 12–24 mm long, villous on the front side; rostellum triangular. *Capsule* ellipsoid, ca 14 by 6 mm.

Myanmar.— Shan State [Taunggyi District, 1,330 m, 11 Jan. 2016, *Saw Lwin SL 217 (RAF!)*]. Lower Myanmar [*Boxall s.n.* (**K!**)].

Distribution.— Widespread in subtropical and tropical Asia; recorded from the E Himalayas, NE India, E & S Myanmar, Thailand, Laos, Vietnam, S & SW China, Taiwan, S Japan and the Philippines.

Ecology and phenology.— Found in evergreen broad-leaved forest, often in wet places; in Myanmar recorded at ca 1330 m elev. In neighbouring China the plants are found at 800–1,400 m elev. Flowering in Myanmar has been recorded in January.

Notes.— In a letter on the type sheet of *Phaius roseus* Lord Scarborough says he may have got it from Assam (India).

In Myanmar, there are also unverified reports from Kachin State, Sagaing Region, Chin State and Mandalay Region (Kress *et al.*, 2003: 86).

3. *Phaius nanus* Hook.f., Fl. Brit. India 6: 192. 1890 [as *Phajus*]; Hook.f., Icon. Pl.: 21. 1892 [as *Phajus*]; Pearce & Cribb, Orch. Bhutan: 305. 2002; Stone & Cribb, Histor. Monogr. Rev. *Phaius* and *Gastrorchis*: 69, fig. 58, map 14. 2017. Type: India, West Bengal, Duars, *Gamble 6672b* (holotype **K!**).

Terrestrial plants, 16–25 cm tall. *Pseudobulbs* ca 2 by 2 cm. *Leaves* to 4, evergreen, fully developed during flowering, lanceolate, acuminate, 36–44 by 4–6 cm; petioles 4–9 cm long. *Inflorescences* from the base of the plant, erect, glabrous; racemes 2.5–3 cm long, flowers 2 or 3; bracts persistent, lanceolate, acute, to 20 mm long. Flower colour not known; pedicel and ovary about 15 mm long. *Sepals* lanceolate, acuminate, ca 23 by 8 mm. *Petals* oblanceolate, acuminate, ca 23 by 10 mm. *Lip* shallowly 3-lobed, to 25 by 20 mm; mid-lobe suborbicular, slightly emarginate; callus as 3 keels; spur conical, 2–3 mm long. *Column* ca 15 mm long.

Myanmar.— Kachin State [greater Myitkyina area, 245 m, 2 Mar. 1910, *Lace 5236* (**E!**, **K!**)].

Distribution.— E Himalayas, NE India and N Myanmar.

Ecology and phenology.— Reported from grassy places at ca 245 m elev. Flowering in Myanmar has been recorded in March.

Notes.— A very poorly known species, only known from a few collections made over a hundred years ago.

4. *Phaius takeoi* (Hayata) H.J. Su, Quart. J. Exp. Forest. Nation. Taiwan Univ. 3: 77. 1989; Chen *et al.*, Fl. China 25: 290. 2009; Chen *et al.*, Fl. China 25, Illustrations: figs. 415.1–4 & 416.1–18. 2010; Kurzweil in Fl. Thailand: 590, pl. LI: 4. 2014;

Stone & Cribb, Histor. Monogr. Rev. *Phaius* and *Gastrorchis*: 195, figs. 184–187, map 51. 2017.— *Calanthe takeoi* Hayata, Icon. Pl. Formosan. 9: 111. 1920.— *Paraphaius takeoi* (Hayata) J.W.Zhai, Z.J.Liu & F.W.Xing, Molec. Phylogen. Evol. 77: 221. 2014. Type: Taiwan, Taipei, 24 Oct. 1917, *Takeo s.n.* (holotype **TI**) [*fide* Lin *et al.*, 2016]. Fig. 4E.

Terrestrial plants, 40–70(–100) cm tall, glabrous except for the flowers. *Pseudobulbs* elongate-clavate, 20–40 by 1.3–2 cm. *Leaves* 5–8, in the upper part of the stem, blade elliptic or elliptic-lanceolate, acuminate, 22–40 by 5–8 cm. *Inflorescences* from the lower nodes of the pseudobulb, erect, 30–60 cm long, unbranched or rarely branched; racemes 10–18 cm long, flowers 4 to 15, laxly arranged; bracts persistent, lanceolate, acute, to 17 mm long. *Flowers* yellowish green, lip white, widely opening; pedicel and ovary 20–32 mm long, glabrous or sparsely puberulent. *Sepals* elliptic-oblong, acute or obtuse, 27–35 by 7–10.5 mm, glabrous or sparsely puberulent. *Petals* oblanceolate, obtuse or acute, 28–33 by 6–8 mm, glabrous. *Lip* orbicular, weakly 3-lobed, 30–34 by 24–28 mm, united with the column base; side lobes subovate, obtuse, enveloping the column; mid-lobe orbicular, emarginate; callus as 2 or 3 obscure ridges; spur clavate, 5.8–9 mm long. *Column* 15–25 mm long, hairy on the front side; rostellum ligulate.

Myanmar.— Shan State [Taunggyi District, Sept. 2009, *Nyan Tun s.n.* (**SING!**)].

Distribution.— E Myanmar, Thailand, Laos, Vietnam, SW China and Taiwan.

Ecology and phenology.— Found in broad-leaved forest; elevation not recorded in Myanmar but in neighbouring China the plants are found at 500–1,400 m elev. Flowering in Myanmar has been recorded in September.

5. *Phaius tankervilleae* (Banks) Blume, Mus. Bot. 2: 177. 1856 [as *tankervillii*]; Holttum, Orch. Malaya: 170, figs. 28 & 28A. 1953; Seidenfaden, Opera Bot. 89: 43, fig. 19, pl. IIId. 1986; Seidenfaden, Opera Bot. 114: 100. 1992; Seidenfaden & Wood, Orchids Penins. Malays. Singap.: 176, fig. 76a, pl. 10c. 1992; Pearce & Cribb, Orch. Bhutan: 305. 2002, excl. pl. 11 (bottom left); Cribb *et al.*, Kew Bull. 59: 549, figs. 1–2. 2004; Cribb, Orchid Rev. 116: 330, colour photo on page 328. 2008; Chen *et al.*, Fl. China 25: 291. 2009 [as *tancarvilleae*];

Chen *et al.*, Fl. China 25, Illustrations: fig. 417.5, 420.1–5. 2010; Kurzweil, *Adansonia*, sér. 3, 32: 94. 2010; Barretto *et al.*, Wild Orch. Hong Kong: 423, figs. 348–353. 2011; Kurzweil in Fl. Thailand: 590, fig. 319, pl. LI: 5. 2014; Kurzweil & Cribb, Males. Orchid J. 17: 102, fig. 37. 2016; Stone & Cribb, *Histor. Monogr. Rev. Phaius and Gastrorchis*: 93. 2017.— *Limodorum tankervilleae* Banks, Icon.: t. *Limodorum tankervilleae*. 1788.— *Bletia tankervilleae* (Banks) R.Br., Bot. Mag. 44: t. 1924. 1817. Type: Engraving by MacKenzie from Sowerby's original drawing dated 1787 (BM), lectotype selected by Mabberley, 2011: 476. Fig. 4C–D.

var. **tankervilleae**

Stone & Cribb, *Histor. Monogr. Rev. Phaius and Gastrorchis*: 95, figs. 88–90 & 94, map 22, pl. 10–11. 2017.

— *Phaius blumei* Lindl., Gen. Sp. Orchid. Pl.: 127. 1831. Type: cultivated, based on *Limodorum incarvillei* Blume (Bijdr. Fl. Ned. Ind.: 374. 1825).

— *Phaius blumei* Lindl. var. *assamica* Rchb.f., Gard. Chron., n.s., 17: 558. 1882. Types: India, Assam, Griffith s.n. (syntype W); India, Assam, Staur s.n. (syntype W); Myanmar, Griffith s.n. (syntype W); Myanmar, Parish s.n. (syntype W) [fide Stone & Cribb, 2017].

— *Phaius wallichii* of authors, non Lindl.

Terrestrial plants, 60–200 cm tall, glabrous except for the lip and column. *Pseudobulbs* largely obscured by the bases of the leaves, best visible on old, leafless shoots. *Leaves* 2–6, evergreen, lanceolate, acute or acuminate, 30–105 by 4–20 cm; petioles to 35 cm long. *Inflorescences* from the pseudobulb base, erect; racemes (4.5–)15–30 cm long, flowers 5–30, laxly arranged; bracts caducous, to 50 by 15 mm. *Flowers* nodding, large, sepal and petal inside brown and outside white, lip pale purple with pink or mauve rim; pedicel and ovary mostly 28–50 mm long. *Sepals* ovate-lanceolate or elliptic-lanceolate, acute or acuminate, 41–60 by 9–19 mm. *Petals* ovate-elliptic, acute, 40–60 by 8–18 mm. *Lip* obovate, shallowly 3-lobed, 37–55 by 25–43 mm, united with the column base, basal part hairy; side lobes ovate, obtuse, enveloping the column; mid-lobe ovate-oblong, obtuse; callus as 2 obscure ridges; spur cylindric, 5–12 mm long. *Column* 16–25 mm long, sparsely hairy. *Capsule* ellipsoid, to 50 by 20 mm.

Myanmar.— Kachin State [Putao Township, 365 m, 17 Apr. 1926, *Kingdon-Ward* 6629 (K!); Bhamo District, 1874, *Parish* 363 (K!); ? same locality, *Parish* 371 (not located), fide Parish, 1883: 196, as *Phaius blumei*]. Shan State [unlocalised, fide Saw Lwin, 2003: 24; 2007: 250]. Yangon Region [unlocalised, 20 m, *Comber* s.n., photographic record, fide SOF, 2018]. Without locality [Griffith s.n. (W); Parish s.n. (W); 21 Mar. 1972, *Ohtsuka* 483 (TI!)].

Distribution.— Widespread in tropical and subtropical Asia and ranging to northern and eastern Australia and the Pacific Islands; recorded from Sri Lanka, India, the Himalayas, Bangladesh, Myanmar, Thailand, Cambodia, Laos, Vietnam, SW & S China, Taiwan, Japan, Peninsular Malaysia, Borneo, Philippines, Sumatra, Java, Sulawesi, Sunda Islands, Moluccas, New Guinea, Solomon Islands, N & E Australia, New Caledonia, Vanuatu, Fiji, Samoa, Tonga and Cook Islands.

Ecology and phenology.— Found in open boggy thicket and swamp-land in forest; in Myanmar recorded at low elevations. Flowering in Myanmar has been reported in March and April.

Notes.— There are also unverified reports from Nogmung Township of Kachin State (Saw Lwin 2007: 255–256).

Phaius wallichii Lindl. was in the past considered conspecific with *P. tankervilleae*, but was recently found distinct because of larger flowers, acuminate tepals and longer lip spurs (Cribb *et al.*, 2004). It was therefore resurrected as a distinct species (see below).

6. *Phaius wallichii* Lindl. in N. Wallich, Pl. Asiat. Rar. 2: 46, pl. 158. 1831; Hook.f., Fl. Brit. India 5: 816. 1890; Pearce & Cribb, Orch. Bhutan: pl. 11 (bottom left). 2002 [as *P. tankervilleae*]; Cribb *et al.*, Kew Bull. 59: 549, figs. 3–4. 2004; Cribb, Orchid Rev. 116: 332, colour photos on pages 329 and 331. 2008; Chen *et al.*, Fl. China 25: 292. 2009; Chen *et al.*, Fl. China 25, Illustrations: fig. 421.1–6. 2010; Kurzweil, *Adansonia*, sér. 3, 32: 97. 2010; Barretto *et al.*, Wild Orch. Hong Kong: 430, figs. 354–357. 2011; Kurzweil in Fl. Thailand: 592, pl. LI: 6. 2014; Stone & Cribb, *Histor. Monogr. Rev. Phaius and Gastrorchis*: 119, figs. 110–119, map 28, pl. 14. 2017. Type: Bangladesh, Sylhet, Wall. Cat. 3747 (holotype K-LINDL!).

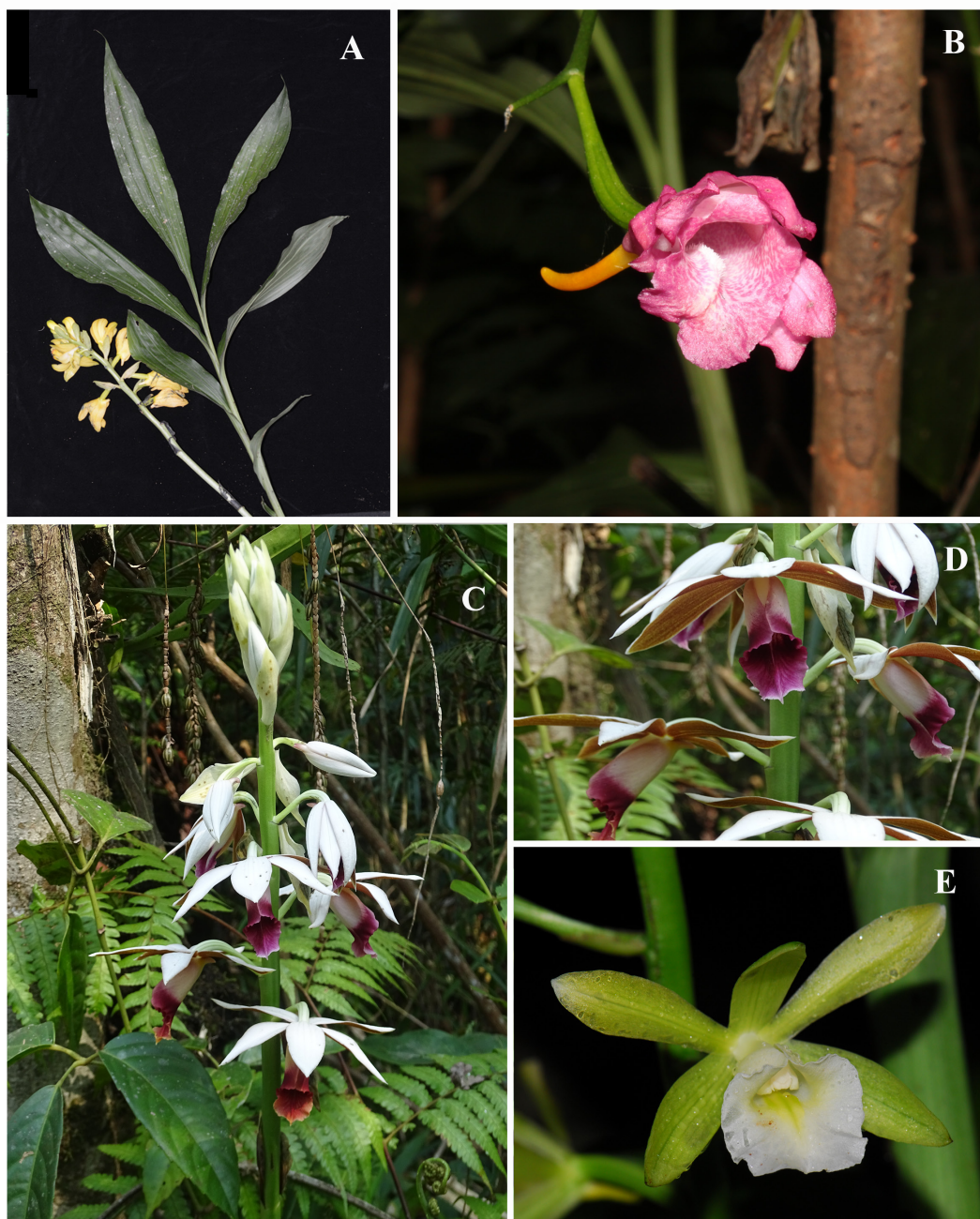


Figure 4. *Phaius* species in Myanmar. A. *P. flavus* (Blume) Lindl.; B. *P. mishmensis* (Lindl. & Paxton) Rchb.f.; C–D. *P. tankervilleae* (Banks) Blume; E. *P. takeoi* (Hayata) H.J. Su. Photos: A by Kate Armstrong, B by Hubert Kurzweil, C–D by Santanu Dey, E by Santi Waththana.

Terrestrial plants, to 100 cm tall; glabrous except for the column. *Pseudobulbs* largely obscured by the bases of the leaves; best visible on old, leafless shoots. *Leaves* usually 4, blade oblong-elliptic, acute or acuminate, 49–70 by 15–24 cm, shortly petiolate. *Inflorescences* from the lower part of the pseudobulb, erect; flowers 4–15, laxly arranged; bracts caducous, ovate-lanceolate, 30–60 mm long. *Flowers* spreading, large, sepals and petals greenish-yellow on both sides, lip white with red and yellow markings; pedicel and ovary 50–55 mm long. *Sepals* ovate-lanceolate, acuminate, to 68 by 12–18 mm. *Petals* oblong-lanceolate, acuminate, to 63 by 17 mm. *Lip* 3-lobed, obovate, to 55 by 53 mm, united with the column base; side lobes rounded, enveloping the column; mid-lobe ovate-triangular, acute; callus as 2 obscure keels; spur cylindric, 11–20 mm long. *Column* 18–22 mm long, pubescent on the front side; rostellum ligulate.

Myanmar.— Upper Myanmar [*Griffith s.n.*, *Kew Distr.* 5292 (K!)]. Mandalay Region [Pyinoolwin District, *vide* Nyan Tun, 2014: 377; Myingyan District, 12 May 2005, *Khin Myo Htwe* 29 (TNS! [s])].

Distribution.— Sri Lanka, N India, Bhutan, Bangladesh, Upper Myanmar, Thailand, Vietnam and SW & S China.

Ecology and phenology.— Found in forest; no elevation information is available in Myanmar but in neighbouring China the elevation is given as 700–1,000 m. Flowering in Myanmar has been reported in May.

DOUBTFULLY RECORDED SPECIES

These species have been recorded from Myanmar but we have not seen any material:

Calanthe odora Griff., reported by Kress *et al.* (2003: 68). The species is widespread and can be expected to occur in Myanmar.

Calanthe × *porphyrea* Rehb.f., reported by Govaerts *et al.* (2019) as a natural hybrid which is endemic to Myanmar. However, there is no mention of it having originated in this country in the protologue.

EXCLUDED SPECIES

Calanthe trulliformis King & Pantl.: The occurrence of this species in Myanmar was reported by Ormerod & Kumar (2003). The record is from the Valley of the Di Chu which is in Arunachal Pradesh (India) near the border with Myanmar. However, due to the close proximity of this locality to the border it can be expected that the species may also turn up in Myanmar one day.

Calanthe sylvatica (Thouars) Lindl. is only found in Africa, Madagascar and the Mascarene Islands. In the past this name was often misapplied to specimens of the similar *C. masuca* (D. Don) Lindl.

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