

# A precursory study of the *Calanthe* group (Orchidaceae) in Thailand

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## ABSTRACT

A review of the Thai species of the *Calanthe* group (Orchidaceae) is presented, based on the examination of over 500 herbarium and spirit specimens, and is a precursor for a later treatment in the *Flora of Thailand*. The group comprises the genera *Calanthe* R.Br., *Phaius* Lour. and *Cephalantheropsis* Guillaumin. In the genus *Calanthe*, 21 species are recognized, one of them being new but incompletely known as only a single flower was available for study. *Calanthe angustifolia* (Blume) Lindl. is newly reported for Thailand. Unusual forms of *C. vestita* Wall. ex Lindl. are commented on, and the extensive variation in the spur length of *C. triplicata* (Willemet) Ames is discussed. Five *Phaius* and one *Cephalantheropsis* species are recognized. Identification keys to the three genera and all species are given, and descriptions are provided for all species. A selection is illustrated by line drawings.

## KEY WORDS

Orchidaceae,  
*Calanthe*,  
*Phaius*,  
*Cephalantheropsis*,  
Thailand.

## RÉSUMÉ

*Étude préliminaire du groupe Calanthe (Orchidaceae) en Thaïlande.*

Cet article présente une revue des espèces thaïlandaises du groupe *Calanthe* (Orchidaceae), basée sur l'examen de plus de 500 spécimens d'herbier et en alcool, ce travail est préliminaire au traitement prévu dans la *Flora of Thailand*. Le groupe comprend les genres *Calanthe* R.Br., *Phaius* Lour. et *Cephalantheropsis* Guillaumin. Dans le genre *Calanthe*, 21 espèces sont reconnues, l'une d'elles étant nouvelle mais insuffisamment connue du fait de la disponibilité d'une unique fleur pour étude. *Calanthe angustifolia* (Blume) Lindl. est nouvellement mentionné de Thaïlande. Des commentaires sont présentés sur des formes inhabituelles de *C. vestita* Wall. ex Lindl., et la variation étendue de la longueur de l'épéron de *C. triplicata* (Willemet) Ames est discutée. Cinq espèces de *Phaius* et une de *Cephalantheropsis* sont reconnues. Des clés d'identification des trois genres et de toutes les espèces sont proposées et les descriptions de toutes les espèces sont fournies. Une sélection d'espèces est illustrée.

## MOTS CLÉS

Orchidaceae,  
*Calanthe*,  
*Phaius*,  
*Cephalantheropsis*,  
Thaïlande.

## INTRODUCTION

The Thai species of the *Calanthe* group (Orchidaceae) are reviewed, comprising the representatives of the genera *Calanthe* R.Br., *Phaius* Lour. and *Cephalantheropsis* Guillaumin. The study will form the basis for a later treatment in the *Flora of Thailand*.

The *Calanthe* group is well characterised by having pseudobulbous or cane-like stems made up of several internodes, distichous plicate leaves, basal or lateral inflorescences (Fig. 1), resupinate flowers with free sepals and petals, normally spurred lips, and a gynostemium with an incumbent anther with eight clavate pollinia. Most species in the group are terrestrial or lithophytic. In their overall distribution all three genera are mainly Asian. *Calanthe* (c. 260 species worldwide) is widespread throughout Australasia but also ranges into tropical and extra-tropical Africa, Madagascar, the Indian Ocean islands as well as the Pacific Ocean islands with a few species, and a single species is also found in Central America (Schuiteman & de Vogel 2000; Pridgeon *et al.* 2005). *Phaius* (c. 40 species) has a similar distribution but is far less widespread in Africa and Asia and is absent from Central America. Finally, the small genus *Cephalantheropsis* (five species) is only found in South-East Asia, ranging from north-eastern India eastwards as far as southern China and the Philippines, and southwards as far as Sumatra.

The three genera are considered as closely related (Pridgeon *et al.* 2005). The distinction of *Calanthe* and *Phaius* has been a consistent problem in the past. *Calanthe* is characterised by having a lip which is normally extensively fused with the gynostemium. In contrast, the lip of the genus *Phaius* is usually free from the gynostemium. However, there are a number of exceptions in both genera regarding their lip-gynostemium fusion, indicating that this character is not very reliable. Several *Calanthe* species have lips which are only incompletely united with the gynostemium and there are even a few where this fusion is absent (the latter is of interest in the present paper as a few of the Thai species have free lips). In the genus *Phaius* the lip is sometimes basally united with the gynostemium (up to one third). In the absence of unique characters of the genera

*Calanthe* and *Phaius* their monophyly is increasingly questioned, and preliminary molecular evidence raises further doubts in this regard (M. Fay and M. Chase, pers. comm. August 2008). The third genus in the group, *Cephalantheropsis*, is horticulturally hardly valuable and has therefore attracted far less attention in the past. The genus is characterised by having a lip which is almost entirely free from the gynostemium but differs from *Phaius* in lacking a spur. It is hoped that a sound phylogeny of the *Calanthe* group, based on molecular and other evidence, will be established in the near future to address the relationships of the species. As there is currently no comprehensive study of the entire group all three genera are here recognized in their classical circumscription.

The large genus *Calanthe* has been divided into two subgenera and several sections by Schlechter (1912), and most later authors have followed his subgeneric classification. Subgenus *Preptanthe* (Rchb.f.) Schltr., with large swollen pseudobulbs and annual leaves (Fig. 1C), comprises only c. eight species which are found mainly in continental Asia but one species also ranges into Malesia as far eastwards as New Guinea. Subgenus *Calanthe*, without prominent pseudobulbs and with evergreen leaves (Fig. 1A, B), comprises the vast majority of the species and is very widespread in its distribution. This subgenus is further subdivided into six sections, two of which are represented in Thailand. Section *Calanthe* has persistent floral bracts while section *Styloglossum* (Breda) Schltr. is characterised by having caducous bracts (the mature inflorescences of the latter group therefore lack floral bracts altogether).

In Thailand *Calanthe* and *Phaius* are well represented by 21 and five species respectively, while only a single species of the genus *Cephalantheropsis* is known in the country. Previously important contributions to our knowledge of the Thai species of these three genera were made in the works of the late Dr Gunnar Seidenfaden (Seidenfaden & Smitinand 1961; Seidenfaden 1975, 1986). Though invaluable as the first complete inventory of the orchid flora of the kingdom and as a sound basis for further floristic work, Seidenfaden's treatments lack descriptions which are provided in the present



FIG. 1. — Growth habits in the *Calanthe* group: **A**, *Calanthe puberula* Lindl.; **B**, *Calanthe clavata* Lindl.; **C**, *Calanthe rosea* (Lindl.) Benth.; **D**, *Phaius tankervilleae* (Banks ex L'Hér.) Blume; **E**, *Cephalantheropsis obcordata* (Lindl.) Ormerod. Drawn by Mr Teo Shuan Hao. Semi-diagrammatic. Scale bars: 5 cm.

review. Furthermore, a considerably larger amount of material is now available for study, and obviously also the nomenclature was updated here.

The Thai species of the genus *Calanthe* are distributed in all parts of the country with the largest concentration found in the Northern, North-Eastern, Eastern and Peninsular floristic regions. Preferred habitats are evergreen and deciduous forest at low and middle altitudes, often with pine and bamboo. Occasionally plants of *C. odora* Griff. and *C. simplex* Seidenf. thrive in marshy grassland and savanna, respectively. One species is new but is only known from a single flower and can therefore not be described at the moment. *Calanthe angustifolia* (Blume) Lindl. is added to the list of the Thai *Calanthe* species as a new distribution record, although the presence of this species in Thailand is not surprising given its occurrence in adjacent countries. Several aberrant forms of *C. vestita* Wall. ex Lindl. were found and are discussed below, occurring in areas far outside the main distribution of the species. *Calanthe triplicata* (Willemet) Ames exhibits great variation in its spur length which is also elaborated on below. *Phaius* and *Cephalantheropsis* are known from scattered localities in all parts of the country. The species are either found in moist or dry evergreen forest (*Phaius flavus* (Blume) Lindl., *P. indochinensis* Seidenf. & Ormerod, *P. mishmensis* (Lindl. & Paxton) Rchb.f., *Cephalantheropsis obcordata* (Lindl.) Ormerod) or occur in marshy grassland and bog (*P. tankervilleae* (Banks ex L'Hér.) Blume) at lower and middle altitudes. The habitat ecology of the fifth *Phaius* species, *P. wallichii*, has not been recorded in the Thai specimens.

## MATERIAL AND METHODS

The study is based on the examination of the dry and spirit collections of the herbaria AAU, B, BCU, BK, BKF, BM, C, CMU, K, L, P, PSU, QBG, the herbarium of the Science Faculty of Chiang Mai University (here abbreviated as CMU [Sc]) and the herbarium of the Suan Luang Public Park in Bangkok (abbreviated as Suan Luang). The herbarium information obtained is supplemented by observations made on personal fieldtrips and by literature data. A useful source of information have also been the Seidenfaden working files at the University of Copenhagen.

Synonyms commonly used in South-East Asian botany are cited; for a more complete list of synonyms see the publications of Seidenfaden (1975; 1986). A list of all of the examined Thai material is provided and a question mark indicates an uncertain identification which in most cases is due to incomplete specimens. Descriptions were drafted only from Thai material unless otherwise stated. A section "Illustrations" indicates recently published line drawings; a few examples of these are also reproduced here with permission from the copyright holders. The delimitation of the seven floristic regions of Thailand (Northern, North-Eastern, Eastern, South-Western, Central, South-Eastern, Peninsular) is that commonly used in Thai floristic botany (e.g., in the *Flora of Thailand*, currently edited by Santisuk & Larsen). A frequently cited collecting locality, Khao Yai, if not accompanied by a specific province name is listed as "unspecified" as this National Park occupies parts of several provinces in the Eastern, Central and South-Eastern floristic regions.

### ARTIFICIAL KEY TO THE GENERA *CALANTHE* R.BR., *PHAIUS* LOUR. AND *CEPHALANTHEROPSIS* GUILLAUMIN IN THAILAND

1. Stems with prominent swollen ovoid or conical pseudobulbs; leaves annual, with pronounced abscission layer; rachis and sepals strongly soft-hairy ..... *Calanthe* in part (subgenus *Preptanthe*), p. 61
- Stems either with inconspicuous pseudobulbs which are largely hidden among the leaf sheaths or altogether cane-like; leaves evergreen without prominent abscission layer; rachis and sepals glabrous or shortly hairy ..... 2
2. Gynostemium almost always completely united with the lip base; stems with conical or cylindrical and mostly adjacent pseudobulbs; inflorescence usually arising from the ba-

- sal part of the leafy shoot or rarely from the upper parts of the cylindrical pseudobulbs well above the ground; inflorescences lax, semi-dense or dense; flowers most commonly small or medium-sized, sepals mostly 8-18 mm long and petals mostly 8-16 mm long. Very rarely the lip base only fused to one to two thirds of the gynostemium and the upper gynostemium portion free, but then the pseudobulbs spaced on a creeping rhizome and the inflorescences arising next to the leafy shoots directly from the rhizome (only in *Calanthe clavata* and *C. densiflora*) ..... *Calanthe* in part, p. 61
- Gynostemium united with the lip base only at the base or up to one third, stems as adjacent pseudobulbs or cane-like. Inflorescences lax to semi-dense ..... 3
3. Lip with short or long spur; inflorescences arising either from the base of the pseudobulbous shoot or halfway up the cane-like stem; flowers large with the sepals mostly 23-70 mm long and the petals mostly 20-63 mm long ..... *Phaius*, p. 92
- Lip base without a sac or spur; inflorescence arising halfway up the cane-like stem; flowers smaller with sepals 10-19 mm long and petals 10-18 mm long ... *Cephalantheropsis*, p. 101

## SYSTEMATICS

### Genus *Calanthe* R.Br.

*Botanical Register* 7: pl. 573 ("578") (1821), *nom. cons.*; Hooker, *Flora of British India* 5: 847-856 (1890); Seidenfaden, *Dansk Botanisk Arkiv* 29: 9-50 (1975); Pridgeon *et al.*, *Genera Orchidacearum* 4: 122-127 (2005). — Type species: *Calanthe veratrifolia* R.Br. (= *C. triplicata* (Willemet) Ames).

(For generic synonyms see Pridgeon *et al.* 2005)

### DESCRIPTION

Terrestrial, epilithic or very rarely epiphytic herbs, evergreen or deciduous, (12-)25-100(-150) cm tall, Thai species generally pseudobulbous herbs. Basal sheaths below the pseudobulb few, mostly already partly or entirely decayed at the flowering time. Pseudobulbs either inconspicuous and largely hidden by the petioles of the foliage leaves or prominent and enclosed by silvery-grey leaf sheaths, most commonly close together and only very rarely spaced out on an elongate rhizome, derived from several nodes but in subgenus *Preptanthe* the largest part made up of one node and only the bottom and top part of the pseudobulb several-noded. Leaves few, plicate, annual or perennial, lanceolate-oblong, acute or acuminate, glabrous or hairy, narrow basal part mostly erect or suberect and the upper wider portion more or less arching or pendent, less commonly the entire leaf suberect or spreading (particularly in those species that have short leaves); with grooved petioles the lower part of which sometimes forms

a pseudostem. Inflorescences erect or suberect, unbranched, racemose, glabrous or pubescent, mostly arising from the basal part of the pseudobulb and only very rarely directly from the rhizome next to a pseudobulb; peduncles usually with sterile bracts, a few of them clustered at its base, sometimes dry at the flowering time, often hairy, the lower sheathing; floral bracts broadly ovate-lanceolate, persistent or caducous, mostly hairy. Flowers few to many, mostly small- or medium-sized and only rarely large and showy, resupinate; dominating colours in Thai species are white, pink, yellow and green, flowers usually turn blackish-blue when damaged or with age. Ovary mostly hairy, rarely distinct from the pedicel. Sepals free, spreading or campanulate, often hairy especially on the outside. Petals similar to the sepals but almost always glabrous, spreading. Lip entire or 3-lobed, midlobe frequently bipartite, base mostly completely united with the gynostemium and only rarely partly or entirely free, disc often with a callus, almost always spurred; spur long or short, clavate, slender or saccate. Gynostemium long or short, glabrous or hairy; anther incumbent, operculate, with 8 waxy, clavate pollinia; rostellum bifid or beaked; stigma in a cavity below the rostellum.

### DISTRIBUTION

A genus of *c.* 260 species distributed mainly in Asia, spreading into Australia and the Pacific Ocean islands, with a few species also found in tropical and extratropical Africa, the Indian Ocean Islands and Central America; 21 species in Thailand.

ARTIFICIAL KEY TO THE THAI SPECIES OF THE GENUS *CALANTHE* R.BR.

1. Stems with prominent swollen ovoid or conical pseudobulbs; leaves annual, with prominent abscission layer; rachis and sepals soft-hairy ..... subgenus *Preptanthe*, 2
- Stems with obscure conical or cylindric pseudobulbs largely hidden among the leaf sheaths; foliage leaves perennial; rachis and sepals glabrous or shortly hairy ..... subgenus *Calanthe*, 9
2. Lip deeply or shallowly 3-lobed ..... 3
- Lip unlobed ..... 7
3. Lip midlobe deeply bilobulate; side lobes spreading and not much broadening towards their apex; lip base and gynostemium extensively fused ..... 4
- Lip midlobe entire or emarginate; side lobes much broadening towards the apex; lip and gynostemium free or nearly so ..... 5
4. Flowers white or cream, usually with some yellow or red at the lip base; sepals 20-30 mm long ..... 1. *Calanthe vestita*, p. 63
- Flowers pink or rarely white; sepals 11-18 mm long ..... 2. *Calanthe rubens*, p. 65
5. Floral bracts 28-40 mm long; basal keel on the lip hypochile obscure ..... 3. *Calanthe hirsuta*, p. 66
- Floral bracts to 22 mm long; lip hypochile with three usually prominent fleshy keels ... 6
6. Median keel of the lip hypochile extending onto the midlobe as a high thin lamella ..... 4. *Calanthe succedanea*, p. 68
- Median keel of the lip hypochile extending onto the midlobe as a low rounded keel or strong vein ..... 5. *Calanthe cardioglossa*, p. 69
7. Flowers small with the sepals 9-14 mm long; lip rounded triangular to flabellate, hypochile with three fleshy keels ..... 6. *Calanthe labrosa*, p. 72
- Flowers large and showy, sepals mostly over 19 mm long ..... 8
8. Lip not united with the gynostemium, hypochile rolled around it; lip blade rounded rectangular, truncate or emarginate ..... 7. *Calanthe rosea*, p. 73
- Lip completely united with the gynostemium; lip blade fan-shaped and apically emarginate ..... 21. *Calanthe* indet., p. 90
9. Floral bracts caducous (= falling off early); flowers often white or yellow and not opening widely ..... section *Styloglossum*, 10
- Floral bracts persistent ..... section *Calanthe*, 15
10. Spur apex strongly hooked through 180° or more; flowers yellow-orange with sepals 12-14 mm long ..... 8. *Calanthe pulchra*, p. 74
- Spur not hooked at the apex ..... 11
11. Lip side lobes minutely auriculate, mostly less than 0.5 mm long; spur usually 4-6 mm long ..... 9. *Calanthe lyroglossa*, p. 75
- Lip side lobes distinct, 1.9 mm long or longer; spur mostly 8-15 mm long ..... 12
12. Flowers white, lip often partly yellow; lip midlobe deeply emarginate ..... 10. *Calanthe angustifolia*, p. 76
- Flowers yellow or orange-yellow; lip midlobe various ..... 13

13. Gynostemium united with the lip base along its entire length; lip midlobe pointed ..... 11. *Calanthe speciosa*, p. 78  
 — Gynostemium united with the lip only for one to two thirds and the upper portion of the gynostemium free; inflorescence arising from the rhizome next to the leafy shoot ..... 14
14. Raceme cylindrical; rachis 10.5-22 cm long; peduncle to 30 cm long; spur clavate, somewhat curved ..... 12. *Calanthe clavata*, p. 79  
 — Raceme globose to subcylindrical; rachis 1-3(-5) cm long; peduncle 9-18 cm long ..... 13. *Calanthe densiflora*, p. 80
15. Spur absent; flowers lavender or light purple; lip midlobe without pronounced raised lamellae ..... 14. *Calanthe puberula*, p. 81  
 — Spur present ..... 16
16. Lip unlobed or 2-lobed ..... 17  
 — Lip 3-lobed, the midlobe emarginate or further splits into two spreading lobules ..... 18
17. Flowers large; sepals 15-18 mm long; lip clawed, spur 2-4 mm long ..... 15. *Calanthe biloba*, p. 82  
 — Flowers smaller; sepals 9-14 mm long; gynostemium densely and shortly pubescent; in Thailand currently only known from the Chiang Dao area of Chiang Mai Province ..... 16. *Calanthe simplex*, p. 82
18. Spur (8-)10-12 mm long ..... 17. *Calanthe odora*, p. 83  
 — Spur over 18 mm long ..... 19
19. Spur pointing upwards, 30-52 mm long; flowers purple or white flushed with purple and turning yellow at age; median sepal 12.5-16 mm long; lip midlobe deeply emarginate to bipartite, with each lobule broadly oblong and mostly 6-8.8 × 8-12 mm ..... 18. *Calanthe ceciliae*, p. 84  
 — Not this combination of characters ..... 20
20. Flowers white, callus usually yellow or orange-red; lip side lobes oblong, spreading and pointing forwards; midlobe deeply bilobulate ..... 19. *Calanthe triplicata*, p. 85  
 — Flowers mauve to purple or rarely white with rose lip; lip midlobe fan-shaped and emarginate; side lobes oblong-auriculate ..... 20. *Calanthe sylvatica*, p. 89

1. *Calanthe vestita* Wall. ex Lindl.

*Genera and Species of Orchidaceous Plants*: 250 (1833); Hooker, *Flora of British India* 5: 852 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 333 (1961); Seidenfaden, *Dansk Botanisk Arkiv* 29: 26 (1975); Seidenfaden, *Opera Botanica* 114: 89 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 165 (1992); Comber, *Orchids of Sumatra*: 255 (2001); Pridgeon *et al.*, *Genera Orchidacearum* 4: 125 (2005). — *Preptanthe vestita* (Wall. ex Lindl.) Rchb.f., *Flore des Serres et des Jardins de l'Europe* 8: 245 (1853). — *Phaius vestitus* (Wall. ex Lindl.) Rchb.f., *Gardener's Chronicle* 1867: 264 (1867). — *Alismorkis vestita* (Wall. ex Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type:

Myanmar, Tavoy, *Wallich s.n.*, Wallich's Catalogue 7345 (holo-, K-LINDL).

MATERIAL EXAMINED. — ?North-Eastern, Nong Khai, 28.XI.1987, *Sukhakul* sub *Seidenfaden & Smitinand* 9393 (C spirit); 26.XI.1984, 9508 (C spirit); 26.XI.1984, 9509 (C spirit); 23.XI.1987, 9592 (C spirit). — ?South-Western, Kanchanaburi, XI. [year not given], *Thaithong* 779 (BCU spirit). — Peninsular, Ranong, Khao Chang, 4.I.1929, *Kerr* 0679 (B, BK, C, K). — Peninsular, Ranong, Khlong Nang Yon, 25.II.1974, *Geesink et al.* 7605 (B, C, C spirit, K, L). — Peninsular, Ranong, 19.XII.1979, *Jacobsen* 117 (C spirit); *Seidenfaden & Smitinand* 6101 (C spirit). — Peninsular, Phangnga, Khao Phra Mi, 9.I.1966, *Hansen & Smitinand* 11867 (BKF, C). — Peninsular, Phangnga, Nang Yon, 23.XI.1973, *Santisuk*

668 (BKF). — Peninsular, Phangnga, Ko Ra, 3.I.1974, *Seidenfaden & Smitinand 6583* (C spirit). — Without locality, 26.XI.1997, *Nanakorn et al. 9981* (QBG spirit); *Seidenfaden & Smitinand 5869* (C spirit).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: pl. XIV (s.n.) (1961); Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 9a-c, pl. IV (1975); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 71a, b, pl. 9a (1992); Comber, *Orchids of Sumatra*: pl. on page 255 (2001); Pridgeon *et al.*, *Genera Orchidacearum* 4: fig. 264.2A-J, pl. 36 (2005).

#### DESCRIPTION

Usually epiphytic herbs, occasionally epilithic, very rarely terrestrial, deciduous, 43-76(-125) cm tall. Basal sheaths not seen. Pseudobulbs conspicuous, ovoid, conical, covered by greyish-silvery leaf sheaths, 7-10 × 2-2.5 cm, glabrous, close together, several-noded with the largest part made up of a single internode. Leaves 1-4, annual and usually not present at the flowering time, lanceolate-elliptic, acuminate, 28-45 × (4.6-)7.6-12 cm, glabrous; petioles 4-5 cm long. Inflorescences arising from the base of the pseudobulb, usually erect at the base and nodding in the upper part, much longer than the leaves (if present), softly pubescent; peduncles 27-52 cm long; sterile bracts 3-7, scattered along the flowering stem and a few clustered at its base, erect to suberect or spreading, lanceolate-oblong, acute or acuminate, 2.1-4.7 cm long, sparsely pubescent, sheathing; raceme lax, 7- to 15-flowered; rachis 16-30(-40) cm long; floral bracts persistent, broadly ovate-lanceolate, acuminate, 16-30 × 5-12 mm, much shorter than the pedicel plus the ovary, pubescent. Flowers to 55 mm across, white or cream and usually with yellow or more rarely red lip base. Ovary indistinguishable from the pedicel, 35-54 mm long, straight, densely pubescent. Sepals obovate-elliptic, acuminate to apiculate, indistinctly 5- or 7-veined, pubescent especially on their outside; median sepal 20-30 × 7-12 mm; lateral sepals oblique, 21-30 × 7-9.3 mm. Petals obovate-elliptic, obtuse, apiculate, indistinctly 3- to 7-veined from the base, 22-27 × 9-11 mm, glabrous. Lip 3-lobed, 24-32 × 19-36 mm, base completely united with the gynostemium, softly pubescent on the outside base and otherwise glabrous, often with a small

auricle on each side where the lip is joined onto the gynostemium, spurred; midlobe bipartite, 10-14 × 17-24 mm, sinus obtuse and often with a tiny tooth, each lobule spreading, oblong, obtuse; side lobes oblong, obtuse, 9-15 × 8-12 mm, not much widening towards the apex, spreading and pointing forwards; lower part of the disk with three longitudinal keels, area around these keels with short scale-like hairs; spur cylindrical, softly pubescent, 20-30 mm long, pointing backwards at the base and strongly curved forwards above. Gynostemium 10-12 mm long, glabrous or sparsely pubescent; rostellum bilobed. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

This species is quite rare in Thailand. All confirmed records come from the Ranong-Phangnga area in the northern parts of the Thai Peninsula and from adjacent islands, and in addition there are a few doubtful records from the North-East and South-West. Generally widespread in SE Asia, ranging from Myanmar to Indochina and the whole of the Malay Archipelago as far east as New Guinea. Found mostly as an epiphyte in evergreen forest, often found associated with limestone, from sea level to about 60 m. Flowering mainly from November to February.

#### REMARKS

*Calanthe vestita* has attracted much attention among orchid growers and has given rise to many hybrids. The species can easily be recognized by its large white or cream-coloured flowers with yellow or red markings on the lip base, the deeply bilobulate lip midlobe and the spreading lip side lobes.

*Calanthe vestita* is interesting from a habitat-ecological point of view as it is the only Thai species in its genus which is predominantly epiphytic. Having prominent pseudobulbs the species is well adapted to a climate with a pronounced dry season.

The collection *Thaithong 779* from Kanchanaburi is unusual in the small size of the tepals, in the lip that lacks any ornaments and in its flowering time in November. Four collections from Nong Khai Province (*Sukhakul* sub *Seidenfaden & Smitinand 9393, 9508, 9509, 9592*) are largely intermediate in their flower size between *C. rubens* and *C. vestita*



TABLE 1. — Floral characters of *Calanthe vestita* Wall. ex Lindl., *C. rubens* Ridl. and the four doubtful collections from Nong Khai Province. All measurements in mm.

	<i>Calanthe vestita</i>	Nong Khai collections	<i>Calanthe rubens</i>
length ovary plus pedicel	35-54	31-35	23-35(-45)
median sepal	20-30 × 7-12	20-22 × 9.2-10.8	(11-)-13-17 × 3.7-6(-8)
lateral sepals	21-30 × 7-9.3	20-22 × 8-10	(11-)-13-16(-18) × 3.5-6(-7.7)
petals	22-27 × 9-11	19-21 × 11-13	(10-)-11-16 × 4-8(-10.5)
total lip length	24-32	21-23	(10-)-15-20(-28)
lip midlobe	10-14 × 17-24	8.5-10 × 15-19	(3-)-4-7 × 5-11(-12.5)
lip side lobes	9-15 × 8-12	9-10 × 9-9.5	(3-)-4-6(-8) × 2.3-5(-9)
length lip spur	20-30	19-34	13-20(-21)
gynostemium length	10-12	9-9.5	4-7(-8)

though approaching the concept of the latter species in its current delimitation (Table 1). Flowers are white with pink lip base in 9393, white with light purple lip base in 9508, white with dark purple lip base in 9509 and pure white in 9592. In the spirit jars of these four collections and in letters found in the Seidenfaden working files they are variously referred to *C. rubens* and *C. vestita*. The specimens are here interpreted as unusual forms of *C. vestita* although the identification is uncertain. Apart from the morphological similarity this identification is also more likely from a phytogeographical point of view as *C. vestita* has been reported in neighbouring Laos (Schuiteman *et al.* 2008).

## 2. *Calanthe rubens* Ridl. (Fig. 2)

*Gardeners' Chronicle*, III, 1890: 576 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 333 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 792 (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: 30 (1975); Seidenfaden, *Opera Botanica* 114: 89 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 165 (1992). — *Alismorkis rubens* (Ridl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — *Preptanthe rubens* (Ridl.) Ridl., *Flora of the Malay Peninsula* 4: 123 (1924). — Types: Peninsular Malaysia, Langkawi, date illegible, *Curtis* 218 (syn-, SING!); Peninsular Malaysia, Langkawi, 3.I.1890, *Curtis s.n.* (syn-, SING!).

ADDITIONAL MATERIAL EXAMINED. — Eastern, Nakhon Ratchasima, Kao Sisiat, 18.I.1925, *Kerr* 0214 (BK, C, K). — Eastern, Si Sa Ket, *Seidenfaden & Smitinand* 8137 (C spirit). — Central, Saraburi, Menam Pasak

Kengkoi, 9.XII.1923, *Kerr* 0122 (C, K). — Central, Saraburi, XII. 1963, *Cumberlege* 506 (K spirit). — South-Eastern, Prachin Buri, *Songkakul* 80 (BKF spirit). — South-Eastern, Rayong, Khao Cha Mao, *Shimizu et al.* 23473 (C spirit). — South-Eastern, Chanthaburi, Kao Subap, 7.I.1930, *Kerr* 0785 (BK, C, K, L). — South-Eastern, Chanthaburi, *Seidenfaden & Smitinand* 5884 (C spirit). — Peninsular, Surat Thani, Ban Tham Pueng, 21.II.2006, *Suksathan* 3817-1 (QBG, QBG spirit). — Peninsular, Surat Thani, Ko Samui, 25.I.1929, *Kerr s.n.* (K). — Peninsular, Surat Thani, 22.II.1930, *Kerr* 0790 (BK, K). — Peninsular, Phangnga, Ko Chong Lat, *Seidenfaden & Smitinand* 6487 (C spirit). — Peninsular, Phangnga, 28.XI.1929, *Kerr* 0720 (BK, C, K); *Kerr s.n.* (BK SN243536); 27.II.1929, *Kerr s.n.* (K). — Peninsular, Krabi, Kow-Pra Bahng Krahm Wildlife Sanctuary, 18.I.2006, *Maxwell* 06-76 (CMU [Sc], CMU [Sc] spirit). — Peninsular, Krabi, Ban Khao Thong, 20.I.1966, *Seidenfaden & Smitinand* 6260 (C spirit). — Peninsular, Nakhon Si Thammarat, Tung Song, 13.II.1928, *Put* 2361 (BK, C, K). — Peninsular, Trang, 29.XI.1985, *Kurzweil* 706 (K). — Peninsular, Satun, Adang, 12.I.1928, *Kerr* 0486 (BK, C, K, L). — Peninsular, Satun, Tang Wa, 6.I.1928, *Kerr s.n.* (KH2006/01478-255). — Peninsular, Satun, Ko Terutao, *Seidenfaden & Smitinand* 6549 (C spirit). — Peninsular, Satun, Taleban National Park, 21.I.85, *Seidenfaden & Smitinand* 9363 (C spirit). — Peninsular, Satun, *Way s.n.* (C L69/2006-40). — Peninsular, Pulau Kopang, 28.XI.1918, *Haniff & Low* 3564 (SING). — Peninsular, Selim, I. 1923, *Put* sub *Smith* 001 (K). — Without locality, *Menzies & DuPuy* 53 (K spirit); 7.I.1988, *Nanakorn et al.* 10440 (QBG spirit); *Niyomdham* 2135 (BKF spirit); *Thaithong* 798 (BCU spirit).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: fig. 253 (1961); Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 10a-c, pl. V (1975); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 71c, pl. 9b (1992).

## DESCRIPTION

Terrestrial or lithophytic herbs, deciduous, 25-75(-132) cm tall. Basal sheaths not seen. Pseudobulbs prominent, ovoid, conical, 2.5-12 × 2.5-3.5 cm, close together, several-noded with the largest part made up of a single internode, covered by greyish-silvery leaf sheaths, glabrous. Leaves 1-3, annual and usually not present at the flowering time, lanceolate-oblong, acute or acuminate, to 60 × 15 cm, glabrous; petioles 5-6 cm long. Inflorescences arising from the base or middle of the pseudobulb, erect at the base and nodding in the apical part, softly pubescent; peduncles 36-50(-75) cm long; sterile bracts 5-12, scattered along the flowering stem and a few clustered at its base, erect or suberect, lanceolate-oblong, acute or acuminate, (1.5-)2.7-6.5 cm long, pubescent or sparsely pubescent, sheathing, occasionally decayed at the flowering time and only the leaf scar visible; raceme lax or semi-dense, 5- to many-flowered; rachis gradually increasing in length for some time (*vide* Seidenfaden & Wood 1992), 10-30 cm long; floral bracts persistent, ovate-lanceolate, long-acuminate, (10-)14-22 × (4-)6-11 mm, much shorter than the pedicel plus the ovary, pubescent. Flowers 15-20(-23) mm across, pink or purple, often with a red throat, rarely white, gynostemium light violet, operculum cream, spur light green to light brown. Ovary indistinguishable from the pedicel, 23-35(-45) mm long, pubescent. Sepals ovate-lanceolate, acute or apiculate, 3- or 5-veined, outside pubescent, inside glabrous or with scattered hairs; median sepal (11-)13-17 × 3.7-6(-8) mm; lateral sepals reflexed, (11-)13-16(-18) × 3.5-6(-7.7) mm. Petals obovate-elliptic, obtuse, apiculate, 3- to 7-veined, (10-)11-16 × 4-8(-10.5) mm, glabrous or with scattered hairs. Lip 3-lobed, (10-)15-20(-28) × (10.5-)20-26 mm, base completely united with the gynostemium, sometimes with two small auricles at the base of the free portion, without prominent ornaments but basal part sometimes with three obscure longitudinal ridges, spurred, glabrous or with scattered hairs; midlobe (3-)4-7 × 5-11(-12.5) mm, deeply emarginate with two elongate oblong and spreading lobules, sinus obtuse, to 3 mm deep, sometimes with a tiny tooth; side lobes oblong, obtuse, spreading, (3-)4-6(-8) × 2.3-5(-9) mm, not much widened towards the apex;

spur cylindrical, pointing backwards at the base and strongly curved forwards above, pubescent, 13-20(-21) mm long. Gynostemium 4-7(-8) mm long, glabrous; rostellum bilobed. Fruits ellipsoid, 17-23 × 6-10 mm.

## DISTRIBUTION AND PHENOLOGY

Widespread but scattered in most parts of Thailand except the Northern, North-Eastern and South-Western regions. Also recorded in Indochina, the Philippines and Peninsular Malaysia. The species is found on rocks in evergreen forest, often associated with limestone and sometimes on the edge of evergreen swamp forest, from sea level to 800 m. Flowering mainly from December to February.

## REMARKS

Diagnostic characters of this species are the medium-sized pink flowers with bilobulate lip midlobe and spreading side lobes. It is thus rather similar to *C. vestita* but differs in its flower colour and size. A further difference is the primarily epilithic growth (*C. vestita* is mainly epiphytic).

The collection *Kerr 0122* from Saraburi was originally identified as *Calanthe vestita* Lindl. and later also listed as such by Seidenfaden (1975: 30). Its pink flowers and the short sepals (10-12 mm) are not known in this species but fit the concept of *C. rubens*. However, the single remaining flower of the collection is very unusual in its lip shape, having side lobes which are much longer and wider than the lip midlobe.

Seidenfaden & Smitinand (1961) report on a white form found in Surat Thani Province (Peninsular Thailand).

3. *Calanthe hirsuta* Seidenf.

*Dansk Botanisk Arkiv* 29: 39 (1975). — Type: Thailand, Nakhon Ratchasima Province, Ban Tha Chang, 24.XII.1930, *Put 3497* (?holo-, BK; iso-, B!, C!, K!, P!).

*Calanthe* sp., Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 335 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965); based on *Put 3497*.

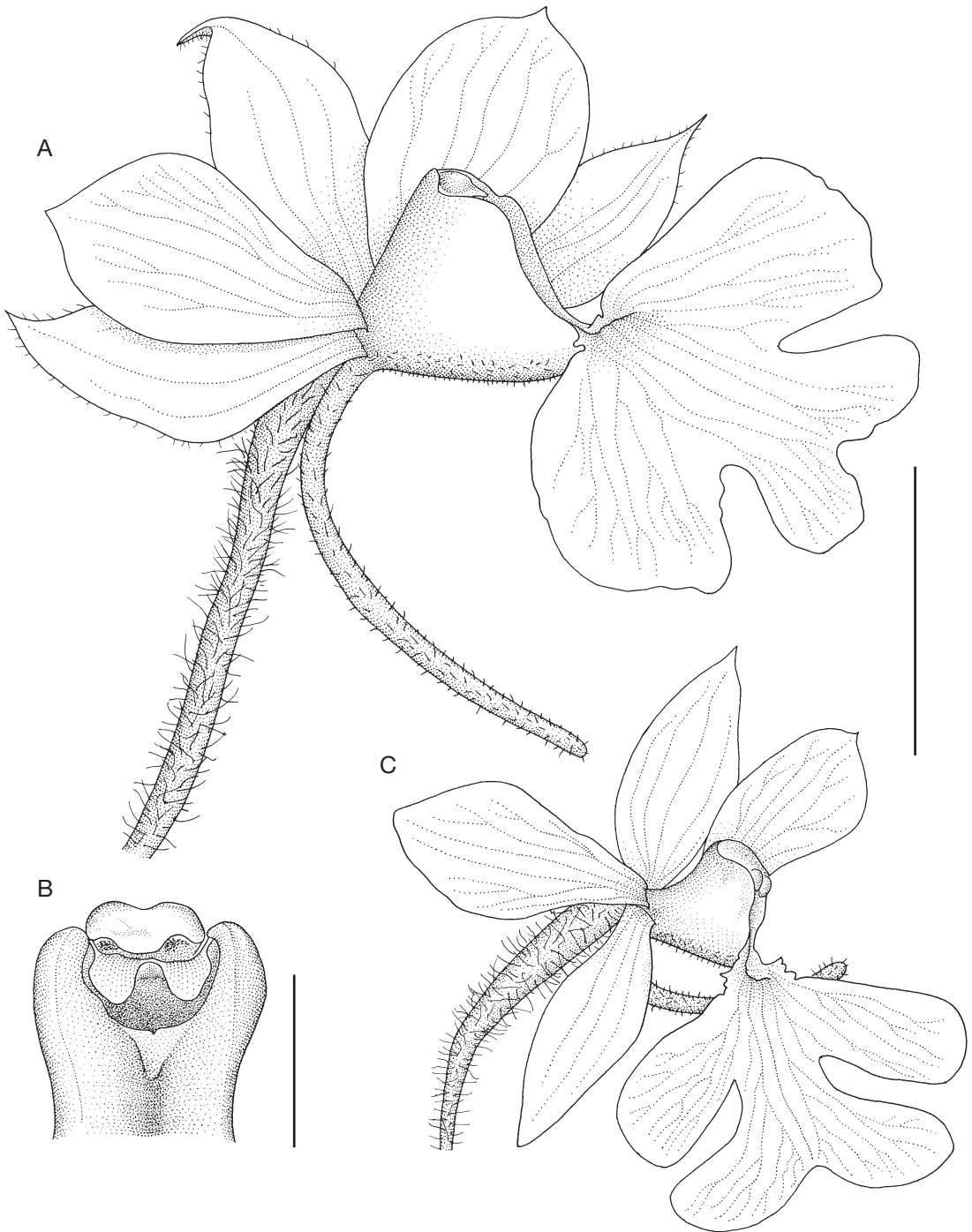


FIG. 2. — *Calanthe rubens* Ridl.: **A, C**, flower; **B**, top part of gynostemium. A, B, Thai plant, *Seidenfaden & Smitinand 6487*; C, Philippine plant, *Weber 406*. Reproduced with permission from the University of Copenhagen, drawn by Kai Olsen. Scale bars: A, C, 1 cm; B, 3 mm.

ADDITIONAL MATERIAL EXAMINED. — Eastern, Chaiyaphum, *Sukhakul* sub *Seidenfaden & Smitinand* 9578 (C spirit); 9594 (C spirit). — Central, Nakhon Nayok, Khao Yai, ?*Buakhlai* 122 (BCU spirit); 24.I.1965, *Seidenfaden & Smitinand* 5846 (C spirit). — Unspecified, Khao Yai, *Cumberlege* 903 (K spirit).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: fig. 255a-d (1961) [as *Calanthe* sp. Put 3497]; Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 13a-c (1975).

#### DESCRIPTION

Terrestrial herbs, deciduous, (38-)67-83 cm tall. Basal sheaths not seen. Pseudobulbs prominent, ovoid, conical, c. 5 × 3 cm, close together, covered by greyish-silvery leaf sheaths, glabrous, with a constriction below the apex. Leaves not present at the flowering time, not seen. Inflorescences arising from the basal part of the pseudobulb, erect at the base and nodding in the apical part, softly pubescent; peduncles 35-55 cm long; sterile bracts 5-9, erect or suberect, scattered along the flowering stem and a few clustered at its base, lanceolate-oblong, acuminate, 1-5 cm long, pubescent, the lower sheathing, occasionally decayed at the flowering time; raceme semi-dense, 4- to many-flowered; rachis (7-)15-22 cm long; floral bracts persistent, ovate-lanceolate, acuminate, (28-)30-40 × 3-10 mm, densely pubescent. Flowers to 30 mm across, light rosa and lip with darker dots; sepals and petals with recurved apices. Ovary indistinguishable from the pedicel, 26-40 mm long, pubescent. Sepals ovate-lanceolate, aristate-acuminate, 4- to 5-veined, (14-)16-21 × (5.5-)6-7 mm, pubescent on the outside. Petals ovate-elliptic, obtuse, acuminate, 3- or 5-veined, 13.5-18 × 5-7.7 mm, glabrous. Lip 3-lobed, 15-20 × 16-20 mm, base not united with the gynostemium, spurred, glabrous; midlobe rounded or oblong, slightly emarginate, 4-13 × 3.5-4(-12) mm; side lobes flabellate, obtuse, 2.5-10 × 5-7(-12) mm, much broadening towards the apex; callus consisting of one fat, very obscure keel at the base; spur cylindrical, (25-)27-35 mm long, pubescent. Gynostemium 4-6 mm long, with a column-foot up to 3 mm long. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

Very rare in the Eastern and Central regions, currently considered as endemic to Thailand. The habitat is

not known, collections come from 1300 to 2000 m. Flowering between December and January.

#### REMARKS

This species is very similar to *Calanthe cardioglossa* (Seidenfaden 1975) but differs by having much longer floral bracts. Further differentiating characters are the spur which is mostly more than 27 mm long and the lip which is apically emarginate and lacks the prominent keels found in *C. cardioglossa*. Originally this species was thought to belong into the affinity of *C. rubens* (Seidenfaden & Smitinand 1961).

Two collections of this species from Chaiyaphum (*Sukhakul* sub *Seidenfaden & Smitinand* 9578 and 9594) agree with the type specimen in their structure but differ in their somewhat larger size.

#### 4. *Calanthe succedanea* Gagnep.

*Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 3: 324 (1931); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 339 (1961); Seidenfaden, *Dansk Botanisk Arkiv* 29: 32 (1975); Seidenfaden, *Opera Botanica* 114: 89 (1992). — Types: Laos, Bassac, *Thorel* 2629 “2623” (syn-, P!); Cambodia, Popokwil, Kampot, I. 1904, *Geoffray* 354 (syn-, P!).

ADDITIONAL MATERIAL EXAMINED. — Northern, Mae Hong Son, Huay Hei, *Triboun* 281 (l) (BK spirit). — Northern, Chiang Mai, Doi Suthep, *Wattthana* 2157 (QBG spirit). — Northern, Phitsanulok, Khao Soi Dao, *Shimizu et al.* 23873 (C spirit). — North-Eastern, Phetchabun, Thung Salaeng Luang, 29.XII.1982, *Koyama et al.* 31927 (BKF); 30.XII.1975, *Seidenfaden & Smitinand* 5606 (C spirit). — North-Eastern, Loei, Phu Krading, 14.XI.1979, *Shimizu et al.* 22676 (BKF, C spirit); 23076 (C spirit); 23216 (C spirit). — Eastern, Chaiyaphum, Phu Khieo, XI.[year not given], without collector 39 (BKF spirit). — South-Eastern, Chanthaburi, Khao Soi Dao, *Chatchai s.n.* (BCU spirit 008945); 13.XI.1969, *v. Beusekom & Smitinand* 2191 (AAU, BKF, C, E, L). — ?Without locality, *Suratabandu s.n.* (K spirit).

ILLUSTRATIONS. — Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 11a, b (1975).

#### DESCRIPTION

Terrestrial or lithophytic herbs, once recorded as an epiphyte (*Triboun* 281 (l)), deciduous, 30-47 cm

tall. Basal sheaths not seen. Pseudobulbs prominent, ovoid, conical, 2.5-11.5 × 2-3 cm, close together, covered by greyish-silvery leaf sheaths, glabrous. Leaves 4, apparently short-lived, usually present at the flowering time, lanceolate-oblong, acute, 16-49 × 3.8-11.8 cm, almost always glabrous; petioles 3-7 cm long. Inflorescences arising from the base of the pseudobulb, erect, softly pubescent; peduncles 18-35 cm long; sterile bracts 3-6, erect or suberect, scattered along the flowering stem and a few clustered at its base, lanceolate-oblong, acuminate, 1.3-3.6 cm long, pubescent, sheathing; raceme lax, up to 11-flowered; rachis 12-14 cm long; floral bracts persistent, ovate-lanceolate, long-acuminate, (12-)15-19 × 3-6 mm, shorter than the pedicel plus the ovary, pubescent. Flowers to 21 mm across, pink, lip dark purplish flecked inside; flowers turning orange-red or yellow when older. Ovary indistinguishable from the pedicel, 20-35 mm long, pubescent. Sepals ovate-lanceolate, aristate-acuminate, pubescent on the outside; median sepal 3- to 5-veined, 9-13.8 × 4.5-5.6 mm; lateral sepals 3- to 4-veined, 10-14 × 4.5-6 mm. Petals obovate-elliptic, obtuse or subacute, 3-veined, 8-13 × 3.3-6 mm. Lip 3-lobed, 11-14 × 16-20 mm, base not united with the gynostemium, spurred; midlobe broadly rounded, 4-8 × 4-9 mm; side lobes spreading, oblong, obtuse, 4-8.3 × 4-9.5 mm, much broadening towards the tip, wavy-edged; callus consisting of three fleshy keels in the basal third of the lip, median keel continuing onto the epichile as a high thin lamella; spur cylindrical, 15-29 mm long, pubescent. Gynostemium 3-4 mm long, straight, stout, with a c. 3 mm long column-foot. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

In Thailand, *Calanthe succedanea* is only known in the northern and eastern parts of the country. It has also been recorded in Indochina. The species is found in dry evergreen forest from about 550-1200 m. Flowering in November and December.

#### REMARKS

*Calanthe succedanea* and *C. cardioglossa* are very similar and share the 3-lobed lip with wavy-edged truncate side lobes which are much broadening towards the apex as well as the gynostemium which

is not united with the lip base. In *C. succedanea* the median keel of the hypochile continues onto the epichile as a high thin lamella while in *C. cardioglossa* it continues onto the epichile merely as a low rounded keel or strong vein. Intermediates in this respect were not found in the present study, and consequently both are recognized as separate species. Previously the two taxa were referred to as possibly conspecific by Seidenfaden & Smitinand (1961) but were later recognized as separate species by Seidenfaden (1975).

The high thin lamella of the lip midlobe is very short in the collection *Koyama et al.* 31927.

#### 5. *Calanthe cardioglossa* Schltr.

(Fig. 3)

*Repertorium Specierum Novarum Regni Vegetabilis* 2: 85 (1906); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 338 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: 35 (1975); Seidenfaden, *Opera Botanica* 114: 89 (1992). — *Calanthe cardiochila* Kraenzl., *Repertorium Specierum Novarum Regni Vegetabilis* 7: 83 (1909), orth. var. — Type: Thailand, Chiang Mai Province, Doi Suthep, near waterfalls, 700-1700 m, 18.XII.1904, *Hosseus* 249 (?holo-, M!; iso-, P!, K!).

*Calanthe hosseusiana* Kraenzl., *Repertorium Specierum Novarum Regni Vegetabilis* 7: 82 (1909). — Type: Thailand, Chiang Mai Province, Doi Suthep, near waterfall, *Hosseus s.n.* (iso-, AMES!).

ADDITIONAL MATERIAL EXAMINED. — Northern, Mae Hong Son, Pai, 7.XII.1973, *Seidenfaden & Smitinand* 8055B (C spirit). — Northern, Chiang Mai, Doi Suthep, *Thai-Danish Botanical Studies* 5581 (C spirit); 31.X.1909, *Kerr* 64 (C spirit, K); 31.X.1987, *Maxwell* 87-1345 (BKF, CMU, CMU spirit, L); 25.XII.1988, 88-1398 (CMU, L); X.1958, *Seidenfaden & Smitinand* 2900 (C spirit); 16.XII.1984, *Shigeyuki Mitsuta* T 50202 (BKF); 13.XII.1957, *Smitinand* 4023 (BKF); 9.XI.1958, *Sorensen et al.* 6077 (C). — Northern, Chiang Mai, Chom Thong District, 14.I.1936, *Garrett* 1043 (K). — Northern, Chiang Mai, Doi Chiang Dao, 6.XII.1965, *Hennipman* 3250 (BKF, C, L). — Northern, Chiang Mai, Doi Inthanon, 25.XII.1964, *K.* 1483 (BKF, L); 8.I.1983, *Koyama et al.* 32110 (BKF); 3.I.1991, *Maxwell* 91-8 (CMU, L); 26.XI.1997, *Nanakorn et al.* 9970 (QBG, QBG spirit); 16.XII.1987, *Santisuk* 1609 (BKF); *Tagawa et al.* 2443 (C spirit). — Northern, Chiang Mai, Doi

Nang Ka, 18.XI.1930, *Put 3433* (BK, C, K); *3465* (BK, C, K). — Northern, Chiang Mai, Omkoi, *Seidenfaden & Smitinand 5065* (C spirit). — Northern, Chiang Mai, Mae Chaem, *Seidenfaden & Smitinand s.n.* (C spirit vial 5691). — Northern, Phitsanulok, Phu Soi Dao, 25.XI.2006, *Wattbana & Kurzweil 2189* (QBG, QBG spirit, SING). — Northern, Phitsanulok, Nakornthai, 29.X.2001, *Wattbana & Suksathan 1553* (QBG spirit). — North-Eastern, Loei, Phu Krading, 7.-9.XI.1970, *Charoenphol et al. 4734* (AAU); 30.X.1984, *Murata et al. T 42076* (BKF); 30.X.1984, *T 42077* (BKF, C spirit); *T 42907* (C spirit); *T 43061* (C spirit); 14.XI.1979, *Shimizu et al. 22675* (BKF, C spirit); 14.XI.1979, *22700* (BKF, C spirit); *23079* (C spirit); XI. 1954, *Smitinand 2111* (BKF). — North-Eastern, Loei, Phu Luang, 17.XI.1968, *Chermisrivatthana 1148* (BK); 26.XI.1957, *Dee 1002* (BKF); ? *1001* (BKF). — ?North-Eastern, Loei, Phurna, 10.X.1966, *Kasem 504* (BK). — North-Eastern, Khon Kaen, Phu Khieo Game Reserve, 7.XI.1984, *Murata et al. T 41748* (BKF, C spirit). — North-Eastern, Phetchabun, Phu Mieng, *Seidenfaden & Smitinand 5445* (C spirit); 1.IV.1964, *5487* (C spirit). — Eastern, Chaiyaphum, Nam Phrom, 11.XII.1971, *v. Beusekom et al. 4165* (BKF, C, K, L). — Eastern, Ubon Ratchathani, Phu Jong Na Yoi National Park, 24.XI.2005, *Suddee et al. 2605* (BKF spirit, QBG). — South-Western, Prachuap Khiri Khan, Huai Yang National Park, II. [year not given], *Middleton et al. 3745* (BKF spirit). — Central, Nakhon Nayok, Khao Yai, *Seidenfaden & Smitinand 9539* (C spirit). — South-Eastern, Prachin Buri, *Thaithong 335* (BCU spirit). — ?Peninsular, Ranong-Surat Thani, Khao Pawta Leong Kaeo, 29.XI.1973, *Santisuk 705* (BKF). — Without locality, ?*Khantchai 705* (BKF); *Kerr 10* (K).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: fig. 259a-d, pl. XIV (2846) (1961); Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 12a-d, pl. VI (1975).

#### DESCRIPTION

Terrestrial, lithophytic or very rarely epiphytic herbs, deciduous, (19-)30-68 cm tall. Basal sheaths already decayed at the flowering time. Pseudobulbs prominent, ovoid, conical, 2.5-8.5 × 1.5-3 cm, close together, sometimes constricted in the lower third, several-noded with the largest part made up of a single internode, covered by greyish-silvery leaf sheaths, glabrous. Leaves (1-)2(-4), annual and usually not present at the flowering time, lanceolate-oblong, acute or acuminate, (15-)22-47 × 4-7 cm, glabrous; petioles 3-6(-9) cm long. Inflorescences arising from the basal part of the pseudobulb, erect at the base and nodding in the

apical part, softly pubescent; peduncles (10-)21-53 cm long; sterile bracts 2-9, erect or suberect, scattered along the flowering stem and a few clustered at its base, lanceolate-oblong, acute or acuminate, 1.2-5 cm long, pubescent, the lower sheathing, occasionally decayed at the flowering time and then only their leaf scars visible; raceme lax or semi-dense, pubescent, (2-)5- to 20-flowered; rachis (2-)5-15(-22) cm long; floral bracts persistent, ovate-lanceolate, acute or acuminate, 9-20(-22) × 5-8(-10) mm, shorter than the pedicel plus the ovary, pubescent. Flowers 14-18 mm across, pink to lilac and lip with red and white lines and patches, less commonly perianth lobes white with red dots, spur sometimes greenish; flowers turning orange-red with age; upper half of sepals and petals usually recurved. Ovary indistinguishable from the pedicel, 23-50 mm long, pubescent, often dark purple. Sepals similar, ovate-lanceolate, aristate-acuminate, 3- to 5-veined, (8-)9-14 × 3-8 mm, pubescent on the outside. Petals ovate-elliptic, obtuse, 3- or 5-veined, 9.3-14 × 2.9-4.5 mm, glabrous. Lip shallowly to deeply 3-lobed, 9-15 × 13-22 mm, base not united with the gynostemium, spurred; midlobe rounded oblong, apically usually entire, 3-7(-8) × (6.5-)7-8 mm; side lobes suberect, oblong, obtuse, 3-10 × 4-8(-10) mm, much broadening towards the tip, margins undulate; with three prominent (rarely obscure) fleshy keels at the base and the middle one extending onto the midlobe as a rounded keel or strong vein; spur cylindrical, straight, 15-25(-28) mm long, pubescent, parallel to the ovary. Gynostemium 3-5 mm long, straight, subglabrous or pubescent; rostellum bilobed, column-foot to 3(-4) mm long. Fruits ellipsoid, c. 20 × 8 mm.

#### DISTRIBUTION AND PHENOLOGY

Widespread in all parts of Thailand, particularly common in the northern and eastern parts; only a doubtful record from the Peninsula. The species is also known in Indochina. Found on decaying wood and in soil in evergreen and deciduous forest, often among limestone boulders, from about 300 to 1640 m. Sandstone and granite are reported as bedrock. Flowering mainly from October to January.



FIG. 3. — *Calanthe cardioglossa* Schltr.: **A**, flower; **B**, gynostemium and lip; **C**, top part of gynostemium; **D**, pollinia and operculum. *Seidenfaden & Smitinand* 5487. Reproduced with permission from the University of Copenhagen, drawn by Kai Olsen. Scale bars: A, B, 1 cm; C, D, 3 mm.

## REMARKS

As shown by the large number of available collections this is one of the commonest species in its genus in Thailand. Similar to *Calanthe succedanea*, differing only in details of the lip structure.

6. *Calanthe labrosa* (Rchb.f.) Rchb.f.

*Gardeners' Chronicle*, n.s., 1883: 44 (1883); Hooker, *Flora of British India* 5: 856 (1890); Seidenfaden, *Dansk Botanisk Arkiv* 29: 41 (1975); Seidenfaden, *Opera Botanica* 124: 15 (1995); Chen *et al.*, *Flora of China*, vol. 25: 309 (2009). — *Limatodis labrosa* Rchb.f., *Gardeners' Chronicle*, n.s., 11: 202 (1879). — *Calanthidium labrosum* (Rchb.f.) Pfitzer in Engler & Prantl (eds), *Die Natürlichen Pflanzenfamilien* 2 (6): 153 (1888). — *Alismorkis labrosa* (Rchb.f.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Myanmar, Moulmein, *Veitch's collectors* (not known).

MATERIAL EXAMINED. — Northern, Chiang Mai, Doi Chiang Dao, 31.I.1996, *Maxwell 96-149* (BKF, CMU [Sc], CMU [Sc] spirit); 11.XII.1983, *Rasmussen* sub *Seidenfaden & Smitinand 9163* (C spirit). — ?Northern, Chiang Mai, 2.XI.[year not given], *Thaithong 519* (BCU spirit). — Northern, Chiang Rai, Doi Tung, 30.XI.2005, *Maxwell 05-681* (CMU [Sc], CMU [Sc] spirit); 20.X.2006, *Palee 1041* (CMU [Sc], CMU [Sc] spirit). — North-Eastern, Khon Kaen, Phu Khieo, 7.XI.1984, *Murata et al. T 41675* (BKF, C spirit, L). — Peninsular, Ranong, Khao Po Ta Luang Kaew, 6.XII.1994, *BCU Herb. Tr. 1041* (BCU spirit). — ?Without locality, without collector (K spirit 51295).

ILLUSTRATIONS. — Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 15a, b (1975); Seidenfaden, *Opera Botanica* 124: fig. 6a-e (1995).

## DESCRIPTION

Lithophytic, terrestrial or very rarely epiphytic herbs, deciduous, 25-30 cm tall. Basal sheaths not seen. Pseudobulbs prominent, ovoid, conical, 2-8 × 1.5-4 cm, close together, made up of several internodes with the largest part derived from a single node, covered by greyish-silvery leaf sheaths, glabrous. Leaves 1-3, annual and usually not present at the flowering time, lanceolate-oblong, acute or acuminate, 25-44 × 8.9-10.4 cm, glabrous; petioles 10-12 cm long. Inflorescences arising from the basal part of the pseudobulb, erect at the base and nodding in the apical part, softly pubescent;

sterile bracts 4-7, erect or suberect, scattered along the flowering stem and a few clustered at its base, lanceolate-oblong, acute or acuminate, 1-3 cm long, pubescent, the lower sheathing; occasionally decayed at the flowering time and only their scars visible; raceme lax or semi-dense, 3- to 10-flowered; floral bracts persistent, ovate-lanceolate, acuminate, 10-20 × 7-14.2 mm, much shorter than the pedicel plus the ovary, pubescent. Flowers 20-25 mm across, with violet or light violet sepals, petals and lip epichile, lip hypochile white, spur pale pink, also reported as white-pink and fading yellow, lip sometimes with dark pink dots, gynostemium pink, violet or orange, pollinia whitish. Ovary indistinguishable from the pedicel, 22-30(-40) mm long, densely pubescent. Sepals ovate-lanceolate, aristate-acuminate, 3- or 5-veined, 9-14 × 3-5.8(-6.8) mm, pubescent on the outside. Petals ovate-elliptic, subacute, 5-veined, 9.5-15 × 4-5.5 mm, glabrous. Lip unlobed, rounded triangular, 11-15 × 13-19 mm, base not united with the gynostemium, spurred, edge very wavy; with three fleshy keels at the base which normally become lower towards the lip apex but are sometimes developed into a lamella, rarely the ridges very obscure; spur cylindrical, 22-29 mm long, pubescent, straight, parallel to the ovary. Gynostemium 4-6.5 mm long, glabrous or glandular-hairy, straight or slightly curved, with a 3-3.5 mm long column-foot. Fruits not seen.

## DISTRIBUTION AND PHENOLOGY

In Thailand known from a few widely scattered localities in the North, North-East and the Peninsula. Also recorded in Myanmar and S China. Mostly terrestrial or epilithic on limestone in deciduous and evergreen forest with bamboo, from about 850 to 1950 m. Flowering mainly from October to January.

## REMARKS

This species is very similar to *Calanthe cardioglossa* but has an undivided lip. It has only recently been reported in Thailand (Seidenfaden 1995). Seidenfaden also commented on a specimen from Kanchanaburi Province (*Sukhakul* sub *Seidenfaden & Smitinand 9580*) which differs in its apically incised lip, and a formal separation giving it varietal status was considered. However, the lip base of the speci-



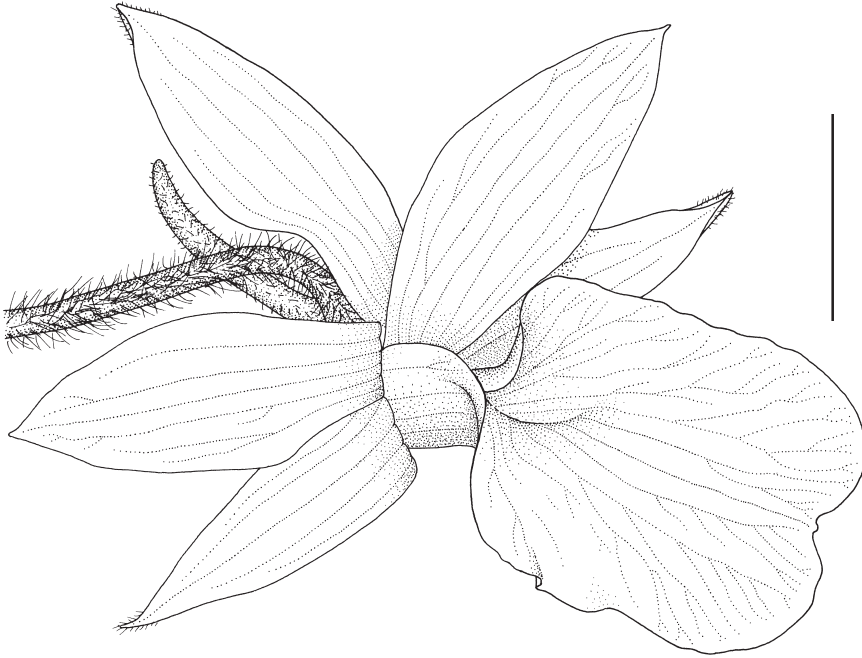


FIG. 4. — *Calanthe rosea* (Lindl.) Benth., flower. *Thai-Danish Botanical Studies* 9208. Reproduced with permission from the University of Copenhagen, drawn by Kai Olsen. Scale bar: 1 cm.

men is extensively fused with the gynostemium, and it appears that the specimen is altogether different from *C. labrosa* as had been earlier suggested by Seidenfaden himself (notes in his working files in Copenhagen). In the present paper it is listed as “*Calanthe* indet.” (see below).

#### 7. *Calanthe rosea* (Lindl.) Benth. (Fig. 4)

*Botanical Journal of the Linnean Society* 18: 309 (1881); Hooker, *Flora of British India* 5: 856 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 333 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 792 (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: 39 (1975). — *Limnatis rosea* Lindl., *Paxton's Flower Garden* 3: 35 (1852). — *Alismorkis rosea* (Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Myanmar, Moulmein, Province of Martaban, *Lobb s.n.* (not known).

MATERIAL EXAMINED. — Northern, Nan, Sakoen National Park, 30.XI.2006, *Watthana 2190* (QBG, QBG

spirit). — Northern, Lampang, Jae Sawn National Park, 6.XII.1995, *Maxwell 95-1294* (BKF, CMU [Sc], CMU [Sc] spirit, L). — Northern, Tak, Doi Mussoe, 6.XII.1960, *Smitinand 7050* (BKF, C, C spirit). — North-Eastern, Phetchabun, Thung Salaeng Luang, 21.XII.1964, *Seidenfaden & Smitinand 5372* (C spirit). — South-Western, Uthai Thani, Huai Ka Kaeng Game Reserve, 20.II.1970, *v. Beusekom & Santisuk 2862* (AAU, BKF, C spirit, E, L). — South-Western, Sai Yok, *Thai-Danish Botanical Studies 9208* (C spirit); 23.XII.1931, *Kerr s.n.* (K H2006/01478-261); 4.XII.1961, *Larsen 8490* (C, E, SING); 31.XII.1963, *Seidenfaden & Smitinand 4315* (C spirit). — South-Western, Kanchanaburi, Ta Kanum, 21.I.1926, *Kerr 0262* (BK, C, K). — South-Western, Thong Pha Phum District, 29.XI.1982, *Koyama et al. 30453* (BKF). — South-Western, Kanchanaburi, Sangkhlaburi, 14.I.1994, *Maxwell 94-39* (CMU [Sc], CMU [Sc] spirit, L). — South-Western, Kanchanaburi, Ban Mae Numb Noi, 30.XII.1961, *Phengklai 355* (BKF). — South-Western, Kanchanaburi, Huay Bankan, 8.XI.1971, *v. Beusekom et al. 3517* (BKF, C, K, L). — South-Western, Phetchaburi, Kaeng Kra Chan National Park, 4.XII.1993, *Larsen et al. 45025* (AAU). — South-Eastern, Prachin Buri, IX. 1987, *Thaithong 210* (BCU, BCU spirit). — Without locality, 26.XI.1997, *Nanakorn et al. 9978* (QBG, QBG spirit).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: fig. 254 (1961); Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 14 (1975).

#### DESCRIPTION

Lithophytic or very rarely epiphytic herbs, deciduous, 22-55(-66) cm tall. Basal sheaths not seen. Pseudobulbs prominent, ovoid to oblong, 2.4-14 × 1-3.5 cm, close together, several-noded with the largest part made up of a single internode, covered by greyish-silvery leaf sheaths, glabrous, sometimes narrowed in the middle. Leaves to 4, annual and usually not present at the flowering time, broadly elliptic-oblong, acute, 37-40 × 5.8-11 cm, glabrous; petioles 3.5-6 cm long. Inflorescences arising from the base or middle of the pseudobulb, erect at the base, sometimes slightly nodding in the apical part, softly pubescent; peduncles to 40 cm long; sterile bracts 4-8, erect or suberect, scattered along the flowering stem and a few clustered at its base, lanceolate-oblong, acute or acuminate, 1-6 cm long, pubescent, sheathing; partly decayed at the flowering time; raceme lax or semi-dense, 5- to many-flowered; rachis 10-20 cm long; floral bracts persistent, membranous, ovate-lanceolate, acuminate or long-acuminate, 12-25(-33) × 3-8 mm, pubescent. Flowers pink or pale pink, lip often darker, hypochile sometimes white. Ovary indistinguishable from the pedicel, 20-29 mm long, pubescent. Sepals ovate-lanceolate, acute, apiculate, 3- or 5-veined, pubescent on the outside; median sepal (15-)19-30 × 5-8 mm; lateral sepals oblique, (16-)18-30 × 3.7-7 mm. Petals obovate-elliptic, slightly wider than the sepals, shortly acuminate, 5- or 3-veined, (16-)20-30 × (4-)5.3-8.5(-9) mm, largely glabrous but sometimes with scattered hairs near the apex. Lip unlobed, rounded rectangular, (17-)23.5-35 × (10-)12.5-16 mm, not united with the gynostemium, apex emarginate, truncate or sometimes slightly apiculate, hypochile rolled around the gynostemium, spurred, without ornaments; spur cylindrical, pubescent, 11-16 mm long. Gynostemium 3.5-6 mm long, pubescent. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

In Thailand frequent in the North and South-West; in addition one record each in the North-East and

South-East. Also found in Myanmar. Locally common on limestone rocks in mixed dry deciduous forest or dry evergreen forest or scrub, also in bamboo forest, from about 200 to 900 m. Flowering mainly from November to January.

#### REMARKS

*Calanthe rosea* is one of the most attractive Thai calanthes, easily distinguished from all others by the large flowers with an unlobed rounded rectangular lip. The species is commonly found growing on limestone rocks, but the specimen *Kerr 0262* was found growing as an epiphyte.

The collection *v. Beusekom & Santisuk 2862* differs from the typical *Calanthe rosea* in its considerably longer floral bracts (measuring 30-33 mm).

#### 8. *Calanthe pulchra* (Blume) Lindl.

*Genera and Species of Orchidaceous Plants*: 250 (1833); Comber, *Orchids of Java*: 92 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 173 (1992); Seidenfaden, *Opera Botanica* 124: 17 (1995); Comber, *Orchids of Sumatra*: 256 (2001). — *Amblyglottis pulchra* Blume, *Bijdragen*: 371 (1825). — *Alismorkis pulchra* (Blume) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Indonesia, Java, Mt. Seribu, in forest, *Blume s.n.* (holo-, ?BO).

*Calanthe curculigoides* Lindl., *Genera and Species of Orchidaceous Plants*: 251 (1833); Hooker, *Flora of British India* 5: 854 (1890). — Types: Penang (Peninsular Malaysia) and Singapore, *Wallich s.n.*, *Wallich's Catalogue* 7340 (syn-, K-WALL; isosyn-, P!).

MATERIAL EXAMINED. — Peninsular, Nakhon Si Thammarat, Khao Luang, XI. [year not given], *Jongananrok 632* (BKF spirit). — Peninsular, Songkhla, *Thorut 20* (BCU spirit). — Peninsular, Yala, Banang Sata, 10.X.1991, *Larsen et al. 42272* (AAU, C spirit). — Peninsular, Yala, Hala Bala, 4.IX.2005, *Poopath 378* (BKF spirit).

ILLUSTRATIONS. — Comber, *Orchids of Java*: pl. on page 92 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 74d-f, pl. 10a (1992); Comber, *Orchids of Sumatra*: pl. on page 256 (2001).

#### DESCRIPTION

Terrestrial herbs, evergreen, glabrous, 40-60 cm tall. Basal sheaths 2, oblong-lanceolate, acute,

8-15 × 1.4-1.6 cm. Pseudobulbs inconspicuous and largely enclosed by leaf sheaths, close together, several-noded. Leaves 2-6, perennial, lanceolate-elliptic, acute or acuminate, (43-)64-75 × 6-10.8 cm; with grooved petioles 21-24 cm long. Inflorescences erect, arising from the base of the leafy shoot, shorter than the leaves; peduncles 33-42 cm long; sterile bracts 3-6, erect or suberect, lanceolate-oblong, subacute, 2-5 cm long, the lower sheathing; raceme semi-dense or dense, 40- to 60-flowered; rachis 7-18 cm long; floral bracts caducous, lanceolate, acute, 3-4 cm long, concave. Flowers not opening widely, about 11 mm across, yellow-orange, lip often orange-red or red. Ovary indistinguishable from the pedicel, 10-15 mm long. Sepals elliptic-lanceolate, acuminate or apiculate, 3-veined; median sepal very concave, 13-14 × 4.5-6 mm; lateral sepals 12-13 × 3.9-4.6 mm. Petals obovate-lanceolate, acute, apiculate, 3- or 5-veined, 11-12 × 5.2-6.2 mm. Lip 3-lobed, 10-11 mm long, base completely united with the gynostemium, spurred; midlobe rectangular, apically obtuse, truncate or emarginate, apiculate, 3.1-4.3 × 2.2-2.7 mm; side lobes erect, rounded, 1.1-2 × 2-2.7 mm; callus as three prominent or obscure keels with the two outer swollen between the lip side lobes; spur cylindrical, c. 10 mm long, apex hooked through 180 degrees or more. Gynostemium 4.5-7 mm long, rostellum long-beaked. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

This species is widespread in western Malesia and reaches Peninsular Thailand. Also recorded in Indochina. The habitat ecology is not known in Thailand but elsewhere the species is found in rainforest in the lowlands and hills, from about 1000 to 1100 m. Flowering from September to November.

#### REMARKS

In Malesia there is a group of several species with medium-sized yellow or orange flowers and caducous floral bracts, among the species which range into Thailand including this species, *Calanthe angustifolia* and *C. speciosa*. Within the group *C. pulchra* is well characterised by its hooked spur apex.

### 9. *Calanthe lyroglossa* Rchb.f. (Fig. 5)

*Otia Botanica Hamburgensia*: 53 (1878); Seidenfaden, *Dansk Botanisk Arkiv* 29: 22 (1975); Seidenfaden, *Opera Botanica* 114: 99 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 175 (1992); Chen *et al.*, *Flora of China* Vol. 25: 295 (2009). — *Alismorkis lyroglossa* (Rchb.f.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Philippines, Luzon, Mt. Mahahai, 1838, *Wilkes' expedition*, without collector and number (holo-, ?W; ?iso-, GH!; AMES, drawing of possible isotype!).

#### var. *lyroglossa*

*Calanthe foerstermannii* Rchb.f., *Gardeners' Chronicle*, n.s., 1883: 814 (1883); Hooker, *Flora of British India* 5: 854 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 335 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965). — *Alismorkis foerstermannii* (Rchb.f.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Eastern Myanmar, *Förstermann s.n.* (?holo-, W).

*Calanthe nephroidea* Gagnep., *Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 22: 625 (1950). — Type: Vietnam, Pnom Sapoum, Ht. Donnai, in forest, 1000-1200 m, 23.II.1933, *Poilane 22125* (holo-, P!).

ADDITIONAL MATERIAL EXAMINED. — North-Eastern, Loei, Phu Krading, 7-9.XI.1970, *Charoenphol et al. 4722* (AAU); 18.VII.1953, *Dee 659* (BKF); *Larsen et al. 4722* (C spirit); 2-3.XI.1984, *Murata et al. T 42893* (C spirit, L); XII.1958, *Seidenfaden & Smitinand 3145* (C spirit); 3709A (C spirit); 16.XI.1979, *Shimizu et al. 23152* (BKF, C spirit). — North-Eastern, Loei, Phu Luang, 15.XI.1968, *Chermisirivatthana 1060* (BK). — Eastern, Chaiyaphum, Tunkameng, 17.XI.1971, *v. Beusekom et al. 4392* (BKF, C, K, L). — Eastern, Nakhon Ratchasima, Khao Yai, 7.I.1963, *Phengkklai 706* (BKF, SING). — Eastern, Nakhon Ratchasima, Khao Lem, 28.XII.1930, *Put 3565* (C, K). — Central, Nakhon Nayok, Khao Yai, 5.II.2001, *Maxwell 01-37* (BKF, CMU [Sc], CMU [Sc] spirit). — Peninsular, Ranong, Khao Pawta Leong Kaeo, 29.XI.1973, *Santisuk 739* (BKF, C spirit); 9.XII.1979, *Shimizu et al. 26690* (BKF). — Peninsular, Phangnga, Khao Pawta Leong Kaeo, 27.II.1974, *Geesink et al. 7665* (AAU, B, BKF, C, K, L). — Peninsular, Nakhon Si Thammarat, Khao Luang, 25.I.1966, *Hansen & Smitinand 12068* (BKF, C, SING); *Seidenfaden & Smitinand 6277* (C spirit); VIII. [year not given], *Smitinand 1300* (BKF); 17.V.1968, *v. Beusekom & Phengkklai 828a* (BKF, L). — Peninsular, Pattani, Kao Kalakuri, 10.IX.1923,

*Kerr 0110* (BK, C, K, L). — Without locality, *BCU Herb. Tr. 1039* (BCU spirit); *Nanakorn et al. 16347* (QBG spirit).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand—A Preliminary List*, part III: fig. 256a-f (1961) [as *Calanthe foerstermannii* Rchb.f.]; Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 8a-f, pl. III on page 27 (1975); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 74g-k, pl. 10b (1992).

#### DESCRIPTION

Terrestrial herbs, evergreen, glabrous, 43-58 cm tall. Basal sheaths 1-2, linear, to 11(-18.5) × 1 cm, often largely decayed at the flowering time and consisting only of dry veins; once observed with a narrowly lanceolate blade *c.* 11.5 × 1 cm. Pseudobulbs inconspicuous and largely enclosed by the leaf sheaths, 2-3 cm long, close together, several-noded. Leaves 3-6(-7), perennial, lanceolate-oblong, acuminate, 35-89(-101) × (3.6-)6-8 cm; with grooved petioles 9-28(-40) cm long. Inflorescences erect, arising from the base of the leafy shoot; peduncles 24-46 cm long; sterile bracts 2-4(-6), scattered along the flowering stem and a few clustered at its base, erect, lanceolate-oblong, acute or subacute, sometimes mucronate, 3-7.5 cm long, sheathing; raceme semi-dense or dense, many-flowered; rachis (5-)8-19 cm long; floral bracts caducous, ovate-lanceolate, acute to acuminate, 21-35 × 3.5-8 mm. Flowers to 10 mm across, yellow, rarely whitish yellow, lip and spur once reported as soon turning black (?drying out), gynostemium pale yellow; flowers reported as odourless. Ovary (6-)8-14 mm long, with a very pronounced distinction from the 3.5-6 mm long pedicel. Sepals elliptic-lanceolate, acute or acuminate, sometimes shortly caudate, 3- or 5-veined; median sepal 6-9(-10) × 2-5 mm; lateral sepals 7.8-9(-10) × 2.7-7 mm. Petals ovate-elliptic, acute or acuminate, 3-veined, 6.5-9(-9.5) × 2.8-5.5 mm. Lip weakly 3-lobed, 7-10 mm long and to 8.3 mm wide, base completely united with the gynostemium, spurred; midlobe reniform or transversally oblong, apex emarginate, 3-4.5(-5) × 5.5-7(-8.3) mm; side lobes small, auriculate, mostly under 0.5 mm long; lip with two small keels near the base; spur cylindrical and apically clavate, more or less parallel to the pedicel, 4-6(-7) mm long, sometimes apically slightly bifid. Gynostemium

3-5 mm long, stout; rostellum beaked, stigma cavity rather wide. Fruits ellipsoid, *c.* 10 × 5 mm.

#### DISTRIBUTION AND PHENOLOGY

In Thailand found in the North-Eastern, Eastern, Central and Peninsular regions. Elsewhere widespread from India to W Malesia and S China. Found in evergreen forest, also in secondary vegetation, from 725 to 1300 m. Sandstone has been reported as bedrock. Flowering: July-September and November-February.

#### REMARKS

This species is easily distinguished from all other Thai species of *Calanthe* sect. *Styloglossum* because of its small yellow flowers and the minute auriculate lip side lobes.

Only the typical variety is known in our region, var. *longibracteata* P.O'Byrne occurring in Java. It differs from the typical variety by its very long and persistent floral bracts.

### 10. *Calanthe angustifolia* (Blume) Lindl.

*Genera and Species of Orchidaceous Plants*: 251 (1833); Hooker, *Flora of British India* 5: 854 (1890); Seidenfaden, *Nordic Journal of Botany* 6: 161 (1986); Comber, *Orchids of Java*: 92 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 171 (1992); Comber, *Orchids of Sumatra*: 258 (2001); Chen *et al.*, *Flora of China* Vol. 25: 295 (2009). — *Amblyglottis angustifolia* Blume, *Bijdragen*: 369 (1825). — *Alismorkis angustifolia* (Blume) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Indonesia, Java, Buitenzorg, in mountain forest, *Blume s.n.* (not found).

MATERIAL EXAMINED. — Peninsular, Nakhon Si Thammarat (only photo seen). — Peninsular, Yala, Hala-Bala, 4.IX.2005, *Poopath 369* (BKF spirit).

ILLUSTRATIONS. — Comber, *Orchids of Java*: pl. on page 92 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 74a, b (1992).

#### DESCRIPTION

(MAINLY AFTER THE THAI SPECIMEN)

Terrestrial herbs, evergreen, glabrous, *c.* 30 cm tall. Basal sheaths largely decayed at the flowering time, to 5.5 cm long. Pseudobulbs inconspicuous

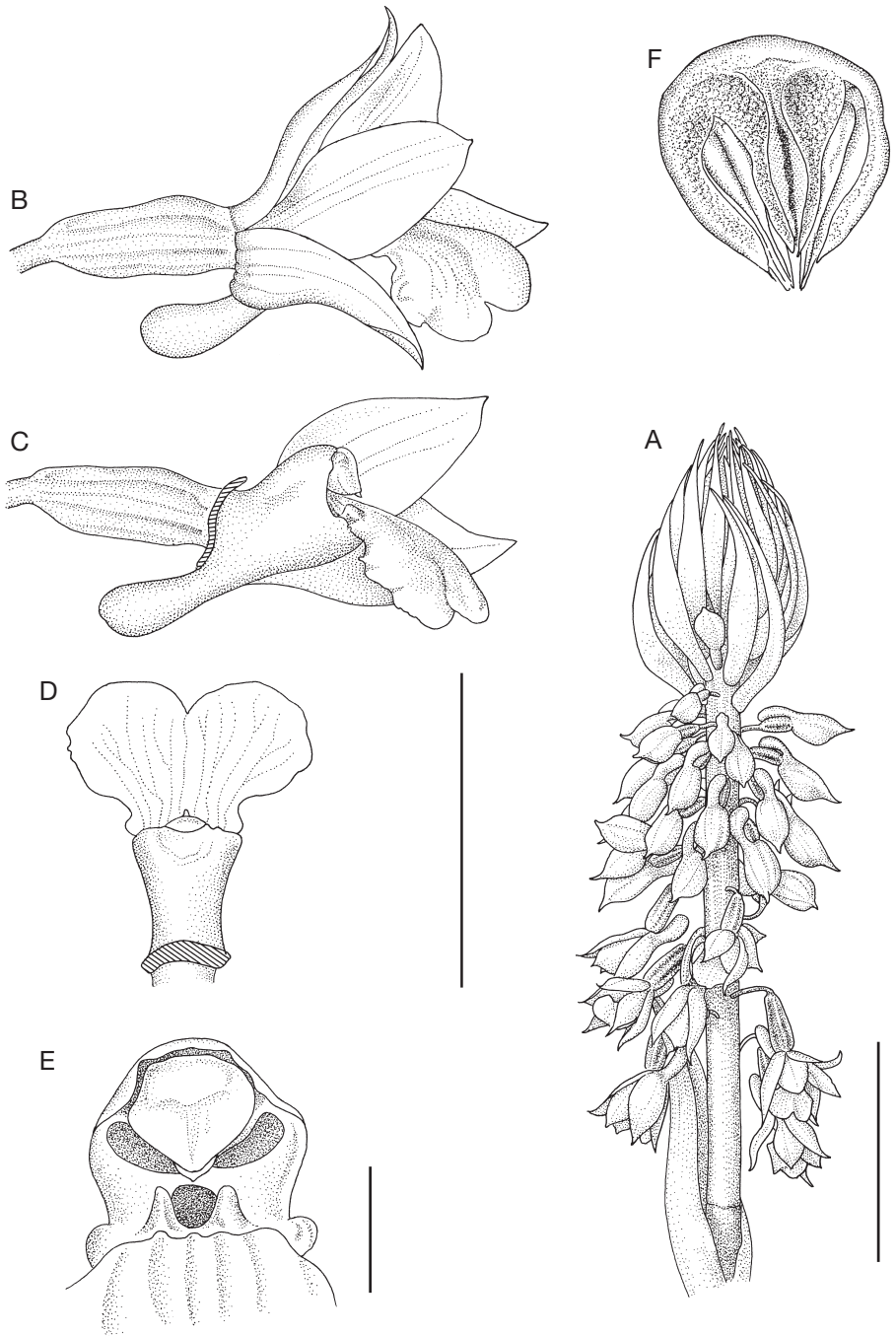


FIG. 5. — *Calanthe lyroglossa* Rchb.f. var. *lyroglossa*: **A**, inflorescence; **B**, **C**, flower (right lateral sepal and petal removed in C); **D**, lip and gynostemium from above; **E**, gynostemium; **F**, operculum. A, Taiwanese plant, *Nackejima* 8979; B-F, Thai specimen, *Seidenfaden & Smitinand* 3709 A. Reproduced with permission from the University of Copenhagen, drawn by Kai Olsen. Scale bars: A, 3 cm; B-D, 1 cm; E, 2 mm; F, 1 mm.

and largely enclosed by the leaf sheaths, several-noded, to 7.5 cm long, spaced on the rhizome 5-6.5(-9) cm apart; rhizome creeping, slender, with *c.* 2 cm long internodes. Leaves 3-6, perennial, linear-lanceolate, acute or acuminate, 18-50 × 1-3.75 cm; with grooved petioles to 14 cm long. Inflorescences erect, arising from the base of the leafy shoot; peduncle 15-23 cm long; sterile bracts 4, erect or suberect, lanceolate-oblong, acute, to 2.5 cm long, two of them at the stem base and the remainder scattered on the stem; raceme semi-dense or lax, *c.* 25-flowered; rachis 5-7.5 cm long; floral bracts caducous. Flowers white and usually with some yellow on the lip, callus deep yellow; not opening very widely. Ovary 6-8 mm long, distinct from the 6-7 mm long pedicel. Sepals ovate-elliptic, acute or acuminate, mucronate, 5-veined, 10-13 × 5-7 mm. Petals broadly ovate-elliptic, narrowed at the base, acute, 4-veined, 9.5-11 × 5.5-8 mm. Lip 3-lobed, to 12.5 × 7-8 mm, completely united with the gynostemium, spurred; midlobe obovate, apically deeply emarginate, 5-5.5 × 6.7-8 mm; side lobes erect, oval or rounded-square, 1.9-2.2 × 1.5-2.3 mm; callus as two short erect and triangular keels between the lip side lobes; spur clavate, 8-10 mm long. Gynostemium 4-6.5 mm long. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

This species is widespread in SE Asia, ranging from western Malesia to Indochina and S China and has only recently been recorded in the extreme south of the Thai Peninsula. The only confirmed Thai specimen was growing in mountain forest near the summit at about 1440 m. Flowering in September. In the Malesian part of the distribution area the plants are found in moss forest and mountain forest up to 2000 m.

#### REMARKS

This is a new distribution record for Thailand. *Calanthe angustifolia* is distinct from all other Thai species in *Calanthe* sect. *Styloglossum* with its white flowers and the yellow on the lip, and also the apically deeply cleft lip with its two basal calli is characteristic. A variety *flava* has been described in Peninsular Malaysia which differs by entirely cream

or yellow flowers, but as some populations consist of a mixture of white, cream and yellow plants the recognition of the variety does not appear justified (Seidenfaden & Wood 1992).

#### 11. *Calanthe speciosa* (Blume) Lindl.

*Genera and Species of Orchidaceous Plants*: 250 (1833); Comber, *Orchids of Java*: 93 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 175 (1992); Comber, *Orchids of Sumatra*: 261 (2001); Chen *et al.*, *Flora of China*, vol. 25: 296 (2009). — *Amblyglottis speciosa* Blume, *Bijdragen*: 371 (1825). — *Alismorkis speciosa* (Blume) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Indonesia, Java, Batam and Buitenzorg, in forest, *Blume s.n.* (syn-, L).

*Calanthe scortechinii* Hooker, *Flora of British India* 5: 854 (1890). — *Alismorkis scortechinii* (Hook.f.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Peninsular Malaysia, Perak, *Scortechinii s.n.* (holo-, K!).

ILLUSTRATIONS. — Comber, *Orchids of Java*: pl. on page 92 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 75g-i (1992); Comber, *Orchids of Sumatra*: pl. on page 262 (2001).

DESCRIPTION (AFTER COMBER 1990, 2001; SEIDENFADEN & WOOD 1992)

Terrestrial herbs, evergreen. Pseudobulbs inconspicuous and largely enclosed by the leaf sheaths, *c.* 5.5 × 2.2 cm long, close together, several-noded. Leaves 4-7, perennial, lanceolate-elliptic, to 120 × 15 cm; with grooved petioles to 25 cm long. Inflorescences erect, arising from the base of the leafy shoot, shorter than the leaves, to 80 cm tall; peduncles to 55 cm long; sterile bracts 5, lanceolate; raceme semi-dense or dense, many-flowered, in the Thai specimen illustrated by Vaddhanaphuti (2005) apparently only 10-15-flowered; rachis 25 cm long; floral bracts caducous, lanceolate, whitish, *c.* 70 × 22 mm. Flowers orange-yellow or golden yellow, mostly opening widely, to 30 mm broad, the Thai specimens are reported to be only up to 10 mm in diameter (Vaddhanaphuti 2005). Sepals ovate, acuminate and acute, *c.* 17 × 9 mm, the laterals a little wider. Petals similar, shortly acuminate, *c.* 15 × 8 mm. Lip 3-lobed, to 20 mm long, base completely united with the gynostemium, spurred;

midlobe rectangular and broadened towards the tip, apically shortly pointed, *c.* 7 mm long; side lobes rounded triangular, spreading, acute or obtuse, *c.* 4 × 4 mm; spur *c.* 10 mm long. Gynostemium *c.* 6.5 mm long. Fruits not known.

#### DISTRIBUTION AND PHENOLOGY

Widespread in Malesia from Sumatra eastwards as far as the Moluccas, in S China and S Japan. Also recorded in Peninsular Thailand, but the identity could not be confirmed as no voucher could be traced. The habitat is not known and the plants are said to flower in October.

#### REMARKS

No material of this species has been seen, but it is listed here because it was included in a recent publication on native Thai orchids (Vaddhanaphuti 2005).

There appears to be variation in the size of the flowers. The flower size of Sumatran population is about 30 mm (Comber 2001), while a specimen from Peninsular Malaysia was illustrated with flowers about 19 mm in diameter (Seidenfaden & Wood 1992). Flowers of the Thai specimen illustrated by Vaddhanaphuti (2005) are apparently only 10 mm in diameter.

### 12. *Calanthe clavata* Lindl.

*Genera and Species of Orchidaceous Plants*: 251 (1833); Hooker, *Flora of British India* 5: 854 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: 22 (1975); Seidenfaden, *Nordic Journal of Botany* 6: 162 (1986); Seidenfaden, *Opera Botanica* 114: 99 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 175 (1992); Pearce & Cribb, *Flora of Bhutan* 3 (3): 295 (2002); Chen *et al.*, *Flora of China*, vol. 25: 296 (2009). — *Alismorkis clavata* (Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: India/Bangladesh border, Sylhet, Wallich *s.n.*, Wallich's Catalogue 7343 (holo-, K-WALL).

MATERIAL EXAMINED. — Northern, Chiang Mai, Doi Suthep, 8.XII.1910, *Kerr 210* (C spirit, K). — Northern, Chiang Mai, Doi Pui, 22.XI.1989, *Maxwell 89-1434* (CMU). — Northern, Chiang Mai, Doi Inthanon, XI.[year not given], *Koorkhamthod et al. 272* (BKF

spirit). — Northern, Chiang Mai, Jawng Tong, 15.I.1993, *Maxwell 93-41* (CMU [Sc], CMU [Sc] spirit). — Peninsular, Chumphon, *Thorut 19* (BCU spirit). — Peninsular, Surat Thani, Ko Pa-ngan, 10.IV.1929, *Kerr 0742* (K); 7.XI.1927, *Put 1192* (BK, C, K); 9.XI.1927, *1239* (BK, K). — Without locality, without date, *Pumicong 331* (QBG, QBG spirit).

ILLUSTRATIONS. — Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 7a-d (1975); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 75j, k (1992).

#### DESCRIPTION

Terrestrial herbs, evergreen, glabrous, 28–80 cm tall. Basal sheaths 1–2, 2–20 × *c.* 1 cm. Pseudobulbs inconspicuous, several-noded, 10–12 cm apart on a creeping rhizome, the segments with *c.* 7 internodes, rhizome *c.* 1 cm thick. Leaves 2–6, perennial, lanceolate-oblong, acute, 23–90 × 3.4–9.5 cm; with grooved petioles 13–20 cm long. Inflorescences erect, arising on the rhizome next to the leafy shoot; peduncles to 30 cm long; sterile bracts 4–8, scattered along the flowering stem and a few clustered at its base, erect or suberect, inflated, tubular, lanceolate-oblong, acute, 2.8–6 cm long, sometimes falling off early; raceme cylindric, dense or semi-dense, many-flowered; rachis 10.5–22 cm long; floral bracts caducous, narrowly lanceolate, long-acuminate, 30–50 × 3–8 mm. Flowers to 20 mm across, yellow, operculum whitish. Ovary 7–8.8 mm long, with a pronounced distinction from the 8–12 mm long pedicel. Sepals ovate-elliptic, acuminate or apiculate, 5- to 7-veined; median sepal 9–14 × 4–6.7 mm; lateral sepals 10–15 × 4–7 mm. Petals obovate-elliptic to somewhat spatulate, acute, 5- to 7-veined, 9–14 × 4–6.5 mm. Lip 3-lobed, 8–13.5 mm long, spurred; midlobe rounded rectangular, apically emarginate, 3–5 × 3–4.3 mm, sometimes with a small tooth in the sinus; side lobes round, 2–3 × 2–3 mm, with two short lamellate keels between them; spur clavate, 8–10 mm long, somewhat curved, apically sometimes slightly bifid. Gynostemium 5.6–7 mm long, united with the lip in the lower two thirds and the upper part free. Fruits ellipsoid, 10–13 × 5–6 mm.

#### DISTRIBUTION AND PHENOLOGY

In Thailand only recorded in the North and the Peninsula. Generally widespread from the eastern Himalayas to Indochina and China and southwards

to Peninsular Malaysia. Found in evergreen and deciduous forest with pine, on damp ground by stream, from about 700 to 1400 m. Recorded over granite. Flowering mainly in November and December, and occasionally in January and April.

## REMARKS

*Calanthe clavata* and the following species *C. densiflora* are very similar with their fairly dense inflorescences which arise directly from the rhizome next to the leafy stem, and also their flower structure lacks obvious differences. The two species have been considered as conspecific in the past (e.g., King & Pantling 1898), but were maintained as two separate species by Seidenfaden (1975, 1992) and Pearce & Cribb (2002) which is also followed here. However, the latter authors point out that “further fieldwork is needed to resolve the difficulty”.

*Calanthe clavata* differs in its laxer and longer inflorescence (rachis 10.5–22 cm long; as opposed to 1–3[–5] cm long in *C. densiflora*) and longer peduncle (to 30 cm long; as opposed to 9–18 cm long in *C. densiflora*). Also the flowers of *C. clavata* are normally smaller, with sepals measuring 9–15 mm (mostly 14–16 mm long in *C. densiflora*), and also have a shorter gynostemium (5.6–7 mm in *C. clavata*; as opposed to mostly 12–13 mm in *C. densiflora*). Another difference is the spur which is clavate in *C. clavata*, but cylindric to weakly clavate in *C. densiflora*.

An interesting feature of the two species is the gynostemium which is united with the lip only in its basal one to two thirds and the upper gynostemium-portion is free. In *Calanthe clavata* the collection *Thorut 19* is unusual as the fusion of the lip to the gynostemium is fairly extensive with only the top part of the gynostemium free.

13. *Calanthe densiflora* Lindl.

*Genera and Species of Orchidaceous Plants*: 250 (1833); Hooker, *Flora of British India* 5: 855 (1890); Seidenfaden, *Dansk Botanisk Arkiv* 29: 22 (1975); Seidenfaden, *Opera Botanica* 114: 99 (1992); Pearce & Cribb, *Flora of Bhutan* 3 (3): 295 (2002); Chen *et al.*, *Flora of China*, vol. 25: 295 (2009). — *Alismorkis densiflora* (Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type:

India/Bangladesh border, Sylhet, *Wallich s.n.*, Wallich's Catalogue 7344 (holo-, K).

*Phaius epiphyticus* Seidenf., *Nordic Journal of Botany* 5: 159 (1985), syn. nov.; Seidenfaden, *Opera Botanica* 89: 44 (1986); Phukan & Mao, *Orchid Review* 110: 160 (2002). — Type: Thailand, Loei Province, Phu Luang, 1400–1500 m, 16.III.1980, *Seidenfaden & Smitinand* 8687 (holo-, C spirit!).

ADDITIONAL MATERIAL EXAMINED. — North-Eastern, Phetchabun, *Suksathan 121* (BCU spirit). — North-Eastern, Phu Luang, *Thaithong 481* (BCU spirit).

ILLUSTRATIONS. — Seidenfaden, *Nordic Journal of Botany* 5: fig. 2a–f, pl. 1a (1985) [as *Phaius epiphyticus* Seidenf.]; Seidenfaden, *Opera Botanica* 89: fig. 20a–f (1986) [as *P. epiphyticus* Seidenf.]; Seidenfaden, *Opera Botanica* 114: fig. 52a–c (1992); Phukan & Mao, *Orchid Review* 110: figs 126, 128 (2002) [as *P. epiphyticus* Seidenf.].

## DESCRIPTION

Terrestrial, ?sometimes epiphytic herbs, evergreen, 40–60 cm tall, glabrous. Basal sheaths not seen. Pseudobulbs inconspicuous and largely hidden among the leaves, several-noded, covered by large dry sheaths, 2.5–6(–10) cm apart on an elongate wavy rhizome, its segments *c.* 0.5–1 cm thick. Leaves 2–4(–5), perennial, elliptic or oblong-elliptic, acute and acuminate, (18–)30–40 × 2–6 cm; with grooved petioles to 22 cm long (often much less). Inflorescences arching or suberect, arising next to the leafy shoots directly from the rhizome, less than half as long as the leafy shoot; peduncles 9–18 cm long; sterile bracts 2–5, erect, tubular and inflated, ovate-lanceolate or elliptic-lanceolate, acute, 1.8–3.7 cm long, scattered on the peduncle and one or two at its base; raceme globose to subcylindric, dense, 12- to 20-flowered; rachis 1–3(–5) cm long; floral bracts caducous, elliptic-lanceolate, acute or acuminate, 10–20(–40) × 7–8(–20) mm, hyaline, white. Flowers 17–26 mm across, yellow, hypochile and side lobes of the lip sometimes with a faint red-purple tinge. Ovary indistinguishable from the pedicel, (10–)14–18(–25) mm long. Sepals elliptic-lanceolate, acute, acuminate or aristate, 3- to 5-veined; median sepal (12–)14–16(–18) × 4–6.2(–8) mm; the laterals similar but slightly narrower. Petals oblanceolate to somewhat spatulate, acute, 3- to 5-veined, (11–)12–15(–18) × (2–)4.2–4.6(–6) mm. Lip 3-lobed, 10–13 × 8.6–13.8 mm,



spurred; midlobe broadly rounded to subquadrate, shallowly emarginate or truncate, 4.5-5(-6) × (4-)5-6(-7) mm, apex obtuse or emarginate, straight or recurved; side lobes ovate to subtriangular, erect, 3.5-9 × 3-3.5 mm, with two diverging fleshy triangular or half-moon shaped lamellae between them which are highest at the distal end; spur cylindrical or slightly clavate, straight, 8.5-15(-20) mm long. Gynostemium (8.5-)12-13 mm long, straight or curved, united with the lip for 3-4.5 mm. Fruits ellipsoid, 10-11 × 5-6 mm.

#### DISTRIBUTION AND PHENOLOGY

In Thailand only recorded in the North-East. Generally widespread in continental Asia from the Himalayas to Indochina and S China; also found in S Japan and Taiwan. Found in broad-leaved or mixed forest, often with bamboo, from 1350 to 1530 m.

#### REMARKS

*Phaius epiphyticus* Seidenf. is in its vegetative and floral structure identical with *Calanthe densiflora* and is therefore considered as conspecific here, as also suggested by P. Ormerod (hand-written letter dated 7.VII.1998 in the Seidenfaden working files in Copenhagen) and P. Cribb (pers. comm. on 24.XI.2008). The origin of the species name *epiphyticus* is not clear – in the aforementioned letter Seidenfaden himself had noted that there was no definitive evidence that the plant was indeed an epiphyte.

#### 14. *Calanthe puberula* Lindl.

*Genera and Species of Orchidaceous Plants*: 252 (1833); Hooker, *Flora of British India* 5: 848 (1890); Seidenfaden, *Opera Botanica* 114: 94 (1992); Pearce & Cribb, *Flora of Bhutan* 3 (3): 289 (2002); v. d. Bult, *Natural History Bulletin of the Siam Society* 53: 261 (2005); Chen *et al.*, *Flora of China*, vol. 25: 298 (2009). — *Alismorkis puberula* (Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: India/Bangladesh border, Sylhet, Wallich s.n., Wallich's Catalogue 7342 (holo-, K-WALL).

MATERIAL EXAMINED. — Northern, Tak, Umphang, 24.IV.2001, v.d. Bult 412 (CMU [Sc], CMU [Sc] spirit). — Northern, Phitsanulok, IX.[year not given], *Suksathan* 120 (BCU spirit).

ILLUSTRATIONS. — Seidenfaden, *Opera Botanica* 114: fig. 50a, b (1992).

#### DESCRIPTION

Terrestrial herbs, evergreen, 25-60 cm tall. Basal sheaths not seen. Pseudobulbs inconspicuous and largely enclosed by the leaves, ovoid, conical, 2-4 × c. 1.5 cm, close together, several-noded. Leaves 5-7, perennial, elliptic-oblong, acuminate, 6-25 × 3-7 cm; with grooved petioles 7-10 cm long. Inflorescences erect, arising from the base of the leafy shoot, pubescent or puberulous, greenish-purple; peduncles 17-25 cm long; sterile bracts erect or suberect, lanceolate, subacute, acuminate, 1.8-3.2 cm long, glabrous, not sheathing; raceme lax, few- to many-flowered; rachis 6-12 cm long; floral bracts persistent, lanceolate, acuminate, puberulous, 15-25 × 3-5 mm, as long as or slightly shorter than the ovary plus the pedicel. Flowers to 30 mm across, lavender or light purple; all tepals puberulous on the outside. Ovary indistinguishable from the pedicel, linear, 15-30 mm long, puberulous. Sepals similar, spreading, ovate-lanceolate, acute, acuminate, 5-veined, 9-16 × 4-6.2 mm. Petals linear-oblong, acuminate, subacute or acute, 9-13 × 1-1.9 mm. Lip 3-lobed, 10-15 × 6-11 mm, base extensively united with the gynostemium, spurless; midlobe ovate, apiculate, 5-9.5 × 4.5-7.5 mm, front margins erose; side lobes oblong, obtuse, 4-6 × 3-3.5 mm, spreading and pointing forwards; disk with two calli at the base but without raised lamellae. Gynostemium stout, c. 4-6.5 × 3 mm. Fruits ellipsoid, c. 30 × 14 mm.

#### DISTRIBUTION AND PHENOLOGY

In Thailand known from only two collections made in the North. Generally widespread from N India to S China, Taiwan, Japan and Korea. Found in hill evergreen forest from 1300 to 2100 m. In Thailand found flowering in April and September.

#### REMARKS

*Calanthe puberula* was recorded in Thailand as recently as 2005. It is currently the only Thai species which does not have a lip spur and can therefore hardly be mistaken for any other. Also spurless is *C. tricarinata* Lindl. which is widespread from

Pakistan to Myanmar and Japan but this species has not been recorded in Thailand as yet.

### 15. *Calanthe biloba* Lindl.

*Folia Orchidacea* 6: 3 (1854); Hooker, *Flora of British India* 5: 848 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 335 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: 12 (1975); Pearce & Cribb, *Flora of Bhutan* 3 (3): 284 (2002); Chen *et al.*, *Flora of China*, vol. 25: 299 (2009). — *Alismorkis biloba* (Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: India, Sikkim, 4000 ft, *Hooker 246* (holo-, K!).

*Calanthe biloba* var. *obtusata* E.C.Parish & Rchb.f., *Transactions of the Linnean Society of London* 30: 144 (1874). — Type: Myanmar, Tenasserim, *Parish 254* (holo-, K!).

*Calanthe biloba* var. *diptera* Hook.f., *Flora of British India* 5: 848 (1890). — Type: India, Naga Hills, *Prairie 72* (holo-, K!).

*Calanthe biloba* var. *treutleri* Hook.f., *Flora of British India* 5: 848 (1890). — Type: India, Sikkim, alt 6000 ft, *Treutler 1155* (holo-, K!).

MATERIAL EXAMINED. — Northern, Chiang Mai, Doi Inthanon, 29.XII.1926, *Garrett 362* (K); 19.XI.1930, 608 (BKE, K). — North-Eastern, Loei, Phu Luang, *Wichiansin s.n.* (BCU spirit 11056). — Without locality, *Chueachan s.n.* (QBG spirit 17585); *Thorut s.n.* (BCU spirit 6014).

ILLUSTRATIONS. — Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 1a, b (1975).

#### DESCRIPTION

Terrestrial herbs, evergreen, 40-70 cm tall. Basal sheaths one to few, mostly decayed at the flowering time and only their veins remaining. Pseudobulbs inconspicuous and largely enclosed by the leaves, cylindrical, 4-12 cm long, close together, several-noded. Leaves 3-4, perennial, broadly elliptic, acute, acuminate, 12-40 × 4.6-10.3 cm, with undulate margins, glabrous; with grooved petioles to 15 cm long. Inflorescences arising from the base of the leafy shoot or in its basal part well above the ground, shortly pubescent; peduncles 20-35 cm long; sterile bracts 3-4, scattered along the flowering stem, erect

or suberect, narrowly lanceolate, long-acuminate, 1-3.5 cm long, shortly pubescent, the lower sheathing; raceme erect, lax, few- to many-flowered; rachis 11-22 cm long; floral bracts persistent, narrowly lanceolate, acute, shortly pubescent, 9-20 × 1-3 mm, shorter than the ovary plus the pedicel. Flowers 20-35 mm across, red-brown, yellow or violet-spotted, lip pale violet, spur pink. Ovary indistinguishable from the pedicel, 20-25 mm long, pubescent. Sepals oblong-elliptic, acuminate to caudate, 5-veined, 15-18 × 5-8.5 mm, glabrous or pubescent on the outside and sometimes slightly puberulous on the inside. Petals oblong-lanceolate, somewhat clawed, acuminate, 3-veined, 15-16 × 3-6 mm, glabrous. Lip 2-lobed, broadly ovate to reniform, 19-25 × 20-26 mm, extensively united with the gynostemium, clawed, apically deeply incised, incision 5-6 mm deep and 8-10 mm wide, with a minute tooth in the middle, shortly spurred, erose or undulate on the margins; callus in the form of two obscure keels in the centre of the blade; spur conical, 2-4 mm long. Gynostemium 5-7 mm long, with a column-foot 2-6 mm long. Fruits ellipsoid, *c.* 30 × 15 mm.

#### DISTRIBUTION AND PHENOLOGY

In Thailand known from a few collections made in the North and North-East. Generally widespread on the Asian continent from the Himalayas to Myanmar and S China. The habitat ecology has not been recorded; collections were made at altitudes of between 1460 and 1550 m. Flowering in November and December.

#### REMARKS

A very distinct species with large flowers, short lip spurs and a clawed broadly reniform and apically incised lip.

### 16. *Calanthe simplex* Seidenf.

*Dansk Botanisk Arkiv* 29: 42 (1975); Chen *et al.*, *Flora of China*, vol. 25: 299 (2009). — Type: Thailand, Chiang Mai Province, Doi Chiang Dao, 21.XII.1931, *Put 4470* (holo-, K!; flower from holo-, C spirit!).

ADDITIONAL MATERIAL EXAMINED. — Northern, Chiang Mai, Doi Chiang Dao, *Baramee s.n.* (BCU spirit 009884); 7.XII.1985, *Kurzweil 665* (K); 10.XI.1995,

*Maxwell 95-1148* (C, C spirit, CMU [Sc], CMU [Sc] spirit, L); 16.XII.1997, *Nanakorn et al. 10199* (QBG spirit); XI.[year not given], *Suddee et al. 2456* (BKF spirit); *Suksathan s.n.* (BCU spirit 009016).

ILLUSTRATIONS. — Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 16a, b (1975).

#### DESCRIPTION

Terrestrial herbs, apparently evergreen, 40-55(-94) cm tall. Basal sheath 1, linear, *c.* 12 × 1-1.5 cm, apparently fresh. Pseudobulbs inconspicuous, enclosed by the leaf sheaths, 4.5-8.5 × 1-1.5 cm, close together, several-noded. Leaves 2-3, lanceolate-oblong, acute, acuminate, 20-60 × 3.2-10.5 cm, glabrous; with petioles 7-15 cm long. Inflorescences arising from the base of the leafy shoot, densely hirsute, dull dark violet; peduncles 30-36(-75) cm long; sterile bracts 4-6, erect or suberect, scattered along the flowering stem and a few clustered at its base, lanceolate-oblong, acute, (1.1-)1.9-4.1 cm long, sparsely hirsute, sheathing or not; raceme lax or semi-dense, 12- to 30-flowered; rachis 10-19 cm long; floral bracts persistent, ovate-lanceolate, acute, acuminate, 15-23 × 3.5-6 mm, longer than the pedicel plus the ovary, hirsute. Flowers: perianth and gynostemium light yellow-green, operculum cream; all perianth lobes hirsute on the outside. Ovary 6-9 mm long, distinct from the 5-9 mm long pedicel, both light green with violet tinge, densely pubescent. Sepals ovate-lanceolate, acute, shortly acuminate, 5-veined, 9-14 × 4.5-7.8 mm. Petals obovate-elliptic, sometimes slightly clawed, 3-veined, 8-12 × 2.5-5.3 mm. Lip unlobed, broadly reniform, 10-15 × 8-16 mm, base completely united with the gynostemium, spurred, marginally undulate or irregularly and rather coarsely dentate, apex often emarginate; callus as three basal keels; spur cylindrical, straight, 8-12.5 mm long, sparsely hairy. Gynostemium 4-8 mm long, with stiff hairs. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

In Thailand only known on the Doi Chiang Dao mountain massif in Chiang Mai Province in the North. The species was previously considered endemic to Thailand, but is listed in the *Flora of China* (Chen *et al.* 2009) as occurring in S China (Yunnan). The

respective specimens were not seen in the present study, but according to the description the plants clearly match the Thai specimens of *Calanthe simplex*. In Thailand found in rugged limestone terrain in disturbed open forest or in savanna from 1700 to 1850 m. Flowering in November and December.

#### REMARKS

A distinct species with small or medium-sized yellow-green flowers with unlobed lip and strongly hairy gynostemium. In his description, Seidenfaden (1975) pointed out similarities with the Burmese *C. wardii* W.W.Sm. (now included in *C. whiteana* King & Pantl.), from which it differs by strongly hairy sepals and petals and the stiff hairs on the gynostemium. *Calanthe wardii* also differs by having strongly developed calli at the spur entrance which are not found in *C. simplex*.

Based on the poor material that was available at the time Seidenfaden (1975) provisionally referred this species to subgenus *Preptanthe*, but a recently collected specimen with well-developed leaves and obscure pseudobulbs (*Maxwell 95-1148*) indicates that the species should be placed in section *Calanthe*.

#### 17. *Calanthe odora* Griff.

*Notulae ad Plantas Asiaticas* 3: 365 (1851); Hooker, *Flora of British India* 5: 853 (1890); Pearce & Cribb, *Flora of Bhutan* 3 (3): 288 (2002); Seidenfaden & Pedersen, *Opera Botanica* 22: 529 (2002); Chen *et al.*, *Flora of China*, vol. 25: 301 (2009). — *Alismorkis odora* (Griff.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: India, Upper Assam, Suddyah, 10.IV.1836, *Griffith 477* (holo-, ?K).

*Calanthe angusta* Lindl., *Folia Orchidacea* 6: 7 (1854); Hooker, *Flora of British India* 5: 849 (1890); Seidenfaden, *Botanisk Tidsskrift* 67: 106 (1972); Seidenfaden, *Dansk Botanisk Arkiv* 29: 12 (1975); Seidenfaden, *Opera Botanica* 114: 94 (1992). — *Alismorkis angusta* (Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: India, Khasia, *Lobb s.n.* (holo-, K!).

MATERIAL EXAMINED. — Northern, Chiang Mai, Mae Sanam, 27.VI.1978, *Phengkhai et al. 4134* (BKF). — Northern, Chiang Mai, Omkoi, 14.V.1977, *Santisuk 958* (BKF). — Northern, Chiang Mai, Ob Luang, 11.VI.1968, *v. Beusekom & Phengkhai 1145* (AAU, BKF, C, K, L). —

North-Eastern, Phetchabun, Nam Nao, *Pollawatn s.n.* (BCU spirit 008944). — Eastern, Chaiyaphum, Phu Kiew Wildlife Sanctuary, 2.V.1997, *Pooma 1527* (BKF). — Eastern, Chaiyaphum, Tunkamang, 29.V.1994, *Geesink et al. 7056* (BKF, K, C). — South-Eastern, Trat, Khao Kuap, 23.V.[year not given], *Put 2983* (C).

ILLUSTRATIONS. — Seidenfaden, *Botanisk Tidsskrift* 67: fig. 26a, b (1972) [as *Calanthe angusta* Lindl.]; Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 2a, b (1975) [as *C. angusta* Lindl.].

#### DESCRIPTION

Terrestrial herbs, evergreen, 12-50(-62) cm tall. Basal sheaths 1 or 2, 1.5-7 cm long. Pseudobulbs inconspicuous and largely enclosed by the leaves, up to 2.5 cm long, close together, several-noded. Leaves 3-5, perennial, elliptic-oblong, acute, 13-25 × 1.5-4.2 cm, upper surface glabrous, lower surface hairy or subglabrous; with obscure grooved petioles to 5 cm long. Inflorescences erect, arising from the base of the previous year's leafless pseudobulb, pubescent; peduncles 26-35 cm long; sterile bracts 3-6, scattered along the flowering stem and a few clustered at its base, the lower erect or suberect and the upper spreading, the lower sheathing, broadly ovate-lanceolate, obtuse, 0.9-2.8 cm long, subglabrous or sparsely pubescent, with rather pronounced veins; raceme semi-dense or dense, 6- to many-flowered; rachis 2-9 cm long; floral bracts persistent, broadly ovate, acute, acuminate, 8-15 × 3-6 mm, shorter than the pedicel plus the ovary, sparsely pubescent or glabrous, with pronounced veins. Flowers 12-20 mm across, white with a yellow centre or with yellow spots on the lip; sweetly scented. Ovary indistinguishable from the pedicel, 13-15(-21) mm long, pubescent. Sepals broadly ovate-elliptic, obtuse or subacute, 3- or 5-veined, sometimes slightly pubescent on the outside; median sepal 7.5-12 × 5-7.7 mm; lateral sepals similar but slightly narrower. Petals oblong, obtuse or truncate, slightly mucronate, 3- to 5-veined, 7.5-12 × 3.1-5 mm, sometimes puberulous at the base. Lip (8-)11-15 mm long, 3-lobed and the midlobe further divided into two elongate and spreading lobules, base completely united with the gynostemium, spurred, sometimes hairy at the base but glabrous above; midlobe bipartite, sinus acute, each lobule oblong, 3.8-6.2 × 2.2-3.6 mm; side lobes oblong,

obtuse, 3.8-6 × 1.6-3.5 mm, spreading and pointing forwards; basal callus a semi-circular cluster of warty lumps; spur cylindrical, (8-)10-12 mm long, subglabrous to sparsely hairy. Gynostemium 3-4 mm long, sparsely hairy. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

In Thailand known from a few scattered records made in the northern and eastern parts of the country. Generally widespread on the Asian continent from NE India to Indochina and S China. Found in swampy spots in open pine and dipterocarp forest and also in marshy grassland on loamy soil, from 850 to 1100 m. Flowering in May and June.

#### REMARKS

*Calanthe odora* is very similar to *C. triplicata* and has been treated within its synonymy (Seidenfaden 1975), but differs clearly in the shorter spur. Furthermore, the inflorescences of *C. odora* appear from an old wilted shoot, as opposed to *C. triplicata* where the inflorescence arises from a fresh leafy shoot (Seidenfaden & Pedersen 2002). Also the usually sweetly scented flowers of *C. odora* are a distinguishing feature from *C. triplicata* with its normally odourless flowers (Pearce & Cribb 2002: 289). In Thailand *C. odora* is found in marshy grassland and swampy soil in open forest, while *C. triplicata* occurs usually in shaded forest habitats.

#### 18. *Calanthe ceciliae* Rchb.f.

*Gardeners' Chronicle*, n.s., 19, 1883: 432 (1883); Seidenfaden, *Dansk Botanisk Arkiv* 29: 19 (1975); Comber, *Orchids of Java*: 95 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 169 (1992); Comber, *Orchids of Sumatra*: 271 (2001). — Type: Peninsular Malaysia, *Low s.n.* (not known).

*Calanthe burmanica* Rolfe, *Bulletin of Miscellaneous Information Kew* 1907: 129 (1907). — Type: Myanmar, Shan State, without collector (holo-, K!).

MATERIAL EXAMINED. — ?Northern, Nan, Sapan Waterfall, 6.VII.2001, *Srisanga 1956* (QBG [fragment]). — Peninsular, Phangnga, Sra Nang Manora, 16.X.2006, *Pumicong 495* (QBG, QBG spirit). — Peninsular, Phangnga, 11.III.1930, *Kerr 0801* (C, C spirit, K). — Peninsular, Krabi, Kow-Pra Bahng Krahm Wildlife Sanctuary,

8.VIII.2006, *Maxwell 06-536* (CMU [Sc], CMU [Sc] spirit). — Peninsular, Krabi, Phanom Bencha, 13.IX.1983, *Seidenfaden & Smitinand 9346* (C spirit). — Peninsular, Pattani, Bukit, 24.I.1931, *Put 3606* (K). — Peninsular, Narathiwat, Waeng, 16.VIII.1995, *Larsen et al. 45660* (AAU, BKF, QBG). — ?Peninsular, Narathiwat, Hala-Bala, 12.VII.1995, *Niyomdham 4468* (BKF [largely eaten]) (*vide* Thaitong). — Without locality, *Puudjaa 22* (BKF spirit); without collector *02-2007-498* (QBG spirit).

ILLUSTRATIONS. — Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 5a-c (1975); Comber, *Orchids of Java*: pl. on pages 94 and 95 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 72b, c, pl. 9c (1992) [incorrectly labelled as *Calanthe sylvatica* (Thouars) Lindl.]; Comber, *Orchids of Sumatra*: pl. on page 271 (2001).

#### DESCRIPTION

Terrestrial herbs, evergreen, 35-54(-100) cm tall. Basal sheath 1, glabrous, to 10 cm long. Pseudobulbs inconspicuous and largely enclosed by the leaves, close together, several-noded. Leaves 2-5, perennial, lanceolate-oblong, acuminate, acute, 30-35 × 5-9.2(-11.2) cm, upper surface glabrous, lower surface usually hairy; petioles 7-12.5 cm long. Inflorescences arising from the base of the leafy shoot, sparsely hairy; peduncles 29-48 cm long; sterile bracts 3-4, inserted half-way up the flowering stem and one or two at its base, erect, suberect or the upper spreading, lanceolate-oblong, acute, 0.8-1.3 cm long, glabrous or hairy, the lower sheathing; raceme semi-dense or dense, 10- to 12-flowered; rachis (3-)6-9.8 cm long, light green or dull purple; floral bracts persistent, broadly ovate-lanceolate, acute or subacute, 6-9.8 × 4.5-5.5 mm, much shorter than the pedicel plus the ovary, hairy. Flowers 20-30 mm across, purple or white flushed with purple and turning yellow at age, gynostemium recorded as white or purple. Ovary indistinguishable from the pedicel, (29-)32-35 mm long, sparsely hairy. Sepals spreading, ovate-elliptic, obtuse or acute, 3- or 5-veined, glabrous; median sepal 12.5-16 × 6-9.3(-9.7) mm; lateral sepals 13-17 × 5.5-9 mm. Petals obovate-elliptic, spatulate, obtuse or subacute, 5-veined, (12.5-)13-15 × 7.3-8 mm, glabrous. Lip 3-lobed, (20-)21-23 mm long, base completely united with the gynostemium, spurred, glabrous; midlobe deeply emarginate to bipartite, apical sinus narrow, each lobule broadly oblong, 6-8.8(-10) ×

8-12(-16) mm, margins erose; side lobes spreading and pointing to the sides, oblong, widening from the base, to 12 × 5.3 mm, margins entire; with a papillate callus at the base; spur cylindric, pointing upwards, 30-52 mm long. Gynostemium 4.5-6 mm long. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

In Thailand known from the Peninsula, with one doubtful collection made in the North. Generally widespread in Myanmar and SW Malesia. Found in evergreen rainforest with bamboo on sandy acid soil, also in freshwater swamp forest, from 75 to 400 m. Limestone has been recorded as bedrock. Flowering from March to October.

#### REMARKS

Similar to *Calanthe triplicata* but distinguished by the long upwards-pointing spurs, the purple or white and purple-tinted flowers and the orientation of the lip side lobes which are not forwards-pointing.

#### 19. *Calanthe triplicata* (Willemet) Ames (Figs 6; 7)

*Philippine Journal of Science*, C 2: 326 (1907); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: 15 (1975); Seidenfaden, *Nordic Journal of Botany* 6: 161 (1986); Comber, *Orchids of Java*: 94 (1990); Seidenfaden, *Opera Botanica* 114: 94 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 169 (1992); Comber, *Orchids of Sumatra*: 273 (2001); Pearce & Cribb, *Flora of Bhutan* 3 (3): 293 (2002); Chen *et al.*, *Flora of China*, vol. 25: 302 (2009). — *Orchis triplicata* Willemet, *Annalen der Botanik (Usteri)* 18: 52 (1796). — Iconotype: Rumphius, *Herb. Amboin.* 6: t. 52, fig. 2 [as *Flos triplicata*] (1750)!

*Limodorum veratrifolium* Willd., *Species Plantarum* 4: 122 (1805). — *Calanthe veratrifolia* (Willd.) R.Br. ex Ker Gawl., *Botanical Register* 9: pl. 720 (1823); Hooker, *Flora of British India* 5: 851 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 337 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965). — *Amblyglottis veratrifolia* (Willd.) Blume, *Bijdragen*: 370 (1825). — Type: Indonesia, West Java, Mt. Salak, based on Pre-Linnean names (not known).

*Calanthe furcata* Bateman ex Lindl., *Edward's Botanical Register* 24: 28 (1838). — *Alismorkis furcata* (Bateman ex Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Philippines, Luzon, *Cuming s.n.* (holo-, K!).

*Calanthe diploxiphion* Hook.f., *Flora of British India* 5: 849 (1890). — *Alismorkis diploxiphion* (Hook.f.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Peninsular Malaysia, Perak, Goping, *Kings collectors 6014* (holo-, SING!; iso-, L!).

*Calanthe anthropophora* Ridl., *Journal of the Federated Malay States Museums* 5: 167 (1915), syn. nov.; Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 335 (1961); Seidenfaden, *Dansk Botanisk Arkiv* 29: 19 (1975). — Type: Thailand, hills of Ko Samui, 7.V.1913, *Robinson 5701* (holo-, K!).

*Calanthe pubescens* Ridl., *Bulletin of Miscellaneous Information Kew* 1923: 117 (1923); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 169 (1992). — Type: Peninsular Malaysia, Bukit Besar, in forest, 600 m, *Gwynne-Vaughan 261* (holo-, K!).

ADDITIONAL MATERIAL EXAMINED. — Northern, Chiang Mai, Doi Suthep, 21.VI.1914, *Kerr 94* (C); 13.VI.1957, *Khantchai 599* (BKF); *Seidenfaden & Smitinand 2220* (C spirit); 18.V.1958, *Sorensen et al. 3539* (C). — Northern, Chiang Mai, Doi Saket, 24.V.1993, *Maxwell 93-488* (CMU [Sc], CMU [Sc] spirit, L). — Northern, Chiang Mai, Mae Awn, 16.VI.2005, *Maxwell 05-392* (CMU [Sc], CMU [Sc] spirit). — Northern, Chiang Mai, Omkoi, *Seidenfaden & Smitinand 5024* (C spirit). — Northern, Chiang Rai, *BCU Herb. Tr. 1751* (BCU, BCU spirit). — Northern, Lampang, Jae Sawn National Park, 21.VI.1996, *Maxwell 96-832* (CMU [Sc], CMU [Sc] spirit, L). — Northern, Tak, Doi Hua Mot, 25.V.1933, *Garrett 780* (BKF). — Northern, Tak, Huay Khao Laem, *Seidenfaden & Smitinand 7340* (C spirit). — Northern, Tak, *Seidenfaden & Smitinand 7343* (C spirit). — North-Eastern, Phetchabun, Nam Nao, 6.VI.1981, *Seidenfaden & Smitinand 8720* (C spirit); 22.V.1985, *8768* (C spirit); 21.V.1984, *8774* (C spirit); 21.V.1951, *Smitinand 492* (BKF). — North-Eastern, Loei, Phu Krading, 8.VIII.1966, *Bunchuai 172* (BKF). — Eastern, Chaiyaphum, Ban Nam Phrom, 23.V.1974, *Geesink et al. 6856* (BKF, C, L). — Eastern, Nakhon Ratchasima, Khao Yai, *Seidenfaden & Smitinand 5810* (C spirit). — Eastern, Nakhon Ratchasima, *Asa s.n.* (BKF SN076343). — South-Western, Kancharaburi, between Kritee and Meung Chah, 9.VII.1973, *Geesink & Phengklai 6213* (BKF, C, L). — South-Western, Kancharaburi, Thong Pha Phum, *Sakol 2644* (BK); 8.VI.2002, *v.d. Bult 555* (BKF, CMU [Sc], CMU [Sc] spirit). — South-Western, Kancharaburi, Sisawat, *Seidenfaden & Smitinand 4206*

(C spirit); 18.V.1962, *Kasem 146* (BK). — Central, Nakhon Nayok, Khao Yai, 9.IV.2004, *Buakhlai 18* (BCU spirit, BKF); 11.X.1999, *Chongko 42* (BKF, CMU [Sc], CMU [Sc] spirit, L); *Seidenfaden & Smitinand 5868* (C spirit). — South-Eastern, Prachin Buri, *Thaithong 1353* (BCU spirit). — South-Eastern, Chon Buri, Siricha District, 18.IV.1976, *Maxwell 76-240* (AAU, BK, L). — South-Eastern, Chon Buri, Khao Khieo, 22.IV.1971, *Smitinand & Thephasdin 11488* (BKF). — South-Eastern, Chanthaburi, Doi Soi Dao Nue, 13.V.1974, *Geesink et al. 6753* (BKF, C, L). — South-Eastern, Chanthaburi, Soi Dao, 14.V.1974, *Maxwell 74-497* (AAU, BK). — South-Eastern, Chanthaburi, Khao Soi Dao, 23.I.1956, *Smitinand 3230* (BKF). — Peninsular, Surat Thani, Ko Samui, 9.IV.1927, *Kerr 0395* (B, BK, C, K, L). — Peninsular, Surat Thani, Ko Pha-ngan, 2.VI.1927, *Put 749* (B, BK, C, L). — Peninsular, Krabi, Khao Phanom Bencha, 26.III.1930, *Kerr 0807* (BK, C, L); *Williams et al. 1890* (BKF spirit). — Peninsular, Nakhon Si Thammarat, Khao Kai Chang, 28.III.1953, *Phloenchir 489* (BKF). — Peninsular, Nakhon Si Thammarat, Khiriwong, *Suvarnakoses 1890* (BKF). — Peninsular, Nakhon Si Thammarat, Khao Luang, 24.V.1968, *v. Beusekom & Phengklai 997* (BKF, C, L). — Peninsular, Nakhon Si Thammarat, 14.III.2006, *Khunwasi 027* (BCU). — Peninsular, Phattalung, Khao Boo-Khao Yah National Park, 13.VI.1987, *Maxwell 87-553* (BKF, BKF spirit, CMU, L, PSU). — Peninsular, Satun, Khao Keo Range, 12.III.1928, *Kerr 0531* (BK, C, K, L). — Peninsular, Pattani, Khao Kala Kiri, 31.III.1928, *Kerr 0553* (BK, C, K, L). — Unspecified, Khao Yai, *Cumberlege 818* (BKF spirit); 19.V.1965, *Phengklai 1048* (BKF); *Seidenfaden & Smitinand 5753* (C spirit). — Without locality, 29.V.2006, *Pumicong 288* (QBG, QBG spirit); without collector and number (BCU spirit 009071).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: fig. 258a, b (1961) [as *Calanthe veratrifolia* (Willd.) R.Br. ex Ker Gawl.]; Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: pl. XXXVII (5810) (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 3a, b, pl. I (1975); Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 4 (1975) [as *C. anthropophora* Ridl.]; Comber, *Orchids of Java*: pl. on page 94 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 73a, b, pl. 9d (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 72d, e (1992) [as *C. pubescens* Ridl.]; Comber, *Orchids of Sumatra*: pl. on page 273 (2001); Pearce & Cribb, *Flora of Bhutan* 3 (3): pl. 11 (2002).

#### DESCRIPTION

Terrestrial or epilithic herbs, evergreen, 50-90 (-150) cm tall. Basal sheaths few, to 3.5 cm long,

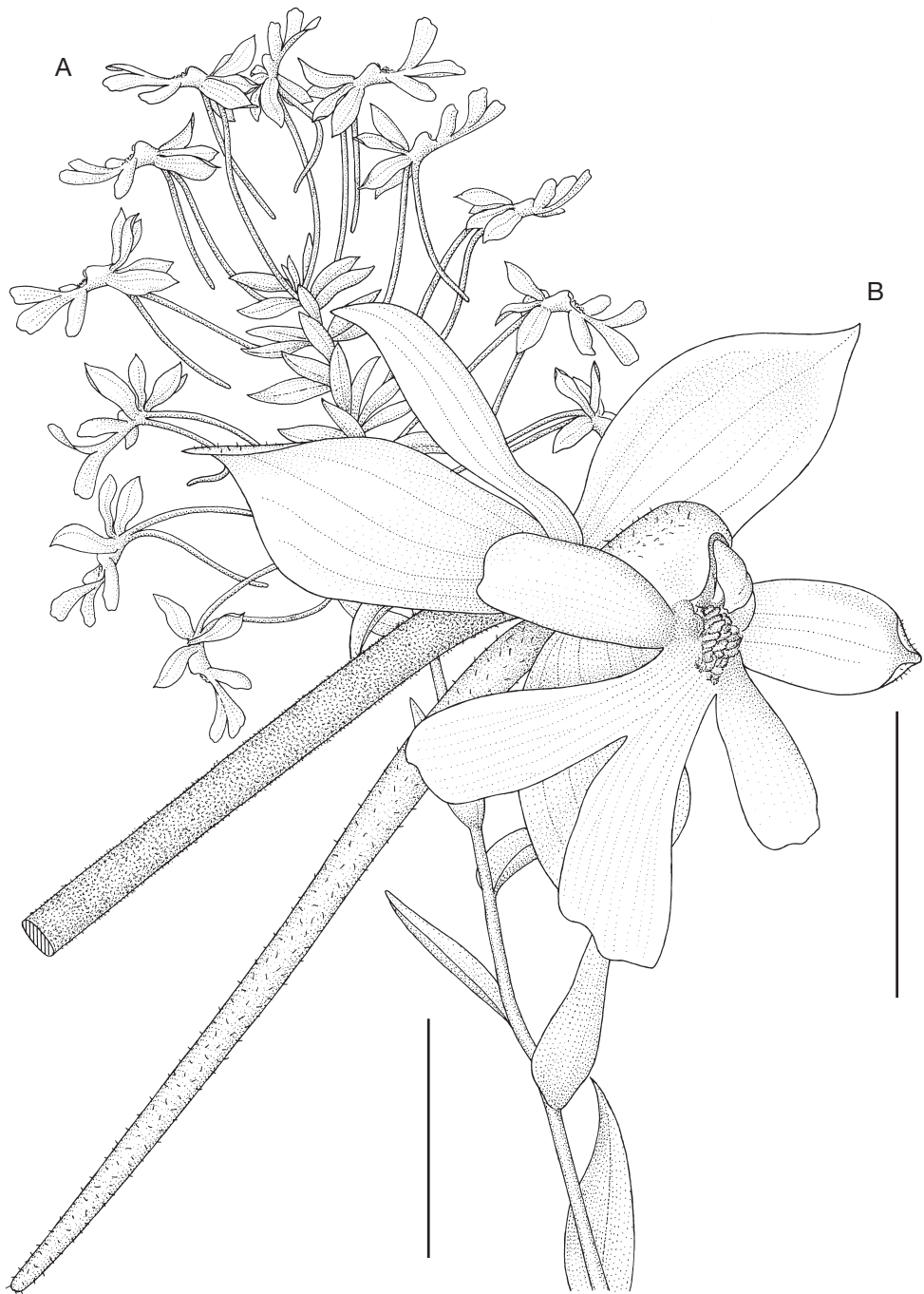


FIG. 6. — *Calanthe triplicata* (Willemet) Ames: **A**, inflorescence; **B**, flower. A, Garrett 780; B, Seidenfaden & Smitinand 7343. Reproduced with permission from the University of Copenhagen, drawn by Kai Olsen. Scale bars: A, 5 cm; B, 1 cm.

glabrous, sometimes decayed at the flowering time. Pseudobulbs inconspicuous and largely enclosed by the leaves, ovoid, conical, to 2 cm long, close together, several-noded. Leaves (2-)3-6, perennial, elliptic-oblong, acuminate, (28-)36-66 × 4.4-15 cm, upper surface glabrous or with scattered hairs, lower surface hairy or glabrous; with grooved petioles (5-)8-26 cm long. Inflorescences erect, arising from the base of the leafy shoot, pubescent; peduncles 50-68(-100) cm long; sterile bracts 3-6, scattered along the flowering stem and a few clustered at its base, erect, suberect or spreading, lanceolate-oblong, acute or subacute, 1.8-6.2 cm long, hairy, the lower sheathing; raceme semi-dense or dense, many-flowered; rachis 4-20 cm long; floral bracts persistent, broadly ovate-lanceolate, acute or subacute, 7-33 × (3-)6-15 mm, much shorter than the pedicel plus the ovary, hairy, margins entire. Flowers to 50 mm long and 28 mm across, white with pale green tips on the sepals, once reported as greyish (*Bunchuai* 172), once reported as yellow-green (*v.d. Bult* 555), always with yellow, red or rarely pink callus on the lip base, flowers turning blue when damaged or with age; sepals and petals lying in one plane and often facing backwards; flowers once reported as scented (*Bunchuai* 172). Ovary indistinguishable from the pedicel, 29-55(-60) mm long, hairy. Sepals obovate-lanceolate, acuminate or apiculate, often mucronate, mucros to 3 mm long, 3- or 5-veined, 9.8-18 × 3-8.8 mm, hairy especially on the outside. Petals obovate-elliptic, obtuse or truncate, sometimes apiculate, 3-veined, 8.2-15.5 × 2-6(-8) mm, sometimes with scattered hairs, indistinctly clawed. Lip 14-22 mm long, deeply 3-lobed and the midlobe further divided, base completely united with the gynostemium, spurred, hairy at the base but glabrous above; midlobe bipartite with two elongate and spreading lobules, sinus acute and often with a tiny tooth, apical incision 4-6 mm deep, each lobule oblong, pointing forwards, 5-12 × 1.3-4(-6) mm, apex obtuse or truncate; side lobes obliquely oblong, spreading and pointing forwards, obtuse, 5-7(-10) × 2-4(-7) mm; disc with a callus at the base, consisting of a number of wart-like papillae; spur cylindrical, sparsely hairy, more or less parallel to the pedicel, 18-27(-48) mm long, sometimes apically bifid. Gynostemium 4-7(-9) mm long, sparsely hairy. Fruits ellipsoid, 28-35 × 13-15 mm.

#### DISTRIBUTION AND PHENOLOGY

This is the most common Thai *Calanthe* species, and is widespread and common throughout the country. Generally one of the most widespread species in the genus, ranging from Madagascar and adjacent islands through the whole of tropical and subtropical Asia to New Guinea, E Australia and the Pacific Ocean Islands. The Thai populations are found in evergreen forest with bamboo, often near streams and frequently on rocks, from 200 to 1400 m. Recorded over granite, sandstone and limestone. Flowering mainly from March to July, but also recorded in October.

#### REMARKS

*Calanthe triplicata* is well characterised with its white flowers which have a lip with four spreading lobes (side lobes and the deeply bipartite midlobe) and a mostly yellow or orange callus at the base. The species is very variable in floral and vegetative characters, but the variation appears to be continuous and infraspecific taxa can apparently not be recognized. However, many of the variations have received formal names in the past as is suggested by the long list of synonyms.

In Thailand there is extensive variation in the spur length which ranges from 18 to 48 mm. As shown in Figure 7 the spur lengths of either under 22 mm or over 30 mm are the more common situation, but the occurrence of several intermediate forms suggests that a recognition of infraspecific taxa on the basis of the spur length is not justified. Interestingly, the spur length in Thailand appears to be geographically linked as spurs of 18 to 22 mm length are mainly found in the Thai Peninsula while those above 22 mm are more common in the continental parts of Thailand (Northern, North-Eastern, Eastern, South-Western, Central and South-Eastern regions).

As already pointed out by Seidenfaden (1975: 19) *Calanthe anthropophora* Ridl., only known from the type collection made in Ko Samui (Surat Thani Province), does not differ significantly from *C. triplicata*. It is here considered synonymous with the latter.

The collection *Smitinand* 3230 is atypical in its flowers as the lobules of the lip midlobe and the



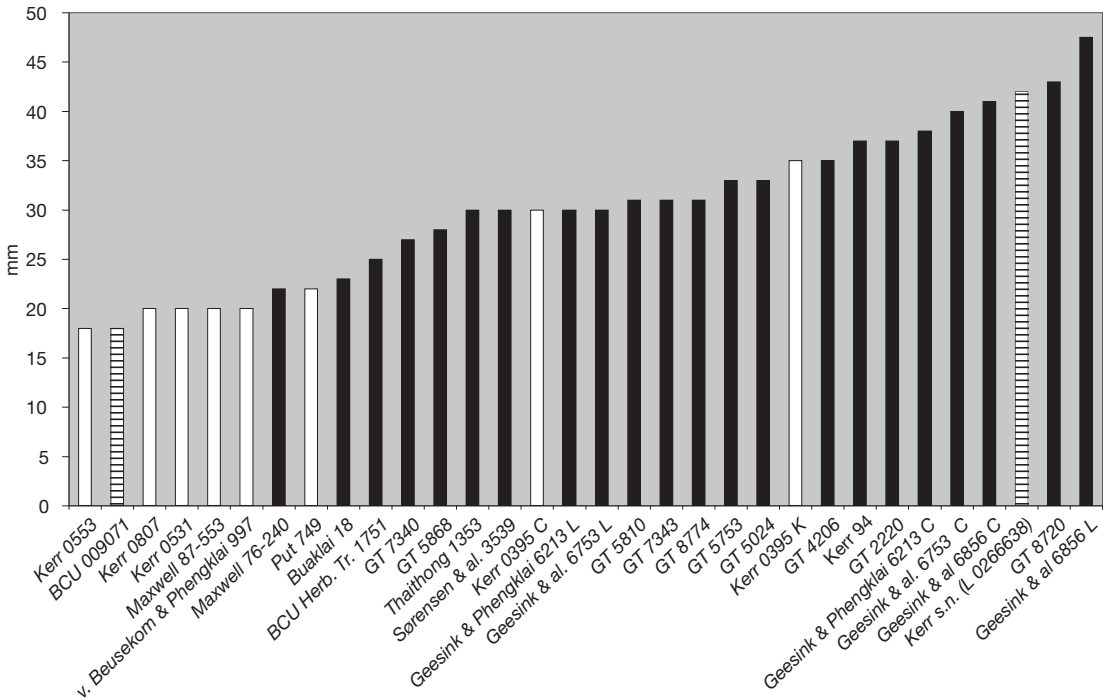


FIG. 7. — Spur length in various Thai specimens of *Calanthe triplicata* (Willemet) Ames. **Black bars**, continental populations (Northern, North-Eastern, Eastern, South-Western, Central and South-Eastern regions); **white bars**, populations in the Thai Peninsula; **striped bars**, locality unknown; **GT**, collections made by Gunnar Seidenfaden and Tem Smitinand.

lip side lobes are narrowly triangular-lanceolate and subacute at their apex.

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

*Genera and Species of Orchidaceous Plants*: 250 (1833); Comber, *Orchids of Java*: 96 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 167 (1992); Seidenfaden, *Opera Botanica* 124: 17 (1995); Comber, *Orchids of Sumatra*: 269 (2001); Pearce & Cribb, *Flora of Bhutan* 3 (3): 290 (2002); Chen *et al.*, *Flora of China*, vol. 25: 300 (2009). — *Centrosia sylvatica* Thouars, *Histoire particulière des plantes Orchidées*: pl. 35 (1822). — *Bletia sylvatica* (Thouars) Bojer, *Hortus Mauritianus*: 318 (1837). — *Alismorkis centrosis* (Thouars) Steud., *Nomenclator Botanicus*, ed. 2, 1: 49 (1840). — Type: Mascarenes, *Thouars s.n.* (holo-, P!; iso-, P!).

*Bletia masuca* D.Don, *Prodromus Florae Nepalensis*: 30 (1825). — *Zoduba masuca* (D.Don) Buch.-Ham., *Prodromus Florae Nepalensis*: 30 (1825), *nomen nudum*. — *Calanthe masuca* (D.Don) Lindl., *Genera and*

*Species of Orchidaceous Plants*: 249 (1833); Hooker, *Flora of British India* 5: 850 (1890); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 337 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 793 (1965); Seidenfaden, *Dansk Botanisk Arkiv* 29: 19 (1975). — Type: Nepal, Narainhetty, *Buchanan-Hamilton s.n.* (holo-, BM; iso-, K!, LINN Herb. no. 1403.11.1 [fide Pearce & Cribb 2002]).

*Amblyglottis emarginata* Blume, *Bijdragen*: 370 (1825). — *Calanthe emarginata* (Blume) Lindl., *Genera and Species of Orchidaceous Plants*: 249 (1833). — Type: Indonesia, Java, Mt. Gede, *Blume s.n.* (holo-, L!).

*Calanthe wightii* Rchb.f. in Walpers, *Annales Botanicæ Systematicæ* 6: 932 (1864). — Type: India, Tamil Nadu, Courtallum, ?*Wight* 2992 (holo-, K!; iso-, AMES!).

*Calanthe versicolor* Lindl., *Sertum Orchidaceum*: pl. 42 (1871). — Type: cult (holo-, K).

ADDITIONAL MATERIAL EXAMINED. — Northern, Nan, Sapan Waterfall, 7.IX.1995, *Larsen et al.* 46153 (AAU, SING). — Northern, Nan, Doi Phu Kha, 23.IX.2000,

*Srisanga 1654* (QBG). — North-Eastern, Phetchabun, Phu Mieng, 1.VI.1964, *Seidenfaden & Smitinand 5500* (C spirit). — North-Eastern, Loei, Phu Krading, XII.1958, *Seidenfaden & Smitinand 3065* (C spirit); 22.VIII.1960, *3708* (C spirit); 22.VIII.1960, *3709* (C spirit). — North-Eastern, Loei, *Thaithong 866* (BCU spirit). — Eastern, Chaiyaphum, Phu Khieo, VII. 1973, *Seidenfaden & Smitinand 8129* (C spirit). — Peninsular, Pattani, Be-tong, 2.VIII.1923, *Kerr 070* (K). — Peninsular, Yala, Hala-Bala, 26.II.1999, *Niyomdham & Puudjaa 5671* (BKF). — Peninsular, Narathiwat, Sirindhorn Waterfall, III.[year not given], *Niyomdham 6443* (BKF spirit). — Without locality, *Puudjaa 225* (BKF spirit); *Thorut s.n.* (BCU spirit 008962).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand—A Preliminary List*, part III: fig. 257a-c (1961); Seidenfaden & Smitinand, *The Orchids of Thailand—A Preliminary List*, part IV, 2: pl. XXXVIII (5500) (1965) [as *Calanthe masuca* (D.Don) Lindl.]; Seidenfaden, *Dansk Botanisk Arkiv* 29: fig. 6a-d, pl. II (1975) [as *C. masuca* (D.Don) Lindl.]; Comber, *Orchids of Java*: pl. on page 96 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 72a (1992); Comber, *Orchids of Sumatra*: pl. on page 270 (2001).

#### DESCRIPTION

Terrestrial herbs, evergreen, 30-65 cm tall. Basal sheaths not seen. Pseudobulbs inconspicuous and largely enclosed by the leaves, narrowly conical, 1.5-5 cm long, close together, several-noded. Leaves 2-4, perennial, broadly lanceolate-elliptic, acute, acuminate, 22-40 × 5.5-12 cm, upper surface glabrous or pubescent, lower surface pubescent; with grooved petioles 5-11(-13) cm long. Inflorescences arising from the base of the leafy shoot, pubescent; peduncles to 50 cm long; sterile bracts 2-4, scattered along the flowering stem and clustered at its base, erect or suberect, lanceolate-oblong, acute or subacute, 1-2.5 cm long, pubescent, the lower sheathing; raceme semi-dense or lax, 7- to 15-flowered; rachis 5.2-17 cm long; floral bracts persistent, broadly ovate-lanceolate, acute or subacute, 7-16(-21) × 3-8 mm, shorter than the pedicel plus the ovary, pubescent. Flowers 20-45 mm across, opening widely, mauve to purple, rarely white with rosa lip and turning rusty with age, callus yellow. Ovary indistinguishable from the pedicel, 17-35 mm long, pubescent. Sepals ovate-elliptic, short-acuminate, 3- or 5-veined, glabrous or pubescent on the outside; median sepal 20-26(-30) × 8.2-11(-13) mm;

lateral sepals 21-25(-28) × 6-10(-12) mm. Petals obovate-elliptic, subacute or obtuse, mucronate, 3- or 5-veined, 19-25 × 7-15 mm, glabrous. Lip 3-lobed, 17-26 mm long, base completely united with the gynostemium, spurred, glabrous; midlobe fan-shaped and apically emarginate, 10-16 × 12-15(-21) mm, clawed, with erose front margins; side lobes oblong-auriculate, obtuse, 3.5-5(-9.5) × 1.5-3.5(-4) mm; callus at the base of the midlobe 3-lamellate, warty; spur cylindrical, curved, 30-48 mm long, sometimes apically bifid. Gynostemium (3.5-)5-6 mm long, glabrous. Fruits ellipsoid, 20-30 × 5-10 mm.

#### DISTRIBUTION AND PHENOLOGY

Found in most parts of Thailand except the South-Eastern, Central and South-Western regions. Generally very widespread from tropical and extra-tropical Africa through Madagascar to tropical and subtropical Asia as far eastwards as Sulawesi and the Lesser Sunda Islands. In Thailand found in evergreen forest and scrub forest, from 150 to 1500 m. Flowering at different times of the year.

#### REMARKS

*Calanthe sylvatica* is very variable in many features but due to the lack of discontinuities it is not possible to split it into infraspecific taxa. The species is distinct with its emarginate or shallowly bilobed lip midlobe and the small lip side lobes.

The specimen *Puudjaa 225* differs by having significantly larger flowers with median sepals 32 mm long, lateral sepals 34 × 12 mm, petals 26 × 12.7 mm, spurs 50 mm long and ovary + pedicel 48 mm long. However, from the label it is not clear whether it is a wild-growing plant or is in fact a cultivar.

#### 21. *Calanthe* indet. (Fig. 8)

MATERIAL EXAMINED. — Kanchanaburi, “near the Burmese border”, XII.1983, *Sukhakul* sub *Seidenfaden & Smitinand 9580* (C spirit [a single flower and part of an inflorescence axis]).

#### DESCRIPTION

Rachis densely hairy. Floral bracts persistent, ovate-lanceolate, acuminate, 18 × 7 mm, shorter than the

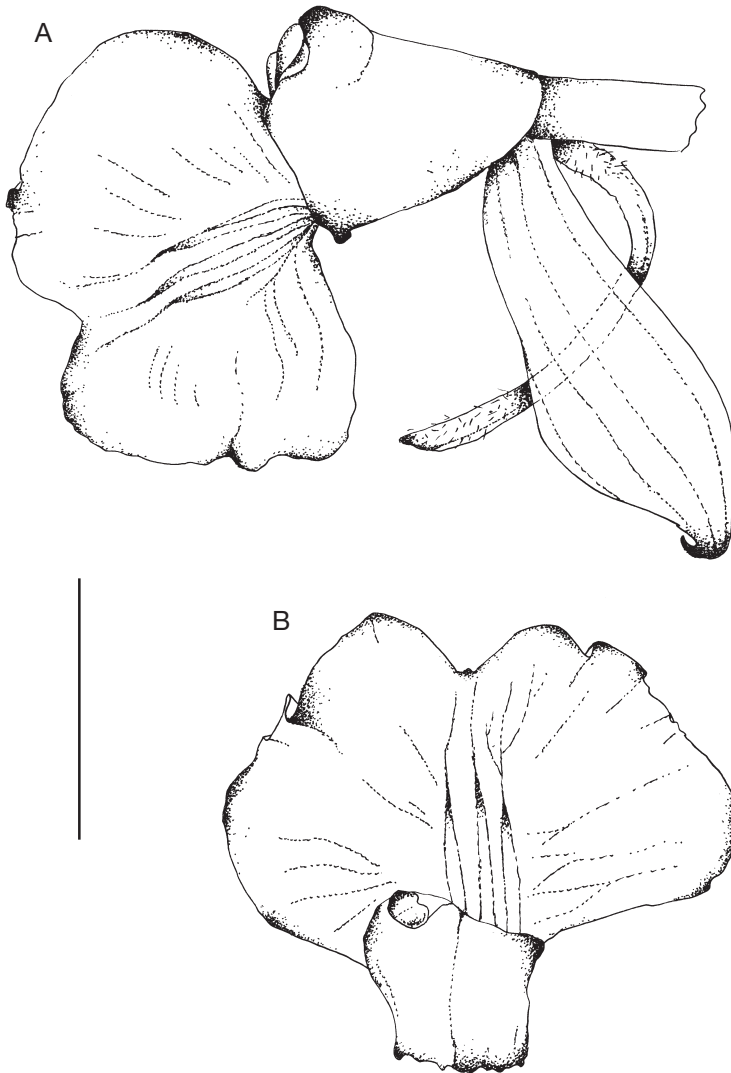


FIG. 8. — *Calanthe* indet., lip and gynostemium seen from the side and from above. From *Sukhakul* sub *Seidenfaden* & *Smitinand* 9580. Drawn by Mrs Lay Keng Ong after a pencil sketch held in the *Seidenfaden* working files (Copenhagen). Scale bar: 1 cm.

pedicel plus the ovary, pubescent. Flowers  $41 \times 37$  mm across, opening widely. Ovary indistinguishable from the pedicel, 23 mm long, pubescent. Sepals elliptic, mucronate, pubescent; median sepal  $20 \times 6.5$  mm; lateral sepals  $21 \times 7.4$  mm. Petals elliptic, mucronate,  $18 \times 8$  mm, subglabrous. Lip unlobed, broader than long, fan-shaped and apically emarginate,  $20 \times 20$  mm, base extensively united with the gynoste-

mium, spurred, margins crisped, obtuse-dentate and undulate, with a minute tooth in the apical incision; callus in the form of three longitudinal ridges in the lower half; spur cylindrical, forwards curved, 18 mm long, pubescent. Gynostemium 9 mm long, glabrous except for a few hairs at the back of the anther cap.

This plant was found growing together with *Calanthe vestita*. According to a short description provided

by Mr Sukhakul (found in the Seidenfaden working files), the pseudobulbs of the plant resemble those of *C. vestita* and are not constricted. The rachis is about 32 cm long and is covered with thin white hairs. Flowers were said to be white with orange-yellow at lip base. Flowering plants were found in December.

#### REMARKS

In a fax to Mr P. Sukhakul dated 5.II.1993 (? , date not clearly written) Seidenfaden regarded the plant as the representative of a new species which differs from *C. vestita* by having an unlobed lip, but also a similarity with *C. labrosa* was pointed out. In a later paper Seidenfaden provisionally referred this plant to *C. labrosa* although it was pointed out that it differs in a number of characters from typical specimens and may deserve recognition as a separate variety (Seidenfaden 1995: 15).

The fusion lip-gynostemium is extensive which raises doubts regarding its affinity to *C. labrosa*. As it does not match any currently known species it is here considered as new but a formal description of the plant will have to wait until the plant is re-collected and more complete material is available for study.

#### Genus *Phaius* Lour.

*Flora Cochinchinensis*: 529 (1790); Hooker, *Flora of British India* 5: 816-818 (1890) [as *Phajus*]; Seidenfaden, *Opera Botanica* 89: 41-49 (1986); Pridgeon *et al.*, *Genera Orchidacearum* 4: 149-151 (2005). — Type species: *Phaius grandifolius* Lour.

(For generic synonyms see Pridgeon *et al.* 2005)

#### DESCRIPTION

Terrestrial or very rarely epiphytic herbs, in the *Flora of Thailand* area glabrous except for the

lip and the gynostemium, 40-200 cm tall; stems either short and pseudobulbous or elongate-fusiform and cane-like, several-noded. Basal sheaths few, mostly already partly or entirely decayed and absent at the flowering time. Pseudobulbs (if present) inconspicuous and largely hidden by the petioles of the leaves, close together and the rhizome between the shoots short. Leaves one to few, perennial, plicate, lanceolate-oblong, acute or acuminate, with grooved petioles which sometimes form a pseudostem. Inflorescences unbranched, arising from the base of the leafy shoot or one third to half-way up the stem; peduncles usually with one to few tubular and sheathing sterile bracts; flower-bearing part racemose, erect, mostly few-flowered, floral bracts persistent or caducous. Flowers mostly large and showy, resupinate, often yellow, pink or white, turning blackish-blue when damaged or with age. Ovary not distinct from the pedicel. Sepals and petals similar, free, spreading or campanulate. Lip clearly or obscurely 3-lobed, base free from the gynostemium or united with it only in the lower third, with short or elongate spur, disc often with a callus in the form of keels, side lobes usually more or less erect and enclosing the gynostemium. Gynostemium long, lacking a column-foot, mostly hairy especially on the front side; anther incumbent, operculate, with 8 waxy, clavate pollinia; rostellum entire; stigma in a cavity below the rostellum.

#### DISTRIBUTION

A genus of *c.* 40 species distributed mainly in Asia, the Malay Archipelago and the Philippines, with a few species also found in tropical Africa, Madagascar, the Mascarene Islands, N Australia and the south-west Pacific Ocean Islands; five species in Thailand.

#### ARTIFICIAL KEY TO THE THAI SPECIES OF THE GENUS *PHAIUS* LOUR.

1. Plants with basal pseudobulbs; inflorescence arising from the base of the leafy shoot or very rarely from the upper part of a cylindrical pseudobulb well above the ground (up to 18 cm) ..... 2
- Plants with cane-like stems; inflorescence arising one third to half-way up the stem ... 4
2. Lip midlobe hardly protruding; flowers spreading, mostly yellow to greenish, lip with orange or brown markings ..... 1. *Phaius flavus*, p. 93

- Lip midlobe clearly protruding; flowers spreading, subnutant or nutant ..... 3
- 3. Sepals and petals 40-58(-63) mm long, with brown-red inner surfaces and white outer surface; lip purple with dark venation and pale pink or white rim; spur 5-8(-9) mm long ..... 2. *Phaius tankervilleae*, p. 94
- Sepals and petals up to 68 mm long, greenish yellow on both sides, lip white with yellow and purple markings in the throat; spur 11-15 mm long ..... 3. *Phaius wallichii*, p. 97
- 4. Spur short, to 6 mm long; sepals and petals brownish-yellow or white on the outside, brownish-purple with yellow edges on the inside, lip white or golden yellow with reddish brown markings, apical part nearly pure yellow ..... 4. *Phaius indochinensis*, p. 98
- Spur 10-18 mm long; sepals and petals pink to light purple or brownish-red ..... 5. *Phaius mishmensis*, p. 100

1. *Phaius flavus* (Blume) Lindl.  
(Fig. 9)

*Genera and Species of Orchidaceous Plants*: 128 (1831); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 328 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 792 (1965); Seidenfaden, *Opera Botanica* 89: 41 (1986); Comber, *Orchids of Java*: 99 (1990); Seidenfaden, *Opera Botanica* 114: 99 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 177 (1992); Comber, *Orchids of Sumatra*: 283 (2001); Pearce & Cribb, *Flora of Bhutan* 3 (3): 303 (2002); Chen *et al.*, *Flora of China*, vol. 25: 290 (2009). — *Limodorum flavum* Blume, *Bijdragen*: 375 (1825). — *Bletia flava* (Blume) Wall. ex Lindl., *Genera and Species of Orchidaceous Plants*: 127 (1831). — Type: Indonesia, Java, Mt. Gede, in forest, *Blume's collector* (holo-, L).

*Bletia woodfordii* Hook., *Botanical Magazine* 54: pl. 2719 (1827). — *Phaius woodfordii* (Hook.) Merr., *Journal of the Arnold Arboretum* 29: 211 (1948); Seidenfaden, *Botanisk Tidsskrift* 65: 336 (1970). — Type: Trinidad (?), *Woodford s.n.* (holo-, K).

*Phaius maculatus* Lindl., *Genera and Species of Orchidaceous Plants*: 127 (1831); Hooker, *Flora of British India* 5: 817 (1890). — Type: Nepal, *Wallich s.n.*, *Wallich's Catalogue* 3748 (holo-, K-LINDL!; iso-, BM, K-WALL).

*Limodorum crispum* Reinw. ex Blume, *Museum Botanicum Lugduno-Batavum* 2: 180 (1856). — *Phaius crispus* Blume, *Museum Botanicum Lugduno-Batavum* 2: 180 (1856). — Type: Indonesia, western Java, *Kuhl & van Hasselt s.n.* (holo-, L).

ADDITIONAL MATERIAL EXAMINED. — Northern, Chiang Mai, Doi Inthanon, 18.VI.1928, *Garrett 543* (K, P); 11.V.1983, *Larsen 74/307* (C spirit); *Menzies & DuPuy 293* (K spirit); 4.VI.1985, *Rasmussen* sub *Seidenfaden &*

*Smitinand 9257* (C spirit). — Northern, Chiang Mai, Jawm Tong, 1.VII.1992, *Maxwell 92-346* (CMU [Sc], CMU [Sc] spirit). — Northern, Chiang Mai, Chiang Dao, 16.VII.1958, *Smitinand 4713* (BKF). — Northern, Chiang Mai, 31.VII.1968, *Larsen et al. 2960* (AAU, C spirit, E, K, L, P). — Northern, Nan, Doi Phu Kha, 20.III.2000, *Srisanga 1342* (QBG). — Northern, Tak, Mussoe, 2.XII.1969, *Seidenfaden & Smitinand 7399* (C spirit). — Northern, Tak, 2.XII.1968, *Seidenfaden & Smitinand 7342* (C spirit). — Northern, Phitsanulok, *Intamusika 81* (QBG spirit). — North-Eastern, Loei, Phu Luang, 4.IV.1983, *Rasmussen* sub *Seidenfaden & Smitinand 9109* (C spirit). — South-Western, Kanchanaburi, cultivated, without collector and number (K spirit 50617). — Without locality, 1.VI.1994, *Thorut s.n.* (BCU spirit H5975).

ILLUSTRATIONS. — Seidenfaden, *Opera Botanica* 89: fig. 18a-f, pl. IIIc (1986); Comber, *Orchids of Java*: pl. on page 100 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 76c, d, pl. 10d (1992); Comber, *Orchids of Sumatra*: pl. on page 283 (2001); Pearce & Cribb, *Flora of Bhutan* 3 (3): fig. 69a-l (2002); Pridgeon *et al.*, *Genera Orchidacearum* 4: fig. 275.1A-L (2005).

DESCRIPTION

Terrestrial or rarely lithophytic herbs, evergreen, glabrous except for the gynostemium, 40-100 cm tall; stems pseudobulbous. Basal sheaths largely decayed at the flowering time and only the veins remaining. Pseudobulbs inconspicuous, largely obscured by the leaf sheaths, elongate, conical to cylindrical, 9-12(-23) × 1.2-3 cm, close together, several-noded. Leaves 4-6, ovate-elliptic to elliptic-oblong, acute, (20-)30-60 × (1.5-)3.7-15 cm, green with white or yellow blotches; with petioles 17-23 cm long, sheathing base of the leaves forming

a pseudostem 13-19 cm long. Inflorescences usually arising from the basal parts of the leafy shoot and only very rarely from the upper parts of the pseudobulbs to 18 cm above the ground; peduncles usually longer than 35 cm; sterile bracts 4, erect or spreading, scattered along the flowering stem and clustered at its base, elliptic-lanceolate, acute, sheathing, (1-)2.5-5 cm long; raceme semi-dense or lax, (2-)13- to 17-flowered; rachis usually 5-20 cm long; floral bracts persistent, ovate-lanceolate, acute or subacute, 8-20 × 5-10.7 mm, much shorter than the pedicel plus the ovary. Flowers spreading, usually in shades of yellow and green, lip with orange or brown markings or brown margin, lip hypochile and spur sometimes white, gynostemium white with red streaks. Ovary indistinguishable from the pedicel, (16-)25-32 mm long. Sepals obovate-lanceolate, acute, 5- or 7-veined; median sepal (23-)25-43 × (6-)8-16 mm; lateral sepals 25-42 × 10-17 mm. Petals obovate-elliptic, somewhat clawed, usually obtuse, 5- to 9-veined, (25-)30-42 × (7-)9.5-15.5 mm. Lip very shallowly 3-lobed and midlobe hardly protruding, 23-45 × 25-45 mm, basal 2-7 mm united with the gynostemium and free above, spurred, front margins crisped-undulate especially on the midlobe; disk with three obscure keels; spur cylindrical, 5-8(-16) mm long. Gynostemium 17-20 mm long, sparsely hairy on the front side. Fruits ellipsoid, *c.* 25 × 5 mm.

#### DISTRIBUTION AND PHENOLOGY

In Thailand mainly found in the North with one record each from the North-East and South-West. Generally widespread on the Asian continent from NE India to China and southwards to Peninsular Malaysia, in the whole of Malesia and on some of the Pacific Ocean Islands as far eastwards as Samoa. Found in evergreen forest near streams, sometimes with pine, from about 1000 to 1650 m. Flowering at different times of the year.

#### REMARKS

This species is very variable in its leaf blotching, flower colour and lip shape (including the spur) (Seidenfaden 1986). It is well distinguished from other Thai *Phaius* species by its medium-sized to large mostly yellow to greenish flowers and the

inflorescences which arise at the base of the leafy shoots.

#### 2. *Phaius tankervilleae* (Banks ex L'Hér.) Blume

*Museum Botanicum Lugduno-Batavum* 2: 177 (1856); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 328 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 792 (1965) excluding syn. *P. wallichii* Lindl.; Seidenfaden, *Opera Botanica* 89: 43 (1986); Comber, *Orchids of Java*: 101 (1990); Seidenfaden, *Opera Botanica* 114: 100 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 176 (1992); Comber, *Orchids of Sumatra*: 284 (2001); Pearce & Cribb, *Flora of Bhutan* 3 (3): 305 (2002); Cribb *et al.*, *Kew Bulletin* 59: 549 (2004); Cribb, *Orchid Review* 116: 330 (2008); Chen *et al.*, *Flora of China*, vol. 25: 291 (2009). — *Limodorum tankervilleae* Banks ex L'Hér., *Sertum Anglicum*: 28 (1789). — *Bletia tankervilleae* (Banks ex L'Hér.) R.Br., *Botanical Magazine* 44: pl. 1924 (1817). — Type: China, cultivated (holo-, BM).

*Phaius grandifolius* Lour., *Flora Cochinchinensis*: 529 (1790). — Types: Cochinchina and China, *Loureiro s.n.* (syn-, not known).

*Limodorum incarvillei* Pers., *Synopsis Plantarum* 2: 520 (1807), nom. superfl.

*Limodorum incarvillei* Blume, *Bijdragen*: 374 (1825). — Type: cultivated, *Blume s.n.* (?holo-, L).

*Phaius blumei* Lindl., *Genera and Species of Orchidaceous Plants*: 127 (1831). — Type: cultivated, based on *Limodorum incarvillei* Blume.

*Phaius blumei* var. *assamica* Rchb.f., *Gardeners' Chronicle*, n.s., 17: 558 (1882). — India, Assam, *Griffith s.n.*; Syntypes (not found), India, Assam, *Staur s.n.*; Myanmar, *Griffith s.n.*; Myanmar, *Parish s.n.*

*Phaius blumei* var. *pulchra* King & Pantl., *Annals of the Royal Botanical Garden Calcutta* 8: 108 (1898). — Type: India, Sikkim, "in tropical valleys", 1891, *Pantling 139* (holo-, K!; iso-, BM).

*Calanthe bachmaensis* Gagnep., *Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 22: 509 (1950). — Type: Vietnam, Hué, Grande Cascade, Bach-ma, 1000 m, 15.IV.1939, *Poilane 29735* (holo-, P!).

(For a complete synonymy see Cribb *et al.* 2004)

ADDITIONAL MATERIAL EXAMINED. — Northern, Chiang Mai, Doi Suthep, ?*Kerr s.n.* (K H2007/02483-165); *Kerr*

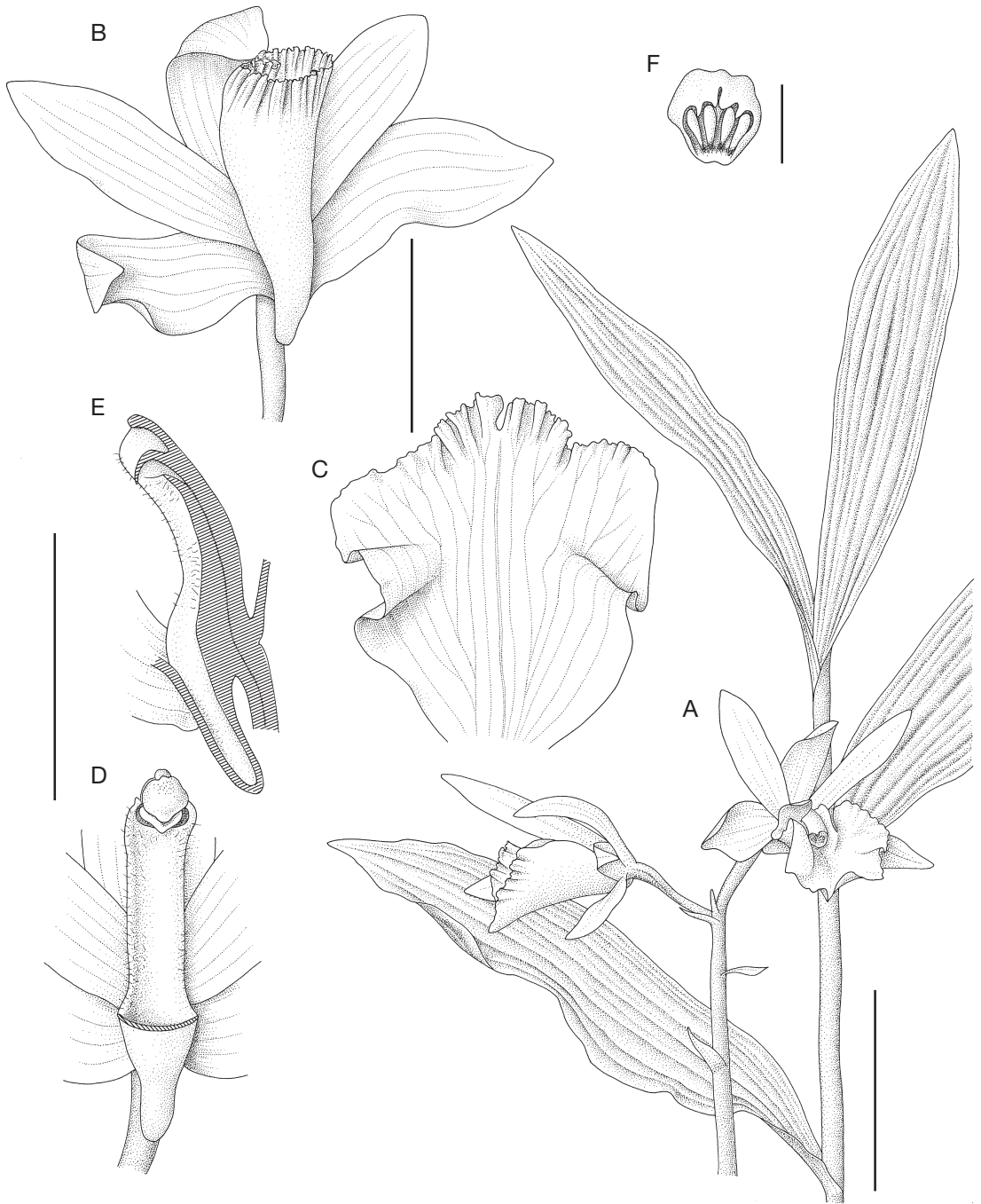


FIG. 9. — *Phaius flavus* (Blume) Lindl.: **A**, top of plant; **B**, flower seen from below; **C**, lip; **D**, gynostemium; **E**, section through gynostemium and spur; **F**, operculum and pollinia. A, *Seidenfaden & Smitinand* 7399; B-F, *Larsen et al.* 307. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul. Scale bars: A, 3 cm; B-E, 2 cm; F, 3 mm.

18 (K); without collector and number (K H2007/02483-167); 5.IV.1991, *Nunie 1* (CMU). — Northern, Chiang Mai, Hod, 13.III.2001, *Sankamethawee 134* (CMU [Sc], CMU [Sc] spirit, L). — Northern, Chiang Mai, Doi Inthanon, 8.V.1958, *Sørensen et al. 3283* (C). — ?Northern, Phitsanulok, Thung Salaeng Luang, 20.III.1966, *Seidenfaden & Smitinand 5569* (C spirit). — Northeastern, Loei, Dan Sai, 30.III.1924, *Kerr 0164* (BK, C, K, P). — Eastern, Chaiyaphum, Phu Khieo, *Seidenfaden & Smitinand 8133* (C spirit). — Peninsular, Trang, Thung Khai, 25.X.1993, *Larsen et al. 43984* (AAU). — Without locality, *Nanakorn et al. 9979* (QBG spirit); *Thaithong 1024* (BCU spirit); *Thaithong s.n.* (BCU spirit).

ILLUSTRATIONS. — Seidenfaden, *Opera Botanica* 89: fig. 19a-f, pl. III d (1986); Comber, *Orchids of Java*: pl. on page 101 (1990); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 76a, pl. 10c (1992); Comber, *Orchids of Sumatra*: pl. on page 284 (2001); Cribb *et al.*, *Kew Bulletin* 59: figs 1, 2 (2004); Pridgeon *et al.*, *Genera Orchidacearum* 4: pl. 43 (2005); Cribb, *Orchid Review* 116: pl. on page 328 (2008).

#### DESCRIPTION

Terrestrial herbs, evergreen, glabrous except for the gynostemium, to 200 cm tall; stems pseudobulbous. Basal sheaths 1-2, elliptic-lanceolate, 3.5-17 cm long. Pseudobulbs inconspicuous and enclosed by the leaf bases, conical to ovoid, 2.5-6 cm long, close together, several-noded. Leaves 4-5, lanceolate-oblong, acute, 30-105 × (4-)6-20 cm; with petioles (9-)15-25(-38) cm long. Inflorescences arising from the base of the pseudobulbs; peduncles longer than 50 cm; sterile bracts 6-10, scattered along the flowering stem and a few clustered at its base, erect, lanceolate-oblong, acute, acuminate, apiculate, (1-)4-6 cm long, sheathing, rarely already fallen off at the flowering time and only the leaf scars visible; raceme erect, lax to semi-dense, 6- to 20-flowered; rachis (4.5-)15-30 cm long; floral bracts persistent or caducous, to 50 mm long. Flowers: sepals and petals reddish brown on the inside and white on the outside, lip purple with dark veins and a pale apical rim, spur and gynostemium white; flowers nutant or subnutant, sepals and petals similar, lying in one plane and facing downward; reported as fragrant. Ovary indistinguishable from the pedicel, (25-)28-48 mm long. Sepals ovate-lanceolate, acute or acuminate, 7-veined, 41-58(-63) × 9-16(-17.5) mm. Petals ovate-elliptic, acute, 3- to 7-veined, 40-55(-58) × 8-18 mm. Lip

3-lobed with its midlobe clearly protruding, 37-55 × 25-43 mm, obovate, acute or truncate, base united with the gynostemium for about 3 mm, spurred, margins undulate; midlobe ovate-oblong, obtuse, 20-25 mm wide; side lobes curved upwards and enveloping the gynostemium; callus in the form of three obscure ridges over the entire length or only part of it; spur cylindrical, curved, 5-8(-9) mm long, apex normally entire. Gynostemium 19-21 mm long, sparsely hairy especially on the base and the anther cap. Fruits ellipsoid, to 55 × 17 mm, pendent on a short pedicel, glabrous.

#### DISTRIBUTION AND PHENOLOGY

In Thailand scattered in the Northern, Eastern and Peninsular parts. Outside this country very widespread in tropical and subtropical Asia from Nepal, India and Sri Lanka to S China and Japan and the whole of Malesia as far eastwards as New Guinea, northern and eastern Australia and several of the Pacific Ocean Islands. In open swampy grassland and bog from the lowlands to 2000 m. Flowering recorded at different times of the year.

#### REMARKS

*Phaius tankervilleae* was one of the first tropical orchids introduced in England when it was brought from China in 1778. Since then it has been widely cultivated in England and continental Europe and has been illustrated in numerous horticultural journals. This and the following species *P. wallichii* have mostly been considered as conspecific in the recent literature. However, as pointed out by Cribb *et al.* (2004) and Cribb (2008) the two are distinct in a number of characters and were consequently recognized as separate species. Flowers of *P. tankervilleae* have shorter and normally entire lip spurs (usually 5-8 mm; as opposed to over 11 mm long and almost always bifid in *P. wallichii*); tepals with red-brown inner surfaces and white outer surfaces (yellowish green on both surfaces in *P. wallichii*); and a lip which is purple with dark venation and has a pink and white rim (white with yellow and purple markings in *P. wallichii*). Further differences are also found in the sizes of the sepals, petals and lip which measure mostly 40-58 mm in *P. tankervilleae* and 46-70 mm in *P. wallichii*. Measurements



TABLE 2. — Floral characters of various Thai specimens of *Phaius tankervilleae* (Banks ex L'Hér.) Blume and *P. wallichii* Lindl. All measurements in mm. —, measurement not available; ?, identification uncertain.

	median sepal	lateral sepals	petal	lip spur
<i>P. tankervilleae</i>				
Kerr 0164	45-58 × 11-14	41-52 × 9-13	40-50 × 8-11	8 or 9, entire
Nanakorn et al. 9979	61 × 16	60 × 16	57 × 13	6
?Seidenfaden & Smitinand 5569	59 × 17.5	58 × 17	58 × 16	7, bifid
Seidenfaden & Smitinand 8133	—	48 × 13.5	—	8, entire
Sørensen et al. 3283	63 × 15	63 × 15	55 × 18	5, entire
Thaithong 1024	45 × 12	48 × 13	42 × 11	6
Thaithong s.n.	46 × 13	48 × 12	43 × 10	7
<i>P. wallichii</i>				
?Pooma s.n.	68 × 18	67 × 18	62 × 17	12, entire
Seidenfaden & Smitinand 5025	61 × 17	62 × 17	58 × 15	12, bifid
Seidenfaden & Smitinand 5257	53 × 14	51 × 15	—	11, bifid
Seidenfaden & Smitinand 5644	52 × 18	53 × 16	—	11, bifid
Seidenfaden & Smitinand 7677	53 × 14	55 × 15	—	12, bifid

of flower features in various examined specimens are given in Table 2.

Seidenfaden (1986) discussed the complicated nomenclatural history of *Phaius tankervilleae*, making particular reference to his synonyms *P. grandifolius* Lour., *P. blumei* Lindl., *P. bicolor* Lindl. and *P. wallichii* Lindl. Also the different ways of spelling the species epithet “*tankervilleae*” were discussed.

Comber (1990) reported that the flowers of Javanese plants of this species are self-pollinating, and that they are hanging down afterwards. It is possible that this is also the case in other parts in the distribution area, as suggested by the frequently nutant or subnutant flowers.

### 3. *Phaius wallichii* Lindl.

In N. Wallich, *Plantae Asiaticae Rariores* 2: 46, pl. 158 (1831); Hooker, *Flora of British India* 5: 816 (1890); Cribb et al., *Kew Bulletin* 59: 549 (2004); Pridgeon et al., *Genera Orchidacearum* 4: pl. 44 (2005); Cribb, *Orchid Review* 116: 332 (2008); Chen et al., *Flora of China*, vol. 25: 292 (2009). — India, Sylhet, Wallich s.n., Wallich's Catalogue 3747 (holo-, K-WALL!; iso-, BM).

*Phaius bicolor* Lindl., *Genera and Species of Orchidaceous Plants*: 128 (1831). — Type: Sri Lanka, *Macrae* 24 (holo-, K!).

*Phaius longicornu* Guillaumin, *Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 29: 348 (1957). —

Type: Vietnam, Dalat Reg., near Gougah and Manline, 26.IV.1955, *C.R.S.T. 211* (holo-, P!).

*Phaius magniflorus* Z.H.Tsi & S.C.Chen, *Acta Phytotaxonomia Sinica* 32: 560 (1994). — Type: China, Yunnan, Mengla, 900 m, in forest, 10.V.1991, *Tsi 91-564* (holo-, PE).

(For a complete synonymy see Cribb et al. 2004)

ADDITIONAL MATERIAL EXAMINED. — Northern, Mae Hong Son, Mae Sariang, 20.III.1966, *Seidenfaden & Smitinand 5257* (C spirit). — ?Northern, Chiang Mai, Mae Sanam, *Pooma s.n.* (BKF spirit). — Northern, Chiang Mai, Omkoi, III. 1969, *Seidenfaden & Smitinand 5025* (C spirit). — Northern, Chiang Mai, 6.III.1971, *Seidenfaden & Smitinand 7677* (C spirit). — North-Eastern, Phetchabun, 20.III.1966, *Seidenfaden & Smitinand 5644* (C spirit).

ILLUSTRATIONS. — ?Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: pl. XIV (2327) (1961) [as *Phaius tankervilleae* (Banks ex L'Hér.) Blume]; Tsi & Chen, *Acta Phytotaxonomia Sinica* 32: p. 554, figs 13-17 (1994) [as *P. bannanensis* Z.H.Tsi & S.C.Chen]; Pearce & Cribb, *Flora of Bhutan* 3 (3): pl. 11 (2002) [as *P. tankervilleae* (Banks ex L'Hér.) Blume]; Cribb et al., *Kew Bulletin* 59: figs 3, 4 (2004); Pridgeon et al., *Genera Orchidacearum* 4: pl. 44 (2005); Cribb, *Orchid Review* 116: pl. on pages 329 and 331 (2008).

### DESCRIPTION

Terrestrial herbs, evergreen; stems pseudobulbous. Basal sheaths not seen. Pseudobulbs inconspicuous,

ovoid or fusiform, 10-14.5 × 4.5-5.7 cm, close together, several-noded. Leaves *c.* 4, elliptic, acute, 49-70 × 15-24 cm; indistinctly petiolate. Inflorescences arising from the middle of the pseudobulb; sterile bracts several, scattered along the flowering stem and a few clustered at its base, erect, lanceolate-oblong, acute, sheathing, slightly pilose; raceme erect, lax, 4- to 15-flowered; floral bracts caducous, 30-50 mm long. Flowers: sepals and petals greenish yellow on both sides, lip white with a red disk and yellow lines in the throat; flowers spreading, sepals and petals similar, lying in one plane and facing downward. Ovary indistinguishable from the pedicel, 40-55 mm long. Sepals ovate-lanceolate, acuminate or long-acuminate, 7-veined, in the examined Thai material to 68 mm long and 12-18 mm wide. Petals lanceolate-elliptic, acuminate, 5-veined, to 63 × 12-17 mm. Lip 3-lobed with its midlobe clearly protruding, 45-65 × 27-53 mm, obovate, acute, base united with the gynostemium, spurred, front margins crispate-undulate; midlobe ovate, 25-30 mm wide; side lobes curved upwards and enveloping the gynostemium; callus as three obscure keels; spur in the examined Thai material 11-15 mm long, almost always apically bifid. Gynostemium 16-18 mm long. Fruits as in *Phaius tankervilleae*.

#### DISTRIBUTION AND PHENOLOGY

In Thailand recorded in the North and North-East. Elsewhere the species is widely distributed from the Himalayas eastwards as far as S China and southward to Sri Lanka and possibly Sumatra. The habitat ecology has not been recorded; one of the confirmed collections was made at 1100 m. Thai specimens for which dates were recorded were collected in March.

#### REMARKS

The species was previously included in the concept of the preceding species *Phaius tankervilleae* and is therefore found under this name in most herbarium, spirit and living collections, but was recently resurrected following the studies of Cribb *et al.* (2004) and Cribb (2008). As some of the differentiating characters are found in the flower colour it is difficult to re-identify preserved specimens. Although

*Phaius wallichii* was listed as occurring in Thailand by Cribb *et al.* (2004) and Cribb (2008), no particular Thai specimens were cited.

#### 4. *Phaius indochinensis* Seidenf. & Ormerod (Fig. 10)

*Opera Botanica* 124: 17 (1995). — Type: Thailand, Phetchabun Province, Thung Salaeng Luang, Salaeng Haeng River, 24.II.1964, *Seidenfaden & Smitinand 5603* (holo-, C spirit!).

*Phaius mishmensis* auct. non (Lindl. & Paxt.) Rchb.f.: Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 329 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 792 (1965).

*Phaius indigoferus* auct. non Hassk.: Seidenfaden, *Opera Botanica* 89: 49 (1986); Seidenfaden, *Opera Botanica* 114: 101 (1992).

*Phaius brevicealcaratus* ms. (name in the spirit collection at C).

ADDITIONAL MATERIAL EXAMINED. — North-Eastern, Loei, Na Haew, *Nanakorn et al. 10443* (QBG spirit). — North-Eastern, Loei, Phu Krading, XII. 1958, *Seidenfaden & Smitinand 3068* (C spirit); XII. 1958, *Sorensen et al. 6196* (C). — North-Eastern, Loei, *Dee 407* (BKF); *460* (BKF). — North-Eastern, without exact locality, *Thaithong 1618* (BCU spirit). — South-Eastern, Chanthaburi, Khao Soi Dao, *Chatchai s.n.* (BCU spirit 009045); 12.XII.1924, *Kerr 0201* (BK, C, K); 13.XI.1969, *v. Beusekom & Smitinand 2177* (L). — South-Eastern, Chanthaburi, Khao Soi Dao Nua, XII. [year not given], *Harwood 2002* (BKF spirit). — Peninsular, Chumphon, *Thorut 7* (BCU spirit). — Peninsular, Pattani, Kao Kala Kiri, 9.IX.1923, *Kerr 0107* (C spirit, K). — Without locality, 2.XII.1995, *Thorut 603* (Suan Luang).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: fig. 250a, b (1961) [as *Phaius mishmensis* (Lindl. & Paxt.) Rchb.f.]; Seidenfaden, *Opera Botanica* 89: fig. 22a-g, pl. IVa (1986) [as *P. indigoferus* Hassk.]; Seidenfaden, *Opera Botanica* 114: fig. 54a-g (1992) [as *P. indigoferus* Hassk.].

#### DESCRIPTION

In Thailand terrestrial herbs, evergreen, glabrous except for the lip, the gynostemium and sometimes also the inflorescence stalks, 60-94 cm tall; stems elongate-fusiform and cane-like, 33-45 × 1-1.2 cm, thickened, several-noded. Basal sheaths erect, tubular,

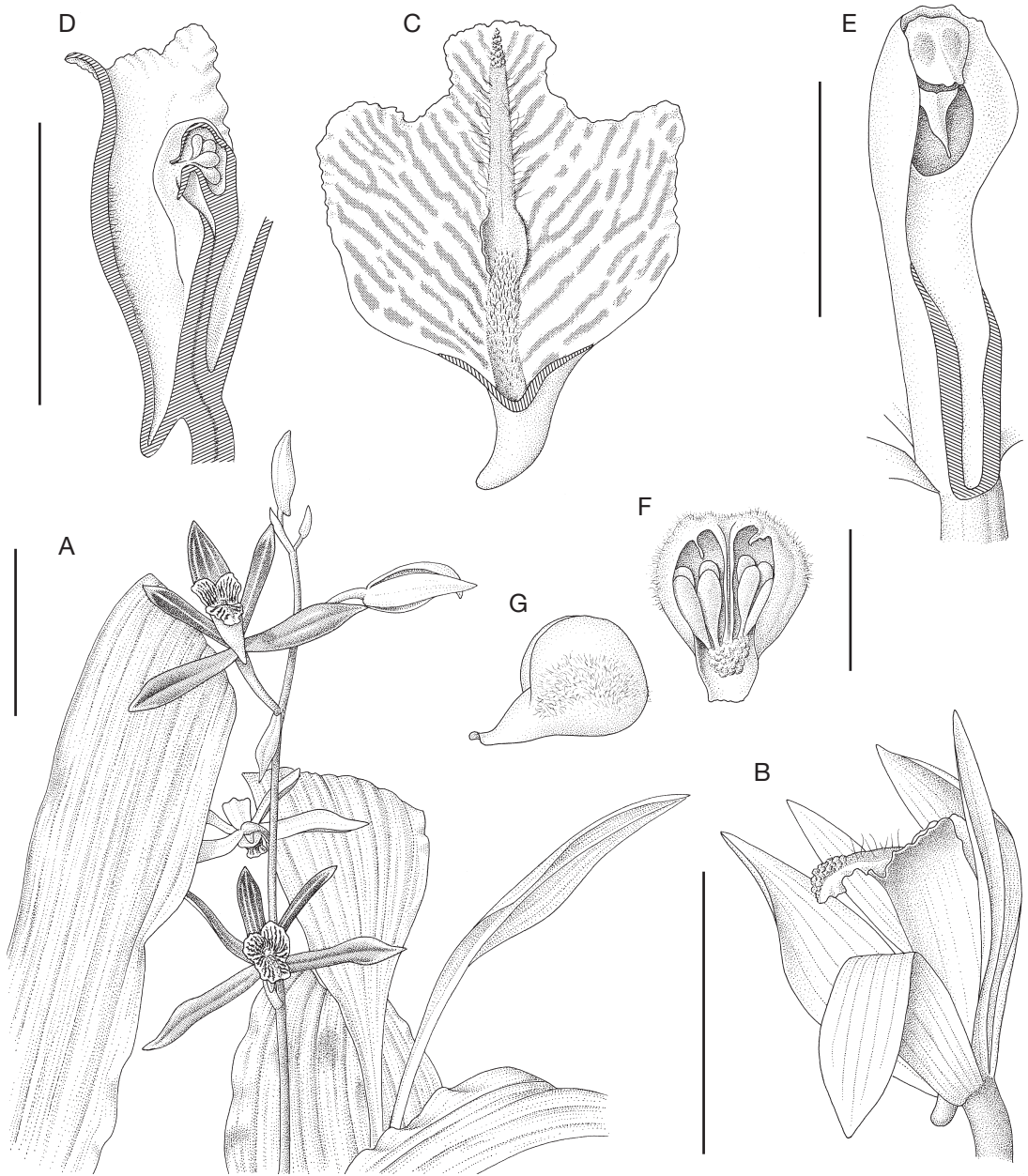


FIG. 10. — *Phaius indochinensis* Seidenf. & Ormerod: **A**, top of plant; **B**, flower; **C**, lip; **D**, section through gynostemium and lip; **E**, gynostemium; **F**, operculum and pollinia; **G**, operculum. *Seidenfaden & Smitinand 5603* (type specimen). Reproduced with permission from the University of Copenhagen, drawn by Poul Juul. Scale bars: A, 5 cm; B, 3 cm; C, D, 2 cm; E, 1 cm; F, G, 3 mm.

6.3-10 × 0.9-1.8 cm, the upper with a foliose blade up to 10 × 4.5 cm and thereby grading into the leaves. Leaves 4-5, lanceolate-elliptic, acute, arising from the

upper part of the stem, about (20-)30-50 × (4.3-)5-8(-10) cm, with petioles 2-13(-33) cm long; sheathing leaf bases forming a pseudostem 5-13 cm long.

Inflorescences 1-2, arising on the leafy shoot about one third or half-way up the stem, usually glabrous but sometimes sparsely puberulous; peduncles 30-52 cm long; sterile bracts 3-4, erect, lanceolate-elliptic, acute, 2.9-5.8 cm long, sheathing, sometimes decayed with only the veins remaining or fallen off altogether at the flowering time; raceme lax, 5-12-flowered; rachis (6.5-)12-23 cm long; floral bracts caducous, narrowly ovate-lanceolate, acute, 20-30 mm long, nearly the same length as the pedicel plus the ovary. Flowers: sepals and petals brownish-yellow or white on the outside, brownish-purple with yellow edges or "gold yellow with heavy purple streaks" on the inside, lip white or golden yellow with reddish brown stripes and many red-purple dots, apical part nearly pure yellow. Ovary indistinguishable from the pedicel, 20-38 mm long. Sepals spreading, obovate-lanceolate, shortly apiculate, 5- or 7-veined, 26-40(-47) × 6-13 mm. Petals similar, narrowly lorate-elliptic, obtuse, 5-veined, 28-36(-42) × 3-6(-8) mm. Lip 3-lobed, 21-32 × 15-31 mm, basal 6-8 mm united with the gynostemium and free above, spurred, upper surface hairy on the median callus, sometimes also the basal part of the lip outside shortly hairy; midlobe rounded square, truncate, apiculate, 3-9(-12) × 6-13 mm, apical part slightly erose, apex mostly decurved; side lobes erect but their tips spreading, triangular, obtuse, 5-10 × 6-12 mm; a broad fat callus along the median line of the lip nearly over its entire length, proximal part finely pubescent, in the middle a short widened part with raising edges, on the lip epichile the callus narrowing and apically rugose, with scattered long white hairs; spur conical, (2-)4-6 mm long. Gynostemium 19-22 mm long, sparsely hairy, with broad wings in the apical portion. Fruits ellipsoid, 25-48 × 5-15 mm.

#### DISTRIBUTION AND PHENOLOGY

In Thailand found in the North-Eastern, South-Eastern and Peninsular regions. Also recorded in Indochina. Found in dry evergreen forest, often near streams, from about 500 to 1300 m. Flowering mainly from November to December.

#### REMARKS

The occurrence of the Javanese *Phaius indigoferus* Hassk. was reported in Thailand by Seidenfaden

(1986) but was later found to be the result of a misidentification as the Thai specimens differ from this species considerably in the colour pattern of the flower and in the lip shape. They were therefore separated into a new species *P. indochinensis* Seidenf. & Ormerod.

While the Thai populations are said to be terrestrial, an epiphytic habitat of this species in Laos was recorded by Schuiteman *et al.* (2008).

#### 5. *Phaius mishmensis* (Lindl. & Paxton) Rchb.f.

*Bonplandia* 5: 43 (1857); Hooker, *Flora of British India* 5: 817 (1890); Seidenfaden, *Opera Botanica* 89: 47 (1986); Seidenfaden, *Opera Botanica* 114: 101 (1992); Pearce & Cribb, *Flora of Bhutan* 3 (3): 303 (2002); Chen *et al.*, *Flora of China*, vol. 25: 291 (2009). — *Limatodis mishmensis* Lindl. & Paxton, *Paxton's Flower Garden* 3: 36 (1852). — Type: North-eastern India, Assam, Mishmee Hills, *Griffith s.n.* (holo-, K).

*Phaius roseus* Rolfe, *Bulletin of Miscellaneous Information Kew* 1893: 6 (1893). — Type: West Africa (?), *Scarborough s.n.* (holo-, K!).

*Calanthe crinita* Gagnep., *Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 3: 322 (1931). — *Phaius crinita* (Gagnep.) Seidenf., *Bulletin du Muséum national d'Histoire naturelle*, sér. 3, Bot. 71: 141 (1972). — Type: Vietnam, Tam-dao, Province Vinh-yen, *Eberhardt 3694* (P!).

*Calanthe ramosa* Gagnep., *Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 22: 626 (1950). — Type: Vietnam, between Dankia and Danle, Haut Donnai, 1500 m, 29.I.1934, *Poilane 23521* (holo-, P!).

non *Phaius mishmensis* (Lindl. & Paxt.) Rchb.f.: Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 329 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 792 (1965) which is *P. indochinensis*.

ADDITIONAL MATERIAL EXAMINED. — Northern, Nan, Doi Khun Sathan, 19.XI.1993, *Larsen et al. 44577* (AAU, C spirit, SING). — Northern, Lampang, Jae Sawn National Park, 30.X.1996, *Maxwell 96-1425* (CMU [Sc], CMU [Sc] spirit). — Northern, Phitsanulok, Phu Hin Rong Kla, XI.[year not given], *Koonkhunthod et al. 253* (BKF spirit). — North-Eastern, Loei, Phu Luang, *Baramée s.n.* (BCU spirit 008977); 15.XI.1968, *Chermisrivatthana 1071* (BKE, C spirit); I.[year not given], *Suddee & Puud-jaa 527* (BKF spirit); *Wichiansin et al. s.n.* (BCU spirit 009168). — North-Eastern, Loei, Na Haew, 26.XI.1997,

*Nanakorn et al.* 9997 (QBG spirit). — Without locality, without collector 4 (BKF spirit).

ILLUSTRATIONS. — Seidenfaden, *Opera Botanica* 89: fig. 21a, b (1986); Pearce & Cribb, *Flora of Bhutan* 3 (3): fig. 69m, n (2002); Pridgeon *et al.*, *Genera Orchidacearum* 4: 150, fig. 275.1M-N (2005).

#### DESCRIPTION

Terrestrial herbs, evergreen, glabrous except for the lip and anther cap, 40–140 cm tall; stems cane-like, narrowly fusiform-cylindric, 15–65 × 1–1.9 cm, thickened, several-noded. Basal sheaths erect, tubular, *c.* 8 × 1.2 cm, the upper with a foliose blade up to 10 × 3.9 cm and thereby grading into the leaves. Leaves 4–7, arising from the upper part of the stem, elliptic-lanceolate, acuminate, 15–50 × (3.5–)5.8–7.8 cm, with petioles (3–)9–23 cm long, sheathing leaf bases forming a pseudostem 5–14 cm long. Inflorescences 1–2, arising on the sides of the leafy shoot about one third or half-way up the stem; peduncles 20–27 cm long; sterile bracts 2–3, erect, elliptic-lanceolate, acute, 1.9–4.1 cm long, sheathing; raceme lax, 10- to 15-flowered; rachis 17–32 cm long; floral bracts caducous, not seen. Flowers 50–60 mm across, pink to purple or brownish red, lip pink or white and speckled with purple, turning yellow with age, lip hairs white, spur yellow-green. Ovary indistinguishable from the pedicel, 25–38 mm long. Sepals similar, spreading, obovate-lanceolate, acute, 5- or 7-veined, 25–37(–44) × 5–10(–12) mm. Petals similar but narrower, lanceolate-elliptic, obtuse or acute, 3- or 5-veined, 20–30(–39) × 4–8.3 mm. Lip 3-lobed, 24–31 × 15–31 mm, basally fused to the gynostemium for 2–3.5 mm, spurred, margin irregularly undulate; midlobe subquadrate to oblong, truncate or emarginate, 3–7 × 12–16 mm; side lobes erect, obtuse, 4–5 × 8–10 mm; disk with a fat hairy ridge along the proximal two thirds, with a glabrous lamellate callus near the apex; spur cylindrical, often curved, 10–18 mm long. Gynostemium straight, 12–20(–24) mm long, with wide apical wings, anther cap sparsely hairy. Fruits ellipsoid, *c.* 14 × 6 mm.

#### DISTRIBUTION AND PHENOLOGY

Found in the Northern and North-Eastern regions. Generally widespread on the Asian continent from

NE India to S China, and also recorded in S Japan, Taiwan and the Philippines. Found in evergreen forest from about 900 to 1300 m. Granite has been recorded as bedrock. Flowering mainly from October to November.

#### REMARKS

*Phaius mishmensis* differs from *P. indochinensis* in its longer spurs (longer than 10 mm; as opposed to mostly 4–6 mm in *P. indochinensis*).

#### Genus *Cephalantheropsis* Guillaumin

*Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 32: 188 (1960); Seidenfaden, *Opera Botanica* 89: 38–40 (1986); Ormerod, *Orchid Digest* 62: 155–159 (1998); Pridgeon *et al.*, *Genera Orchidacearum* 4: 127–129 (2005). — Type species: *Cephalantheropsis lateriscapa* Guillaumin.

#### DESCRIPTION

Terrestrial or epilithic herbs, evergreen, hirsute or subglabrous; stems cane-like and elongate-fusiform, close together, several-noded. Basal sheaths few, mostly already partly or entirely decayed and absent at the flowering time. Leaves few, spreading, plicate, perennial, lanceolate-oblong, acute or acuminate, inserted in the upper part of the stem, with the petioles forming a pseudostem. Inflorescences unbranched, arising one third to half-way up the stem; sterile bracts few, tubular and sheathing; flower-bearing part racemose, unbranched, few- to many-flowered, erect; floral bracts caducous. Flowers small or medium-sized, resupinate, yellow in the Thai species, turning blackish-blue when damaged or with age. Ovary not distinct from the pedicel. Sepals and petals similar, free, spreading. Lip 3-lobed, largely free from the gynostemium and united with it only at the very base, spurless, side lobes usually erect and partly enclosing the gynostemium. Gynostemium erect or suberect, hairy; anther incumbent, operculate, with 8 waxy, clavate pollinia; stigma in a cavity below the rostellum.

#### DISTRIBUTION

A small genus of five species distributed in Asia from NE India through the whole of SE Asia eastwards

as far as the N Moluccas and northwards as far as Taiwan and S Japan; a single species in Thailand.

*Cephalantheropsis orbicdata* (Lindl.) Ormerod  
(Fig. 11)

*Orchid Digest* 62: 157 (1998); Chen *et al.*, *Flora of China*, vol. 25: 289 (2009). — *Bletia orbicdata* Lindl., *Genera and Species of Orchidaceous Plants*: 123 (1831). — Type: North-eastern India, Sylhet, *Wallich s.n.* (not found).

*Calanthe gracilis* Lindl., *Genera and Species of Orchidaceous Plants*: 251 (1833); Hooker, *Flora of British India* 5: 855 (1890). — *Limatodis gracilis* (Lindl.) Lindl., *Folia Orchidacea* 6: 11 (1855). — *Alismorkis gracilis* (Lindl.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — *Paracalanthe gracilis* (Lindl.) Kudô, *Journal of the Society of Tropical Agriculture* 2: 236 (1930). — *Cephalantheropsis gracilis* (Lindl.) S.Y.Hu, *Quarterly Journal of the Taiwan Museum* 25: 213 (1972); Seidenfaden, *Nordic Journal of Botany* 2: 216 (1982); Seidenfaden, *Opera Botanica* 89: 38 (1986); Seidenfaden, *Opera Botanica* 114: 102 (1992); Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: 180 (1992). — *Gastrorchis gracilis* (Lindl.) Aver., *Preliminary List of Vietnamese Orchids*: 203 (1988). — Type: North-eastern India, Sylhet, *Wallich s.n.*, *Wallich's Catalogue* 7341 (holo-, K-LINDL!; iso-, K-WALL!).

*Calanthe tubifera* Hook.f., *Flora of British India* 5: 855 (1890). — *Alismorkis tubifera* (Hook.f.) Kuntze, *Revisio Generum Plantarum* 2: 650 (1891). — Type: Upper Myanmar, Ava, *Griffith* 5279 (holo-, K!).

*Calanthe bursicola* Gagnep., *Bulletin du Muséum national d'Histoire naturelle*, sér. 2, 22: 509 (1950). — Type: Vietnam, Upper Donnai, Sapoum, 23.II.1933, *Poilane* 22124 (holo-, P!).

*Phaius longipes* auct. non (Hook.f.) Holttum: Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: 329 (1961); Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part IV, 2: 792 (1965).

ADDITIONAL MATERIAL EXAMINED. — North-Eastern, Loei, Phu Krading, 7-9.XI.1970, *Charoenphol et al.* 4710 (BKF, K, P, SING); X.1951, *Dee* 461 (BKF); 7.IX.1911, *Larsen et al.* 470 (C spirit); 1.XI.1984, *Murata et al.* T 42512 (L); 1.XI.1984, T 42689 (BKF, L); 16.XI.1979, *Shimizu et al.* 23147 (BKF, C spirit); XII.1958, *Sørensen et al.* 6197 (BKF, C); 28.XI.1965, *Tagawa et al.* T 549 (BKF, C spirit); 16.XII.19634, *Umpai* 148 (BK); 24.XII.1971, *v. Beusekom et al.* 4560 (BKF, C, C spirit, K, L, P). — North-Eastern, Loei, Phu Luang,

15.XI.1968, *Chermisirivatthana* 1107 (BK); 5.XII.1965, *Tagawa et al.* T 1563 (BKF, C spirit). — South-Western, Kanchanaburi, Khao Ri Yai, 1.II.1926, *Kerr* 0269 (B, BK, C, C spirit, K, L, P). — Central, Nakhon Nayok, Khao Yai, 8.III.1964, *Hansen et al.* 11383 (BKF, C, K); *Kitichate* 180 (BCU spirit); 17.II.1983, *Niyomdham* 532 (BKF); 8.III.1964, *Seidenfaden & Smitinand* 5832 (C spirit). — Central, Nakhon Nayok, 18.II.1983, *Menzies & DuPuy* 35 (K spirit). — South-Eastern, Prachin Buri, Khao Yai, 16.II.1966, *Hennipman* 3945a (L). — South-Eastern, Prachin Buri, *Thaithong* 983 (BCU spirit). — Peninsular, Ranong, Khao Pawta Luang, 1.II.1929, *Kerr* 0702 (BK, C, C spirit, K). — Peninsular, Trang, Khao Sung, *Kerr* 0573 (K). — Unspecified, Khao Yai, *Cumberlege* 739 (BKF spirit); III. 1964, 1071 (BKF spirit, K spirit). — Without locality, *Chueachan s.n.* (QBG spirit 17587).

ILLUSTRATIONS. — Seidenfaden & Smitinand, *The Orchids of Thailand – A Preliminary List*, part III: fig. 251a-c (1961) [as *Phaius longipes* (Hook.f.) Holttum]; Seidenfaden, *Opera Botanica* 89: fig. 17a-i, pl. IIIb (1986) [as *Cephalantheropsis gracilis* (Lindl.) S.Y.Hu]; Seidenfaden & Wood, *The Orchids of Peninsular Malaysia and Singapore*: fig. 77a-i (1992) [as *C. gracilis* (Lindl.) S.Y.Hu]; Ormerod, *Orchid Digest* 62: figs. 1d, e, 2g-i (1998).

DESCRIPTION

Terrestrial or epilithic herbs, evergreen, 50-90 cm tall; stems cane-like, narrowly fusiform-cylindric, 37-55 × 0.5-1 cm, several-noded. Basal sheaths erect, tubular, 4-10.1 cm long, the upper sometimes with a foliose blade up to 5 × 2 cm, thereby grading into the leaves. Leaves 3-9, arising from the stem all along its length or only in the upper half, elliptic-lanceolate, acuminate, (17-)22-37(-62) × (2.8-)3-5.7 cm, glabrous; with petioles 3-11(-20) cm long; sheathing leaf bases forming a pseudostem 2-5 cm long. Inflorescences 1-2, 30-66 cm long, arising in an axillary position on the sides of the leafy shoot in its lower half, hirsute (sometimes very sparsely so at the base); peduncles (15-)25-45 cm long; sterile bracts (3-)4-8, scattered along the flowering stem and a few clustered at its base, erect, elliptic-lanceolate, acute, sheathing, (0.6-)2.1-4.6 cm long, subglabrous or sparsely hairy; sometimes already fallen off at the flowering time and only the leaf scars visible; raceme lax or semi-dense, 15- to many-flowered; rachis (5-)10-20 cm long, with hirsute hairs that sometimes have a pink tinge; floral bracts caducous, narrowly lanceolate, long-acuminate, glabrous.

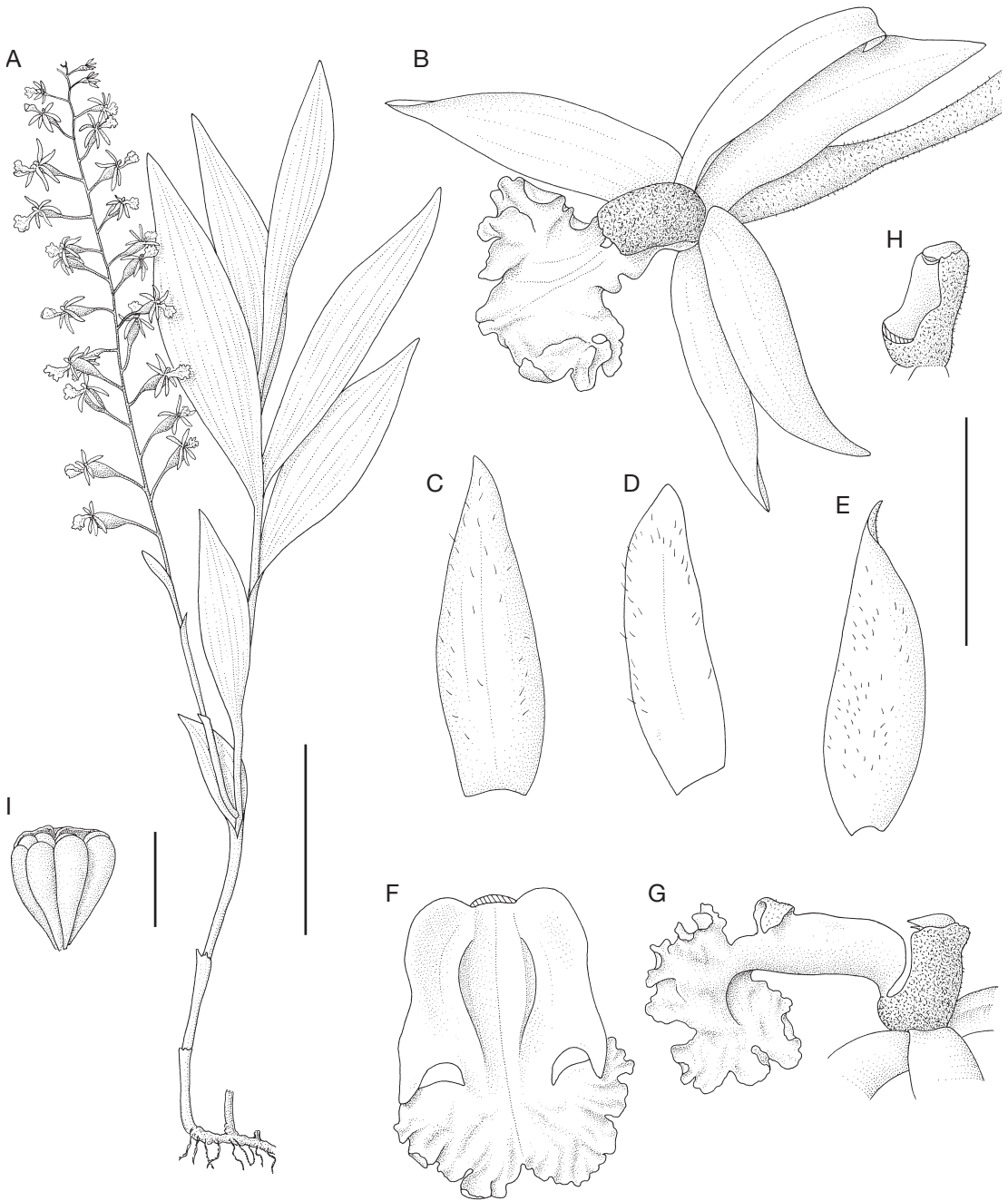


FIG. 11. — *Cephalantheropsis obcordata* (Lindl.) Ormerod: **A**, plant; **B**, flower; **C**, median sepal; **D**, petal; **E**, lateral sepal; **F**, lip; **G**, lip and gynostemium; **H**, gynostemium; **I**, pollinia. A, *Evrard 2083*; B-I, *Seidenfaden & Smitinand 5832*. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul. Scale bars: A, 10 cm; B-H, 1 cm; I, 1 mm

Flowers 20-30 mm across, yellow or orange-yellow, also recorded as sepals and petals brownish-yellow and lip white with brown patch on the disk. Ovary indistinguishable from the pedicel, (15-)18-26 mm long, densely hairy. Sepals similar, linear to oblong-elliptic, acute, 3-veined, 10-19 × 2-6.8 mm, hairy on the outside especially in their upper part, inside glabrous or with scattered hairs. Petals obovate-lanceolate, acute, 3-veined, 10-18 × 2-4.5 mm, hairy or subglabrous. Lip 3-lobed, 8-15(-18) × 5-10(-14) mm, united with the gynostemium only at the very base, spurless, base pubescent, two lateral areas with short and rather stout hairs near the upper end of the side lobes, otherwise glabrous; midlobe flabellate, bilobulate, 3.5-8 × 5-10 mm, decurved, margin crispate; side lobes erect, falcate, tips pointing forwards, 1.7-5 × 1-3 mm; disk with two longitudinal ridges over most of its length or only in its basal half. Gynostemium 3-6 mm long, densely hairy. Fruits not seen.

#### DISTRIBUTION AND PHENOLOGY

In Thailand found in all regions except the North and East. Generally widespread from NE India to S China and Japan, and in Malesia as far eastwards as the Moluccas. Found in dry evergreen forest from about 1100 to 1400 m. Once reported over sandstone. Flowering from September to December and from February to March.

#### REMARKS

Easily recognized by the many-flowered inflorescences which arise in lateral position on the cane-like stems and the small or medium-sized spurless yellow flowers.

*Cephalantheropsis obcordata* was previously widely known as *Calanthe gracilis* and, after its transfer to the genus *Cephalantheropsis*, as *Cephalantheropsis gracilis*. As the species was later shown to be conspecific with *Bletia obcordata* Lindl., its name had to change to *Cephalantheropsis obcordata*, which is the older epithet.

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#### REFERENCES

- CHEN X., LIU Z., ZHU G., LANG K., JI Z., LUO Y., JIN X., CRIBB P. J., WOOD J. J., GALE S. W., ORMEROD P., VERMEULEN J. J., WOOD H. P., CLAYTON D. &



- BELL A. 2009. — Orchidaceae, in WU Z., RAVEN P. H. & HONG D. (eds), *Flora of China*, vol. 25. Science Press, Beijing; Missouri Botanical Garden Press, St. Louis: 1-570.
- COMBER J. B. 1990. — *Orchids of Java*. Bentham-Moxon Trust, Royal Botanic Gardens, Kew, 407 p.
- COMBER J. B. 2001. — *Orchids of Sumatra*. Natural History Publications, Kota Kinabalu, 1026 p.
- CRIBB P. J. 2008. — *Phaius tankervilleae* and *P. wallichii*. *Orchid Review* 116: 328-333.
- CRIBB P. J., SUN M. & BARETTO G. 2004. — *Phaius tankervilleae* and *P. wallichii* (Orchidaceae), a pair of confused species. *Kew Bulletin* 59: 547-554.
- KING G. & PANTLING R. 1898. — The orchids of the Sikkim Himalayas. *Annals of the Royal Botanical Garden Calcutta* 8: 1-342.
- PEARCE N. R. & CRIBB P. J. 2002. — The orchids of Bhutan, in *Flora of Bhutan*, vol. 3 (3). Royal Botanic Garden Edinburgh and Royal Government of Bhutan, 643 p.
- PRIDGEON A. M., CRIBB P. J., CHASE M. W. & RASMUSSEN F. N. 2005. — *Genera Orchidacearum*, vol. 4 (Epidendroideae, part 1). Oxford University Press, Oxford, 672 p.
- SCHLECHTER R. 1912. — Die Orchidaceen von Deutsch Neu Guinea. *Repertorium Specierum Novarum Regni Vegetabilis, Beiheft* 1: 1-1079.
- SCHUITTEMAN A. & DE VOGEL E. 2000. — *Orchid genera of Thailand, Laos, Cambodia and Vietnam*. Nationaal Herbarium Nederland, University of Leiden, Thai-English edition, Thai text 109 p., English text + photographs 118 p.
- SCHUITTEMAN A., BONNET P., SVENGSUKSA B. & BARTHÉLÉMY D. 2008. — An annotated checklist of the Orchidaceae of Laos. *Nordic Journal of Botany* 26: 257-316.
- SEIDENFADEN G. 1975. — Orchid genera in Thailand I. *Calanthe* R.Br. *Dansk Botanisk Arkiv* 29 (2): 1-50.
- SEIDENFADEN G. 1986. — Orchid genera in Thailand XIII. Thirty-three epidendroid genera. *Opera Botanica* 89: 1-216.
- SEIDENFADEN G. 1992. — The orchids of Indochina. *Opera Botanica* 114: 1-502.
- SEIDENFADEN G. 1995. — Contributions to the orchid flora of Thailand. XII. *Opera Botanica* 124: 1-90.
- SEIDENFADEN G. & PEDERSEN H. 2002. — Contributions to the orchid flora of Thailand XVI. *Nordic Journal of Botany* 22: 525-534.
- SEIDENFADEN G. & SMITINAND T. 1961. — *The Orchids of Thailand – A preliminary list*, part III. The Siam Society, Bangkok, p. 327-516.
- SEIDENFADEN G. & SMITINAND T. 1965. — *The Orchids of Thailand – A preliminary list*, part IV, 2. The Siam Society, Bangkok, p. 647-870.
- SEIDENFADEN G. & WOOD J. J. 1992. — *The Orchids of Peninsular Malaysia and Singapore*. Olsen & Olsen, Fredensborg, 779 p.
- VADDHANAPHUTI N. 2005. — *A Field Guide to the Wild Orchids of Thailand*, ed. 4. Silkworm Books, Chiang Mai, 272 p.

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