

## The genus *Habenaria* (Orchidaceae) in Thailand

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**ABSTRACT.** The taxonomy of the Thai species of the largely terrestrial orchid genus *Habenaria* Willd. is reviewed. Forty-six species are recognised. *H. humidicola* Rolfe, *H. poilanei* Gagnep. and *H. ciliolaris* Kraenzl. are newly recorded for Thailand based on a single collection each, although the identification of the latter two is uncertain. An aberrant specimen of *H. viridiflora* (Rottler ex Sw.) Lindl. is pointed out. *H. erichmichaelii* Christenson is reduced to synonymy under *H. rhodocheila* Hance. Several difficult and geographically widespread species complexes are identified and the need for future studies of all of the available material over the entire distribution range is emphasized. Based on the herbarium and spirit material examined here the following distribution pattern emerged: about 53 % of all collections of Thai *Habenaria* species were made in northern Thailand (although this may partly be due to collector's bias) and about 15 % in north-eastern Thailand, while only between 4.5 and 7.5 % come from each of the other floristic regions of the country. In addition, an assessment of the conservation status has been made in all species. The present study will form the basis for a later contribution to the Flora of Thailand.

**KEY WORDS:** *Habenaria*, Orchidaceae, Thailand, conservation, identification, morphology, systematics.

## INTRODUCTION

*Habenaria* Willd. is a largely terrestrial orchid genus placed in subfamily Orchidoideae (Pridgeon et al., 2001). The genus currently accounts for about 600 species making it by far the largest in the subfamily. *Habenaria* is pantropical in distribution with approximately equal species numbers found in the continents of America, Africa and Asia (Senghas, 1973–1974). Due to the overall size of the genus and its wide distribution range a comprehensive taxonomic study was attempted only once, by Kraenzlin (1893) in which he recognized 347 species. Many taxonomic problems remain in the genus and further critical studies are needed, particularly in order to address questions regarding the relationships in many of the species complexes as well as the generic delimitation of *Habenaria* in general. In the last few years a number of genera were split off (such as *Platantheroides* Szlach., *Kraenzlinorchis* Szlach., *Smithanthe* Szlach. & Marg., *Medusorchis* Szlach.) but are not based on detailed research results, which would also need to include molecular data in our present age. These genera are not followed here as the arguments supporting their separation from *Habenaria* are not very convincing.

In Thailand *Habenaria* is well represented with 46 species. The largest number of species is found in the northern and north-eastern parts of the country. Thai *Habenaria* species are normally terrestrial and are found in various forest types, ranging from dry to

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moist deciduous or evergreen forest, bamboo forest, pine forest and open tree savanna, thriving from low altitudes to over 2000 m. In forests the *Habenaria* species are often found in open areas with grass or broad-leaved herbaceous cover. A few species are also found in grassland or bog, for example *H. rumphii* (Brongn.) Lindl. In addition, *H. vidua* E.C.Parish & Rchb.f. grows consistently on more or less exposed limestone cliffs and *H. carnea* Weathers is usually found on limestone rocks in evergreen forest. Several other largely terrestrial *Habenaria* species are occasionally also found in rock crevices. Very rarely Thai *Habenaria* species have been found growing as epiphytes (see cf. *H. ciliolaris* Kraenzl., also *H. rhodocheila* Hance was once collected in moss on a tree). While many of the Thai *Habenaria* species are very widespread in Asia, others are rather restricted in their distribution and outside of Thailand are only found in neighbouring countries like Myanmar, Cambodia and Laos. In addition, five species are currently considered endemic to Thailand, namely *H. hastata* Seidenf., *H. humistrata* Rolfe ex Downie, *H. hosseusii* Schltr., *H. longitheca* Seidenf. and *H. porphyricola* Schltr.

At the end of the previous century and at the beginning of the present major contributions to our knowledge of the Thai orchids were made by the Danish Ambassador to Thailand Dr Gunnar Seidenfaden. His studies managed to transform the orchid flora of Thailand from one of the most poorly known on the Asian continent to one of its best known (Seidenfaden, several papers). Seidenfaden's treatments are a complete inventory of the Thai orchid flora, and are based on the examinations of numerous herbarium specimens from within and outside Thailand as well as on an exhaustive literature study. The keys and accurate line drawings in his publications are an invaluable identification aid. Equally valuable are Seidenfaden's studies of related species and his discussions of relationships. Seidenfaden also elaborated on the frequently complicated taxonomic history of the species.

The present review is based on morphological examinations of most of the available herbarium and spirit material and will form the basis for a later treatment of the genus *Habenaria* in the Flora of Thailand. To a large extent the taxonomic concept of Seidenfaden (1977) has been followed. The amount of the material that is now available for study has increased substantially since Seidenfaden's work, thus creating a more complete foundation for floristic work. Unlike previous treatments the present study also contains detailed morphological descriptions of all of the species occurring in Thailand. Nevertheless, several taxonomic problems remain. In several species complexes monographic treatments over the entire distribution range would be needed in order to clarify the taxonomy of the group, which is obviously beyond the scope of the present study. Future work on these species complexes is needed and must also include molecular, cytological and ultrastructural evidence. Three species are here newly reported for Thailand, namely *H. humidicola* Rolfe and *H. ciliolaris* Kraenzl. from northern Thailand and *H. poilanei* Gagnep. from the south-east of the country, although the identification is uncertain in the latter two species. A specimen from Doi Chiang Dao (northern Thailand) also does not clearly match any of the currently recognised species but is here interpreted as an aberrant specimen of *H. viridiflora*.

## MORPHOLOGY

Like many species of subfamily Orchidoideae the species of the genus *Habenaria* are deciduous herbs and have underground root tubers. The Thai representatives are most commonly glabrous except for the floral bracts and the bract-like leaves on the upper part of the stem which may be elongate-papillose or short-hairy on the margins, and occasionally also the tepal margins are short-hairy. Strongly hairy stems with very elongate papillae and stout grouped or branched hairs are found in *H. longithecata*, *H. reflexa* Blume, *H. austrosinensis* Tang & F.T.Wang, and hairy stems with a mixture of short glandular hairs and elongate papillae are found in *H. vidua*. The stems are generally unbranched and most commonly 30–60 cm tall, although they may be as short as 10 cm (in *H. reniformis* (D.Don) Hook.f., *H. porphyricola*, *H. siamensis* Schltr., *H. humistrata* and *H. anomaliflora* Kurzweil & Chantanaorrapint) or can measure over a metre (e.g. in *H. commelinifolia* (Roxb.) Wall. ex Lindl.). The leaves are glabrous and are either basal or cauline, and in the latter case mostly clustered or scattered in the lower stem half. They are generally sheathing at the base and are sessile or shortly petiolate. Leaves in the middle portion of the stem are normally the largest while the leaf size decreases towards the lower and upper stem part. In several species the leaves are basal and adpressed to the substrate (*H. reniformis*, *H. porphyricola*, *H. siamensis*, *H. humistrata*, *H. anomaliflora*, *H. lindleyana* Steud.). The leaves of Thai *Habenaria* species are very diverse in their shape, ranging from linear and grass-like to broadly oval, lanceolate and elliptic. Their apex may be acute, subacute or obtuse and is often pronouncedly mucronate. Leaves often have a semi-translucent border which is also found in *Habenaria* species in nearby regions (e.g. Pearce & Cribb, 2002), although this character is rarely mentioned in the literature. Margins of the leaves are frequently variously papillose. Below the leaves there are generally one to few tubular white or pale-coloured cataphylls, and the uppermost of these may have a short lamina. Most Thai *Habenaria* species have one to few bract-like leaves above the foliage leaves forming a gradual transition to the floral bracts.

The inflorescences are terminal and always unbranched. They range from lax to fairly dense and compact in a head, and bear few to many small, medium-sized or large and generally resupinate flowers. Green, white or yellow colours dominate in the Thai *Habenaria* species, except in *H. rhodocheila* and *H. carnea* where the flowers can be white, pink, red, orange or yellow. The ovary is usually indistinguishable from the pedicel and is smooth or papillose. An exception is *H. corymbosa* E.C.Parish & Rchb.f. where the distinction between the ovary and the pedicel is very pronounced. The sepals are free (though sometimes fused at their very base), unlobed, concave and normally glabrous but sometimes have papillae or short hairs on the margins. The median (= dorsal) sepal is erect (except in *H. corymbosa* where it is reflexed), and the patent, spreading or reflexed lateral sepals are mostly similar in shape but are often variously oblique. A remarkable shape of the lateral sepals is found in *H. commelinifolia*, *H. longithecata*, *H. reflexa* and *H. austrosinensis* where they are so strongly oblique that their front margins form a false apex and point down while the true apex is close behind the base of the median sepal. The glabrous petals are unlobed or less commonly bifid; the two lobes can be more or less equal in size or the anterior lobe can be minute. Most commonly the petals (or in the case of bifid petals their posterior lobes) are erect and are more or less cohering with

the median sepal. Most Thai *Habenaria* species have deeply 3-lobed lips with linear or linear-lanceolate lobes. In some species the side-lobes are wider but laciniate-fimbriate (*H. limprichtii* Schltr., *H. godefroyi* Rchb.f., *H. medioflexa* Turrill, *H. myriotricha* Gagnep., *H. trichosantha* Lindl.). The lips are either 3-lobed from the base or have an unlobed basal part which can be several millimetres long. Unlobed lips are rather uncommon, and are only found in *H. hosseusii*, *H. mandersii* Collett & Hemsl. and *H. dentiostriata* Tang & F.T.Wang and in the two possibly abnormal species *H. malintana* (Blanco) Merr. and *H. anomaliflora*. The lip of Thai *Habenaria* species usually has a spur of various lengths which can be cylindrical or clavate, and is either pendent, forward-curved or reflexed in its orientation. Spurless flowers (always associated with unlobed lips) are only found in *H. malintana* and *H. anomaliflora*. Also the gynostemium (= column) of *Habenaria*, with its lack of a prominent undifferentiated column-part, the 3-lobed rostellum and the sectile pollinia conforms with the situation in other members of the subtribe Orchidinae (Pridgeon *et al.*, 2001). In Thai species the anther is mostly more or less erect or somewhat reflexed and has its thecae adjacent and only rarely separated by a wide connective (e.g. *H. limprichtii*). Usually the thecae are differentiated into thick loculi (the pollen-bearing part) and short or long narrow basal extensions referred to as the anther canals. The auricles on the side of the anther are either inconspicuous or prominent. Stigmas are freely projecting short or elongate processes. The lateral rostellum arms are as long as the anther canals, and the central lobe is usually insignificant or up to half as long as the anther. Exceptions are *H. rhodocheila* and *H. carnea* where the central rostellum lobe is very large and overtops the anther.

## CONSERVATION

In the absence of a comprehensive study of the national conservation status of the Thai *habenarias* the number of localities from which collections are available is here taken as an indication of a species' abundance. This is only a very approximate measure as it is also influenced by collector bias (in that certain collecting localities are favoured over others; Parnell *et al.*, 2003), but appears the best solution at the moment. The usefulness of this approach is also limited by the fact that some of the herbarium collections are rather old and the populations may have disappeared as a result of habitat destruction. The number of available herbarium collections is generally rather low, and the known distribution ranges are therefore almost always fragmented.

Two books on threatened plants in Thailand were published recently (Suddee, 2005; Santisuk *et al.*, 2006). Although they both include only few *Habenaria* species they are nevertheless a useful basis. Assessments of three species according to IUCN criteria were made in one of them (Santisuk *et al.*, 2006).

The number of available natural habitats has obviously decreased in Thailand due to the continued development of the country which has resulted in a general decline of populations (Santisuk *et al.*, 1991), and many of the orchids have only survived in national parks and other nature conservation areas. However, several factors may give a wrong impression of a species' rarity: Individuals of the genus *Habenaria* are comparatively short-lived (compared with many woody plants) and are therefore very sporadic in their

appearance as colonies may disappear quickly. Many *Habenaria* species are not very showy with their frequently greenish flowers and are therefore probably often overlooked. Like for other deciduous plants, habenarias are only visible and recognisable during their flowering time which is usually only one or two months of the year.

The commonest species is the widespread *Habenaria dentata* (Sw.) Schltr. for which 150 collections were examined and which was also frequently seen during personal fieldtrips in various parts of the country. Other common and fairly widespread species are *H. chlorina* E.C.Parish & Rchb.f. (31 collections examined), *H. lindleyana* (78), *H. lucida* Wall. ex Lindl. (45), *H. malintana* (45), *H. rhodocheila* (93), *H. rostelifera* Rchb. f. (51) and *H. rumphii* (34). Also regularly seen are *H. furcifera* Lindl. (26), *H. hosseusii* (25), *H. humistrata* (28), *H. limprichtii* (28) and *H. rostrata* Wall. ex Lindl. (21). Several other species are only known from one or very few collections. Examples in this category are *H. godefroyi*, *H. hastata*, *H. porphyricola*, *H. reniformis* and *H. siamensis*.

### BRIEF PHYLOGENETIC CONSIDERATIONS

As there is currently no sound phylogeny of the genus *Habenaria* based on all of the available evidence it is obviously not possible to construct a phylogeny of the species found in Thailand, but several groups of morphologically similar and probably closely related species can be recognised.

1) The *Habenaria amplexicaulis* group comprises *H. amplexicaulis* Rolfe ex Downie and *H. thailandica* Seidenf. The group is characterised by having several large cauline leaves, flowers with bipartite petals with two elongate lobes and a lip with three nearly equally long linear lobes. The differences between the two species relate to the floral size but are rather minor.

2) The *Habenaria medioflexa* group (*H. medioflexa*, *H. myriotricha* and *H. trichosantha*) is characterised by flowers with entire petals and lacinate or deeply fimbriate lip side-lobes. Within the group *H. medioflexa* is distinct with its gynostemium with slender and rather high auricles while the distinction of the remaining two species is based on minor flower size differences.

3) The *Habenaria longithecata* group (*H. longithecata*, *H. reflexa*, *H. austrosinensis*) has strongly hairy stems and oblique lateral sepals with a false downward pointing apex. Elongate anther canals are found in all species. The Malaysian *H. kingii* Hook.f. is also very similar. *H. commelinifolia* is also similar in the shape of its lateral sepals and the structure of its elongate anther canals but differs by having glabrous stems.

4) The *Habenaria dentata* group (*H. dentata* and *H. malintana*) is characterised by having few, narrow, cauline leaves and fairly large white flowers with usually marginally denticulate sepals and petals. The two species are rather common and frequently co-occur in the same population. They differ in their lip structure, with *H. dentata* having 3-lobed spurred lips while lips of *H. malintana* are unlobed and unspurred, and it is possible that the latter species is merely an abnormal form of the former. However, molecular and other evidence to support this assumption is needed.

5) The *Habenaria rostelifera* group (*H. rostelifera*, *H. rostrata* and *H. erostrata*

Tang & F.T.Wang) has a lip with three equal and spreading linear lobes and a transversal structure in front of the spur entrance. This structure is rather small but prominent in *H. rostrata* and *H. erostrata* but is a ligule measuring several millimetres in *H. rostelifera*. The ovaries are long and beaked in the group.

6) Fairly dense inflorescences, lips with three equal and narrowly oblong lobes, basally extensively fused petals and lips, and short anther canals characterise the *Habenaria marginata* group (*H. marginata* Colebr. and *H. avana* Hook.f.). There appear to be slight differences in the leaf arrangements, but in view of the few collections that are available for study and the variation found in these this difference is probably not very critical. Floral differences are minor and rely mainly on the flower colour.

7) The *Habenaria hosseusii* group (*H. hosseusii*, *H. mandersii* and *H. dentirostrata*) is characterised by having an unlobed and long-spurred lip with involute margins. A prominent erect tongue in front of the spur entrance is found in the group, the exact shape of which is critical in the delimitation of its three species.

8) The seven species of the *Habenaria humistrata* group (*H. humistrata*, *H. siamensis*, *H. porphyricola*, *H. reniformis*, *H. humidicola*, *H. poilanei* and *H. anomaliflora*) are small plants with two to four basal leaves which are adpressed to the ground or spreading just above it. The lip is mostly 3-lobed and has side-lobes which are longer than the midlobe. The exception is *H. anomaliflora* which is probably a constant abnormality with a subactinomorphic perianth.

9) In the *Habenaria rhodocheila* group (*H. rhodocheila* and *H. carnea*) the leaves are basal or scattered in the lower stem portion. In contrast to the other Thai *Habenaria* species the flowers are red, pink, orange, yellow or rarely white, and the lip has four ovate-oblong lobes. An interesting character of this group is the central rostellum lobe which is as high as or higher than the anther.

## MATERIAL AND METHODS

Specimens from the herbaria AAU, B, BCU, BK, BKF, BM, C, CMU, K, L, P, PSU, QBG as well as the Herbarium of Faculty of Science, Chiang Mai University and the herbarium of the Suan Luang Public Park in Bangkok (Thailand) were examined. Herbarium abbreviations follow the Index Herbariorum (<http://sweetgum.nybg.org/ih/>) except in the latter two herbaria for which abbreviations are not available (in the following text abbreviated as ScCMU and Suan Luang, respectively). The symbol [s] after the herbarium abbreviation indicates a spirit specimen. A question mark in front of the locality indicates that the identification is questionable, which in most cases is due to incomplete material. All cited specimens have been examined by the author. Some of the herbarium material was collected during the period of the Thai-Danish, Thai-Dutch and Thai-Japanese expeditions (mostly in the middle of the previous century) and unfortunately some of this is now in a rather poor state. Only complete specimens where the identity could be confirmed are included in the present study. In most cases inadequate collector's notes are available on aspects like the bedrock, soil and habitat; this is a common problem in taxonomic botany.



KEY TO THE *HABENARIA* SPECIES IN THAILAND

1. Petals bilobed, anterior and posterior lobe entire or laciniate; occasionally anterior lobe strongly reduced to a lobule under 3 mm long 2
2. Petal lobes laciniate **1. *H. holotricha*** 4
2. Petal lobes simple; anterior lobe sometimes minute 3
3. Sepal apices long-caudate to long-acuminate or with prominent mucros 4
4. Sepals long-caudate to long-acuminate 5
5. Both petal lobes filiform, in the examined Thai material 15–20 mm long **2. *H. pantlingiana*** 5
5. Posterior petal lobe oblong, 7–11 mm long; anterior lobe strongly reduced, 1.5–3 mm long
3. ***H. stenopetala***
4. ***H. falcatopetala*** 6
4. Sepals not aristate but prominently mucronate
3. Sepal apices neither long-caudate nor mucronate 6
6. Flowers with a sharp distinction between the ovary and the slender-filiform pedicel. Median sepal 3.8–6 mm long **5. *H. corymbosa*** 7
6. Distinction between ovary and pedicel not pronounced. Median sepal 3.5–9 mm long 7
7. Lip midlobe 9–12 mm long. Posterior petal lobe 3-veined **6. *H. amplexicaulis*** 7
7. Lip midlobe 4–7 mm long. Posterior petal lobe with one strong vein and one weaker and shorter vein **7. *H. thailandica*** 8
1. Petals entire 8
8. Lip side-lobes deeply laciniate 9
9. Flowers large. Median sepal 19–28 mm long. Spur 16–21 mm long **8. *H. limprichtii*** 10
9. Flowers smaller. Sepals 16 mm long or shorter. Spur various 10
10. Spur 11–15 mm long. Sepals 3–6 mm long **9. *H. godefroyi*** 11
10. Spur over 31 mm long. Sepals 6–16 mm long 11
11. Auricles slender, subulate, as high as or higher than the anther **10. *H. medioflexa*** 12
11. Auricles rounded small bulges next to the anther 12
12. Median sepal 8–8.5 mm long, lateral sepals 7.5–11.5 mm long **11. *H. myriotricha*** 12
12. Median sepal 10–15 mm long, lateral sepals 12–16 mm long **12. *H. trichosantha*** 13
8. Lip side-lobes entire 13
13. Lateral sepals recurved and very oblique with a broadly rounded anterior margin and nearly straight posterior margin, often inrolled. Lip without a transversal ridge in front of the spur entrance 14
14. Each lateral sepal much longer than the median one; strongly oblique so that the front margin points down and forms a false apex while the true apex is close to the base of the median sepal 15
15. Spur 60–80 mm long. Lip over 30 mm long **13. *H. commelinifolia*** 16
15. Spur up to 25 mm. Lip usually to 30 mm long, rarely as long as 32 mm 16
16. Anther canals 10–12 mm long. Spur 6–7 mm long, thick-clavate and apically globular, hidden between the recurved lateral sepals **14. *H. longithecra*** 17
16. Anther canals 6–8 mm long. Spur cylindric and apically clavate, longer than the lateral sepals 17
17. Spur strongly curved forwards. Petals broadly triangular **15. *H. reflexa*** 17
17. Spur straight, pointing backwards. Petals linear **16. *H. austrosinensis*** 17
14. Lateral sepals not like this; very oblique but spreading and not with a false downward pointing apex **17. cf. *H. ciliolaris*** 17
13. Lateral sepals oblique or not; if lateral sepals prominently oblique then lip generally with a basal transversal ridge or collar in front of the spur entrance 18
18. Central rostellum lobe insignificant or prominent but never as high as or higher than the anther. Flowers mostly with white, green, yellow or brownish colours 19
19. Leaves usually more than two and not flat on the ground. Overall plant size various 20
20. Lip tripartite 21
21. Flowers large. Lateral sepals (7.5–)10–24 mm long. Median sepal 7–17 mm 22
22. Leaves cauline in the lower stem portion, ovate-elliptic. Lip side-lobes very variable but normally flabellate and dentate **18. *H. dentata*** 22
22. Leaves 3–5(–6), subradical, broadly ovate. Lip side-lobes subulate **20. *H. lindleyana*** 23
21. Flowers smaller. Lateral sepals less than 10 mm long and mostly only 4–6 mm. Median sepal under 9 mm long 23
23. Lip midlobe fleshy, upcurved and adnate to the median sepal/petals hood; side-lobes fleshy and recurved. Spur to 25 mm, longer than the ovary **21. *H. lucida*** 23

23. Lip not like this 24
24. Anther canals elongate, (1–)2–5 mm long and clearly differentiated from the much thicker anther loculi, straight, curved upwards or geniculately upwards bent 25
25. Lip side-lobes subulate, shorter than the midlobe 26
26. Lip with a raised ridge in front of the spur entrance, taking the shape of a low collar. Lateral sepals recurved, prominently oblique **22. H. acuifera**
26. Lip without a raised ridge in front of the spur entrance. Lateral sepals spreading and not very oblique **23. H. chlorina**
25. Lip lobes all nearly equally long or side-lobes longer than midlobe 27
27. Ridge at the base of the lip developed as an erect 3–4 mm high obscurely 3-lobed ligule that protrudes above the anther canals. Anther canals rather long, geniculately bent upwards at their middle **24. H. rostellifera**
27. Base of lip only with a rather low collar. Anther canals straight or only slightly curved upwards 28
28. Spur shorter than the ovary. Auricles prominent and rather narrow, nearly as high as the anther **25. H. rostrata**
28. Spur longer than the ovary. Auricles small bulges on the side of the anther 29
29. Inflorescence dense or subdense. Stem glabrous. Leaves scattered in the lower stem portion. Petals oblong, to 4.5 by 2 mm. Spur slightly clavate **26. H. erostrata**
29. Inflorescence lax. Stems short-hairy or elongate-papillate. Leaves clustered well above the ground. Petals broadly ovate, 6–8 by 4–6 mm. Lip side-lobes pointing upwards, lip midlobe recurved below the flower; spur cylindric. Plants normally growing in crevasses in limestone rocks **27. H. vidua**
24. Anther canals shorter than 0.8 mm and usually not clearly distinct from the anther loculi, most commonly only 0.2–0.5 mm long 30
30. Inflorescence lax. Relative spur length various. Lip side-lobes often (but not always!) longer than the midlobe 31
31. Leaves large, (1.9–)2.5–4(–5.7) cm wide, cauline and in a cluster well above the ground **28. H. furcifera**
31. Leaves narrower, not more than 1.1 cm broad, erect or spreading, clustered close to the ground 32
32. Lip side-lobes thread-like and much longer than the midlobe. Leaves grass-like, not more than 0.4 cm wide **29. H. khasiana**
32. Lip side-lobes not thread-like and not much exceeding the midlobe in length. Leaves not grass-like, 0.5–1(–1.1) cm wide 33
33. Lip side-lobes narrowly oblong, slightly longer than the midlobe. Spur to 21 mm long. Petals broadly or narrowly triangular, subacute or obtuse. Anther canals to 0.5(–0.8) mm long **30. H. viridiflora**
33. Lip side-lobes subulate, much shorter than the midlobe. Spur 4–5 mm long. Petals obliquely triangular, acute, with a minute lobe on the distal side. Anther canals ca 0.3 mm long **31. H. hastata**
30. Inflorescence dense or semi-dense. Spur shorter than the ovary. Lip side-lobes as long as or shorter than the midlobe 34
34. Lip midlobe much longer than the side-lobes. Lateral sepals strongly reflexed. Leaves linear or narrowly lanceolate-oblong **32. H. rumphii**
34. Lip lobes normally similar in length. Lateral sepals spreading and forwards pointing. Leaves lanceolate-oblong 35
35. Flowers orange or yellow. Leaves mostly scattered in the middle or basal part of the stem **33. H. marginata**
35. Flowers white. Leaves scattered along the stem **34. H. avana**
20. Lip simple 36
36. Spur obsolete or subobsolete 37
37. Median sepal 9.7–17 mm long **19. H. malintana**
37. Median sepal 5.6–7 mm long **44. H. anomaliflora**
36. Spur present, 28–100 mm long. Lip oblong-spathulate with a raised tongue in front of the spur entrance 38
38. Spur (28–)30–38(–47) mm long. Lamine flange in the middle of the raised tongue stretching



- over most of its length; lateral parts of the tongue without teeth **35. H. mandersii**
38. Spur (48–)60–100 mm long. Lamine flange in the middle of the raised tongue small or minute; lateral parts of the tongue with prominent teeth 39
39. Spur to 70 mm long. Raised tongue in front of the spur entrance bilobulate at apex
- 36. H. denticulata**
39. Spur (48–)60–100 mm long. Raised tongue in front of the spur entrance obtuse or mucronate at apex **37. H. hosseusii**
19. Small plants, with (1–)2–3(–4) radical leaves flat on the ground or spreading just above the soil surface 40
40. Sepals and petals 3.5–4.5 mm long. Spur 5–8 mm long 41
41. Leaves ovate to elliptic 1.4–4 cm long. Spur 5–7.6 mm long but often much shorter
- 38. H. reniformis**
41. Leaves elongate-ovate to elliptic, 4–7 cm long. Spur 7–8 mm long **39. H. humicicola**
40. Sepals and petals longer than 4.5 mm. Spur 4.8–25 mm long 42
42. Spur longer than the ovary, 15–25 mm long. Stigma processes much longer than the anther canals (about 3–5 times as long) **40. H. porphyricola**
42. Spur to 14 mm long, shorter or longer than the ovary. Stigma processes hardly exceeding the anther canals in length 43
43. Ovaries erect, close to the rachis and inflorescence therefore rather slender. Lip side-lobes forming a right angle with the midlobe. Lateral rostellum lobes not widening towards the apex
- 41. H. humistrata**
43. Ovaries patent and inflorescence therefore rather wide. Lip side-lobes and lateral rostellum lobes various 44
44. Lip side-lobes forming an acute angle with the midlobe. The short lateral rostellum lobes bending upwards and widening towards their truncate apex **42. H. siamensis**
44. Lip side-lobes forming a right angle with the midlobe. Lateral rostellum lobes not widening towards their apex **43. cf. H. poilanei**
18. Central rostellum lobe prominent and as high as or higher than the anther. Flowers orange, red, pink or rarely white 45
45. Petals broadly ovate, several-veined. Auricles slender triangular, raising above the anther canals **45. H. carnea**
45. Petals narrow, elliptic-lorate, 1-veined. Auricles inconspicuous **46. H. rhodocheila**

**1. Habenaria holotricha** Gagnep., Bull. Soc. Bot. France 78: 70. 1931; Seidenf., Bot. Tidsskr. 68: 42. 1973; Dansk Bot. Ark. 31(3): 69. 1977; Opera Bot. 114: 56. 1992.—*Medusorchis holotricha* (Gagnep.) Szlach., Orchidee (Hamburg) 55: 489. 2004. Type: Indochina, possibly Laos, no exact locality, *Massie* s.n. (lectotype **P**, designated here, barcode P00426990!).—*Habenaria andamanica* auct. non Hook.f.: Seidenf. & Smitinand, Orchids Thailand: 27. 1959.—*Habenaria polytricha* auct. non Rolfe: Seidenf., Bull. Mus. Paris 3, s. 71, Bot. 5: 132. 1973.

Terrestrial, deciduous. *Stems* to 100 cm tall. *Leaves* 6–10, spreading, cauline and scattered in the middle part of the stem, lanceolate-elliptic, acute or acuminate, mucronate, 13–21 by 3.5–5.1 cm. *Bract-like leaves* 6, lower spreading and upper largely erect, lanceolate, acuminate, 3.3–10 cm long, not or only shortly sheathing. *Inflorescences* semi-dense, many-flowered; rachis 31 cm long; floral bracts lanceolate, acuminate, 25–48 by 4–6 mm. *Flowers* 26–38 mm across; variegated dark red, orange and white; sepals and petals also reported as pale brown and lip white. *Ovary* (including pedicel) 18–22 mm long. *Sepals* long-acuminate, 5-veined; median sepal erect, elliptic-ovate, 15–19 by 5–8 mm; lateral sepals spreading, slightly obliquely elliptic-ovate, 17–19 by 5–7.5 mm. *Petals* suberect, bilobed, both lobes split into several acute linear laciniae 18–25 mm long. *Lip* 21–28 mm long, split into acute linear laciniae 18–23 mm long, with a basal united 5–6.5 by 2–2.6 mm large part; spur cylindric, 17–20 mm long, thickened in the upper part. *Gynostemium* 4–6 mm long, anther canals ca 2 mm long, stigmas ca 3 mm long.

Thailand.— NORTHERN: Chiang Mai [Mae Rim, *Nanakorn et al.* 12630 (**QBG** [s]); Doi Inthanon, *Garrett* 478 (**C** [s], **K**); NORTH-EASTERN: Loei [Na Haew, *Pumicong & Maknoi* 488 (**QBG**, **QBG** [s])]; without exact locality, *BCU* s.n. (**BCU** [s] 008922) [4 collections seen].

Distribution.— Laos.

Ecology.— In moist upper deciduous forest, also found in limestone crevices; 900–2000 m altitude. Flowering: Aug.–Oct.

Conservation.— Material from only three widely scattered specified localities and one unknown locality was available. The species was listed in a book on threatened plants of Thailand (Suddee, 2005: 130). IUCN red list category ‘Endangered’ based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Bot. Tidsskr. 68: figs. 8–9. 1973; Bull. Mus. Natl. Hist. Nat. 3, s. 71, Bot. 5: fig. 4. 1972; Dansk Bot. Ark. 31(3): fig. 35. 1977.

Notes.— In tropical SE Asia there are several *Habenaria* species with the lip side-lobes deeply split into a large number of filiform lobes, and two subgroups can be distinguished. The first comprises those species that have bilobed petals which are often further split into laciniae (including *H. holotricha*, *H. ternatea* Rchb.f., *H. andamanica* Hook.f., *H. polytricha* Rolfe), while the other group has entire petals (among others *H. medioflexa*, *H. myriotricha*, *H. trichosantha*, *H. medusa* Kraenzl., *H. beccarii* Schltr.). Diagnostic characters within the group are the number of the lobes of the petals and the lip, the sepal size and the spur length. The taxonomy of the group was discussed by Seidenfaden (1973) who pointed out that the differences between the species are very small and that a thorough study of the entire group is needed in order to clarify the relationships and to determine whether all species are sufficiently distinct to be recognised. The only Thai species with laciniate-split lip lobes and two-lobed petals is *H. holotricha*. The plant had originally been identified as *H. andamanica* which is indeed very close, and in future may prove to be conspecific.

**2. *Habenaria pantlingiana*** Kraenzl., Orchid. Gen. Sp. 1: 892. 1901; Seidenf., Opera Bot. 124: 12. 1995; Pearce & Cribb, Fl. Bhutan 3(3): 151. 2002; Chen *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009). Type: India, Sikkim, Aug. 1895, *Pantling* 415 (holotype **K!** [*fide* Pearce & Cribb]; isotype **BM**).—*Habenaria seshagiriana* A.N.Rao, J. Econ. Taxon. Bot. 6: 223. 1985; Seidenf., Opera Bot. 114: 56. 1992. nom. nov. pro *Habenaria stenopetala* var. *polytricha* Hook.f., Ann. Roy. Bot. Gard. (Calcutta) 5: 64. 1895; Seidenf., Dansk Bot. Ark. 31 (3): 73. 1977.—*Habenaria polytricha* (Hook.f.) Pradhan, Indian Orchids: Guide Ident. Cult. 68. 1976, nom. inval. Types: India, Sikkim, *Hooker* 358 (syntype **K-LINDL**) [*fide* Pearce & Cribb]; India, Naga Hills, *Prain* s.n. (syntype **K**).

Terrestrial, deciduous, glabrous. *Stems* to 50 cm tall. *Cataphylls* to 7, lanceolate or linear-lanceolate, tubular, to 4.5 cm long, scattered on the stem below the leaves, uppermost leaves with a blade to ca 1 by 0.8 cm. *Leaves* 5–7, spreading, in a cluster above the middle of the stem, ovate-elliptic, acute or acuminate, mucronate, (7.5–)9–14 by 2.5–4.8 cm, margin often somewhat undulate. *Bract-like leaves* 2, erect, tubular, foliaceous,

ovate, acuminate, 2.5–5 cm long, sheathing or not, margins entire. *Inflorescences* dense or semi-dense, ca 20–30-flowered; rachis 4–9 cm long; floral bracts ovate-lanceolate, acuminate to caudate, (19–)21–25 by 3.4–6 mm, shorter than or as long as the ovary plus the pedicel, often papillose, margins entire. *Flowers* 13–16 mm long; green or pale green, lip and petals sometimes whitish, pollinia orange-yellow; the sepals and petals with filiform caudae which take up about one third to half of their length; flowers scented. *Ovary* 11–25 mm long, mostly differentiated from the pedicel which is to 5 mm long. *Sepals* ovate or ovate-lanceolate, long-caudate, 1- or 3-veined; median sepal erect, 22–30 by 3–4 mm; lateral sepals spreading, 18–29 by 3.5–4 mm. *Petals* bilobed into an erect posterior lobe and a spreading anterior lobe, the lobes filiform, in the examined Thai material 15–20 mm long. *Lip* 18–28 mm long, deeply 3-lobed from the base, all lobes filiform; midlobe 18–28 by 0.3–0.4 mm; side-lobes 14–28 by 0.3–0.4 mm; spur cylindric, 19–20.5 mm long, clavate. *Gynostemium* 1.8–2 mm long, anther 4.5 mm long, reflexed, anther canals ca 2 mm long, straight.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, *Pumicong & Watthana* 348 (**QBG** [s]); idem., *Indhamusika* 31 (**QBG** [s]); without exact locality, *Suksathan* 1034 (**BCU** [s]); idem., *Baramee* s.n. (**BCU** [s] 009896)] [4 collections seen].

Distribution.— NE India and Nepal to S China and S Japan.

Ecology.— Found in broad-leaved forest and open grassland; 1500–2000 m altitude. Flowering: July–Aug.

Conservation.— The species is known from only four collections made in Chiang Mai Province in northern Thailand, two of which are from unspecified localities. The two known localities are situated in a wildlife sanctuary which gives the plants a certain amount of protection. IUCN red list category ‘Endangered’ based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Dansk Bot. Ark. 31(3): fig. 38. 1977.

Notes.— This species is very distinct with the long-caudate apices of the sepals and petal lobes, which give the flowers a somewhat spider-like appearance.

**3. *Habenaria stenopetala*** Lindl., Gen. Sp. Orchid. Pl.: 319. 1835; Seidenf., Dansk Bot. Ark. 31(3): 70. 1977; Pearce & Cribb, Fl. Bhutan 3(3): 153. 2002; Chen, S.-C. *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009). Type: India, Kashmir, *Royle* s.n. (holotype **K-LINDL**).—*Habenaria delessertiana* Kraenzl., Annuaire Conserv. Jard. Bot. Genève 1: 108. 1897. Type: Philippines, Luzon, ?Calanang, *Cuming* 2086 p.p. (holotype **G**).—*Habenaria sutepensis* Rolfe ex Downie, Bull. Misc. Inform. Kew 1925: 420. 1925; Seidenf. & Smitinand, Orchids Thailand: 34. 1959. Type: Thailand, Doi Suthep, 27 Aug. 1911, *Kerr* 277 (holotype **K!**). Fig. 1.

Terrestrial, deciduous, glabrous. *Stems* 49–63(–80) cm tall. *Cataphylls* 6, tubular, sheathing, enveloping the stem largely or completely to 27(–38) cm high; uppermost sometimes with a blade to 3 by 0.8 cm. *Leaves* 6–10, spreading, in a cluster near the middle of the stem, oblanceolate-elliptic, acuminate, (8–)10–20 by 2.5–5.3 cm, with an obscure pale semi-translucent border. *Bract-like leaves* 1–5, erect, lanceolate, acuminate, 2.5–3.5 cm long, sheathing or not, with a prominent or obscure pale and semi-translucent

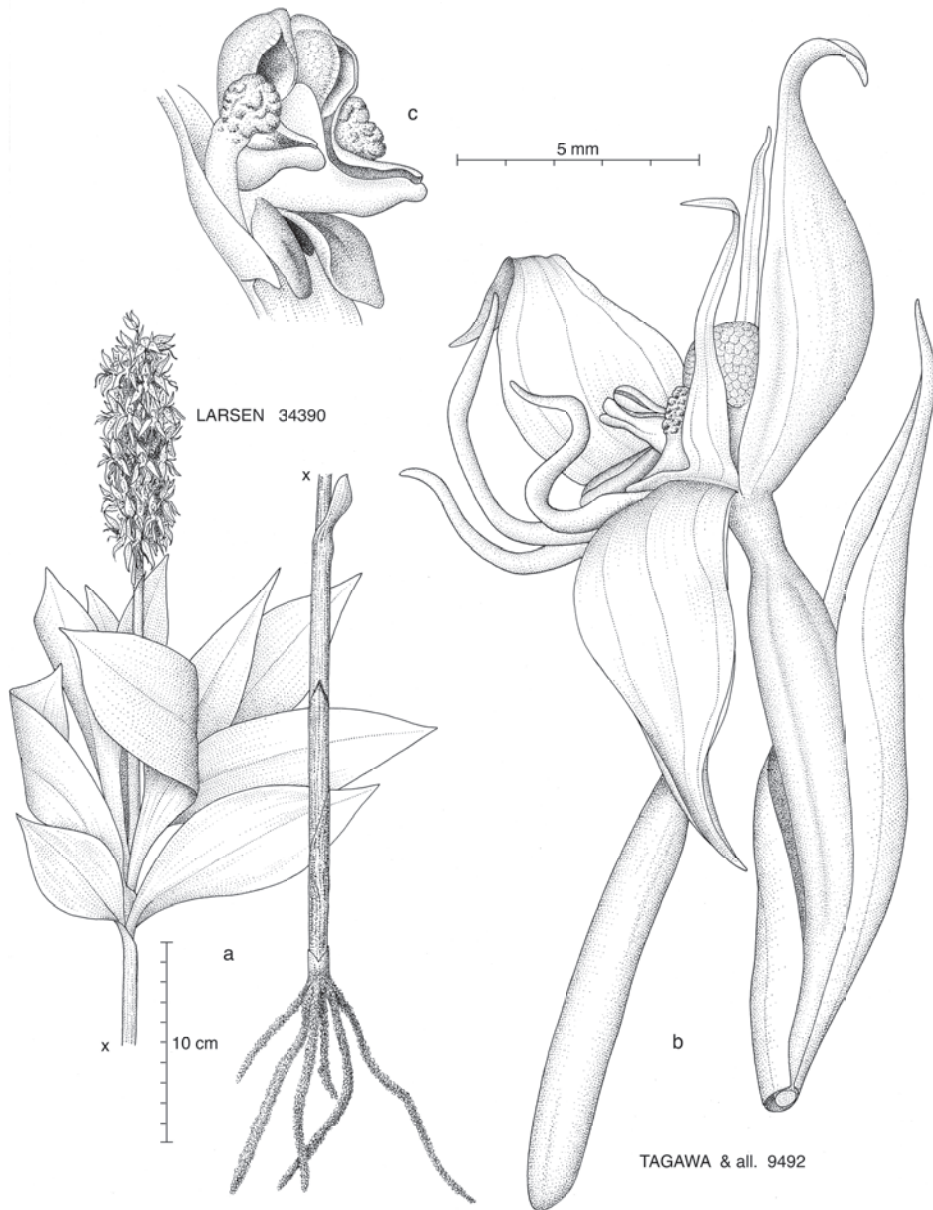


Figure 1. *Habenaria stenopetala* Lindl.: a. plant; b. flower; c. gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

border, margins entire. *Inflorescences* densely or subdensely many-flowered; rachis 4–11 cm long; floral bracts lanceolate, acuminate, 16–22 by 5–7 mm, slightly longer to slightly shorter than the pedicel plus the ovary, margins entire. *Flowers* 10–20 mm across; green or pale green, also recorded as white, anther yellow. *Ovary* (including pedicel) 12.5–17 mm long. *Sepals* elongate-elliptic, long-acuminate, 3-veined; median sepal erect, 9.5–13 by 5–7 mm; lateral sepals spreading, 8–13.8 by 5–5.8 mm. *Petals* bilobed into a posterior lobe nearly as long as the median sepal and a small anterior lobe; posterior lobe erect but not forming a hood with the median sepal, falcately oblong, acute, 1-veined, 7–11 by 1.2–1.8 mm; anterior lobe parallel to the lip base, 1.5–3 by 0.5–0.7 mm long. *Lip* 10–17 mm long, deeply 3-lobed above a basal stalk of 2–4 by ca 3.5 mm, all lobes narrowly attenuate; midlobe 8–13 by 1.5–2 mm; side-lobes 8–11 by 1.1–1.3 mm; spur cylindric, 13–17(–23) mm long, slightly geniculate, thickened towards the apex. *Gynostemium* 4–5 mm long, anther canals ca 2 mm long, straight, stigmas stout, ca 3 mm long.

Thailand.— NORTHERN: Mae Hong Son [Pang Mapha, *Suksathan* 3599 (**QBG**)]; Chiang Mai [Doi Suthep, *illegible* s.n. (**K** H2007/02483-101); idem., *Kerr* 277 (holotype of *Habenaria sutepensis* **K**); idem., *Kerr* s.n. (**C** [s] vial 378); idem., *Seidenfaden & Smitinand* 3014 (**C** [s]); Doi Pui, *Maxwell* 88-977 (**BKF**, **CMU**); idem., *Tagawa et al.* 9492 (**C** [s]); Doi Inthanon, *Wattana* 2410 (**QBG**, **QBG** [s]); idem., *Larsen & Larsen* 34390 (**AAU**, **K**); idem., *Phengkklai et al.* 7211 (**BKF**); Chom Tong District, *Maxwell* 92-487 (**ScCMU**, **ScCMU** [s], **L**, **P**); ? Mae Dang, *Maxwell* 90-23 (**CMU**); Chiang Rai [Khunkorn Waterfall Forest Park, *Boonkerd et al.* KK 1042 (**BCU** [s])]; Phitsanulok [Phu Soi Dao, *RK* 605/50 (**QBG** [s])]; NORTH-EASTERN: Loei [Phu Kradueng National Park, *Triboun* 905 (l) (**BK** [s])]; Phu Luang National Park, *Wichien* s.n. (**BKF** SN149166)]; EASTERN: Ubon Ratchathani [Phu Chong Na Yoi National Park, *Suddee* 2611 (**BKF** [s])] [17 collections seen, 1 of them uncertain].

Distribution.— India and Nepal to S China, S Japan and the Philippines.

Ecology.— Found in primary evergreen forest; 500–1700 m altitude. Recorded over granite and limestone. Flowering: July–Sept.(–Oct.).

Conservation.— Fourteen collections from northern Thailand plus two from the north-east and one from the east have been seen. As all except two of the localities are situated in national parks or forest parks the protection of this species can be considered as adequate at the moment. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 24. 1959 [as *Habenaria sutepensis*]; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 37a–c. 1977; present paper: fig. 1a–c.

Notes.— Within the group of species with bilobed petals, *Habenaria stenopetala* is easily distinguished by the sepals with their long-aristate apices, the dense inflorescence and the 3-lobed lip. A variety *Habenaria stenopetala* var. *polytricha* Hook.f., which has been recognised in the past (e.g. Seidenfaden, 1977) is now referred to *H. pantlingiana* (Seidenfaden, 1995: 12; see above).

**4. *Habenaria falcatopetala*** Seidenf., *Dansk Bot. Ark.* 31(3): 74. 1977; *Opera Bot.* 114: 56. 1992. Type: Thailand, Doi Inthanon, eastern spur ending in Doi Pa Mon, 28 Sept. 1927, *Garrett* 470 (holotype **K!**).—*Habenaria stenopetala* auct. non Lindl.: Gagnep., *Fl. Indoch.* 6: 610. 1934.



Terrestrial, deciduous. *Stems* 50–71(–90) cm tall. *Cataphylls* 4, tubular, sheathing, acute, enveloping the stem to 28 cm high. *Leaves* 5–6, spreading, clustered in the middle of the stem, oblanceolate-elliptic, acute or acuminate, 8–14 by (1.8–)2.4–3.5 cm, sessile, with an obscure pale semi-translucent border. *Bract-like leaves* 1–2, erect, lanceolate, 2.5–3.5 cm long, only basally sheathing, with a prominent or obscure pale and semi-translucent border, margins entire. *Inflorescences* lax, 8-flowered; rachis 14.5–22 cm long; floral bracts lanceolate, acuminate, 15–24 by 4–5 mm, slightly shorter than the pedicel plus the ovary, margins entire. *Flowers* to 31 mm across; pale green. *Ovary* (including pedicel) 26–30 mm long, smooth. *Sepals* oblong-elliptic, rounded to subacute, prominently and shortly mucronate, 3-veined; median sepal erect, 15–17 by 5–8 mm; lateral sepals spreading, similar but slightly shorter and narrower. *Petals* bilobed into an erect posterior lobe and a minute anterior lobe; posterior lobe erect, falcately-oblong, subacute, indistinctly 1-veined, 6–9 by ca 1 mm; anterior lobe reduced to a 0.6–1 mm long lobule, united with the lip base. *Lip* 17–20 mm long, deeply 3-lobed above a basal stalk 5–6 mm long, all lobes linear; midlobe 12–13 by 0.5–0.8 mm; side-lobes 12–14 by 0.6–1 mm; spur cylindric, 18–23 mm long, slightly geniculate, clavate in the apical half, ca 2 mm thick near the apex. *Gynostemium* ca 4.5 mm long; anther canals 1.7–2 mm long, straight, stigmas ca 3.8 mm long.

Thailand.— NORTHERN: Chiang Mai [Doi Inthanon, *Garrett* 470 (holotype **K**)] [1 collection seen].

Distribution.— Vietnam.

Ecology.— Evergreen forest; 1650 m altitude. Flowering: Sept.

Conservation.— In Thailand this species is only known from the type collection but it is also found in Vietnam. Based on its sporadic occurrence the conservation status in Thailand cannot be properly assessed. The species was listed in a book on threatened plants of Thailand (Suddee, 2005: 129). IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 39a–e. 1977.

Notes.— The species is very distinct with its fairly large flowers with mucronate lateral sepals and unequally-bilobed petals. Apparently it is related to *Habenaria stenopetala* and *H. singaporensis* Ridl. (Seidenfaden, 1977).

**5. *Habenaria corymbosa*** E.C.Parish & Rchb.f., *Trans. Linn. Soc. London* 30: 141. 1874; Seidenf. & Smitinand, *Orchids Thailand*: 26. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): 81. 1977. Type: Myanmar, Tenasserim, *Parish* 329 (holotype **K!**). Fig. 2.

Terrestrial or rarely epilithic, deciduous, glabrous. *Stems* 95–130 cm tall, green with purple tinge. *Cataphylls* to 7, elliptic-lanceolate, tubular, sheathing, 1.8–4 cm long, enveloping the stem to 35 cm high. *Leaves* 9–11, spreading, clustered in the middle of the stem, lanceolate, acute, mucronate, 10–21 by 2–4.1 cm, once reported as dry at the flowering time. *Bract-like leaves* 7–10, erect, lanceolate, acute, 2.7–4.8 cm long, largely sheathing, sometimes with pale and papillose margins. *Inflorescences* dense or semi-dense, many-flowered; rachis 5–9 cm long; floral bracts lanceolate, acuminate, 13–27 by 2.5–3 mm, shorter or slightly longer than the pedicel, basal part with a pale semi-



translucent border. *Flowers* 8–10 mm across; green, greenish-brown, red or reddish-green, once reported as white. *Ovary* 9–12 mm long, smooth, with a narrow beak; pedicel sharply distinct from it, (10–)21–22 mm long, smooth. *Sepals* obtuse to subacute; median sepal reflexed, hooded, lanceolate to oblong-suborbicular, 3.8–6 by (2–)2.4–3.5 mm; lateral sepals spreading, obliquely-ovate, 4.1–7 by 2.5–3.5(–4) mm. *Petals* erect, deeply bilobed to near the base, both lobes entire; anterior lobe linear, 6–8(–10) by 0.2–0.5 mm; posterior lobe narrowly-lorate, 3.5–5(–6) by 0.3–0.9 mm. *Lip* 7–10.5 mm long, deeply 3-lobed to near the base, all lobes linear; midlobe 4.5–10 by 0.6–0.8 mm; side-lobes similar but slightly narrower; spur cylindric, 14.5–20 mm long, clavate in the apical third. *Gynostemium* 2.2–3 mm long, anther canals 1–2.5 mm long, straight projecting forwards, stigmas 1.7–2 mm long. *Fruit* ovoid-fusiform, ca 11 by 4.8 mm, with an elongate stalk.

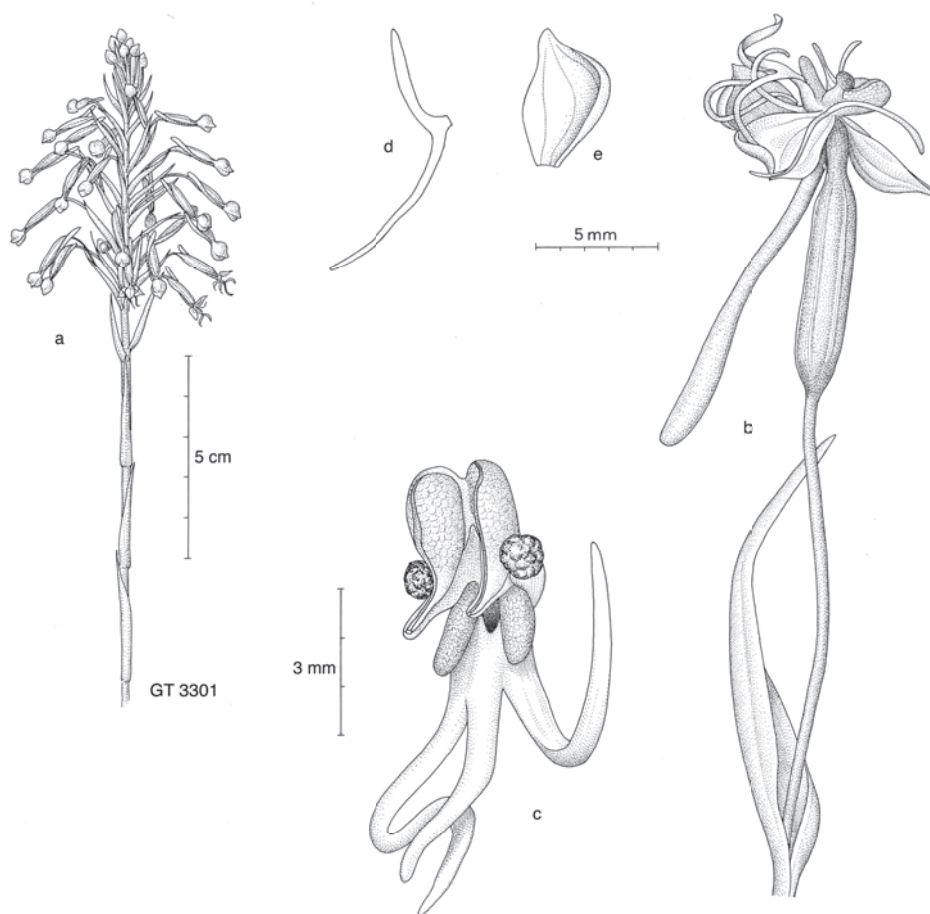


Figure 2. *Habenaria corymbosa* E.C.Parish & Rehb.f.: a. inflorescence; b. flower; c. gynostemium and lip; d. petal; e. lateral sepal. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, *Garrett* 1475 (**K**); *idem.*, *Garrett* 1477 (**K**); *idem.*, *Kerr* 324 (**K**); *idem.*, *Seidenfaden & Smitinand* 3200 (**C** [s]); Doi Suthep, *Sørensen et al.* 6690 (**C**); *idem.*, *Nanakorn et al.* 10548 (**QBG** [s]); *idem.*, *Niyomdham & Hubat* 1339 (**BKF**); *idem.*, *Seidenfaden & Smitinand* 3301 (**C** [s]); Nan [Doi Phu Kha, *Srisanga* 1299 (**QBG**); *idem.*, *Srisanga* 2334 (**QBG**)]; Lampang [Chae Son National Park, *Maxwell* 97-82 (**ScCMU**, **ScCMU** [s], **L**)]; Tak [Doi Pae Pae, *Seidenfaden & Smitinand* 7326 (**C** [s]); *idem.*, *Seidenfaden & Smitinand* 7327 (**C** [s])]; NORTH-EASTERN: Loei [Phu Kradueng National Park, *Kerr* 0928 (**C** [s], **K**)]; SOUTH-WESTERN: Kanchanaburi [Thung Kang Yang Hills, *Thai-Danish Botanical Studies* 10555 (**C** [s])]; WITHOUT LOCALITY: *Nanakorn et al.* 16822 (**QBG** [s]) [16 collections seen].

Distribution.— Myanmar.

Ecology.— In evergreen forest near streams, also in rock crevices; 600–1900 m altitude. Reported over granite and limestone, sometimes in lateritic soils. Flowering: Jan.–March, May, July.

Conservation.— Known from 16 collections made in the north, north-east and south-west, with most of them made in national parks. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— *Seidenf. & Smitinand*, *Orchids Thailand*: fig. 16a–d. 1959; *Seidenf.*, *Dansk Bot. Ark.* 31(3): fig. 44a–e. 1977; present paper: fig. 2a–e.

Notes.— This species is very distinct with its narrow pedicels which are clearly differentiated from the much thicker ovary. One collector’s note indicates that the leaves were already dry and dead at the time of collecting which is probably a consequence of that particular individual flowering in the dry season.

**6. *Habenaria amplexicaulis*** Rolfe ex Downie, *Bull. Misc. Inform. Kew* 1925: 417. 1925; *Seidenf. & Smitinand*, *Orchids Thailand*: 26. 1959; *Seidenf.*, *Dansk Bot. Ark.* 31(3): 74. 1977. Type: Thailand, Chiang Mai, Doi Suthep, 14 Nov. 1909, *Kerr* 211 (holotype **K**!).

Terrestrial, deciduous, glabrous. *Stems* 19–45 cm tall. *Cataphylls* 2–3, tubular, partly sheathing, widened in the upper part, enveloping the stem to 3.5 cm high, uppermost with a blade to 1 by 0.8 cm. *Leaves* 5–9, spreading, cauline and scattered on the stem, the largest in the middle of the stem and getting smaller towards the base and the top, elliptic-ovate or elliptic-obovate, acute or obtuse, to 11.6 by 3 cm, margin slightly papillose. *Bract-like leaves* 0–4, erect, lanceolate-elliptic, acute, 1–2.5 cm long, margins entire or papillose. *Inflorescences* lax, 2–11-flowered (rarely up to 16-flowered); rachis 3.5–13 cm long; floral bracts ovate-lanceolate, acuminate, 15–23(–28) by 5–9(–10.5) mm, slightly shorter to longer than the pedicel plus the ovary, margins entire. *Flowers* 12–19 mm across; green and white, sepals white with greenish tips, lip green, gynostemium white, anther yellow. *Ovary* (including pedicel) 17–20 mm long, smooth. *Sepals* subacute to obtuse, 5-veined from the base; median sepal erect, suborbicular, 5.7–9 by 6–9 mm; lateral sepals obliquely ovate, (6–)7.5–10.5 by 2.5–4.5 mm, basally united with the petals and the lip. *Petals* suberect, deeply bipartite to near the base; posterior lobe narrowly strap-like, 3-veined, 6–11 by 0.5–1.9 mm; anterior lobe filiform, 1-veined, 6–10 by 0.5–0.7 mm. *Lip* 10–13 mm long, deeply and equally 3-lobed to about 1 mm from the base;

all lobes filiform to narrowly linear, 9–12 by 0.5–0.75 mm; spur cylindric, swollen in the distal half, slightly curved forwards, 12–15 mm long. *Gynostemium* 2–4 mm long, anther ca 2.5 mm long, anther canals ca 2 mm long. *Fruit* elliptic-fusiform, about 16.8 mm long, 5 mm in diameter, without apical beak.

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, *Kerr* 211 (holotype **K**); San Kam Phaeng District, *Palee* 331 (**ScCMU**, **ScCMU** [s], **L**); Lampang [Chae Son National Park, *Maxwell* 95-928 (**ScCMU**, **ScCMU** [s], **L**); no exact locality, *Thaithong* 1986 (**BCU** [s])]; Phrae [Song, *Maxwell* 91-1029 (**ScCMU**, **ScCMU** [s])]; Tak [Mae Nun, *Kerr* s.n. (**C** [s] vial 212); no exact locality, *Kerr* s.n. (**K** H2006/01478-116)]; NORTH-EASTERN: Mukdahan [no exact locality, *Thorut* 184 (**BCU** [s])] [8 collections seen].

Distribution.— Vietnam.

Ecology.— Rare in bamboo forest and mixed forest, also found in disturbed areas; 225–1300 m altitude. Reported over shale bedrock. Flowering: June, Sept.–Dec.

Conservation.— Only seven collections from northern Thailand plus one from the north-east were examined here, but few of these are within national parks. IUCN red list category ‘Vulnerable’ based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Dansk Bot. Ark. 31(3): fig. 41. 1977.

Notes.— *Habenaria amplexicaulis* can be recognised by its green and white flowers which have bilobed petals with narrow and elongate segments. Unlike in the related *H. corymbosa* the ovary is not clearly differentiated from the pedicel. A similar species, *H. thailandica*, has been described recently (see below) which differs from *H. amplexicaulis* mainly by its smaller flowers (lip midlobe 9–12 mm in *H. amplexicaulis*, 5–7 mm in *H. thailandica*).

*Habenaria amplexicaulis* belongs to a group of species apparently related to *H. digitata* Lindl. which is centred in India and Sri Lanka. The taxonomic affinities within the group are not clear at the moment and have yet to be resolved. Seidenfaden (1977) pointed out that the distinction of *H. amplexicaulis* and *H. thailandica* from the Indian *H. digitata* will require a monographic study of the entire group which is best left to Indian workers who have easier access to material.

**7. *Habenaria thailandica*** Seidenf., Dansk Bot. Ark. 31(3): 78. 1977; Opera Bot. 114: 56. 1992. Type: Thailand, Chiang Mai Province, foothills of Doi Chiang Dao, 19°20'N 98°50'E, 7 June 1973, *Geesink et al.* 5759 (holotype **L**!; isotype **BKF**).

Terrestrial, deciduous, glabrous. *Stems* 44–50 cm tall. *Cataphylls* 2, tubular, largely sheathing, widened in the upper part, covering the stem to 5 cm high. *Leaves* to 12, spreading, cauline and scattered in the middle portion of the stem or all along it, broadly lanceolate to elliptic, acute, mucronate, (3.5–)8–12 by (1.7–)2.4–3.5 cm, green on both sides but lower surface much paler and sometimes silvery, margins often with papillae. *Bract-like leaves* absent. *Inflorescences* lax, many-flowered; rachis 8–15 cm long; floral bracts lanceolate, acute, (12.3–)20–27 by 0.7–3(–4) mm, longer than the pedicel plus the ovary, margins often with papillae. *Flowers* green or greenish white, petals and lip a few times reported as white, in a doubtful record flower described as pink, gynostemium

green, anther orange, pollinia light yellow. *Ovary* (including pedicel) 14–16 mm long. *Sepals* obtuse to subacute; median sepal erect, hooded, suborbicular to broadly ovate, 3.5–7 by 4–5 mm; lateral sepals spreading or recurved, obliquely lanceolate-ovate, slightly oblique, 5–8 by 2–4 mm. *Petals* suberect to spreading, deeply bilobed to near the base; posterior lobe with one strong and one weaker and shorter vein, 4–6 by ca 1 mm; anterior lobe 1-veined, 3–4.5 by 0.25–0.5 mm. *Lip* 6–7.5 mm long, deeply 3-lobed to near the base; midlobe linear to oblong, entire, 4–7 by ca 0.6 mm; side-lobes similar but shorter, spreading, 3.5–6 mm long; spur cylindric, 9–16 mm long, shorter than the pedicel plus the ovary. *Gynostemium* 2–3 mm long, anther loculi ca 2.2 mm long, anther canals ca 1 mm long, central rostellum lobe measuring about one third of the anther, stigmas ca 1.5 mm long.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, *Geesink et al.* 5759 (holotype **L**); idem., *Maxwell* 89-749 (**CMU**)]; Phayao [Doi Luang National Park, *Petrmitr* 28 (**ScCMU**, **ScCMU** [s])]; Lampang [Chae Son National Park, *Maxwell* 96-747 (**ScCMU**, **ScCMU** [s], **L**)]; SOUTH-WESTERN: Kanchanaburi [Thung Yai Naresuan Wildlife Reserve, *Maxwell* 93-669 (**ScCMU**, **ScCMU** [s])]; Kanchanaburi [Sai Yok, *Larsen et al.* 10356 (**C** [s])]; SOUTH-EASTERN: Chanthaburi [Pong Namron, *Maxwell* 75-475 (**BK**)]; PENINSULAR: Ranong [Ko Kum, *Triboun* 640 (l) (**BK** [s])]; ? LOCALITY ILLEGIBLE: *Kerr* 0191 (**K**) [9 collections seen, 1 of them uncertain].

Distribution.— Indochina.

Ecology.— Rare in dry deciduous or evergreen forest, often with bamboo; 20–645 m altitude. Reported over granite, shale and limestone. Flowering: (May–)June–July, Oct.

Conservation.— *Habenaria thailandica* is known from nine widely scattered collections made in all regions in Thailand except the north-eastern, eastern and central. Most of the collections come from national parks or wildlife sanctuaries which gives the plants a certain amount of protection. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 42a–c. 1977.

Notes.— This is another species in the group around the mainly Indian *Habenaria digitata*, differing from the previous taxon *H. amplexicaulis* by its smaller flowers. For brief comments see above.

**8. *Habenaria limprichtii*** Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 4: 50. 1919; Seidenf., *Dansk Bot. Ark.* 31 (3): 82. 1977; *Opera Bot.* 114: 57. 1992; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009).— *Habenaria pectinata* D. Don var. *limprichtii* (Schltr.) Pradhan, *Indian Orch.: Guide Ident. Cult.* 72. 1976.— *Kryptostoma limprichtii* (Schltr.) Szlach. & Olszewski, in *Fl. Cameroun* 34: 231. 1998.— *Ochrorchis limprichtii* (Schltr.) Szlach., *Richardiana* 4: 55. 2004. Type: Southern China, Yunnan, Tali-fu, *Limpricht* 1024 (holotype **B**†; lectotype **WU**, designated here, herbarium number **WU** 038982!).— *Habenaria oligoschista* auct. non Schltr.: Seidenf. & Smitinand, *Orchids Thailand*: 44, 727. 1959–1965. Fig. 3.

Terrestrial, deciduous, glabrous except for sometimes the tips of the leaves. *Stems* (26–)32–70 cm tall. *Cataphylls* 3, tubular, sheathing, enveloping the stem base to 7 cm

high, uppermost sometimes with a blade to 0.8 by 0.7 cm. *Leaves* (3–)5–7, spreading, cauline and scattered along the stem, narrowly lanceolate-oblong, acute or acuminate, mucronate, 6–14(–20) by 1.5–3.3 cm, with three pronounced veins, surface glabrous or very rarely with sparsely scattered yellow hairs near the tip, margins entire or papillose. *Bract-like leaves* not present. *Inflorescences* lax to semi-dense, (2–)4–10-flowered; rachis (3–)5–17 cm long; floral bracts lanceolate, acuminate, 22–45 by 6–12(–19) mm, longer than the pedicel plus the ovary, margins papillose. *Flowers* 34–43(–55) mm across; with pale yellow green or greenish-white tepals, petals sometimes partly white, lip claw whitish, gynostemium pale green. *Ovary* (including pedicel) 19–30(–33) mm long, with papillose to shortly glandular-hairy keels. *Sepals* subacute, acuminate; median sepal erect, elliptic, 5-veined, 19–28 by 8–15(–20) mm; lateral sepals spreading, elliptic-lanceolate, 3-veined, 19–27 by 6–7.5(–9) mm. *Petals* erect, forming a hood with the median sepal, 3-veined at the base, ovate-lanceolate, acute, with a broadly rounded lobe on the lower part of the anterior side, 20–26 by 8–11 mm, sometimes with elongate papillae on the front margin. *Lip* 22–35 by 15–20 mm, deeply 3-lobed above the 9–12 mm long stalk; midlobe linear to oblong, 15–18(–25) by 1.3–2 mm; side-lobes fringed with linear to oblong main-branch with many filiform side-branches, main-branch 7–22 by 1–1.9 mm, side-branches 3–7 mm long, sometimes branched further; spur cylindric, 16–21 mm long, thickened apically. *Gynostemium* 3–5 mm tall, thecae situated on the far corners of an elongate horseshoe-shaped connective, anther canals 2–4 mm long, rather slender, strongly curved upwards, stigmas to 7 mm long, also curved upwards.

Thailand.— NORTHERN: Mae Hong Son [Doi Pui, *Triboun* 430 (I) (**BK** [s])]; Chiang Mai [Doi Suthep, *Thai-Danish Botanical Studies* 4557 (**C** [s]); idem., *Kerr* 92 (**K**); idem., *Larsen et al.* 46681 (**AAU**); idem., *Maxwell* 88-917 (**CMU**, **L**); ? idem., *Maxwell* 89-886 (in bud) (**CMU**); ? idem., *Seidenfaden & Smitinand* 2603 (in bud) (**C** [s]); idem., *Seidenfaden & Smitinand* 2704 (**C** [s]); idem., *Seidenfaden & Smitinand* 2705 (**C** [s]); idem., *Smitinand & Sleumer* 8300 (**BKF**); idem., *Smitinand & Sleumer* s.n. (**BKF** SN076972); idem., *Sørensen et al.* 4557 (**BKF**, **C**); idem., *Sørensen et al.* 4855 (**C**); Mae Rim, *Nanakorn et al.* 6981 (**QBG**); idem., *Wattana* 2418 (**QBG**, **QBG** [s]); Doi Pha Hom Pok, *Damapong* 97 (**QBG** [s]); Doi Pa Kao, *Garrett* 715 (**BK**, **K**, **P**); Chom Tong, *Maxwell* 92-579 (**ScCMU**, **ScCMU** [s]); Mae Wang, *Maxwell* 04-430 (**ScCMU**); Doi Chiang Dao, *Pongamornkul* 393 (**QBG**); idem., *Seidenfaden & Smitinand* 2816 (**C** [s]); Fang, *Ach Booniti* 17 (**BK**); Hot District, *Pooma* 1034 (**BKF**); Mae Sanam, *Pooma* s.n. (**BKF** [s]); Doi Pui, *Songkakul* 67 (**BKF** [s]); no exact locality, *Suksathan* 1020 (**BCU** [s]); Nan [Doi Phu Kha National Park, *Srisanga et al.* 871 (**QBG**)]; Phitsanulok [Phu Soi Dao National Park, *Suksathan* 2707 (**QBG**)] [28 collections seen, 2 of them uncertain].

Distribution.— Vietnam and China.

Ecology.— Found in open grassy pine forest and evergreen forest, also in open grassland; 1100–2000 m altitude. Several collector notes indicate granite as the bedrock. Flowering: July–Sept.

Conservation.— Recorded in a large number of localities in Mae Hong Son, Chiang Mai, Nan and Phitsanulok provinces in northern Thailand. IUCN red list category 'Least Concern' (IUCN, 2001).



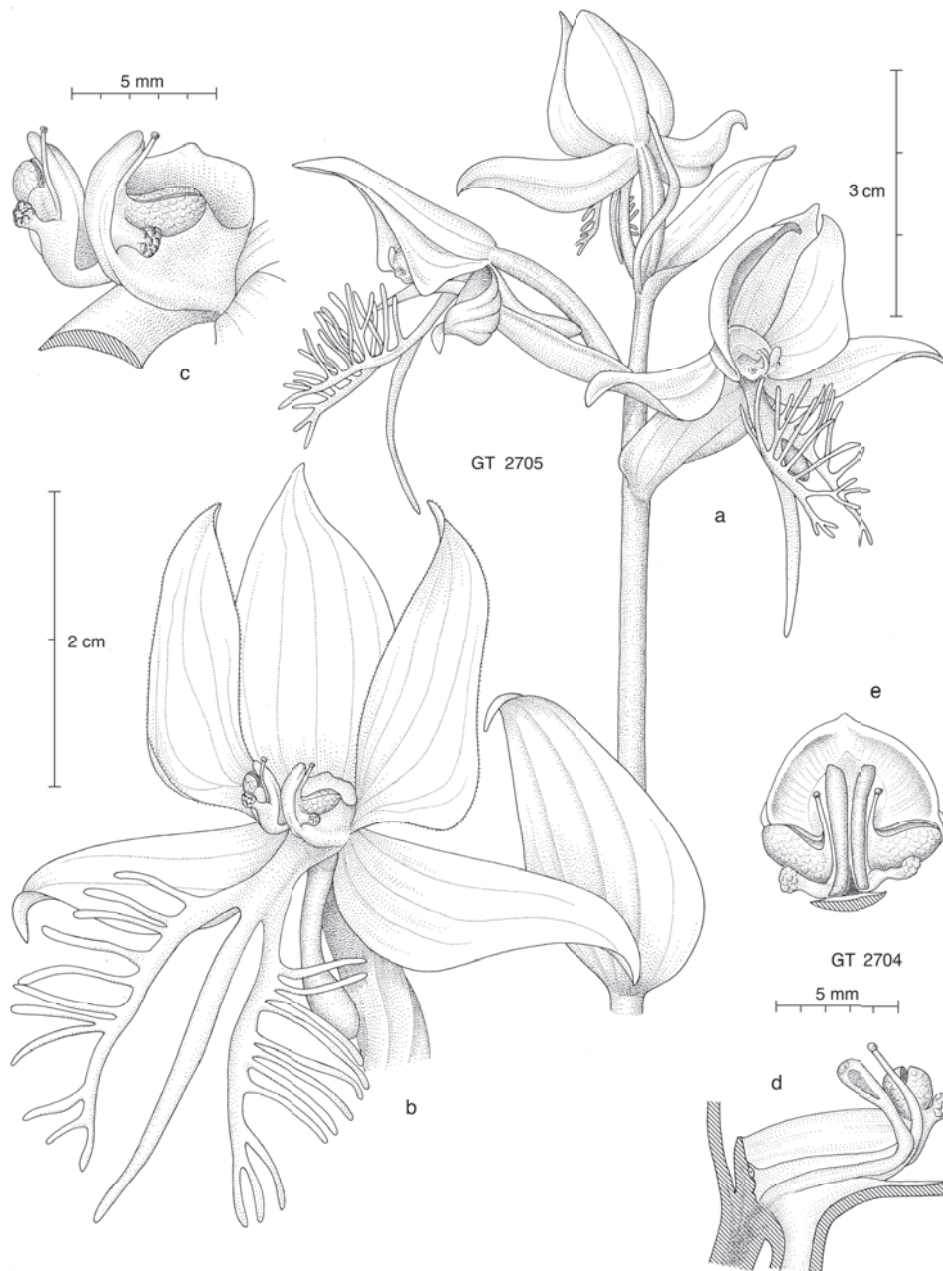


Figure 3. *Habenaria limprichtii* Schltr.: a. inflorescence; b. flower; c.–e. gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.



Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 32, t. II (2697). 1959 [as *Habenaria oligoschista*]; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 46a–e. 1977; present paper: fig. 3a–e.

Notes.— *Habenaria limprichtii* is very distinct with its large flowers (sepals 19–28 mm) and the lip with its fringed side-lobes, and cannot be mistaken for any other species in Thailand. The Thai specimens were first referred to *H. oligoschista* Schltr. following a Kew identification (Seidenfaden & Smitinand, 1959), but later studies showed that the plants are better listed under *H. limprichtii* which is followed here (Seidenfaden, 1977: 82).

Our Thai plant belongs to a group of about a dozen taxa related to the Himalayan *Habenaria pectinata* D. Don which is very much in need of a critical monographic study (Seidenfaden, 1977: 82). In his study of the Thai *Habenaria* species Seidenfaden pointed out that a future comprehensive study of all of the available material over the entire distribution range may well reveal that some of the currently recognised species in this group are merely forms of *H. pectinata*. Pradhan (1976: 72) indeed regarded our Thai species as conspecific with *H. pectinata* (as *H. pectinata* D. Don var. *limprichtii* (Schltr.) Pradhan) but no reasons for this transfer were given. It was very recently suggested by P. Ormerod that the identification of the Thai plants may not be correct as the type specimen of *H. limprichtii* has ligulate petals, while the basally dilated petals found in the Thai specimens rather match the concept of the Chinese *H. yuana* Tang & F.T. Wang which is another species in the *H. pectinata* group (P. Ormerod, pers. comm. to H. Pedersen in September 2007).

**9. *Habenaria godefroyi*** Rchb.f., *Otia Bot. Hamburg.*: 33. 1878; Seidenf., *Bot. Tidsskr.* 70: 64. 1975; *Dansk Bot. Ark.* 31(3): 84. 1977; *Opera Bot.* 114: 58. 1992.— *Kryptostoma godefroyi* (Rchb.f.) Olszewski & Szlach., *Ann. Bot. Fenn.* 37: 299. 2000.— *Ochrorchis godefroyi* (Rchb.f.) Szlach., *Richardiana* 4: 53. 2004. Type: ‘Siam and Cambodia’, Pursat, 18 June 1875, *Godefroy* 399 (holotype **K!**; isotype **P!**).

Terrestrial, deciduous, glabrous. *Stems* 30–38 cm tall. *Cataphylls* 2–3, tubular, erect, sheathing, sometimes with a blade to 8 mm long. *Leaves* 2–3, spreading or suberect, cauline and scattered in the lower stem half, narrowly oblong-elliptic, subacute, 4–8 by 0.3–1 cm. *Bract-like leaves* (0–)2–4, semi-erect or spreading, narrowly lanceolate, 1–4 cm long, shortly sheathing at the base. *Inflorescences* lax, 6–12-flowered; rachis 5–12 cm long; floral bracts ovate-lanceolate, acuminate, 4–7 by 2–2.2 mm, much shorter than the pedicel plus the ovary. *Flowers* to 18 mm across; green. *Ovary* (including pedicel) 16–19 mm long, smooth. *Sepals* obtuse to subacute; median sepal erect, broadly elliptic, 3–5.5 by ca 2.8 mm; lateral sepals spreading, broadly ovate, 4–6 by 1.8–2.8 mm. *Petals* erect, forming a hood with the median sepal, triangular-oblong, subacute, 3–5 by 0.9–1.8 mm. *Lip* 8–12 mm long, deeply 3-lobed to ca 1.5 mm from the base; midlobe linear to oblong, 5–6 by 0.5–1.2 mm; side-lobes longer and deeply lacinate, with up to 7 laciniae, each lacinia 7–12 by ca. 0.3 mm long; spur cylindric, 11–15 mm long, clavate in the apical half, forwards bent. *Gynostemium* ca 2 mm long, anther thecae separated by a moderately wide connective, anther canals ca 1 mm long, stigmas to 2 mm long.

Thailand.— EASTERN: Chaityaphum [Phu Khieo, Seidenfaden & Smitinand 8126 (**C** [s])]; Ubon Ratchathani [Pha Taem National Park, Boonjaras 303 (**BCU**); Soi

Sawan, *Triboun* 1375 (l) (**KKU** [s]); UNSPECIFIED: 'Siam and Cambodia', *Godefroy* 399 (holotype **K**; isotype **P**) [4 collections seen].

Distribution.— Cambodia and Vietnam.

Ecology.— Found in grassy places in evergreen oak forest; 250–900 m altitude. Flowering: June–July(–Aug.).

Conservation.— Found only infrequently in eastern Thailand (the above-listed collections and a photographic record from Ubon Ratchathani). The species was listed in a book on threatened plants of Thailand (Suddee, 2005: 130). IUCN red list category 'Endangered' based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Bot. Tidsskr. 70: fig. 2a–d. 1975; Dansk Bot. Ark. 31(3): fig. 47a–d. 1977.

Notes.— This is a very rare species from eastern Thailand, characterized by fairly small flowers and fringed lip side-lobes with comparatively few laciniae.

**10. *Habenaria medioflexa*** Turrill, Bull. Misc. Inform. Kew 1923: 118. 1923; Seidenf. & Smitinand, Orchids Thailand: 45. 1959; Seidenf., Dansk Bot. Ark. 31(3): 84. 1977; Opera Bot. 114: 58. 1992; Seidenf. & Wood, Orchids Penins. Malaysia & Singapore: 111. 1992; Chen *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009).— *Fimbrorchis medioflexa* (Turrill) Szlach., Orchidee (Hamburg) 55: 490. 2004. Type: Thailand, Phangnga, 6 Dec. 1908, *Haniff & Nur* 3858 (holotype **SING!**; isotype **K!**).— *Habenaria trichochila* Rolfe ex Downie, Bull. Misc. Inform. Kew 1925: 421. 1925; Seidenf. & Smitinand, Orchids Thailand: 45. 1959. Type: Thailand, Chiang Mai, Doi Suthep, 11 Oct. 1910, *Kerr* 264 (holotype **K!**; isotype **P!**).—? *Habenaria myriotricha* var. *confluens* Gagnep., Fl. Indo-Chine 6: 615. 1934.—? *Fimbrorchis myriotricha* var. *confluens* (Gagnep.) Szlach., Orchidee (Hamburg) 55: 491. 2004. Types: Cambodia, Mt. Knang-krepeuh, *Pierre* s.n. (syntype **P!**); Vietnam, Bao-chian and Mt. Dinh, *Pierre* s.n. (syntype **P!**); Vietnam, Cap St. Jacques, *Poillane* 583 (syntype **P!**); Tong-man, *Régnier* 313 (syntype **P!**).— non *Habenaria medioflexa* auct. Turrill: Kerr, Nat. Hist. Bull. Siam Soc. 23: 188. 1969 (= *H. myriotricha* Gagnep.). Fig. 4.

Terrestrial, deciduous, glabrous. *Stems* 23–52 cm tall. *Cataphylls* 1–3, tubular, sheathing, enveloping the stem base up to 5.5 cm high. *Leaves* (3–)5–8, spreading, cauline and scattered in the lower stem half, lanceolate-elliptic, acute or acuminate, mucronate, 12–22 by 2–5.3 cm, with an obscure pale semi-translucent border. *Bract-like leaves* 3–6, spreading to erect, lanceolate, acuminate, 2.7–3.7 cm long, not or only shortly sheathing, with an obscure pale semi-translucent border, margins sometimes minutely denticulate. *Inflorescences* lax, 7–25-flowered; rachis 5–15 cm long; floral bracts lanceolate, acuminate, 15–32 by 3–5 mm, margins papillose or minutely denticulate. *Flowers* 17–20 mm across; sepals and spur green, petals green or white, lip white, anther light yellow. *Ovary* (including pedicel) 24–30 mm long. *Sepals* subacute to acute, 3-veined; median sepal erect, elliptic, 6–8 by 3–4.2 mm; lateral sepals spreading, obliquely ovate, 6–8(–10) by 3.5–5 mm, basally united with the petals and the lip. *Petals* erect, forming a hood with the median sepal, lanceolate-oblong, acute, 1-veined, 7–7.5 by 0.6–1 mm. *Lip* 12–20 by 17–20 mm, deeply 3-lobed above a basal claw 2–3.8 by 1.5–2.2 mm large, sometimes with

small lateral auricles, base with a collar in front of the spur entrance; midlobe narrowly oblong, 7–10 by 0.5–1 mm; side-lobes dissected into many linear laciniae 9–14 mm long; spur cylindric, 35–46 mm long, geniculate and thickened in the middle. *Gynostemium* 3–5 mm long, anther reflexed, anther canals ca 2 mm long, straight; auricles prominent, subulate and as high as or higher than the thecae.

Thailand.—NORTHERN: Chiang Mai [Doi Suthep, *Kerr* 264 (holotype of *Habenaria trichochila* **K**; isotype **P**); idem., *Maxwell* 88-1304 (**BKF**, **BKF** [s], **CMU**, **L**); ? Lampang [Doi Khun Tan National Park, *Thaithong* 117 (**BCU**)]; Kamphaeng Phet [Ban Klong Pong, *Kerr* 379 (**C** [s], **K**)]; Nakhon Sawan [Ban Den, *Kerr* s.n. (**K** H2007/02483-103)]; NORTH-EASTERN: Loei [Sithan, *Seidenfaden & Smitinand* 3048 (**C** [s])]; CENTRAL: Saraburi [Ban Nong Bua, *Put* 1091 (**K**)]; SOUTH-EASTERN: Prachin Buri [*Thaithong* 489 (**BCU**, **BCU** [s])]; Chanthaburi [Pong Namron, *Adisai* 864 (**BK**)]; Khao Soi Dao, *Larsen et al.* 31931 (**AAU**, **C** [s]); Hindat, *Smitinand* 3455 (**BKF**)]; PENINSULAR: Phangnga [*Haniff & Nur* 3858 (holotype **SING**; isotype **K**)]; WITHOUT LOCALITY: *Tiptabiankarn* 2051 (**Suan Luang** [s]) [13 collections seen, 1 of them uncertain].

Distribution.—Peninsular Malaysia (Kedah), Indochina and S China (Yunnan).

Ecology.—Found in mixed deciduous or evergreen forest, sometimes also in bamboo thicket; 100–375 m altitude. The bedrock is reported as granite. Flowering: Aug.–Nov.(–Dec.).

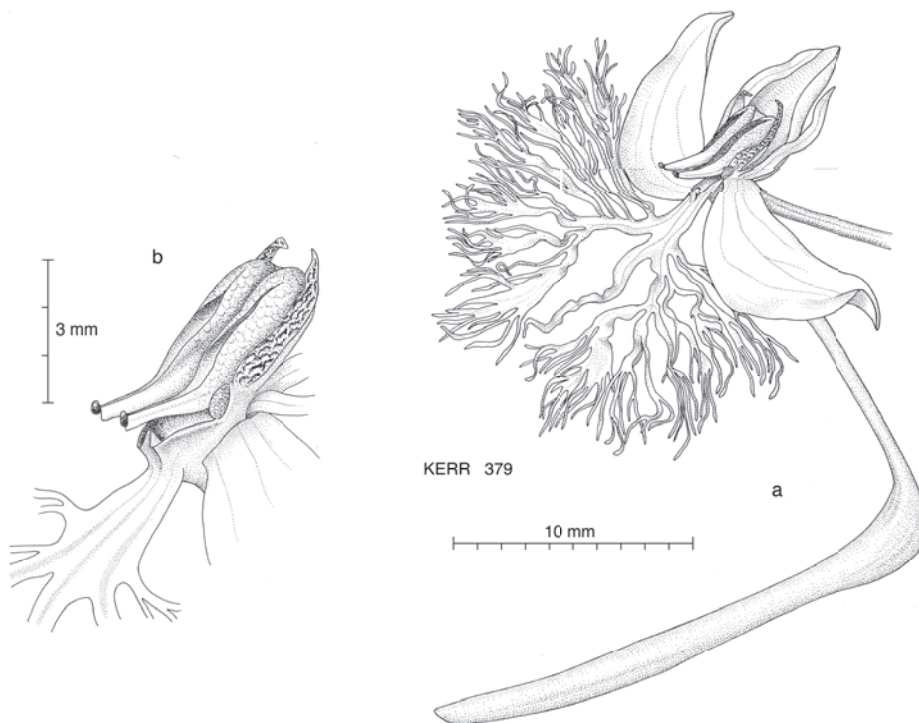


Figure 4. *Habenaria medioflexa* Turrill: a. flower; b. gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Conservation.— Known from 13 collections made in widely scattered localities in all regions except the east and south-west. IUCN red list category ‘Near Threatened’ (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 33. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 48a–b. 1977; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: fig. 46b–c, t. 4a. 1992; present paper: fig. 4a–b.

Notes.— Among the Thai taxa with entire petals and fringed lip side-lobes *Habenaria medioflexa* is the most distinct with its elongate subulate auricles which overtop the gynostemium.

**11. *Habenaria myriotricha*** Gagnep., *Bull. Soc. Bot. France* 78: 72. 1931; Seidenf., *Bot. Tidsskr.* 68: 43. 1973; *Opera Bot.* 114: 60. 1992.— *Fimbrorchis myriotricha* (Gagnep.) Szlach., *Orchidee (Hamburg)* 55: 491. 2004. Type: Laos, Cam-keut, *Spire* 260 (lectotype **P**, designated here, barcode P00430640!).— *Habenaria medioflexa* auct. non Turrill: Kerr, *Nat. Hist. Bull. Siam Soc.* 23: 188. 1969.— *Habenaria medusa* auct. non Kraenzl.: Seidenf., *Bull. Mus. Nat. Hist. Natl.* III, 71: 132. 1972.

Terrestrial or rarely epilithic, deciduous, glabrous except sometimes for the bract margins. *Stems* 19–40 cm tall. *Cataphylls* 3, tubular, sheathing, covering the stem to 4 cm high. *Leaves* (2–)4–5, spreading, cauline and scattered in the lower two thirds of the stem, lanceolate, acute or acuminate, mucronate, 8–15 by 2–2.5 cm, sometimes with insignificant pale semi-translucent border. *Bract-like leaves* 1–3, erect, lanceolate-ovate, acuminate, (2–)3–4.4 cm long, not sheathing, with prominent or obscure pale semi-translucent border, margins minutely denticulate or shortly glandular-hairy. *Inflorescences* lax, few-flowered; rachis 3–4 cm long; floral bracts narrowly lanceolate, acuminate, 15–25 by 2–5 mm, margins entire, elongate-papillose or shortly glandular-hairy. *Flowers* white with green sepals and petals, lip often with some red at the base. *Ovary* (including pedicel) 20–40 mm long. *Sepals* acute, 3-veined, often with papillose margins; median sepal erect, ovate, 8–8.5 by 4–4.2 mm; lateral sepals spreading to somewhat reflexed, obliquely ovate, 7.5–11.5 by 4.75–4.9 mm, basally united with the lip. *Petals* erect, forming a hood with the median sepal, linear, acute or obtuse, 1-veined, 7–8 by 0.5–1 mm, margins papillose. *Lip* 18–25 mm long, deeply 3-lobed above basal united part of 4.5–7 mm; midlobe linear-oblong, convex, more or less papillose, 4–8 by 0.7–1 mm; side-lobes 13–23 mm long, divided into 15–17 laciniae 11.5–20 by 0.25–0.3 mm long; spur cylindric, 31–40 mm long, often thickened in the apical half. *Gynostemium* 3.5–4.5 mm long, with a short basal stalk, anther erect, anther canals 1.7–3 mm long, straight projecting forwards; auricles rounded small bulges next to the anther.

Thailand.— NORTHERN: Tak [Mae Sot, *Songkakul* 124 (**BKF** [s]); Umphang, *Triboun & illegible* 1578 (1) (**BK** [s])]; Kamphaeng Phet [Mae Lamung, *Kerr* 467 (**K**)]; WITHOUT LOCALITY: *Pumicong* 460 (**QBG**, **QBG** [s]); *Thaithong* 1224 (**BCU** [s]); *Tiptabiankarn* 6915 (**Suan Luang** [s]) [6 collections seen].

Distribution.— Laos and Vietnam.

Ecology.— Mostly unknown, once reported in a crevasse in limestone rock, 600 m altitude. Flowering: June–Sept.

Conservation.— Three collections from scattered localities in northern Thailand and three from unspecified localities are known, none of which appear to be situated inside nature conservation areas. IUCN red list category ‘Vulnerable’ based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Bull. Mus. Nat. Hist. Natl. III, 71: fig. 3. 1972; Dansk Bot. Ark. 31(3): fig. 50. 1977.

Notes.— In this treatment I follow Seidenfaden (1992: 60) and Vaddhanaphuti (2005: 166) who maintain *Habenaria myriotricha* as a separate species. Based on his recent studies Seidenfaden (1992) doubted his earlier opinion that *H. myriotricha* is conspecific with the Indonesian *H. medusa* Kraenzl. (Seidenfaden, 1972; 1973), but at the same time he pointed out that in the whole group of *Habenaria* species with laciniate lips the available material is too scarce for studies on the variability of the plants. Nevertheless, Kew’s World Checklist of Monocotyledons (<http://www.kew.org/wcsp/monocots/>), Schuiteman *et al.* (2008) and Cavestro (2007: 206) consider the two taxa as conspecific. Interestingly, neither of the two appear to occur in Peninsular Malaysia as *H. myriotricha* is known from Laos, Vietnam and Thailand while *H. medusa* is found in Sumatra, Java, Borneo and Sulawesi. Although such distribution gaps are indeed known to occur in plants, it adds further doubt to the possible conspecificity of the two taxa.

The differences between this species and the following *Habenaria trichosantha* are also very slight, both being characterised by narrow, entire petals, deeply dissected lips and gynostemium with rather low auricles. They seem to be distinguished merely by flower size: *H. myriotricha* has smaller flowers with median sepals measuring 8–8.5 mm in length, while *H. trichosantha* has median sepals longer than 10 mm.

**12. *Habenaria trichosantha*** Lindl., Gen. Sp. Orchid. Pl.: 324. 1835; Seidenf., Dansk Bot. Ark. 31(3): 86. 1977; Pearce & Cribb, Fl. Bhutan 3(3): 153. 2002.—*Fimbrorchis trichosantha* (Lindl.) Szlach., Orchidee (Hamburg) 55: 491. 2004. Type: Myanmar, Taong Dong, on river Mytinge, Wallich s.n., Wall. Cat. 7028 (holotype **K-LINDL** [*cf.* Pearce & Cribb]; isotype **K-W**).

Terrestrial, deciduous, apparently glabrous except for the bract margins. *Stems* 21–60 cm tall. *Cataphylls* tubular, 1–1.5 mm long, with wide mouth, upper with a blade to 2 cm long. *Leaves* 2–3(–4), spreading, cauline and scattered in the lower stem half, elliptic-ovate, acute, mucronate, 5–11 by 1.6–2.8 cm, sheaths to 2.2 cm long. *Bract-like leaves* suberect or spreading, linear-lanceolate, acuminate, 2–4 cm long. *Inflorescences* semi-dense, 6–9-flowered; rachis 5–7.8 cm long, glabrous; floral bracts lanceolate, acuminate to caudate, 16–25 by 3–4 mm, shorter than the pedicel plus the ovary, margins minutely denticulate to shortly glandular-hairy. *Flowers* 20–27 mm across; uniformly white. *Ovary* (including pedicel) 20–39 mm long. *Sepals* acuminate, 3- or 5-veined; median sepal erect, ovate-oblong, 10–15 by 3.5–4.5 mm, margins denticulate or shortly glandular-pubescent; lateral sepals reflexed, ovate-oblong to lanceolate, 12–16 by 4–6.5 mm. *Petals* suberect, cohering with the median sepal, linear-falcate, acuminate, 1-veined, 10–11 by 1.3–1.5 mm, margins entire or serrulate. *Lip* deeply 3-lobed above a short basal claw; midlobe linear-lanceolate, subacute, 7–11 mm long; side-lobes laciniate, laciniae filiform, 9–12 mm long; spur cylindric, to over 90 mm long, clavate. *Gynostemium* 2–3 mm long, anther



canals 1–2 mm long, auricles rounded small bulges next to the anther, stigmas short and globose.

Thailand.— NORTHERN: ? Sukhothai [Srichalieng, *Kasem* 259 (**BK, C [s]**)] [1 doubtful collection seen].

Distribution.— NE India, Bhutan and Myanmar.

Ecology.— Unknown.

Conservation.— This is a very doubtful record of a widespread species. IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31 (3): fig. 49a–d. 1977.

Notes.— The occurrence of this species in Thailand is in doubt. The only Thai collection, *Kasem* 259 (BK!) is unfortunately in a rather poor state, but differs from the otherwise very similar *Habenaria myriotricha* in its clearly larger flowers. While the original description makes no mention of the colour of the flowers, Pearce & Cribb (2002: 153) give the colour as ‘uniformly white’.

**13. *Habenaria commelinifolia*** (Roxb.) Wall. ex Lindl., *Gen. Sp. Orchid. Pl.*: 325. 1835; Seidenf. & Smitinand, *Orchids Thailand*: 41. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): 89. 1977; *Opera Bot.* 114: 60. 1992; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009).—*Orchis commelinifolia* Roxb., *Fl. Ind.* ed. 1832, 3: 451. 1832. —*Platanthera commelinifolia* (Roxb.) Lindl. in Wallich, *Numer. List*: 7037. 1832. Type: India, Bengal, *Roxburgh* s.n. (not found).

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* (59–)75–150 cm tall. *Cataphylls* 2–4, tubular, sheathing, enveloping the stem base up to 19 cm high, uppermost sometimes with a blade to 2 by 1.7 cm. *Leaves* 3–7, spreading or suberect, cauline and scattered in the lower stem half, lanceolate-oblong, acute and sometimes mucronate, 8.3–18(–32) by 1.3–2.4(–3) cm, margins entire and mostly pale-translucent. *Bract-like leaves* up to 14, suberect, narrowly lanceolate, acute, 4.7–7(–11) cm long, the lower ones sheathing at the base, margins with coarse stiff hairs 0.2–0.4 mm long. *Inflorescences* lax, (7–)10–many-flowered; rachis 10.5–16(–21) cm long; floral bracts narrowly lanceolate, acute to acuminate, (19–)23–37(–62) by 2–4 mm, mostly shorter than the pedicel plus the ovary, margins with coarse stiff hairs 0.2–0.4 mm long. *Flowers* 18–20 mm across (excluding lip); white or greenish-white, turning brown with age. *Ovary* and pedicel 48–70 mm long, smooth. *Sepals* apically rounded or subacute, 3-veined from the base; median sepal erect, suborbicular, deeply hooded, (5–)5.8–7 by 6–8(–11) mm, hood 4–5.5 mm deep; lateral sepals spreading to reflexed, broadly ovate, 11–15 by 7–9.5 mm, more than twice as long as the median sepal, very oblique with a downward-pointing false apex while the true apex is 7–8.3 mm from the sepal base. *Petals* erect, oblong-ovate, obtuse, 3-veined, 5.2–7.2 by 3–3.6 mm. *Lip* over 30 mm long, deeply 3-lobed to 5–8 mm from the base; midlobe linear, entire, 22–37 by ca 1 mm; side-lobes linear to filiform, decurved in the distal three quarters, about as long as or slightly longer or slightly shorter than the midlobe; spur cylindric, 60–80 mm long, clavate in the distal 10–15 mm. *Gynostemium* 2.5–4 mm long, anther canals ca 7 mm long, angled upwards.



Thailand.— NORTHERN: Chiang Rai [between Kok Tong and Mae Kon, *Garrett* 297 (**BKF**, **L**, **K**)]; SOUTH-WESTERN: Kanchanaburi [Hin Dat, *Put* 95 (**BK**, **C**, **K**, **L**)]; CENTRAL: Lop Buri [*Smitinand* 12036 (**BKF**)]; SOUTH-EASTERN: Sa Kaew [Aranyaprathet, *Kerr* 0875 (**K**); idem., *Put* 1964 (**K**); idem., *Put* 3099 (**BK**, **C**, **C** [s], **K**, **L**)]; Prachin Buri [Wattana Nakhon, *Thorut* 197 (**BCU**); no exact locality, *Thaithong* 751 (**BCU** [s], **BCU**)]; WITHOUT LOCALITY: *Thaithong* s.n. (**BCU** 005679) [9 collections seen].

Distribution.— India and Nepal to S China.

Ecology.— Found in grassy places in dipterocarp forest; 50–375 m altitude. Flowering: April, July–Sept.

Conservation.— This species is known from only nine collections made in widely scattered localities in northern, south-western, central and south-eastern Thailand. IUCN red list category ‘Vulnerable’ based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 31. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 51. 1977.

Notes.— *Habenaria commelinifolia* is easily recognised by its robust growth (up to 1.5 m) and the large white flowers with their long narrow lip lobes which are all around 22–37 mm long. The lateral sepals of this and the following three species, *H. longithecra*, *H. reflexa* and *H. austrosinensis*, are very characteristic as they are much longer than the median sepal and are so strongly oblique that their front margin forms a downward-pointing false apex while the true sepal apex is close behind their base.

**14. *Habenaria longithecra*** Seidenf., *Dansk Bot. Ark.* 31(3): 89. 1977. Type: Thailand, Doi Pa Khao W slope, 11 Aug. 1931, *Garrett* 687 (holotype **K**!; isotype **BKF**!).— *Habenaria kingii* auct. non Hook.f.: Seidenf. & Smitinand, *Orchids Thailand*: 35 p.p. 1959.

Terrestrial, deciduous. *Stems* 57–65 cm tall, glabrous below and with both very elongate papillae and stout grouped or branched hairs above. *Cataphylls* 3, tubular with wide opening, basally sheathing, erect, enveloping the stem to 6 cm high, glabrous. *Leaves* 4–6, spreading, cauline and clustered in the lower third of the stem, broadly lanceolate-elliptic, slightly acuminate, mucronate, 8–22 by (2–)3.5–6.5 cm, glabrous. *Bract-like leaves* 4–6, lanceolate, acuminate, 2.5–5.7 cm long, suberect or spreading and hardly sheathing, margins mostly elongate-papillose to shortly glandular-hairy. *Inflorescences* lax, 30–35-flowered; rachis 30–35 cm long, hairy (see above); floral bracts lanceolate, acuminate, 18–34 by 5–7 mm, as long as or shorter than the pedicel plus the ovary, sometimes with very elongate papillae on the midrib, margins shortly glandular-hairy. *Flowers* 20–22 mm across; yellow-green. *Ovary* (including pedicel) 20–25 mm long, beaked, with very elongate papillae and stout grouped hairs. *Sepals* obtuse to subacute, 3-veined; median sepal erect, suborbicular, 2.5–3 by ca 3 mm, sometimes with papillae on the veins (especially the mid-vein); lateral sepals recurved, very obliquely ovate with the front margin forming a downward-pointing false apex while the true apex is ca 4 mm behind the sepal base, 11–14 by 4–6 mm, united with the median sepal and the lip base. *Petals* erect, curved-triangular, obtuse, forming a hood with the median sepal, 1-veined, ca 3 by 1.7 mm. *Lip* 28–32 mm long, 3-lobed above a united 4–4.5 mm long basal part;

midlobe terete, to 28 mm long, spiralling; side-lobes 6.7–9.3 mm long; spur with wide entrance followed by a constriction and above it a globular apex, 6–7 mm long, hidden between the recurved lateral sepals, globular apex ca 2.5 mm in diameter. *Gynostemium* ca 2 mm tall, anther canals 10–12 mm long, straight and projecting forwards, auricles as small bulges on the sides of the anther.

Thailand.— NORTHERN: Mae Hong Son [Doi Pa Kao, *Garrett* 687 (holotype **K**, isotype **BKF**)]; Chiang Mai [Doi Suthep, *Kerr* 353 (**K**); Mae Chaem, *Kerr* 494 (**C** [s], **K**)] [3 collections seen].

Distribution.— Endemic.

Ecology.— Found in dense evergreen forest, 960–1550 m altitude. Flowering: July–Aug.

Conservation.— Known from only three specimens collected in the provinces of Mae Hong Son and Chiang Mai (northern Thailand). It was listed in a book on threatened plants of Thailand (Suddee, 2005: 130). IUCN red list category ‘Endangered’ (Santisuk *et al.*, 2006: 210).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 52a–d. 1977.

Notes.— The species shares hairy stems and elongate straight and forward-projecting anther canals with *Habenaria reflexa* and *H. austrosinensis*, and the long lateral sepals with their downward-pointing false apex with both of these and *H. commelinifolia*.

The type collection of *Habenaria longithecata* and a second collection were originally listed as *H. kingii* Hook.f. by Seidenfaden and Smitinand (1959). However, it differs clearly in its anther canals which are longer than 10 mm and the short spur with its globular apex, and was therefore described as a new species by Seidenfaden (1977: 89).

**15. *Habenaria reflexa*** Blume, *Bijdr.*: 403. 1825; Seidenf. & Smitinand, *Orchids Thailand*: 35, 727. 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): 92. 1977; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: 111. 1992; Comber, *Orchids Java*: 64. 1990; *Orchids Sumatra*: 102. 2001; Pearce & Cribb, *Fl. Bhutan* 3(3): 157. 2002. Type: Java, Kuripan, Blume’s collector (holotype **L** 90316256!).—*Habenaria murtonii* Hook.f., *Fl. Brit. India* 6: 144. 1890. Types: Malaysia, Perak, on limestone rocks, *Scortechini* 552b (syntype ?**K**); Malaysia, Perak, on limestone rocks, *Kunstler* s.n. (syntype not found); Singapore, *Murton* s.n. (syntype ?**K**).—*Habenaria kingii* auct. non Hook.f.: Seidenf. & Smitinand, *Orchids Thailand*: 35 p.p. 1959. Fig. 5.

Terrestrial or epilithic, deciduous. *Stems* 34–59 cm tall, glabrous below, with very elongate papillae and stout grouped or branched hairs above. *Cataphylls* 2–4, tubular, sheathing, enveloping the stem to 6 cm high, glabrous. *Leaves* 3–6, spreading, cauline and clustered in the lower third of the stem, broadly lanceolate-elliptic, shortly petiolate, acuminate, mucronate, 13–18 by 2.5–4.4(–5.3) cm, glabrous. *Bract-like leaves* 5–9, suberect, lanceolate, acuminate, 2–3 cm long, only basally sheathing, glabrous, margins mostly elongate papillose to shortly glandular-hairy. *Inflorescences* lax, (10–) 17–25-flowered; rachis (8.5–) 14–25 cm long, hairy (see above); floral bracts lanceolate,

acuminate, mostly 15–18 by 4–6 mm, shorter than the pedicel plus the ovary, sometimes with very elongate papillae on the midrib, margins shortly glandular-hairy. *Flowers* 10–15 mm across; light green, sometimes whitish. *Ovary* (including pedicel) 17–25 mm long, with very elongate papillae and stout grouped hairs, beak narrow. *Sepals* subacute, 3-veined; median sepal erect, suborbicular, 3–5 by 3–4 mm, occasionally with papillae on the veins (especially on the mid-vein) and on the margins; lateral sepals recurved, very

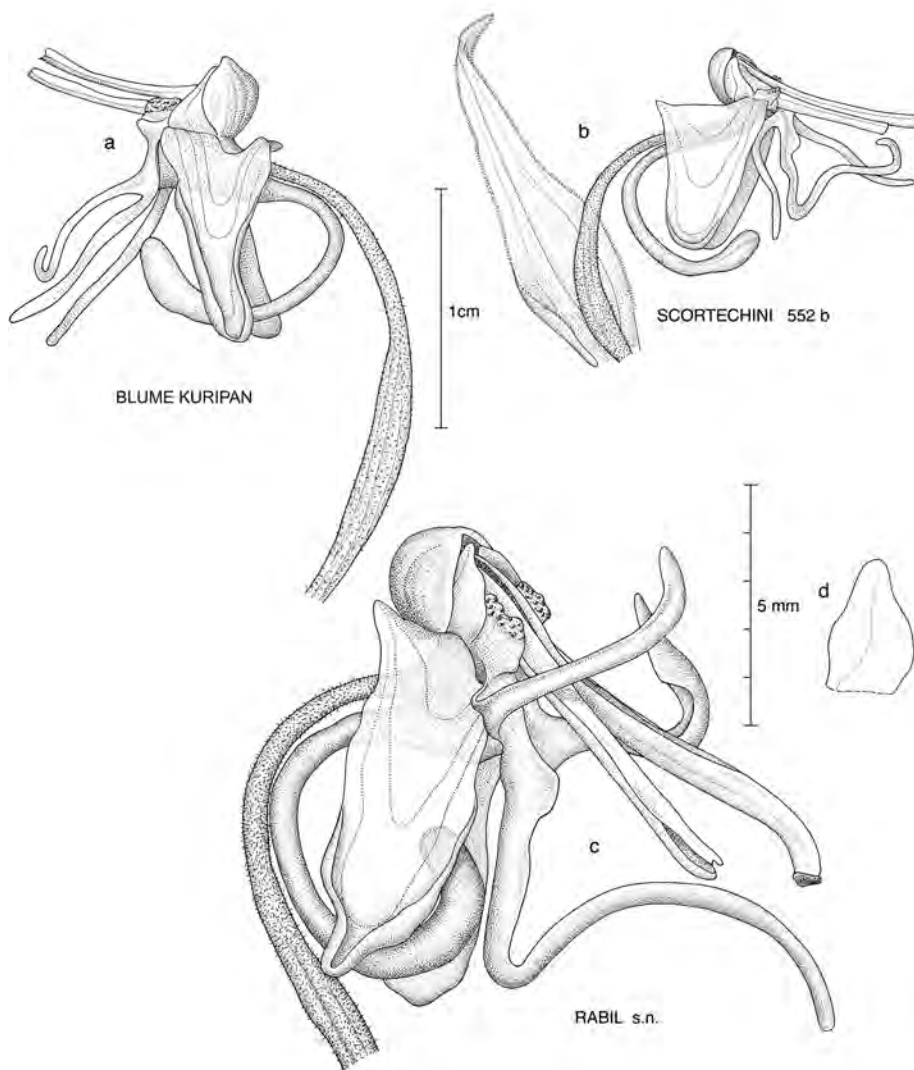


Figure 5. *Habenaria reflexa* Blume: a.–c. flowers from different specimens; d. petal. a. from the type specimen, b. from the type specimen of *H. murtonii* Hook.f. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

obliquely triangular-ovate with the front margin forming a downward-pointing false apex while the true apex is close to and behind the sepal base, basally united with the petals and the lip, 8–11 by 4–4.5 mm. *Petals* erect, broadly triangular, obtuse, forming a hood with the median sepal, 1-veined, 2.5–4 by 1.5–1.8 mm. *Lip* 10–15 mm long, deeply 3-lobed above the united 3.5–4 mm long basal part; midlobe terete, 6.5–14 by 1–1.5 mm long, spiralling; side-lobes similar, 6.2–7.5(–11) by 0.6–1 mm; spur cylindric, 15–18 mm long, thickened towards the apex, sharply curved forwards. *Gynostemium* 2–3 mm tall, anther canals 6–8 mm long, straight, projecting forwards. *Fruit* elliptic-fusiform, about 25 mm long, 3.7 mm in diameter, apical beak ca 10 mm long.

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng National Park, *Thai-Danish Botanical Studies* 7329 (C, C [s]); idem., *Seidenfaden & Smitinand* 3722 (C [s]); idem., *Smitinand* 5849 (BKF, C [s]); no exact locality, *Bunchuai* 138 (BKF)]; PENINSULAR: Chumphon [*Burkill* s.n. (C [s] vial 324)]; Nakhon Si Thammarat [Khiriwong, *Phloenchit* 191 (BKF)]; Thung Song, *Rabil* s.n. (C [s] vial 322); no exact locality, *Rabil* s.n. (K H2006/01478 63)]; Phattalung [Khao Pu Khao Ya, *Larsen et al.* 44034 (AAU, SING); Khao Pu Khao Ya National Park, *Maxwell* 86-711 (PSU)]; Songkhla [Rattaphum District, *Maxwell* 84-414 (BKF, PSU)]; Ton Nga Chang, *Seidenfaden & Smitinand* 9397 (C [s]); WITHOUT LOCALITY: *Baramée* s.n. (BCU [s] 009944) [13 collections seen].

Distribution.— Indochina and W Malesia, possibly also in India.

Ecology.— Found in limestone areas in evergreen or deciduous forest with rattan, also reported on rocks; 125–1200 m altitude. Flowering: July–Nov.

Conservation.— *Habenaria reflexa* is known from 13 collections made in widely scattered localities in north-eastern and peninsular Thailand, several of which are situated in national parks. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 25, t. XXXII (3722). 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 54a–d. 1977; Comber, *Orchids Java*: t. on page 64. 1990; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: fig. 47c–d, t. 4b. 1992; Comber, *Orchids Sumatra*: t. on page 102. 2001; present paper: fig. 5a–d.

Notes.— The species is well-characterised by its hairy stems, the oblique lateral sepals with their downward-pointing false apex, the strongly forwards-curved lip spur and the straight forward-projecting anther canals. The spur is the most obvious difference from the otherwise very similar *Habenaria austrosinensis* (where the spur is pointing straight backwards or upwards).

**16. *Habenaria austrosinensis*** Tang & F.T.Wang, *Bull. Fan Mem. Inst. Biol.* 7: 134. 1936; Seidenf., *Dansk Bot. Ark.* 31(3): 94. 1977; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009). Type: China, Yunnan, Szemao, *Henry* 12467 (holotype K, drawing seen).

Terrestrial, deciduous. *Stems* 24–63(–80) cm tall, glabrous below and with very elongate papillae and stout grouped or branched hairs above. *Cataphylls* 4, tubular, sheathing, enveloping the stem base, 0.7–1.4 cm long, glabrous. *Leaves* 4–6, spreading, cauline and scattered on the stem in the lower part, lanceolate, acute, (14–)21–24 by (2.8–)3–5.9 cm, tapering into a narrow petiole to 5 cm long, glabrous. *Bract-like leaves*

8–10, lanceolate, acute or acuminate, 2–4 cm long, sheathing at the base, margins shortly glandular-hairy. *Inflorescences* lax, many-flowered; rachis 9–33 cm long; floral bracts acuminate-lanceolate, 12–21 by 2.2–4 mm, shorter than the pedicel plus the ovary, glabrous or papillose on the surface, with stiff white short hairs 0.2–0.4 mm long on the margins. *Flowers* 13–15 mm across; greenish-white, anther yellow. *Ovary* (including pedicel) 20–27 mm long, papillose or shortly glandular hairy. *Sepals* often with stiff short hairs on the margins; median sepal erect, suborbicular to broadly elliptic, 2.4–3 by ca 3 mm; lateral sepals recurved, very obliquely ovate with the front margin forming a downward-pointing false apex while the true apex is ca 3.8 mm behind the sepal base, 7–8 by 1.5–3 mm. *Petals* erect, forming a hood with the median sepal, linear, acute, 2.5–3.2 by ca 1 mm. *Lip* to 13 mm long, deeply 3-lobed to near the base, all lobes linear; midlobe ca 12 by 0.6 mm; side-lobes ca 8 by 0.3 mm; spur cylindric and apically clavate, 17–25 mm long, straight, pointing backwards and sometimes upwards. *Gynostemium* ca 3 mm long, anther canals 6.5–7.2 mm long, spreading, auricles insignificant.

Thailand.— NORTHERN: Chiang Mai [Chiang Dao, *Suksathan* 3581 (**QBG**, **QBG** [s])]; EASTERN: Nakhon Ratchasima [Wang Nam Khiao, *Damrongsak Praphat* 788 (**BKF**); Khao Yai National Park, *Larsen et al.* 3234 (**AAU**, **C** [s], **L**, **P**)]; SOUTH-WESTERN: Prachuap Khiri Khan [Hua Hin, *Middleton et al.* 1063 (**BKF** [s])]; SOUTH-EASTERN: Prachin Buri [Kabinburi, *Phengklai* 3046 (**BKF**)]; WITHOUT LOCALITY: *Maxwell* 90-868 (**CMU**) [6 collections seen].

Distribution.— S China.

Ecology.— Found in moist evergreen and bamboo forest; 400–1000 m altitude. Flowering: July–Aug.(–Sept.).

Conservation.— Known from only six collections made in widely scattered localities in northern, eastern, south-western and south-eastern Thailand. IUCN red list category ‘Vulnerable’ based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 55a–c. 1977.

Notes.— The species is similar to the preceding but differs by the long spur which is straight or only slightly curved and points backwards or upwards. Also the petals differ in the two species, *H. reflexa* having broadly triangular petals while those of *H. austrosinensis* are linear.

**17. cf. *Habenaria ciliolaris*** Kraenzl., *Bot. Jahrb. Syst.* 16: 169. 1893; Seidenf., *Dansk Bot. Ark.* 31(3): 95. 1977; *Opera Bot.* 114: 60. 1992; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009). Type: China, Little Hongkong, 14 Aug. 1884, *Ford* 95 (holotype **K**, drawing seen). Fig. 6.

Epiphytic, deciduous, glabrous. *Stems* 18–27 cm tall. *Cataphylls* 2, tubular, sheathing, enveloping the stem base to 1.5 cm high, uppermost with a blade to 1.8 by 1.3 cm. *Leaves* 3–5, spreading, clustered near the base of the stem, lanceolate-elliptic, abruptly and shortly acuminate, mucronate, blade 6–12 by 2–3.7 cm, with an obscure pale border, margins papillose to elongate-papillose. *Bract-like leaves* 2, erect, lanceolate, acuminate, 1.9–3.6 cm long, not sheathing, margins elongate-papillose. *Inflorescences* lax, 7–13-flowered; rachis 7–13 cm long, glabrous, elongate-papillose or denticulate; floral

bracts lanceolate, acuminate, 11–19 by 5–7 mm, margins elongate-papillose to shortly glandular-hairy. *Flowers* mostly closed on the examined specimen, 6–7 mm long; green. *Ovary* (including pedicel) 14.8–16 mm long, with pronounced and occasionally slightly denticulate ribs. *Sepals* 2- or 3-veined, elliptic-ovate, margins papillose; median sepal erect, obtuse, 6–7 by 3–5 mm, with pronounced and occasionally slightly denticulate ribs; lateral sepals oblique, subacute, 6.5–7 by 3–4 mm, basally united with the lip. *Petals* erect, forming a hood with the median sepal, very narrowly triangular, subacute, 1-veined, 6.2–7 by 1.5–2 mm. *Lip* 8–8.3 mm long, deeply 3-lobed from near the base, lobes linear, obtuse; midlobe 5.5–6.4 by 0.9–1 mm; side-lobes 8.9–9.5 by 0.7–0.8 mm; spur cylindric and clavate in its distal half, curved forwards, 16.8–18 mm long. *Gynostemium* 3–4 mm long, anther canals 2–2.7 mm long, stigmas ca 2.5 mm long, auricles 2–2.5 mm from the base.

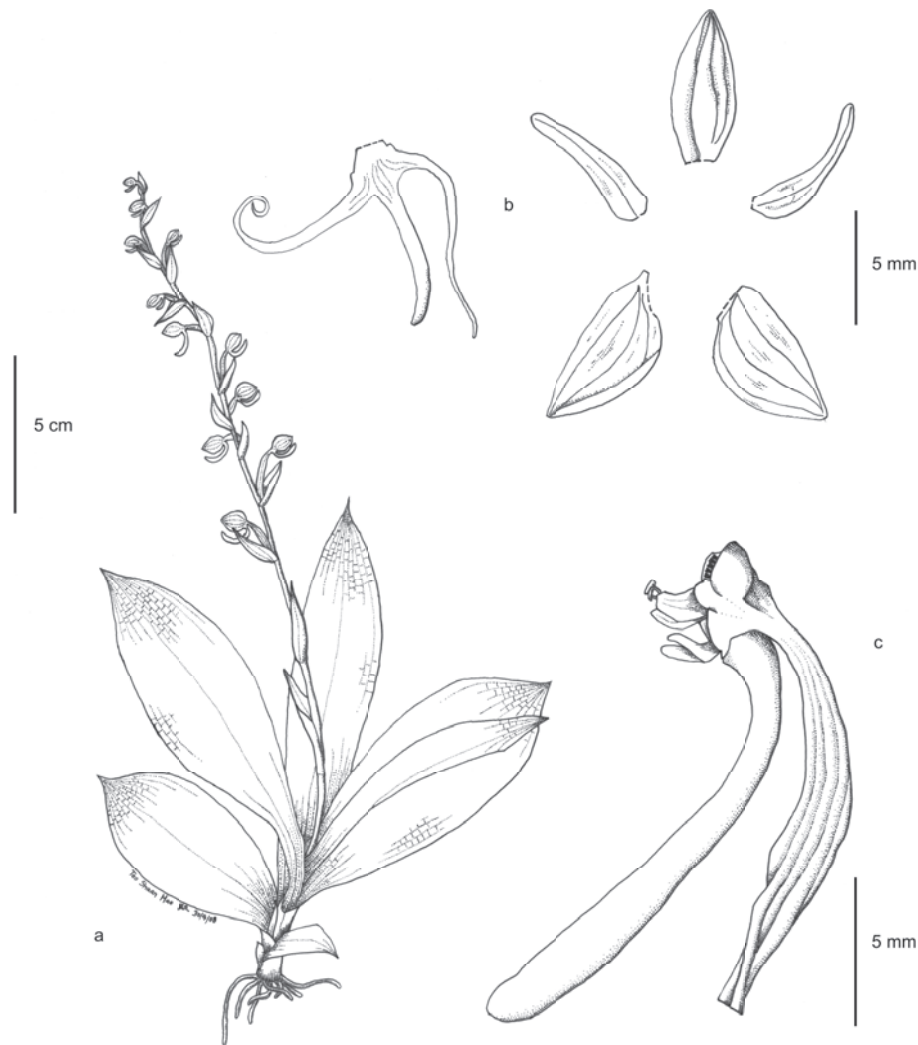


Figure 6. cf. *Habenaria ciliolaris* Kraenzl. a. plant; b. tepals; c. gynostemium and lip spur. All from Srisanga *et al.* 851. Drawn by Teo Shaun Hao.



Thailand.— NORTHERN: Nan [Doi Phu Kha National Park, 19°24'N 101°07'E, *Srisanga, Watthana & La-ongsri* 851 (**QBG**)] [1 doubtful collection seen].

Distribution (of typical *Habenaria ciliolaris*).— SE China and Vietnam.

Ecology.— Our Thai specimen was found growing as an epiphyte in evergreen hill forest; 1400 m altitude. Flowering: July.

Conservation.— IUCN red list category 'Data Deficient' (IUCN, 2001).

Illustrations.— Typical *H. ciliolaris*: Seidenf., Dansk Bot. Ark. 31(3): fig. 56a–b. 1977; Opera Bot. 114: fig. 29a–b. 1992; Thai specimen: present paper: fig. 6a–c.

Notes.— This plant closely matches *Habenaria ciliolaris* Kraenzl. from China and Vietnam. The Thai collection cited above shares with this species the subbasal leaves of a similar shape and size; the lax inflorescence; the size and shape of the median sepal, the petals and the lip; and the clavate and forwards-curved spur which is slightly longer than the ovary. Typical specimens of *H. ciliolaris* differ by having villous or hispid ridged stems, ciliate bracts, and ovaries with very prominent denticulate keels, three of which also continue on the median sepal (Kraenzlin, 1893; Seidenfaden, 1977; Chen *et al.*, in prep.). Furthermore, the lateral sepals are less oblique in our Thai specimen than they are in the type specimen of *H. ciliolaris*. There appears to be some variation as in Taiwanese populations of the species no mention of the ridged ovaries is made in a recent flora treatment, and the bracts were referred to as merely “sometimes ciliate” (Digital Flora of Taiwan, [http://www.efloras.org/florataxon.aspx?flora\\_id=100&taxon\\_id=200028691](http://www.efloras.org/florataxon.aspx?flora_id=100&taxon_id=200028691), accessed 30 April 2009).

Studies of the intraspecific variation of the hairiness of the stems and the floral bracts, as well as the extent of formation of the ridges on the ovary and the median sepal, are needed in order to determine whether the Thai specimen is an aberrant form of *Habenaria ciliolaris* or rather belongs to an undescribed species. If it is indeed *H. ciliolaris* this would be a new distribution record for Thailand.

**18. *Habenaria dentata*** (Sw.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4: 125. 1919; Seidenf. & Smitinand, Orchids Thailand: 39, 727. 1959–1965; Seidenf., Dansk Bot. Ark. 31(3): 98. 1977; Opera Bot. 114: 61. 1992; Seidenf. & Wood, Orchids Penins. Malaysia & Singapore: 113. 1992; Pearce & Cribb, Fl. Bhutan 3(3): 148. 2002; Chen *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009).— *Orchis dentata* Sw., Kongl. Vetensk. Acad. Nya Handl. 21: 207. 1800.— *Platanthera dentata* (Sw.) Lindl., Gen. Sp. Orchid. Pl.: 296. 1835.— *Plantaginorchis dentata* (Sw.) Szlach., Richardiana 4: 64. 2004. Type: Eastern China, Swartz s.n. (holotype **S**).— *Habenaria geniculata* D. Don, Prodr. Fl. Nepal.: 25. 1825.— *Platanthera geniculata* (D. Don) Lindl. in Wallich, Numer. List: 7042. 1832. Type: Nepal, Sept., Buchanan-Hamilton s.n. (not found).— *Habenaria parageniculata* Tang & F.T. Wang, Bull. Fan Mem. Inst. Biol. 7: 137. 1936. Type: Myanmar, Ywathit–Salween Valley, 24 Dec. 1912, Micholitz s.n. (holotype **K**, barcode 000247490!).— *Habenaria* sp. TS 3574; Seidenf. & Smitinand, Orchids Thailand: 41. 1959. Fig. 7.

Terrestrial, deciduous, glabrous but sometimes the margins and midribs of the bracts and the tepals short-hairy. *Stems* (26–)42–83(–101) cm tall. *Cataphylls* 1–3,

tubular, sheathing, enveloping the stem base to 11 cm high, uppermost sometimes with a blade to 3 by 1.7 cm, with a distinct pale semi-translucent border. *Leaves* (2–)4–5(–7), spreading, cauline in the lower stem half, broadly or more rarely narrowly ovate-elliptic, acute, mucronate, (6–)9–20 by 1.5–3.2(–5) cm, margins sometimes wavy. *Bract-like leaves* (3–)5–11, erect, narrowly lanceolate, acuminate, 2–7.5 cm long, not or very shortly sheathing at the base, margins mostly pale and papillose to stiff shortly hairy. *Inflorescences* lax to subdense, (2–)5–many-flowered; rachis (2–)4–8(–9.5) cm long, sometimes minutely denticulate especially below the floral bracts; floral bracts narrowly lanceolate, acute or acuminate, 10–33 by 2–6 mm, usually slightly shorter than the pedicel plus the ovary, margins and sometimes also the midribs papillose to shortly glandular hairy. *Flowers* 13–25(–29) mm across; normally entirely white (in singular cases recorded as pale blue, pinkish white, white with yellow lip or white with green sepals), outsides and apical parts of the inside of the sepals and petals as well as the lip spur sometimes with pale green tinge, gynostemium white or cream, pollinia pale yellow, tan or white; flower reported as scented or odourless; margins of sepals, petals and sometimes also the lip denticulate, papillose or shortly papillose-hairy. *Ovary* (including pedicel) 15–30 mm long, often with a narrow beak, keels pronounced and mostly papillose or shortly glandular-hairy. *Sepals* subacute or acute, sometimes mucronate, 5-veined; median sepal erect, ovate-elliptic, concave, (7–)8.5–13(–16) by (3.5–)4–9 mm; lateral sepals spreading, obliquely ovate, (7.5–)10–12(–17) by 3.4–5.5(–9) mm. *Petals* erect or spreading, narrowly lanceolate, acute, 3-veined, 5–9(–11.5) by (1.2–)1.7–2.8 mm. *Lip* (9–)11–25 by 2.5–17 mm, extremely variable in shape, deeply or shallowly 3-lobed with large or very small side-lobes, usually spreading, basally with a narrow claw (1–)2–7 mm long, with a prominent or insignificant wall-like rim around the spur entrance; midlobe narrowly or broadly oblong or narrowly triangular, acute, (3–)11–15(–22) by 0.7–3 mm; side-lobes spreading, flabellate or ovate, (0.5–)2.9–15(–22) by 1–10(–12) mm, margins mostly dentate; spur cylindric, usually 20–50 mm long, widening towards the apex, mostly geniculate, in abnormal forms (which are not uncommon) sometimes as short as 5 mm. *Gynostemium* (2.5–)3–5 mm long, anther canals 1.5–3 mm long and slightly pointing upwards, central rostellum lobe insignificant and up to half of the anther in length, auricles as small bulges on the sides of the anther, stigmas 2.3–3 mm long. *Fruit* sessile, elliptic-fusiform, 19–26.9 mm long, 3.7–5.4 mm in diameter, beak to 6.4 mm long.

Thailand (selected specimens only).— NORTHERN: Mae Hong Son [Mae Sariang, *Paisooksantivatana* y 356–80 (**BK**); Pai, *Larsen et al.* 46931 (**AAU**, **BKF**)]; Chiang Mai [Doi Suthep, *Kerr* 119 (**K**); Mae Rim, *Kerr* s.n. (**K** H2007/02483–47); Mae Sa, *Larsen et al.* 46626B (**AAU**); Doi Pui, *Maxwell* 90–1108 (**CMU**, **L**); Doi Chiang Dao, *Bunchuai* 1195 (**BKF**); Fang, *Bänzinger* 531 (**K**); Hod, *Sankamethawee* 286 (**ScCMU**, **ScCMU** [s]); Omkoi, *Petrmitr* 490 (**ScCMU**, **ScCMU** [s]); Doi Inthanon, *Larsen & Larsen* 34441 (**AAU**); Muang District, *Maxwell* 88–1205 (**CMU**, **L**); Huai Kayo, *Maxwell* 96–1210 (**ScCMU**, **ScCMU** [s], **L**); Wiang Haeng, *Indhamusika* 67 (**QBG**); Mae Taeng, *Maxwell* 97–1316 (**ScCMU**, **ScCMU** [s]); Mae Wang, *Maxwell* 04–560 (**ScCMU**, **ScCMU** [s]); Amphoe San Pa Tong, *Paisooksantivatana* y 2559–89 (**BK**); Doi Pha Hom Pok, *Triboun* 396 (l) (**BK** [s]); Mae Taeng District, *Shimizu et al.* T 20168 (**BKF**); Chiang Rai [Khunkorn Waterfall Forest Park, *Boonkerd et al.* KK 675 (**BCU**); Wiang Pa Pao, *Sidisunthom & Gardner* 9007 (**ScCMU**, **ScCMU** [s])]; Nan [Amphoe Tha Wang Pha,

*Larsen et al.* 44356 (**AAU**, **C** [s]); Doi Phu Wae, *Srisanga* 1869 (**QBG**); Lamphun [Doi Khun Tan National Park, *Maxwell* 93-1280 (**ScCMU**, **ScCMU** [s])]; Lampang [Chae Son National Park, *Maxwell* 96-1226 (**ScCMU**, **ScCMU** [s], **L**); Doi Khun Tan National Park, *Cumberlege* 634 (**BKF**); Chae Hom, *Palee* 1025 (**ScCMU**, **ScCMU** [s])]; Phrae [Mae Tang, *Kerr* s.n. (**K** H2006/01478-90)]; Uttaradit [Phu Soi Dao, *Wongprasert et al.* s.n. (**BKF** SN144371)]; Tak [Mae Sot, *Triboun* 725 (l) (**BK** [s]); Umphang, *Worachat* 48 (**KKU** [s]); Sukhothai [Muang Kao District, *Maxwell* 71-684 (**AAU**, **BK**, **C** [s] **AAU**, **BK**, **C** [s])]; Phitsanulok [Phu Hin Rong Kla, *Suksathan* 1215 (**QBG**); Kamphaeng Phet [Chong Yen Mae Wong National Park, *Watthana* 1463 (**QBG**); no exact locality, *Kerr* 222 (**K**); NORTH-EASTERN: Phetchabun [Nam Nao National Park, *Thammatawon* 131 (**KKU** [s]); Thung Salaeng Luang National Park, *Kerr* 0943 (**BK**, **C**, **K**); Loei [Phu Kradueng National Park, *Dee* 336 (**BKF**, **C** [s]); Phu Luang National Park, *Thammatawon* 133 (**KKU** [s]); Phu Ruea National Park, *Worachat* 216 (**KKU** [s]); Wang Saphung, Bunnak 34 (**BKF**, **C**); Udon Thani [Phu Pra Bat National Park, *Thammatawon* 167 (**KKU** [s]); Sakon Nakhon [Phu Phan National Park, *Smitinand* s.n. (**BKF** SN105470)]; Mukdahan [*Seidenfaden & Smitinand* 5739 (**C** [s])]; Khon Kaen [Huai Kae Waterfall, *Thammatawon* 104 (**KKU** [s]); EASTERN: Chaiyaphum [Pa Hin Ngam National Park, *Suddee* 167 (**BCU** [s])]; Nakhon Ratchasima [Khao Yai National Park, v. *Beusekom & Charoenphol* 1771 (**L**); Ban Kaeng Khlo, *Vidal* 5114 (**P**); Bua Yai, *Put* 4269 (**BK**, **C**, **K**); Wang Nam Khiao, *Damrongsak Praphat* 210 (**BKF**); Roi Et [Amphoe Phanomprai, *Paisooksantivatana* 1668-85 (**BK**); Ubon Ratchathani [Pha Taem National Park, *Boonjaras* 112 (**BCU**); Khong Chiam, *Maxwell* 01-495 (**ScCMU**, **ScCMU** [s], **L**); SOUTH-WESTERN: Kanchanaburi [Erawan National Park, *Suddee sub Kurzweil* 2476 (**BKF**); Three Pagoda Pass, *Kurzweil* 2486 (**BKF**); Sai Yok, *Phengklai et al.* 14090 (**BKF**); Wangpho, *Chermisiriwatthana* 788 (**BK**); Huai Bankan, v. *Beusekom et al.* 3492 (**BKF**, **C**, **L**); Ratchaburi [Suan Phueng, *Niyomdham* 6992 (**BKF** [s])]; Prachuap Khiri Khan [Sam Roi Yot, *Put* 2523 (**K**); CENTRAL: Saraburi [Ban Nong Bua, *Kerr* 0650 (**C**, **K**); Sam Lan, *Maxwell* 73-567 (**AAU**, **BK**, **BKF**); Ban Nong Bua, *Winit* s.n. (**BK** barcode SN243172)]; Nakhon Nayok [Khao Yai National Park, *Shimizu et al.* T 19760 (**BKF**, **C** [s])]; SOUTH-EASTERN: Prachin Buri [Khao Yai National Park, *Watthana & Riyapan* 927 (**QBG**); Chonburi [Sriracha District, *Maxwell* 75-1034 (**BK**); Chanthaburi [Pong Namron, *Bunnak* 350 (**BKF**, **C**); *Smitinand* 3573 (**BKF**); Hindat, *Smitinand* 3560 (**BKF**); Ban Patong, *Smitinand* 3574 (**BKF**); PENINSULAR: Chumphon [Siap Khuan, *Kerr* 0658 (**BK**, **C**, **C** [s], **K**); Phangnga [Khao Bang Toi Tai, *Triboun* 100 (l) (**BK** [s])] [150 collections seen, 1 of them uncertain].

Distribution.— N India and Nepal to Indochina and China, also in Peninsular Malaysia and possibly the Philippines.

Ecology.— Commonly found in primary or degraded deciduous, mixed or evergreen forest, pine forest, bamboo forest and fruit orchards, also in grassy and disturbed areas, sometimes also collected in fire-damaged habitats; 50–1800 m altitude. *Habenaria dentata* often grows in sandy soils derived from granite, shale and sandstone and has also been reported over limestone. Flowering: (July–)Sept.–Dec.(–Jan.).

Conservation.— Widespread and common throughout Thailand but apparently absent from the southern part of the Thai Peninsula (but found further south in Peninsular Malaysia). IUCN red list category ‘Least Concern’ (IUCN, 2001).

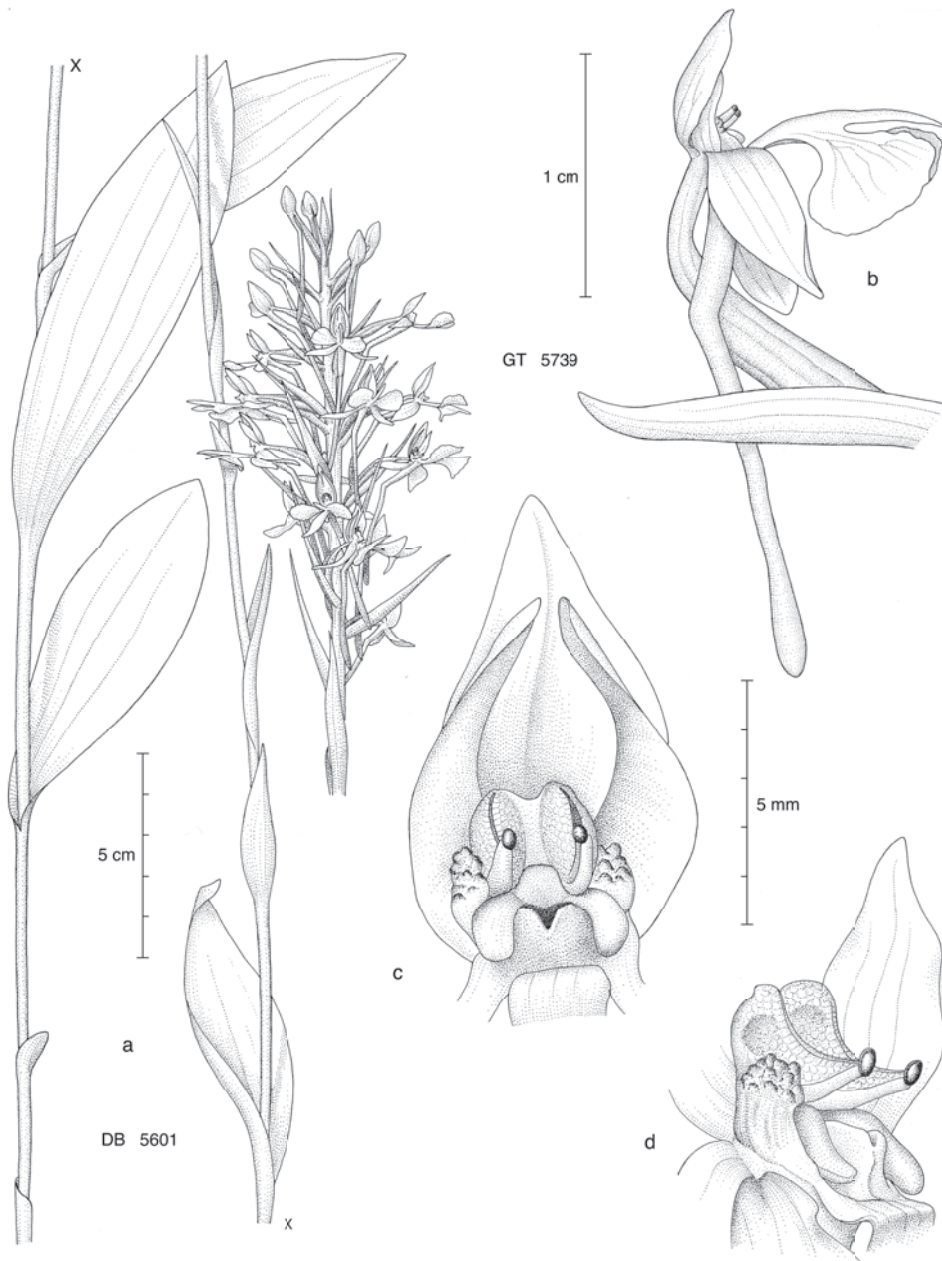


Figure 7. *Habenaria dentata* (Sw.) Schltr.: a. plant; b. flower; c.–d. gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: figs. 28, 29a–d. 1959; Seidenf. & Smitinand, *Orchids Thailand*: fig. 30a–d. 1959 [as *Habenaria* sp. TS 3574]; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 60a–d. 1977; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: fig. 47e–g, t. 4c. 1992; present paper: fig. 7a–d.

Notes.— This is by far the most common *Habenaria* species in Thailand. It is characterised by cauline leaves and comparatively large white flowers with usually minutely denticulate sepal and petal margins. It is very widespread and is found in a wide variety of different habitat types. Not surprisingly, the morphological variation in *H. dentata* is extensive in a number of features, particularly in the lip shape (a range of different lip shapes was illustrated by Seidenfaden & Smitinand, 1959), but the variation appears to be continuous and a taxonomic grouping on the basis of this character cannot, therefore, be made.

Within the species there is a tendency towards the formation of abnormal flowers which is occasionally also found in *Habenaria* species in other parts of the world. The occurrence of abnormal individuals of *H. dentata* in Thailand was previously pointed out by Seidenfaden & Smitinand (1959). The inner perianth segments are absent in rare cases, and the spurs are occasionally reduced to as little as 5 mm. In the specimen *Larsen* 44356 (C [s]!) one of the petals is abnormal in that it has a short sac and is connate with the lip.

*Habenaria malintana* resembles *H. dentata* in several respects. The two species share a general appearance, a fairly large flower size and a white colour, frequently denticulate margins of sepals and petals and have a very similar gynostemium structure. However, *H. malintana* differs by having an unlobed and spurless lip. Both species frequently grow sympatrically as is shown by several mixed herbarium collections. In his study of the Thai *Habenaria* species Seidenfaden (1977: 101) pointed out that *H. malintana* and *H. dentata* are both in need of critical taxonomic study and suspected that the two species might subsequently turn out to be conspecific, with *H. malintana* being merely a peloric form of *H. dentata*. In view of molecular and other modern techniques available to us it is here considered premature to propose formal taxonomic changes based merely on morphological similarity and on the co-occurrence of the two taxa, and until such time as definitive evidence is available it is probably best to maintain *H. malintana* and *H. dentata* as separate species.

In the course of the present study a specimen labelled as “*Habenaria dentata*, form with an entire lip” (*Suddee* 801, BKF!) was re-identified as *H. mandersii*. It needs to be pointed out that, while the variation of lip shapes is enormous in *H. dentata*, forms with an entire and lorate lip have never been observed.

**19. *Habenaria malintana*** (Blanco) Merr., *Sp. Blancoan.*: 112. 1918; Seidenf. & Smitinand, *Orchids Thailand*: 22, 725. 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): 126. 1977; *Opera Bot.* 114: 67. 1992; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009). Type: Philippines, Malinta, near Manila, collector unknown (not found).— *Thelymitra malintana* Blanco, *Fl. Filip.*: 642. 1837.— *Kraenzlinorchis malintana* (Blanco) Szlach., *Orchidee (Hamburg)* 55: 58. 2004.— *Habenaria pelorioides* E.C.Parish & Rchb.f., *Trans. Linn. Soc. London* 30: 139. 1874. Type: Myanmar, Amherst, 1862, *Parish* s.n. (holotype **K**, barcode 000247491!). Fig. 8.



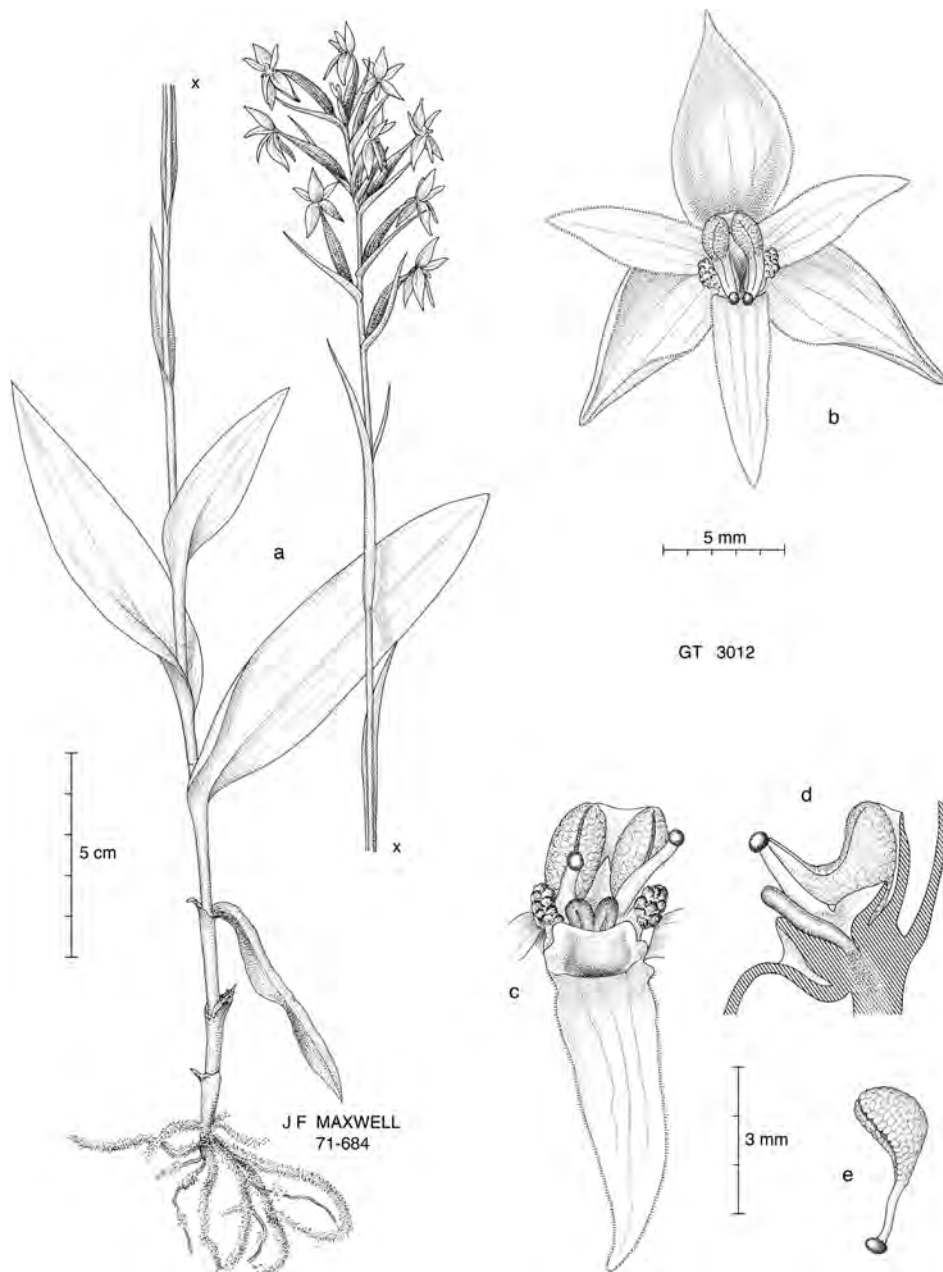


Figure 8. *Habenaria malintana* (Blanco) Merr.: a. plant; b. flower; c. gynostemium and lip; d. section through gynostemium; e. pollinium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.



Terrestrial, deciduous, glabrous but sometimes margins and midribs of bracts and tepals as well as the ovary ribs variously short-hairy. *Stems* 45–50(–77) cm tall. *Cataphylls* 1–3, tubular, sheathing, enveloping the stem base to 11 cm high, uppermost sometimes with a blade to 3 by 1.7 cm, with distinct pale semi-translucent border. *Leaves* (2–)4–5(–7), spreading, cauline and scattered in the lower stem half, broadly or more rarely narrowly oblong-elliptic, acute, mucronate, 4–12 by (1–)2–3(–4.5) cm, margins sometimes wavy. *Bract-like leaves* (3–)5–11, erect, narrowly lanceolate, acuminate, 2–7.5 cm long, not or very shortly sheathing at the base, margins mostly pale and papillose to stiff shortly hairy. *Inflorescences* lax to subdense, (2–)5– many-flowered; rachis (2–)4–8(–9.5) cm long, sometimes minutely denticulate especially below the floral bracts; floral bracts narrowly lanceolate, acute or acuminate, 10–33 by 1–5 mm, margins and sometimes also midribs papillose to shortly glandular-hairy. *Flowers* to 22 mm across; white, distal parts of sepals and spur often light green, gynostemium white, anther light tan or dull yellow. Margins of sepals, petals and lip entire, denticulate or shortly papillose-hairy. *Ovary* (including pedicel) 20–27 mm long, keels pronounced and mostly papillose or shortly glandular-hairy. *Sepals* subacute or acute, sometimes mucronate, 5-veined; median sepal erect, ovate-elliptic, concave, 9.7–13(–17) by 4–5(–6.6) mm; lateral sepals spreading, lanceolate-ovate, 9.3–15(–18) by 4–5(–6.6) mm. *Petals* erect and cohering with the median sepal or spreading, narrowly lanceolate, acute, 3-veined, 7–11 by 1.7–3 mm. *Lip* 6.3–13(–17) by 2.3–3 mm, entire or subentire with minute lateral auricles in the basal part, triangular-ovate, subacute, spreading or erect, basally united with the petals; spur absent, but lip base shallowly saccate forming a small pocket below the rostellum. *Gynostemium* 3–5 mm long, anther canals 1–1.5 mm long and slightly facing upwards, central rostellum lobe insignificant and merely up to half of the anther in length, auricles small bulges on the sides of the anther, stigmas 2.3–3 mm long. *Fruit* elliptic-fusiform, about 3.6 mm long and 3 mm in diameter.

Thailand.— NORTHERN: Mae Hong Son [Pai, *Larsen et al.* 46931 (**AAU**, **BKF**); Pang Ma Pha, *Pilenk et Triboun* 574 (1) (**BK** [s]); Kong Loi village, *Thaithong* 765 (**BCU**)]; Chiang Mai [Doi Suthep, *Kerr* 119A (**L**); idem., *Kerr* 119C (**K**); idem., *Kerr* 119D (**P**); idem., *Kerr* 119E (**K**); idem., *Maxwell* 87-1324 (**BKF**, **CMU**); idem., *Pimchai* 9741 (**C** [s]); idem., *Seidenfaden & Smitinand* 3012 (**C** [s]); idem., *Watthana* 2158 (**QBG** [s]); Mae Rim, *Indhamusika* 154 (**QBG**); idem., *Nanakorn et al.* 225 (**QBG**); Doi Chiang Dao, *Phusomsaeng* 13 (**C** [s], **L**); idem., *Maxwell* 89-1446 (**CMU**); idem., *Maxwell* 90-1187 (**CMU**); idem., *Phloenchit* 885 (**BKF**); Hot District, *Cumberlege* 1285 (**K** [s]); Hod, *Saemyarn* s.n. (**QBG** [s] 27107); idem., *Sankamethawee* 319 (**ScCMU**); Omkoi, *Smitinand* 11833 (**BKF**); near Doi Inthanon, *Tagawa et al.* T 2319 (**BKF**); Mae Klang, *illegible* s.n. (**BKF** SN076929); Mae Dtang, *Maxwell* 97-1303 (**ScCMU**, **ScCMU** [s]); no exact locality, *Thaithong* 516 (**BCU** [s]); Chiang Rai [Doi Luang National Park, *Maxwell* 97-1201 (**ScCMU**, **ScCMU** [s]); Mae Fa Luang, *Maxwell* 06-787 (**ScCMU**, **ScCMU** [s]); ? Khunkorn Waterfall Forest Park, *Boonkerd et al.* KK s.n. (fruiting) (**BCU** 010430)]; Nan [Amphoe Tha Wang Pha, *Larsen et al.* 44358 (**AAU**)]; Lamphun [Doi Khun Tan National Park, *Maxwell* 93-1242 (**ScCMU**, **ScCMU** [s]); Lampang [Chae Son National Park, *Maxwell* 95-927 (**BKF**, **ScCMU**, **ScCMU** [s], **L**); Doi Khun Tan National Park, *Cumberlege* 629 (**BKF**, **C** [s]); idem., *Cumberlege* 632 (**BKF**); Chaehom, *Panatkool* 416 (**ScCMU**); Sukhothai [Muang Kao District, *Maxwell* 71-684 (**AAU**, **BK**,

C [s]); Kamphaeng Phet [Mae Wong National Park, v. d. Bult 604 (**ScCMU**, **ScCMU** [s], **L**); idem., Watthana 1483 (**QBG** [s])]; NORTH-EASTERN: Loei [Phu Luang National Park, *Norsangsri* 1096 (**QBG**); idem., *Norsangsri* 1101 (**QBG**); Phu Ruea National Park, *KKU* 1435 (**KKU** [s]); idem., *Worachat* 371 (**KKU**); Phu Khum Thong, *Dee* 917A (**BKF**)]; EASTERN: Nakhon Ratchasima [Pak Thong Chai, *Phengnaren* 328 (**BKF**)]; PROVINCE NOT SPECIFIED: Thung Salaeng Luang National Park (Phitsanulok or Phetchabun), *Phusomsaeng et al.* 79 (**BKF**); WITHOUT LOCALITY: *Nanakorn et al.* 12680 (**QBG** [s]) [45 collections seen, 1 of them uncertain].

Distribution.— NE India to Indochina and the Philippines.

Ecology.— Found in evergreen, deciduous and pine forest with bamboo, frequently growing together with *Habenaria dentata*, also reported from sandy and disturbed areas; 300–1300 m altitude. Granite, limestone and phyllite were indicated as the bedrock. Flowering: July–Nov.(–Jan.).

Conservation.— Widespread and common in northern Thailand and also in the western parts of north-eastern and eastern Thailand. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 13a–d. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 79a–e. 1977; present paper: fig. 8a–e.

Notes.— *Habenaria malintana* is an unmistakable species with its comparatively large white flowers (median sepals 9.7–17 mm) with unlobed lips and without a spur. For the possible relationship with *H. dentata*, see above.

**20. *Habenaria lindleyana*** Steud., *Nomencl. Bot.*, ed. 2, 1: 717. 1840; Seidenf. & Smitinand, *Orchids Thailand*: 41, 727. 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): 101. 1977; *Opera Bot.* 114: 61. 1992, nom. nov. pro *Habenaria latifolia* Lindl., *Gen. Sp. Orchid. Pl.*: 321. 1835, non Kunth, 1816. Type: Sri Lanka (probably erroneous), *Macrae* s.n. (holotype ?**K-W** [see discussion in Seidenfaden, 1977: 102]).— *Habenaria columbae* Ridl., *Gard. Chron.* 1900 (2): 390. 1900; Seidenf. & Smitinand, *Orchids Thailand*: 37, 727. 1959–1965. Type: Peninsular Thailand, Oct., without locality, *Pereira* s.n. (holotype **SING**, barcode 0056342!).— *Habenaria macroptera* Gagnep., *Bull. Soc. Bot. France* 78: 72. 1931. Type: Vietnam, Mt Baria, Oct. 1866, *Pierre* s.n. (syntype **P!**); ? Laos, without locality, *Massie* s.n. (syntype **P!**). Fig. 9.

Terrestrial, deciduous, glabrous except for the sepals and the lip. *Stems* (15–)24–44(–50) cm tall. *Cataphylls* 2, tubular, sheathing, enveloping the stem up to 3 cm high. *Leaves* 3–5(–6), subradical, in a basal cluster and adpressed to the ground, broadly ovate, acute or acuminate, mucronate, 4.8–10(–15) by (2.1–)3–6(–8.5) cm, sometimes with an obscure pale semi-translucent border. *Bract-like leaves* (4–)6–10(–12), erect but tips often spreading, lanceolate, acute or acuminate, 1.4–3.5 cm long, with an obscure pale and semi-translucent border, margins entire, mostly enveloping the stem as an open sheath. *Inflorescences* lax to semi-dense, (2–)5–25-flowered; rachis (2–)5–15 cm long; floral bracts lanceolate, acuminate, 12–29 by 3–4(–6) mm, shorter than the pedicel plus the ovary, margins entire. *Flowers* (15–)17–25.5 mm across; white with greenish spur apex, base of lip midlobe greenish or with yellow-green markings, tepal outsides sometimes

with a green tinge, gynostemium white; flowers scented. *Ovary* (including pedicel) (22–) 25–34 mm long. *Sepals* rounded to subacute; median sepal erect, ovate-elliptic, 5-veined, 7–10 by (3–)4–7 mm; lateral sepals spreading, elongate-elliptic, 3-veined at the base and 7–10-veined above, 12–22(–24) by 6–10.5 mm, upper surface sometimes with short white scale-like hairs. *Petals* erect, forming a hood with the median sepal, triangular-oblong, acute, 1-veined, 7–11 by 1.7–3 mm. *Lip* (13–)15–25 mm long, 3-lobed from the base, with a collar to 1.5 mm high around the spur entrance, upper surface and sometimes also the margins with short white scale-like hairs; midlobe ovate-lanceolate, 3-veined, (11–)13–23 by 2.9–6 mm; side-lobes subulate, 3–6(–8) by 0.7–1.2(–1.5) mm; spur cylindric, (25–)31–40 mm long, slightly thickened in the upper two thirds. *Gynostemium* 3–4.5 mm long, anther loculi diverging towards the base, anther canals slender, 3–6 mm long, geniculate angled upwards, central rostellum lobe large, about two thirds of the anther in height, stigmas 3–4 mm long.

Thailand (selected specimens only).— NORTHERN: Chiang Mai [Doi Suthep, *Kerr* 261 (**K**); Mae Sa Valley, *Maxwell* 90-1257 (**CMU**, **L**); Doi Chiang Dao, *Vidal* 5251 B (**P**); Hod, *Wattana* 1836 (**QGB**, **QBG** [s]); Ob Luang, *Maxwell* 89-1257 (**CMU**); Chaeng Hualin, *Noi Man* s.n. (**BK** barcode SN243216); Doi Tao, *Smitinand* s.n. (**BKF** SN121849)]; Chiang Rai [Doi Tam Yup, *Garrett* 197 (**BK**, **BKF**, **K**); Nan [Tham Pa Tok, *Larsen et al.* 46431 (**AAU**, **BKF**); Lamphun [Doi Khun Tan National Park, *Maxwell* 93-1281 (**ScCMU**, **ScCMU** [s]); Pa Sang, *Maxwell* 04-603 (**ScCMU**, **ScCMU** [s]); Lampang [Doi Khun Tan National Park, *Maxwell* 94-1078 (**BKF**, **ScCMU**, **ScCMU** [s]); Chae Son National Park, *Maxwell* 95-803 (**ScCMU**, **ScCMU** [s], **L**); Tham Pha Thai National Park, *Maxwell* 96-1356 (**ScCMU**, **ScCMU** [s], **L**); Chaehom, *Palee* 1022 (**ScCMU**, **ScCMU** [s]); Phrae [Mae Ban, *Franck* 437 (**C**, **P**, **SING**); Song District, *Maxwell* 91-869 (**AAU**, **P**); Pha Nang Koi Cave, *Srisanga & Puff* 1076 (**QBG** [s]); Tak [Lansang National Park, *Niyomdham* 889 (**BKF**); Bhumiphon Dam, *Sanchai* 602 (**BK**); Ban Na, *Sinchai* 602 (**BCU**); Nakhon Sawan [Tham Phet Tham Thong Forest Park, v. d. *Bult* 927 (**ScCMU**, **ScCMU** [s]); NORTH-EASTERN: Phetchabun [Thung Salaeng Luang National Park, *Kerr* 0947 (**K**); Loei [Phu Kradueng National Park, *Dee* 351 (**BKF**, **C**, **P**); Wang Saphung, *Dee* 324 (**BKF**); Phu Khum Thong, *Dee* 917 (**BKF**, **C**); EASTERN: ? Chaityaphum [Thap Sathit District, *Pooma et al.* 2936 (**BKF**, **L**); Nakhon Ratchasima [*Sono* 39 (**BKF**, **C**); SOUTH-WESTERN: Phetchaburi [Nongyapong District, *Puudjaa* 1120 (**BKF** [s]); Uthai Thani [Huai Khakhaeng, *Phengklai* 3960 (**BKF**); Khao Phsa-shae, *Sakol* 3083 (**BK**); Kanchanaburi [Khao Salob, *Nimanong & Phusomsaeng* 294 (**BKF**); Sai Yok, *Chongko* 536 (**ScCMU**, **ScCMU** [s]); Ban Khao, *Thai-Danish Botanical Studies* 8082 (**C** [s]); Sisawat, *Kasem* 551 (**BK**); Erawan National Park, *Suddee* sub *Kurzweil* 2477 (**BKF**); Ban Kao, *Larsen* 8228 (**C**); Thong Pha Phum, *Matthapha* 48 (**KKU**); Hindat, *Seidenfaden & Smitinand* 1262 (**C** [s]); Ratchaburi [*Larsen et al.* 1554 (**AAU**, **P**); Prachuap Khiri Khan [Hua Hin, *Kasem* s.n. (**BK** barcode SN243215)]; CENTRAL: Lop Buri [Khao Pung-Huai, *Thaithong* 758 (**BCU**); Chai Badan, *Laksanakorn* 264 (**K**); Saraburi [Muak Lek, *Kerr* s.n. (**P** barcode 00411239); Sam Lan, *Maxwell* 74-713 (**AAU**, **BK**, **L**); Muang District, *Maxwell* 74-920 (**BK**); Ban Nong Bua, *Put* 1079 (**BK**, **K**); Hin Lap, *Put* 2402 (**BK**, **K**); SOUTH-EASTERN: Chon Buri [Sriracha, *Collins* 293 (**K**); Chanthaburi [Pong Namrawn, *Bunnak* 486 (**BKF**); PENINSULAR: no exact locality, *Pereira* s.n. (holotype of *Habenaria columbae* **SING**, barcode 0056342) [78 collections seen, 1 of them uncertain].

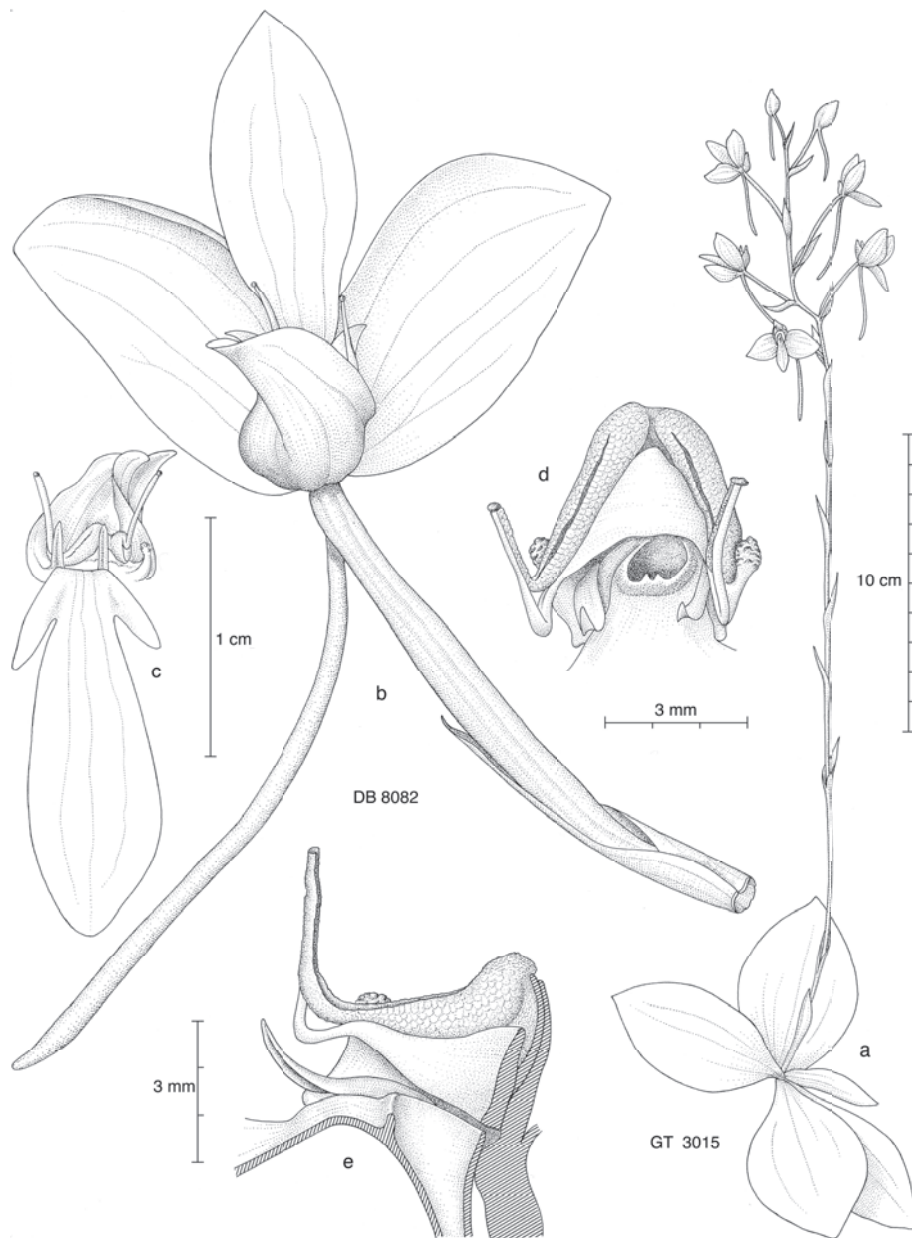


Figure 9. *Habenaria lindleyana* Steud.: a. plant; b. flower; c. lip and gynostemium; d. gynostemium; e. section through gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Distribution.— Laos and Vietnam.

Ecology.— This species is found in damp or dry soil in evergreen and mixed deciduous forest, pine forest and bamboo forest, often in open or disturbed areas or among rocks; 10–900 m altitude. Collector's notes indicate sandstone, granite, shale and limestone as the bedrock. Flowering: (June–)Aug.–Oct.(–Dec.), once recorded in April.

Conservation.— Widespread and common in the northern half of Thailand, with one record on the Thai Peninsula (exact locality not known). IUCN red list category 'Least Concern' (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 27a–c. 1959 [as *Habenaria columbae*]; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 61a–e. 1977; present paper: fig. 9a–e.

Notes.— *Habenaria lindleyana* is a common species in the northern parts of Thailand and can easily be recognised with its rosette of broad leaves adpressed to the soil and the large white flowers with lateral sepals that by far exceed the median sepal in length. Also the lip shape with its ovate-lanceolate midlobe and the much shorter subulate side-lobes is very characteristic.

The type collection of the conspecific *Habenaria columbae* was made somewhere in the Thai Peninsula.

The country of origin of Lindley's type of *Habenaria latifolia*, cited as Ceylon (= Sri Lanka), is probably a mistake as discussed by Seidenfaden (1977).

**21. *Habenaria lucida*** Wall. ex Lindl., *Gen. Sp. Orchid. Pl.*: 319. 1835; Seidenf., *Dansk Bot. Ark.* 31(3): 102. 1977; *Opera Bot.* 114: 63. 1992; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009).— *Platanthera lucida* Lindl. in Wallich, *Numer. List*: 7047. 1832. nom. inval.— *Platantheroides lucida* (Wall. ex Lindl.) Szlach., *Richardiana* 4: 107. 2004.— *Habenella lucida* (Wall. ex Lindl.) Szlach. & Kras-Lap., *Richardiana* 6: 37. 2006. Type: Myanmar, Yangon, *Wallich* s.n., *Wall. Cat.* 7047 (?holotype **K-W**).— *Habenaria recurva* Rolfe ex Downie, *Bull. Misc. Inform. Kew* 1925: 420. 1925; Seidenf. & Smitinand, *Orchids Thailand*: 33, 727. 1959–1965. Type: Thailand, Chiang Mai, Doi Suthep, 1800 ft, in mixed jungle, 19 Aug. 1909, *Kerr* 190 (holotype **K!**; isotypes **L!**, **P**). Fig. 10.

Terrestrial, deciduous, glabrous except sometimes for the bract margins. *Stems* (28–)41–75 cm tall. *Cataphylls* 1–3, tubular, sheathing, enveloping the stem base to 5 cm high, uppermost often with a blade to 5 by 2.5 cm. *Leaves* (2–)4–5(–6), spreading, cauline and clustered in the lower quarter of the stem, lanceolate-elliptic, slightly petiolate, acute, acuminate or rarely obtuse, mucronate, (6–)12–27 by (1.5–)5–6.7 cm, sometimes with an obscure pale border. *Bract-like leaves* (5–)6–10(–16), erect to suberect, lanceolate, acuminate, 1.3–2.7(–4) cm long, not sheathing, margins entire, minutely denticulate or shortly glandular-hairy. *Inflorescences* semi-dense, many-flowered; rachis (11–)15–30(–37) cm long; floral bracts lanceolate, acuminate, (7–)11–23 by 2–5 mm, shorter or longer than the pedicel plus the ovary, margins often shortly glandular-hairy. *Flowers* (6–)9–15 mm across; green, greenish white or yellow-green, gynostemium light green, anther



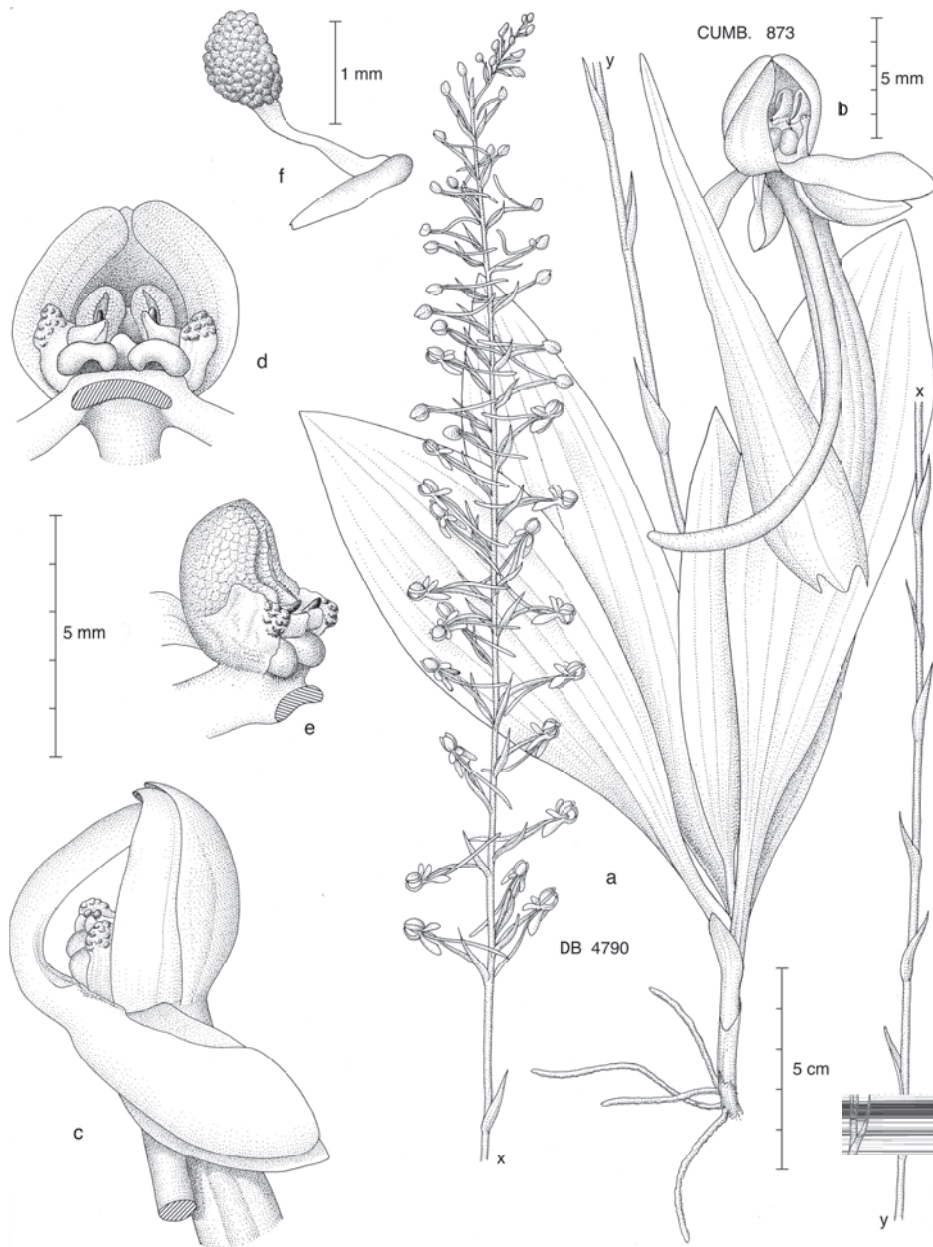


Fig. 10. *Habenaria lucida* Wall. ex Lindl.: a. plant; b.-c. flower; d.-e. gynostemium; f. pollinarium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.



yellow. *Ovary* (including pedicel) 15–20 mm long. *Sepals* rounded, 3-veined; median sepal erect, suborbicular, 3.5–5.1 by 2.7–4(–5.5) mm; lateral sepals reflexed, ovate-elliptic, 4–6 by 1.7–3.5 mm. *Petals* erect, forming a hood with the median sepal, triangular-oblong, obtuse or truncate, veins not prominent, 3.3–4.5 by 1.5–2.8 mm. *Lip* 4–6 mm long, deeply 3-lobed from the base, lobes elliptic-oblong, obtuse, fleshy; midlobe 3.5–5(–6) by 1.2–3.2 mm, curved upwards and adnate to the tips of the petals and the median sepal; side-lobes oblong-elliptic, 3.5–6(–8) by 1.2–2.5 mm, fleshy, recurved; spur cylindric, 16–25 mm long, longer than the ovary. *Gynostemium* 2.3–3 mm long, anther reflexed, anther canals very short, stigmas stout, to 1.2 mm thick.

Thailand.— NORTHERN: Mae Hong Son [Mae Sariang, *Pumicong* 413 (**QBG**, **QBG** [s]); Khun Yuam, *Larsen & Larsen* 34216 (**AAU**, **P**, **L**); Chiang Mai [Doi Suthep, *Garrett* 1357 (**K**); *idem.*, *Kerr* 190 (holotype of *Habenaria recurva* **K**, isotype **L**); ? *idem.*, *Maxwell* 89-981 (in bud) (**CMU**); *idem.*, *Sørensen et al.* 4790 (**C**); *idem.*, *Seidenfaden & Smitinand* 2658 (**C** [s]); *idem.*, *Seidenfaden & Smitinand* 2698 (**C** [s]); Mae Chaem, *Kerr* s.n. (**K** H2007/02483-55); *idem.*, *Kerr* s.n. (**BK** barcode SN243218); Hang Dong, *Maxwell* 87-908 (**CMU**, **L**); San Kam Phaeng, *Maxwell* 89-966 (**CMU**); *idem.*, *Maxwell* 96-1165 (**ScCMU**, **ScCMU** [s], **L**); Doi Chiang Dao, *Maxwell* 90-1044 (**CMU**); Omkoi, *Pumicong* 379 (**QBG**, **QBG** [s], **SING**); Phayao [Doi Luang National Park, *Petrmitr* 149 (**ScCMU**); Lamphun [? Doi Khun Tan National Park, *Maxwell* 93-1086 (in bud) (**ScCMU**, **ScCMU** [s]); *idem.*, *Maxwell* 94-929 (**BKF**, **ScCMU**, **ScCMU** [s], **L**); Lampang [Chae Son National Park, *Maxwell* 95-541 (**BKF**, **ScCMU**, **ScCMU** [s], **L**); *idem.*, *Maxwell* 95-750 (**ScCMU**, **ScCMU** [s]); *idem.*, *Maxwell* 96-1150 (**BKF**, **ScCMU**, **ScCMU** [s], **L**); Doi Luang National Park, *Maxwell* 97-940 (**BKF**, **ScCMU**, **ScCMU** [s]); Phrae [Mae Ban, *Franck* 1473 (**C**, **L**); Tak [Mae Sot District, *Maxwell* 94-895 (**ScCMU**, **ScCMU** [s], **L**); Umphang, *Seidenfaden & Smitinand* 7847 (**C** [s]); *idem.*, *Worachat* 49 (**KKU** [s]); NORTH-EASTERN: Phetchabun [Thung Salaeng Luang National Park, *Kerr* 0942 (**BK**, **C**, **K**); Udon Thani [Phu Pra Bath National Park, *Thammatawon* 168 (**KKU** [s]); Sakon Nakhon [Phu Phan National Park, *Auemporn* 11/1999 (**KKU** [s]); *idem.*, *Thammatawon* 91 (**KKU** [s]); EASTERN: Nakhon Ratchasima [Wang Nam Khiao, *Damrongsak Praphat* 192 (**BKF**); Ubon Ratchathani [Pha Taem National Park, *Boonjaras* 112 (**BCU**); SOUTH-WESTERN: Kanchanaburi [Erawan National Park, *Suddee* sub *Kurzweil* 2475 (**BKF**); ? Ban Erawan, *Shimizu et al.* T 21497 (in bud) (**BKF**); Thong Pha Phum, *Kurzweil* 2479 (**BKF**); *idem.*, *Wongprasert* 998-05 (**BKF**); no exact locality, *Robinson* K245 (**K** [s]); CENTRAL: Saraburi [Muang District, *Maxwell* 74-767 (**AAU**, **BK**, **C** [s], **L**); SOUTH-EASTERN: Prachin Buri [Ban Beung, *Cumberlege* 873 (**C** [s], **K**, **K** [s]); Ban Bung hills, *Larsen et al.* 1141 (**AAU**); no exact locality, *Songkakul* 28 (**BKF** [s]); *idem.*, *Thaithong* 467 (**BCU**, **BCU** [s]); LOCALITY ILLEGIBLE: without collector (**K** 2007/02483-53); WITHOUT LOCALITY: *KKU* 1064 (**KKU** [s]); *idem.*, *Pumicong* 373 (**QBG**, **QBG** [s]) [45 collections seen, 3 of them uncertain].

Distribution.— Myanmar, Indochina and S China.

Ecology.— Found mostly in deciduous and bamboo forest and frequently in areas of mild disturbance, rarely in evergreen forest; sometimes reported near streams or on rocky ground; 50–1300 m altitude. Shale and limestone have been noted as the bedrock. Flowering: (June–)Aug.–Sept.(–Nov.).

Conservation.— Widespread and common in the northern half of Thailand. IUCN red list category 'Least Concern' (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 23, t. II (2656). 1959 [as *Habenaria recurva*]; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 62a–f. 1977; present paper: fig. 10a–f.

Notes.— The most obvious diagnostic character of the species is the lip midlobe of the small green flowers which is curved upwards and adnate to the tips of the petals and the median sepal. Also the reflexed oblong-elliptic lip side-lobes and the long thin spur are very characteristic.

A specimen at K (*sine* collector, K 2007/02483-53!) is rather atypical in the small plant size (28 cm) and in its narrow leaves (to 1.5 cm) but agrees with *Habenaria lucida* very well in all other characters.

**22. *Habenaria acuiifera*** Wall. ex Lindl., *Gen. Sp. Orchid. Pl.*: 325. 1835; Seidenf. & Smitinand, *Orchids Thailand*: 35, 36. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): 106. 1977; *Opera Bot.* 114: 63. 1992; Pearce & Cribb, *Fl. Bhutan* 3(3): 155. 2002 [as *acutifera*]; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009).— *Platanthera acuiifera* Lindl. in Wallich, *Numer. List* 7045. 1832. nom nud. Type: Myanmar, Tavoy, Wallich s.n., Wall. Cat. 7045 (holotype **K-LINDL** [*fide* Pearce & Cribb], drawing seen; isotype **K-W**). Fig. 11.

Terrestrial, deciduous, glabrous except for the bract and tepal margins. *Stems* (17–)24–30(–52) cm tall. *Cataphylls* 2–4, tubular, sheathing, 0.8–3.4(–5) cm long, apical part spreading and often with a small acute and mucronate blade to 2 by 1.5 cm, often with pale border. *Leaves* (1–)2–3, spreading, cauline and scattered in the lower stem half, lanceolate-oblong, acute, mucronate, 3–13(–19) by 0.4–2.2 cm, mostly with pale and semi-translucent border. *Bract-like leaves* 6–11(–15), suberect or spreading, narrowly lanceolate, acuminate, sheathing at the base, 1.4–4.5(–8.5) cm long, with stiff short hairs or elongate papillae on the margins, sometimes with pale and semi-translucent border. *Inflorescences* lax to subdense, 10–18-flowered; rachis 2.5–5(–6) cm long; floral bracts lanceolate, acuminate, 9–18(–25) by 1.3–2.2 mm, almost always with stiff short hairs on the margins. *Flowers* 8–10 mm across; yellow to greenish yellow, white or orange, once also recorded as brown with yellow lip, spur often green in the upper half; sometimes the sepals and less often also the petals with stiff short hairs on the margins; flowers once reported as fragrant. *Ovary* (including pedicel) 8–16(–24) mm long, smooth. *Sepals* subacute, 3- or several-veined; median sepal erect, ovate-lanceolate, 3–5.2 by 2–5 mm; lateral sepals recurved, more or less strongly obliquely ovate-lanceolate, 5–7 by 2.7–4.5 mm. *Petals* erect, oblong, obtuse, 1- or 2-veined, cohering with the median sepal, 3.5–4.8(–5) by 0.9–2.1(–2.6) mm, sometimes papillose on the margins. *Lip* 6–12 by 2.5–5.5 mm, 3-lobed to the base, with a prominent collar in front of the spur entrance; midlobe linear to oblong, 5–10(–12) by 0.5–0.9 mm; side-lobes linear, 1–3 by 0.3–0.6(–0.8) mm, shorter than the midlobe and ranging from about one third to one half of its length; spur cylindric, clavate in the upper third, shorter than the pedicel and the ovary, 7–19 mm long. *Gynostemium* 2.2–4 mm long, anther erect, anther canals ca 2 mm long, central rostellum lobe about half as long as the anther.

Thailand.— NORTHERN: Mae Hong Son [Khun Yuam, *Larsen & Larsen* 34090 (**AAU**, **B**, **BKF**, **K**); Huai Hei, *Triboun* 219 (**l**) (**BK** [s]); Chiang Mai [*Kerr* s.n. (**C** [s] vial 150)]; Phitsanulok [Chattrakan District, *Wongnak* 100 (**QBG** [s]); no exact locality, *Smitinand* s.n. (**BKF** SN114282)]; NORTH-EASTERN: Phetchabun [Thung Salaeng Luang National Park, *Kerr* 0945 (**BK**, **C** [s], **K**); Nam Nao National Park, *Shimizu et al.* T 18295 (**C** [s]); Loei [Phu Kradueng National Park, *Din Nakkaru* 155 (**BKF**); idem., *Prakop Burma* 62 (**BKF**); Kalasin [Phu Sing, *Sakol* 3489 (**BK**); EASTERN: Chaiyaphum [Phu Khiao, *Phengkklai et al.* 12302 (**BKF**); no exact locality, *Thaithong* 865 (**BCU** [s]); Surin

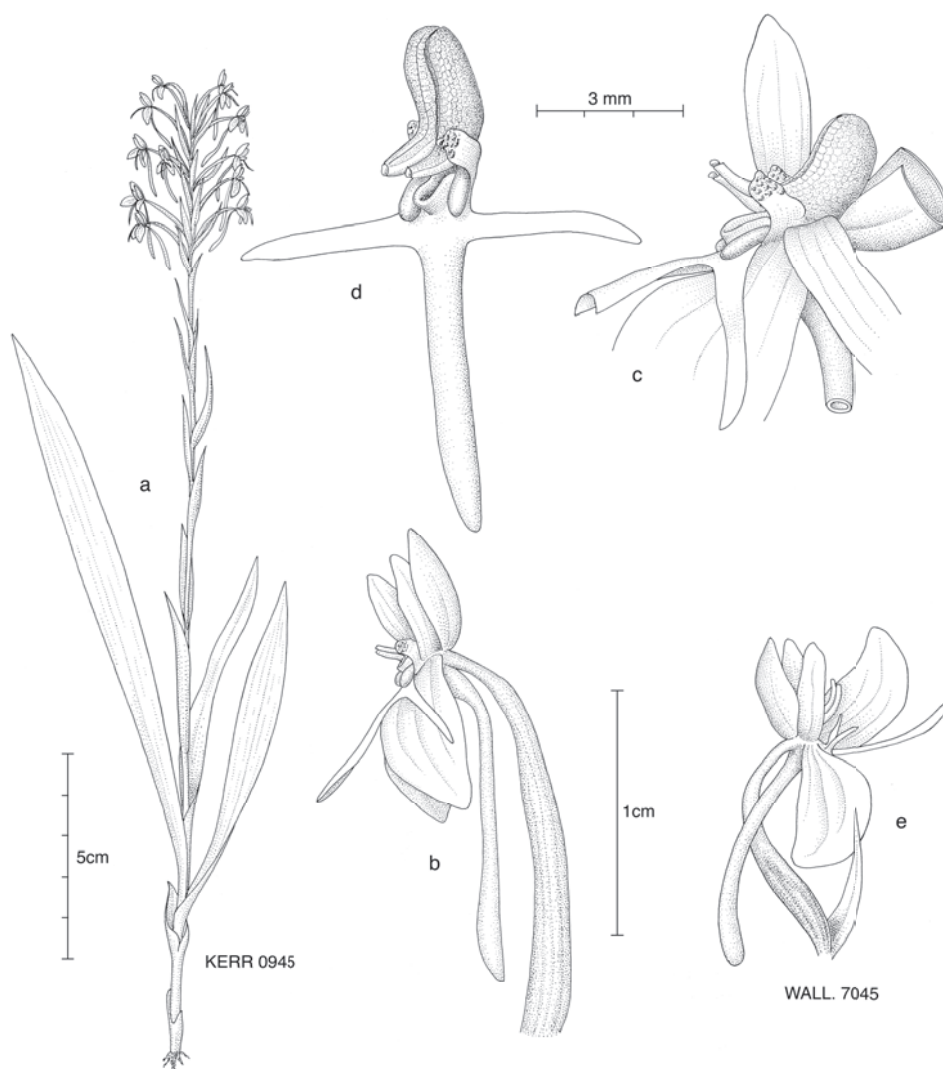


Figure 11. *Habenaria acuifera* Wall. ex Lindl.: a. plant; b., e. flower; c. gynostemium; d. lip and gynostemium. e. from the type specimen. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

[Thatum, Sakol 2093 (**BK, C [s]**); Ubon Ratchathani [Phibun Mangsahan, Pooma *et al.* 2210 (**BKF, L**); Pho Sai District, *Suddee* 789 (**BKF [s]**); WITHOUT LOCALITY: *Comber* 1608 (**K**); *Tiptabiankarn* 1194 (**Suan Luang [s]**) [17 collections seen].

Distribution.— NE India to Indochina and S China, possibly also Peninsular Malaysia.

Ecology.— Occasionally found in evergreen forest, open deciduous dipterocarp forest and pine forest, also in grassy areas by the roadside or in swampy places; 50–1300 m altitude. Flowering: July–Sept.(–Nov.).

Conservation.— Known from 17 collections made in northern, north-eastern and eastern Thailand, with some of the localities situated in national parks. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf., Dansk Bot. Ark. 31(3): fig. 64a–e. 1977; present paper: fig. 11a–e.

Notes.— *Habenaria acuifera* is very similar to *H. chlorina* with its small and mostly yellow flowers and the comparatively short lip side-lobes but can easily be distinguished by the recurved or reflexed and oblique lateral sepals and the collar around the spur entrance. It is also similar to the Chinese *H. linguella* Lindl. although this has a considerably longer spur.

**23. *Habenaria chlorina*** E.C.Parish & Rchb.f., Trans. Linn. Soc. London 30: 140. 1874; Seidenf. & Smitinand, Orchids Thailand: 28, 726. 1959–1965; Seidenf., Dansk Bot. Ark. 31(3): 106. 1977; Opera Bot. 114: 63. 1992. Type: Myanmar, Moulmein, *Parish* 214 (syntype **K!**); Myanmar, Amherst, *Parish* 245 (syntype **K!**). Fig. 12.

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* 12–30(–66) cm tall. *Cataphylls* 2–4, tubular, largely sheathing, enveloping the stem base to 7 cm high, with a free and spreading apical part, acute, mucronate, with a pale semi-translucent border, uppermost often with a small blade to 1 cm long. *Leaves* 3–5, spreading, cauline and scattered in the lower stem half, lanceolate-oblong, acute, mucronate, 4–17 by 0.4–1.1 cm, margins entire with pale semi-translucent border. *Bract-like leaves* 1–7, narrowly lanceolate, acute or acuminate, 1.4–5.5 cm long, erect or suberect, not or only basally sheathing and spreading above, margins with papillae or coarse stiff hairs 0.2–0.3 mm long, sometimes with an obscure pale border. *Inflorescences* lax or semi-dense, 6–30-flowered; rachis 2–8 cm long; floral bracts narrowly lanceolate, acute or acuminate, 11–17 by 1–2.5 mm, slightly longer than the pedicel plus the ovary, with marginal short hairs similar to those on the bract-like leaves. *Flowers* 8–10 mm across; mostly yellow and sometimes tinged with red, also reported as greenish with brown spots, or sepals brown and petals yellow, once reported as having a white lip, spur greenish yellow, gynostemium whitish, cream or greenish yellow; a few times reported as odourless. *Ovary* (including pedicel) 10–15 mm long, ridged but smooth. *Sepals* oblong-ovate, obtuse, several-veined, upper part often papillose on the margins; median sepal erect, hooded, 3.6–5 by 2.5–3.5 mm; lateral sepals usually spreading, not or only weakly oblique, 3-veined, 4–6 by 2.6–3.9 mm. *Petals* erect and forming a hood with the median sepal, ovate-oblong, obtuse, 1-veined, 3.7–5.5 by 1.2–2.4 mm, upper part often papillose on the margins. *Lip* 4–6(–7)

by 1.5–1.7 mm, deeply 3-lobed to near the base, without a raised ridge in front of the spur entrance; midlobe linear-oblong, 4.2–5.8 by 0.5–1.4 mm; side-lobes narrowly triangular, spreading, 2–3.8 by 0.4–0.8 mm; spur cylindric, widened at the base and clavate in the apical third, (8–)8.5–10.8 mm long. *Gynostemium* 2–3 mm long, anther canals 1–1.5 mm long, straight projecting forwards, stigma 1.5–1.8 mm long.

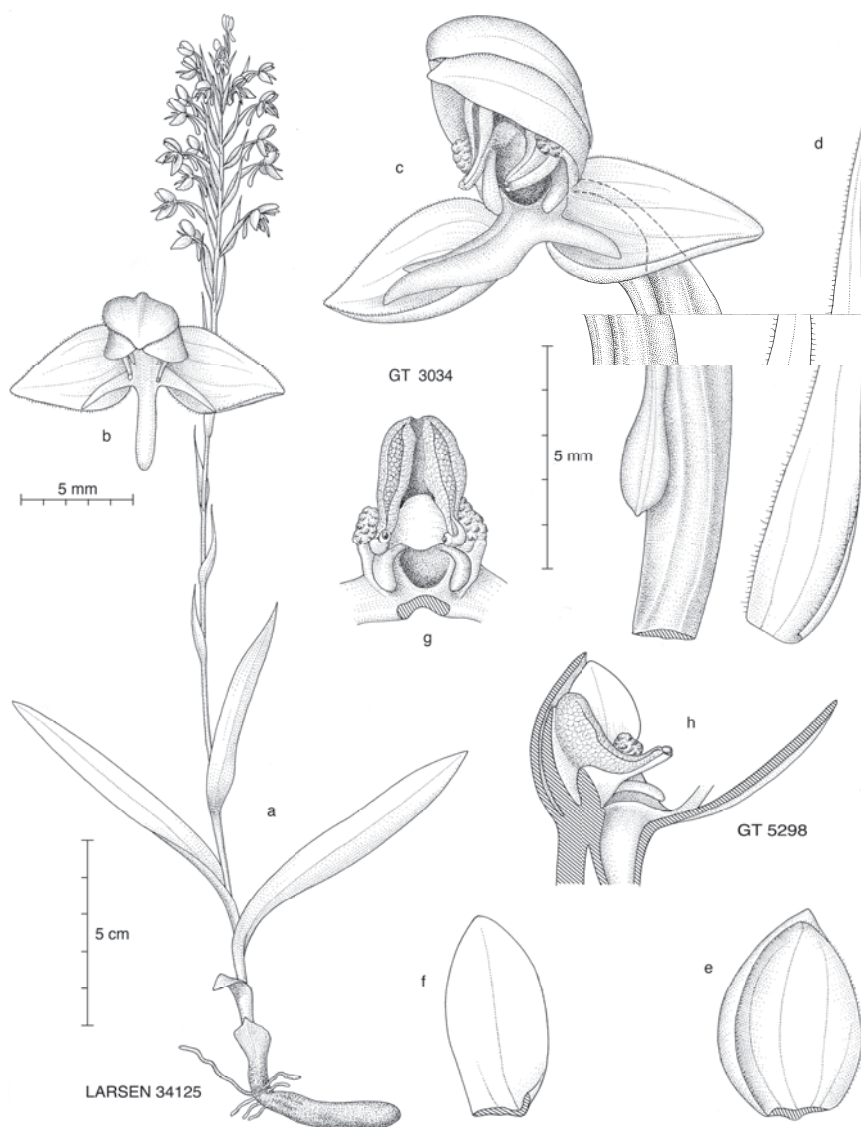


Figure 12. *Habenaria chlorina* E.C.Parish & Rchb.f.: a. plant; b.–c. flower; d. floral bract; e. median sepal; f. petal; g. gynostemium; h. section through gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.



Thailand.— NORTHERN: Mae Hong Son [Khun Yuam, *Larsen & Larsen* 34125 (AAU); Mae Sariang Road, *Seidenfaden & Smitinand* 5298 (C [s]); Mae La Noi, *Srisanga & Puff* 1040 (QBG)]; Chiang Mai [Doi Suthep, *Kerr* 236 (K); idem., *Kerr* 312 (K); idem., *Seidenfaden* 3034 (K [s]); Mae Jam District, *Maxwell* 96-1039 (BKF, ScCMU, ScCMU [s], L); Omkoi, *Maxwell* 96-1069 (BKF, ScCMU, ScCMU [s], L); idem., *Pumicong* 383 (QBG, SING); idem., *Pumicong* 384 (QBG, QBG [s]); Hod District, *Sankamethawee* 236 (ScCMU, ScCMU [s], L); Mae Rim, *Nanakorn et al.* 9695 (QBG); Wieng Hang, *Prateep Rojanadiloke* s.n. (BKF [s]); Mae Taeng, *Seidenfaden & Smitinand* 3034 (C [s]); Mae Sanam, *Smitinand* s.n. (BKF SN076974); Mae Chaem, *Seidenfaden & Smitinand* 9546 (C [s]); Lamphun [Mae Lee, *Winit* 1239 (BK)]; Phrae [Mae Tang, *Nanakorn et al.* 1417 (QBG); idem., *Sørensen et al.* 4710 (BKF, C); idem., *Sørensen et al.* 4716 (BKF, C)]; Sukhothai [Khao Luang, *Niyomdham* 3949 (BKF)]; NORTH-EASTERN: Phetchabun [Nam Nao National Park, *Worachat* 76 (KKU [s]); idem., *Worachat* 274 (KKU [s]); idem., *Murata et al.* T 51777 (BKF)]; Nong Khai [*Thaithong* 506 (BCU [s])]; Sakon Nakhon [Phu Phan National Park, *Auemporn* 7/1999 (KKU [s]); idem., *Thammatawon* 92 (KKU [s])]; WITHOUT LOCALITY: *KKU* 847 (KKU [s]); *KKU* 905 (KKU [s]); *Thorut* 182 (BCU [s]); without collector (BKF [s]) [31 collections seen].

Distribution.— Myanmar and Laos.

Ecology.— Occasionally or common in moist or dry ground in dipterocarp, oak and pine forest, often in sandy soil; 350–1300 m altitude. Granite was noted as the bedrock. Flowering: mainly in Aug. and Sept., rarely recorded as late as Nov.

Conservation.— Widespread and common in northern and north-eastern Thailand. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— *Seidenf. & Smitinand*, *Orchids Thailand*: fig. 18a–d. 1959; *Seidenf.*, *Dansk Bot. Ark.* 31(3): fig. 63a–h. 1977; present paper: fig. 12a–h.

Notes.— This is a very distinct species, characterised by the 3-lobed lip with short side-lobes, the lack of any ornaments on the lip and the spreading lateral sepals which are not or only slightly oblique.

**24. *Habenaria rostellifera*** Rchb.f., *Otia Bot. Hamburg.*: 34. 1878; *Seidenf. & Smitinand*, *Orchids Thailand*: 36. 1959; *Seidenf.*, *Dansk Bot. Ark.* 31(3): 108. 1977; *Opera Bot.* 114: 63. 1992; *Seidenf. & Wood*, *Orchids Penins. Malaysia & Singapore*: 113. 1992; *Chen et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009). Type: ‘Siam or Cambodia’, *Godefroy* 737 (holotype K!).— *Habenaria roseata* Ridl., *J. Straits Branch Roy. Asiat. Soc.* 49: 42. 1908; *Seidenf. & Smitinand*, *Orchids Thailand*: 35, 36, 727. 1959–1965. Type: Trang, June 1906, cultivated at Penang, without collector and number (holotype SING!).— *Habenaria craibiana* Kerr & Rolfe, mss.— *Habenaria downii* Ridl., mss. Fig. 13.

Terrestrial, deciduous, glabrous except for the bract and tepal margins. *Stems* (16–)23–50 cm tall. *Cataphylls* 2, to 2.5 cm long, tubular, erect, largely sheathing, with a spreading blade to 5 mm long, sometimes with a distinct pale semi-translucent border. *Leaves* 2–4, spreading, cauline and scattered in the lower stem half, narrowly oblanceolate-oblong, acute and often mucronate, 4.3–7(–13) by 0.5–1.4 cm, with a



pale semi-translucent border. *Bract-like leaves* 5–8(–11), erect or suberect, lanceolate, acuminate, 2–4(–5.3) cm long, not sheathing, with a prominent or obscure pale and semi-translucent border, margins minutely denticulate to coarsely and shortly glandular-hairy. *Inflorescences* lax to semi-dense, (3–)5–17-flowered; rachis 1.6–3(–5) cm long; floral bracts lanceolate, acuminate, 10–15 by 1.8–3 mm, shorter than the pedicel plus the ovary, margins coarsely and shortly glandular-hairy. *Flowers* 10–15 mm across; mostly pale salmon-pink, pale brown or white, lateral sepals usually with large brown or green blotch in the middle, a few times flowers reported as having chocolate-coloured sepals and white petals, turning dark or to reddish-brown with age; once reported as fragrant; margins of median sepal and petals mostly minutely denticulate or coarsely and shortly glandular-hairy. *Ovary* (including pedicel) (17–)20–25 mm long, with a long beak. *Sepals* rounded to subacute, 3-veined; median sepal erect, suborbicular, 3.9–5.4 by 3–5 mm; lateral sepals reflexed, very obliquely ovate, 5.8–7.5(–8) by 3.3–5.4 mm. *Petals* erect, forming a hood with the median sepal, triangular-oblong, subacute, veins not prominent, 4–5 by 1–2.1 mm, united with the median sepal and the lip base. *Lip* 7–13 mm long, deeply 3-lobed above a short united part, with an obscurely 3-lobed pustulate erect tongue 3–4 mm long in front of the spur entrance which protrudes above the anther canals when seen from the side; midlobe linear to oblong, (5.5–)8–12 by 1–1.6 mm; side-lobes linear to oblong, (7–)8–10(–11.5) by 0.5–1 mm; spur cylindric, 15–23(–25) mm long, nearly as long as the ovary to slightly longer, geniculate, thickened apically. *Gynostemium* 3–4 mm long, anther canals 3–5 mm long, geniculately bent upwards at the middle, stigmas 3–4 mm long. *Fruit* sessile, elliptic-fusiform, to 25 by 4.5 mm, beak to 13 mm long.

Thailand.—NORTHERN: Chiang Mai [San Sai, *Sørensen et al.* 5027 (**C**, **C** [s]); Doi Suthep, *Kerr* 121 (**K**); idem., *Maxwell* 89-1182 (**CMU**); idem., *Sørensen et al.* 4791 (**C**); idem., *Sørensen et al.* 5079 (**C**); ? Chiang Dao, *Maxwell* 89-1094 (in bud) (**CMU**); Mae Rim, *Srisanga & Maknoi* 2190 (**QBG**); no exact locality, *Kerr* s.n. (**K** H2007/02483-85)]; Lamphun [Khun Tan National Park, *Tagawa et al.* 9218 (**C** [s])]; Phrae [Mae Tang, *Seidenfaden* 3022 (**C** [s])]; Sukhothai [Srichalieng, *Kasem* 258 (**BK**)]; NORTH-EASTERN: Phetchabun [Thung Salaeng Luang National Park, *Marcan* 2720 (**BM**)]; Loei [Sitan, *Dee* 183 (**P**)]; EASTERN: Chaiyaphum [Nong Bua Deng, *Larsen et al.* 31876 (**AAU**, **K**)]; SOUTH-WESTERN: Kanchanaburi [*Thaithong* 245 (**BCU**, **BCU** [s])]; CENTRAL: Lop Buri [Chaibadal, *Maitri Banthoengsuk* 15 (**BKF**)]; ? Saraburi [Ban Nong Bua, *Put* 1099 (**K**)]; SOUTH-EASTERN: Sa Kaeo [Aranya Prathet, *Seidenfaden & Smitinand* 8192 (**C** [s])]; Prachin Buri [*Songkakul* 103 (**BKF** [s])]; Rayong [Phu Khao Ya, *Worachat* 37 (**KKU** [s])]; Chanthaburi [Makam, *Larsen* 10085 (**BKF**, **C** [s]); idem., *Phengklai* 1082 (**BKF**, **L**); idem., *Seidenfaden & Smitinand* 3563 (**C** [s]); idem., *Seidenfaden & Smitinand* 8188 (**C** [s]); idem., *Smitinand* s.n. (**BKF** SN077047); idem., *Wattana* 1379 (**QBG** [s]); Muang District, *Maxwell* 73-391 (**BK**)]; Trat [*Smitinand* 1328 (**BKF**)]; PENINSULAR: Chumphon [Sa Wee, *Khompat* KK1 (**PSU**); idem., *Triboun & illegible* 461 (**I**) (**BK** [s]); no exact locality, *Larsen et al.* 1440 (**AAU**, **BKF**, **L**); idem., *Suddee* 320 (**BCU** [s]); idem., *Thaithong* 883 (**BCU** [s])]; Surat Thani [Kanchanadit, *Kerr* 0426 (**BK**, **K**); Kantuli, *Put* 4202 (**K**)]; Nakhon Si Thammarat [Thung Song, *Rabil* 99 (**C**, **K**, **L**)]; Trang [Khao Chong, *Sakol* 3383 (**BK**); Sikao, *Eiadthong* W-5 (**BKF**); idem., *Eiadthong* s.n. (**BKF** [s]); no exact locality, without collector and number (holotype of *Habenaria roseata* **SING**); idem., *Seidenfaden & Smitinand* 8878 (**C** [s])]; Songkhla

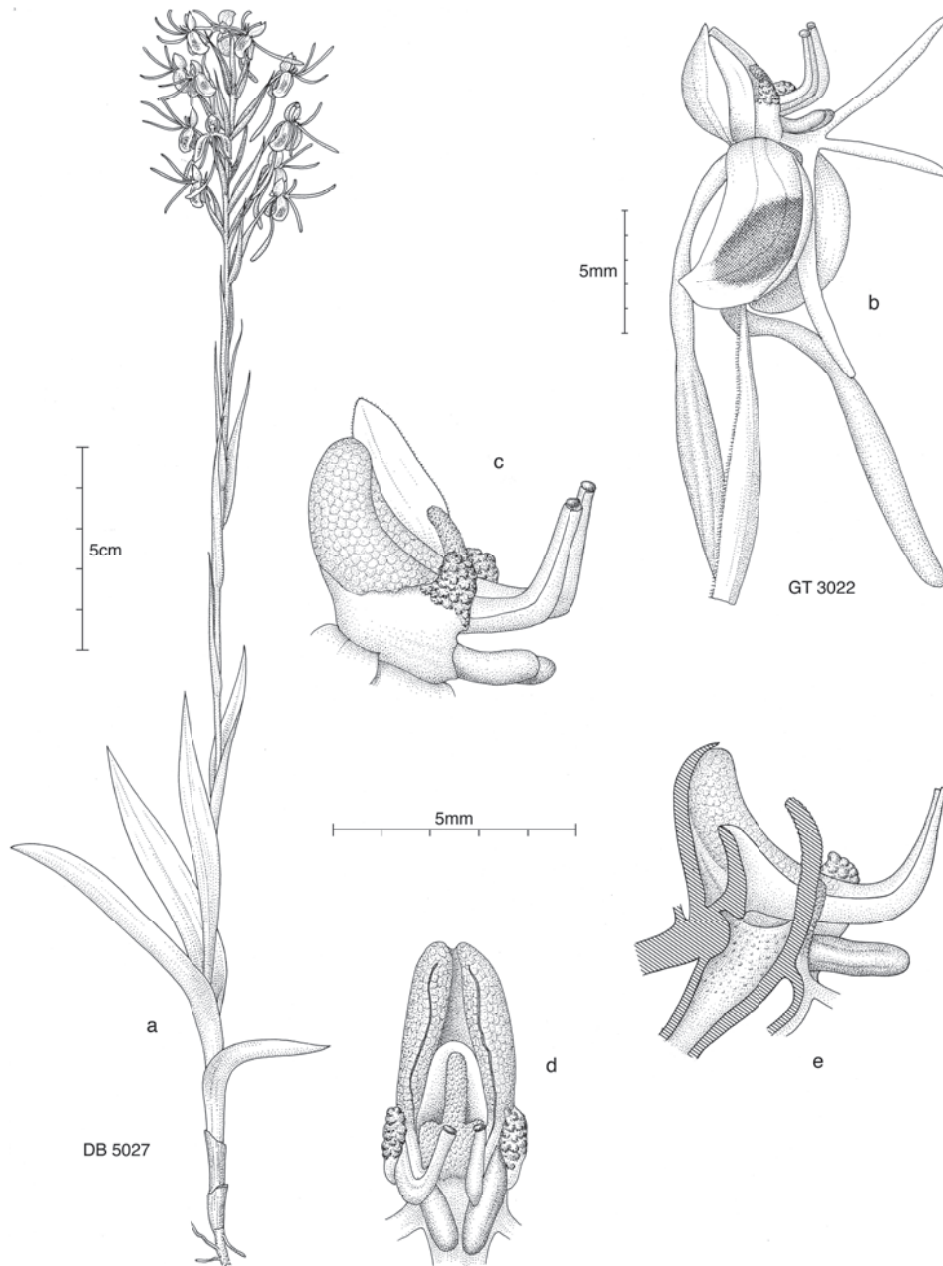


Figure 13. *Habenaria rostellifera* Rchb.f.: a. plant; b. flower; c.–d. gynostemium; e. section through gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

[Sadao, *Kerr* 0617 (**BK**, **K**); Had Yai District, *Maxwell* 84-463 (**BKF**, **C** [s], **PSU**); Pattani [Bannang Sta, *Kerr* 049 (**BK**, **K**); idem., *Kerr* 049A (**BK**, **K**)]; UNSPECIFIED: 'Siam and Cambodia', *Godefroy* 737 (holotype **K**); LOCALITY AND COLLECTOR ILLEGIBLE: (**K**); WITHOUT LOCALITY AND COLLECTOR: s.n. (**C** [s] vial 341); s.n. (**BKF** [s]); BKF s.n. (**BKF** 18288) [50 collections seen, 2 of them uncertain].

Distribution.— Indochina, Peninsular Malaysia and S China.

Ecology.— Found in open places in deciduous forest, in scrub vegetation and in open savanna, also collected in paddy fields, marsh and scrub; from near sea level to 1120 m altitude. Granite is reported as the bedrock; occasionally the species is found on lateritic soils near sea-level. Flowering: June–Sept.(–Nov.).

Conservation.— Widespread and common throughout Thailand except the extreme eastern parts. IUCN red list category 'Least Concern' (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 26a–c, t. XXXII (3563). 1959–1965 [as *Habenaria roseata*]; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 66a–e. 1977; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: fig. 48a–e. 1992; present paper: fig. 13a–e.

Notes.— The prominent 3–4 mm long pustulate tongue in front of the rostellum of this species which is visible as a projecting structure above the anther canals is not found in any other Thai *Habenaria* species. Another easily visible diagnostic character is the lip with its three spreading linear and about equally long lobes and the fairly long anther canals which are geniculately bent upwards. Both *H. rostellifera* and the following species, *H. rostrata*, have ovaries with a prominent beak which can also be clearly seen in the fruiting stage.

The tongue in front of the rostellum is an outgrowth of the lip as shown by Seidenfaden (1977: 110). In the past this structure was sometimes regarded as part of the rostellum. In fact Reichenbach's name *rostellifera* was coined after this perceived origin.

**25. *Habenaria rostrata*** Wall. ex Lindl., *Gen. Sp. Orchid. Pl.*: 325. 1835; Seidenf. & Smitinand, *Orchids Thailand*: 36. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): 110. 1977; *Opera Bot.* 114: 63. 1992; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009).— *Platanthera rostrata* Lindl. in Wallich, *Numer. List*: 7051. 1832. nom. inval. Type: Myanmar, Prome, *Wallich* s.n., *Wall. Cat.* 7051 A (holotype **K**, drawing seen; isotype **GH**). Fig. 14.

Terrestrial, deciduous, glabrous except for the bract margins and the ovary. *Stems* 17–38 cm tall. *Cataphylls* 2–4, erect, tubular, sheathing, enveloping the stem to 5 cm high, uppermost with a blade to 2 by 0.8 cm, with a distinct pale semi-translucent border. *Leaves* 2–4, spreading, cauline and scattered in the lower stem half, narrowly oblanceolate-oblong, acute, mucronate, 4.5–12 by (0.4–)0.8–1.4 cm, with a pale semi-translucent border. *Bract-like leaves* 6–9(–11), erect or suberect, lanceolate, acuminate, 2–5 cm long, not sheathing, with a prominent or obscure pale and semi-translucent border, margins denticulate or coarsely and shortly glandular-hairy. *Inflorescences* lax to semi-dense, (3–)7–18-flowered; rachis (2–)3–7 cm long; floral bracts lanceolate, acuminate,

9–18 by 1–3 mm, shorter than the pedicel plus the ovary, margins coarsely and shortly glandular-hairy. *Flowers* 10–12 mm across (excluding lip); mostly brown, orange-brown or red-orange, but also recorded as yellow or white with dark brown lip, once recorded as purple with white lip, spur or its tip sometimes green. *Ovary* (including pedicel) 19–27 mm long, with a long and narrow beak, hairy. *Sepals* rounded to subacute, 3-veined, margins mostly minutely denticulate; median sepal erect, suborbicular, (3–)3.5–4. 2 by 3–4 mm; lateral sepals reflexed, very obliquely ovate, 5.5–7 by 3–4.8 mm. *Petals* erect, forming a hood with the median sepal, triangular-oblong, subacute, veins not prominent, (3–)4–4.2 by 1.7–1.8 mm, basally strongly united with the lateral sepals and the lip, margins mostly minutely denticulate. *Lip* 8–14 mm long, deeply 3-lobed above a short united part, with a low collar in front of the spur entrance; midlobe linear to oblong, (7–)9–12 by 0.8–1.2 mm; side-lobes linear to oblong, acute, (5–)9–12 by 0.5–0.8 mm; spur cylindric, 17–23(–25) mm long, shorter than the ovary, thickened apically. *Gynostemium* 2.5–3 mm long, anther canals 2–3 mm long, straight or slightly curved upwards, auricles prominent, nearly as high as the anther. *Fruit* elliptic-fusiform, about 22.3 mm long and 4.1 mm in diameter, with a long apical beak to 10.6 mm long.

Thailand.— NORTHERN: Mae Hong Son [Pai, *Srisanga & Puff* 1054 (**QBG**)]; Chiang Mai [Chom Tong District, *Garrett* 742 (**BKF, K**); Ob Luang, *Pumicong* 378 (**QBG**); idem., *Sørensen et al.* 5223 (**C**); Mae Chaem, *Seidenfaden & Smitinand* 9568 (**C [s]**)]; NORTH-EASTERN: Sakon Nakhon [Phu Phan National Park, *Thammatawon* 93 (**KKU [s]**); idem., *Worachat* 272 (**KKU [s]**); Nam Pung Dam, *Triboun* 1283 (l) (**BK [s]**); Mukdahan [Huai Huat National Park, *Pooma et al.* 2548 (**BKF, L**); Phu Pha Tub, *Triboun* 1374 (l) (**KKU [s]**)]; EASTERN: Amnat Charoen [Chanuman District, *Matthapha* 112 (**KKU**)]; Si Sa Ket [Kantaralak District, *Maxwell* 76-509 (**AAU, BK, L**)]; Ubon Ratchathani [Pha Taem National Park, *Boonjaras* 303 (**BCU**); Khong Chiam, *Greijmans* 109 (**BKF, ScCMU, ScCMU [s]**); idem., *Maxwell* 01-411 (**ScCMU, ScCMU [s], L**); idem., *Pooma et al.* 2331 (**L**); Ban Ba Hai, *Niyomdham* 1237 (**BKF**)]; SOUTH-WESTERN: Ratchaburi [*Marcen* 1789 (**BM, C, K**); ? *Kerr* 0169 (**BK, C [s], K**); ? *illegible* 1789 (**C**)]; SOUTH-EASTERN: Chanthaburi [Khao Phra Bat, *Larsen et al.* 32119 (**AAU, C [s]**)] [21 collections seen, 2 of them uncertain].

Distribution.— Myanmar, Indochina and S China (Sichuan and Yunnan).

Ecology.— Found in open places in deciduous or evergreen forest, also in pine forest and open sandy savanna; 50–1120 m altitude. Flowering: July–Sept.(–Oct.).

Conservation.— Widespread but scattered in the northern half of Thailand, but much less common than the similar *Habenaria rostellifera*. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 67a–c. 1977; present paper: fig. 14a–c.

Notes.— The species very much resembles *Habenaria rostellifera* (similar habit, foliage and general flower shape) but differs in the lack of the prominent pustulate tongue at the lip base. Furthermore, its anther canals are only gently upwards-curved (and not abruptly upwards-angled as in *H. rostellifera*). The two species very much resemble each other in the fruiting stage because of their long-beaked ovaries. In herbaria *H. rostrata*

has sometimes been mixed up with *H. acuiifera* but can be distinguished by the long lip side-lobes and the long beak of the ovary.

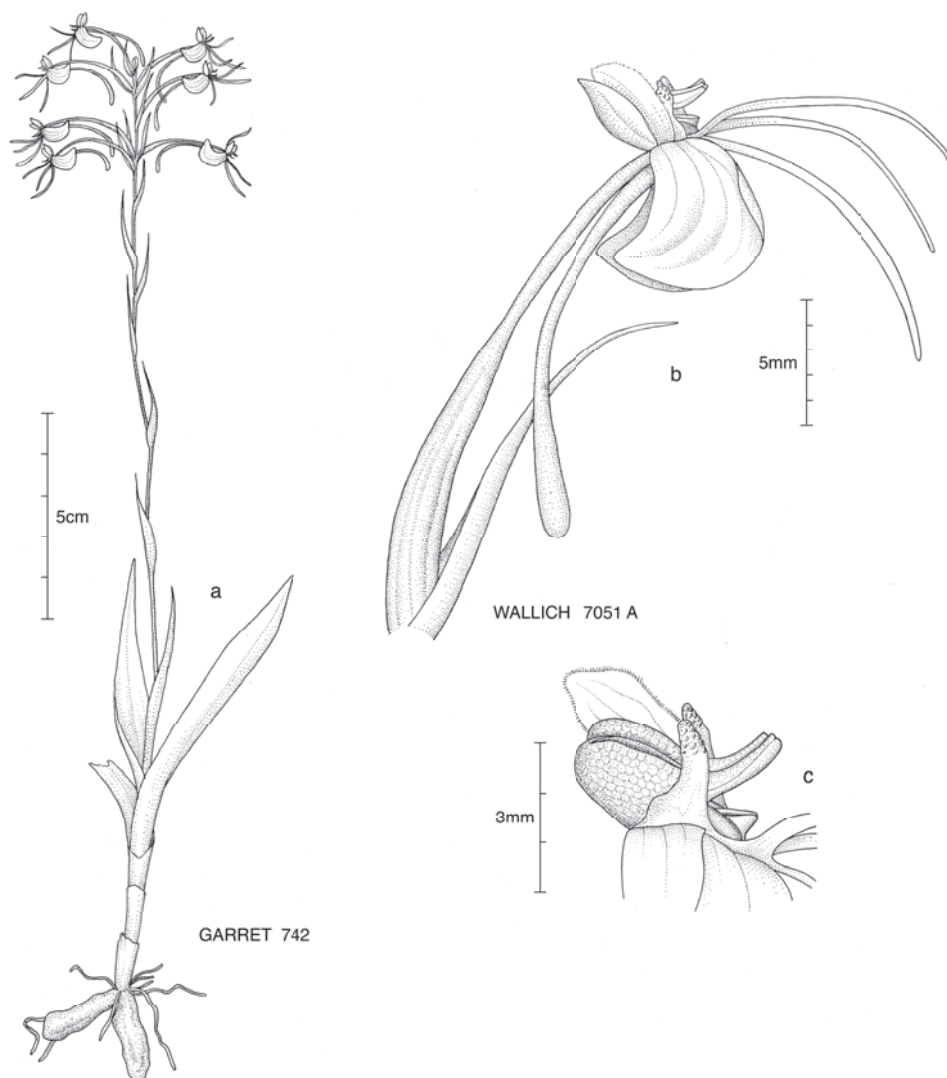


Figure 14. *Habenaria rostrata* Wall. ex Lindl.: a. plant; b. flower; c. gynostemium. b.–c. from the type specimen. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

**26. *Habenaria erostrata*** Tang & F.T.Wang, Bull. Fan Mem. Inst. Biol. 7: 138. 1936; Seidenf., Dansk Bot. Ark. 31(3): 111. 1977; Opera Bot. 114: 63. 1992. Type: Vietnam, Nha Trang Residen, 11 June 1903, *Micholitz* s.n. (holotype **K!**).

Terrestrial, deciduous, glabrous except for the bract margins. Stems 36–43 cm

tall. *Cataphylls* 1–2, tubular, sheathing, enveloping the stem to 3 cm high. *Leaves* 4–5, spreading, cauline and scattered in the lower stem half, narrowly oblong-elliptic, acute, mucronate, 7–13 by 1–2 cm, with a prominent pale semi-translucent border, margins entire. *Bract-like leaves* to 7, spreading or erect, narrowly lanceolate, acuminate, 1.8–3.6 cm long, not or only very shortly sheathing at the base, with a prominent pale semi-translucent border, margins with short stiff hairs. *Inflorescences* dense or subdense, 8–many-flowered; rachis 5–7 cm long; floral bracts narrowly lanceolate, acuminate, 8–16 by 1–2 mm, shorter than the pedicel plus the ovary, margins shortly glandular-hairy or with stiff coarse hairs. *Flowers* to 18 mm across; median sepal, petals and lip white, lateral sepals brown. *Ovary* (including pedicel) 15–19 mm long, beaked. *Sepals* rounded to subacute; median sepal suberect, suborbicular-elliptic, 4.7–5 by 3.3–4 mm, margins papillose; lateral sepals recurved, obliquely ovate, 5–5.9 by 3.5–5 mm. *Petals* erect, oblong, broadly obtuse or subacute, 4–4.5 by 1.2–2 mm, margins papillose. *Lip* to 14 mm long, deeply 3-lobed above an undivided base of 3–4 mm, with a low forward stretching concave tongue ca 2 mm long in front of the spur entrance, lobes linear; midlobe 9–10.3 by ca 0.8 mm; side-lobes similar but slightly narrower; spur cylindric, 21–25 mm long, longer than the pedicel plus the ovary, thickened in its apical third. *Gynostemium* ca 2.8 mm long, anther canals ca 2 mm long, straight, projecting forwards, auricles small.

Thailand.— SOUTH-EASTERN: Sa Kao [Aranya Phrathet, *Kerr* 0845 (**BK**, **K**)] [1 collection seen].

Distribution.— Vietnam.

Ecology.— The Thai specimen known was found on grassy ground; 50 m altitude. Flowering: Aug.

Conservation.— IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 68a–c. 1977.

Notes.— This species is apparently known from a single collection in Thailand. It is similar to *Habenaria rostrata* but differs in the lip spur which is much longer than the ovary and in the shape of the transversal structure on the lip base in front of the spur entrance which is developed as an obscure collar in *H. rostrata* but as a low forward stretching concave tongue ca 2 mm long in *H. erostrata*.

**27. *Habenaria vidua*** E.C.Parish & Rchb.f., *Trans. Linn. Soc. London* 30: 140. 1874; Seidenf., *Dansk Bot. Ark.* 31(3): 112. 1977. Type: Myanmar, Moulmein, *Parish* 116 (syntype **K!**); Myanmar, Moulmein, *Parish* 223 (syntype **K!**). Fig. 15.

Epilithic, deciduous. *Stems* 10–36 cm tall, with a mixture of short glandular hairs and elongate papillae. *Cataphylls* 2–3, tubular, sheathing, enveloping the stem base to 4 cm, glabrous, uppermost with a spreading blade to 1 by 0.7 cm. *Leaves* (2–)3–5, spreading, cauline, in a cluster well above the ground, oblanceolate-elliptic, subacute, mucronate, (3–)8–14 by 1.3–2(–3) cm, glabrous, margins often shortly glandular-hairy. *Bract-like leaves* 1–3, erect or spreading, lanceolate, acute or acuminate, 1.3–2.8 cm long, not sheathing, margins elongate-papillose or shortly glandular-hairy. *Inflorescences* lax, (4–)6–10-flowered; rachis 4–14(–21) cm long, shortly hairy; floral bracts lanceolate,



acuminate, 9–19 by 2.8–4(–5.5) mm, shorter than the pedicel plus the ovary, glabrous, margins elongate-papillose to shortly glandular-hairy. *Flowers* to 17 mm across; white or whitish yellow with green lateral sepals and lip, gynostemium white. *Ovary* (including pedicel) 15–22 mm long. *Sepals* subacute, 3-veined; median sepal erect, suborbicular, 6.5–9 by ca 4 mm, margins and ribs sometimes papillose; lateral sepals reflexed, ovate, 6–7 by 3.8–4.7 mm. *Petals* erect, cohering with the median sepal, broadly ovate, subacute, 2- or 3-veined, 6–8 by 4–6 mm. *Lip* 8–11 mm long, deeply 3-lobed to the base; midlobe recurved below the flower, linear to oblong, 7–10 by 0.8–1.5 mm; side-lobes pointing upwards, linear to oblong, 12–15 by 0.8–1 mm; spur cylindric, 20–30 mm long. *Gynostemium* 2.5–4 mm long, anther canals ca 2 mm long, straight, stigmas much shorter than the anther canals.

Thailand.— NORTHERN: Mae Hong Son [*Thaithong* s.n. (BCU [s])]; Chiang Mai [Doi Chiang Dao, *Khantchai* 981 (BKF, C [s]); idem., *Smitinand & Sleumer* 1037 (C [s], L); idem., *Suksathan* 3574 (QBG, QBG [s]); *Watthana* 2438 (QBG)]; Chiang Rai [Doi Tung, *Pooma* s.n. (BKF [s]); idem., *Maxwell* 06-481 (ScCMU, ScCMU [s])]; Nan [Tham Sakoen National Park, *Watthana* 2113 (ScCMU, QBG, QBG [s], SING)]; Tak [Umphang, *Suksathan* 3500 (QBG [s]); idem., *Worachat* 52 (fruiting) (KKU [s])]; SOUTH-WESTERN: Kanchanaburi [Thong Pha Phum, *Kurzweil* 2480 (BKF)]; Three Pagoda Pass, *Kurzweil* 2485 (BKF); Khao Buing, *Phengklai et al.* 2981 (BKF, C, C [s]) [14 collections seen].

Distribution.— Myanmar.

Ecology.— Usually found in crevasses in limestone on exposed rocks or in evergreen or deciduous forest with bamboo; 740–1800 m altitude. Flowering: June–Sept.

Conservation.— This species is known from 14 collections made in scattered localities in the north and south-west, quite a few of which are situated in national parks. It is not a common species as its occurrence is limited by the presence of suitable sites, but the rocky habitat on cliffs and mountain tops is generally not very likely to become degraded. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 69a–d. 1977; present paper: fig. 15a–d.

Notes.— *Habenaria vidua* is unlike any other of the Thai habenarias with its unusual habitat on limestone rocks, the characteristic lip shape with the midlobe reflexed under the flower and the lip side-lobes sticking up, and the straight elongate anther canals.

A rachis length of 10–15 cm was given as a key character by Seidenfaden (1977) which is inaccurate as the rachis is most commonly shorter than this.

**28. *Habenaria furcifera*** Lindl., *Gen. Sp. Orchid. Pl.*: 319. 1835; Seidenf. & Smitinand, *Orchids Thailand*: 37, 727. 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): 118. 1977; Pearce & Cribb, *Fl. Bhutan* 3(3): 149. 2002; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009). Type: India, Mussooree, *Royle* s.n. (holotype **K-LINDL** [*fide* Pearce & Cribb]).— *Habenaria hamigera* Griff., *Calcutta J. Nat. Hist.* 4: 380. 1844. Type: Bangladesh, *Griffith* 5313 (holotype **K!** [*fide* Pearce & Cribb]). Fig. 16.

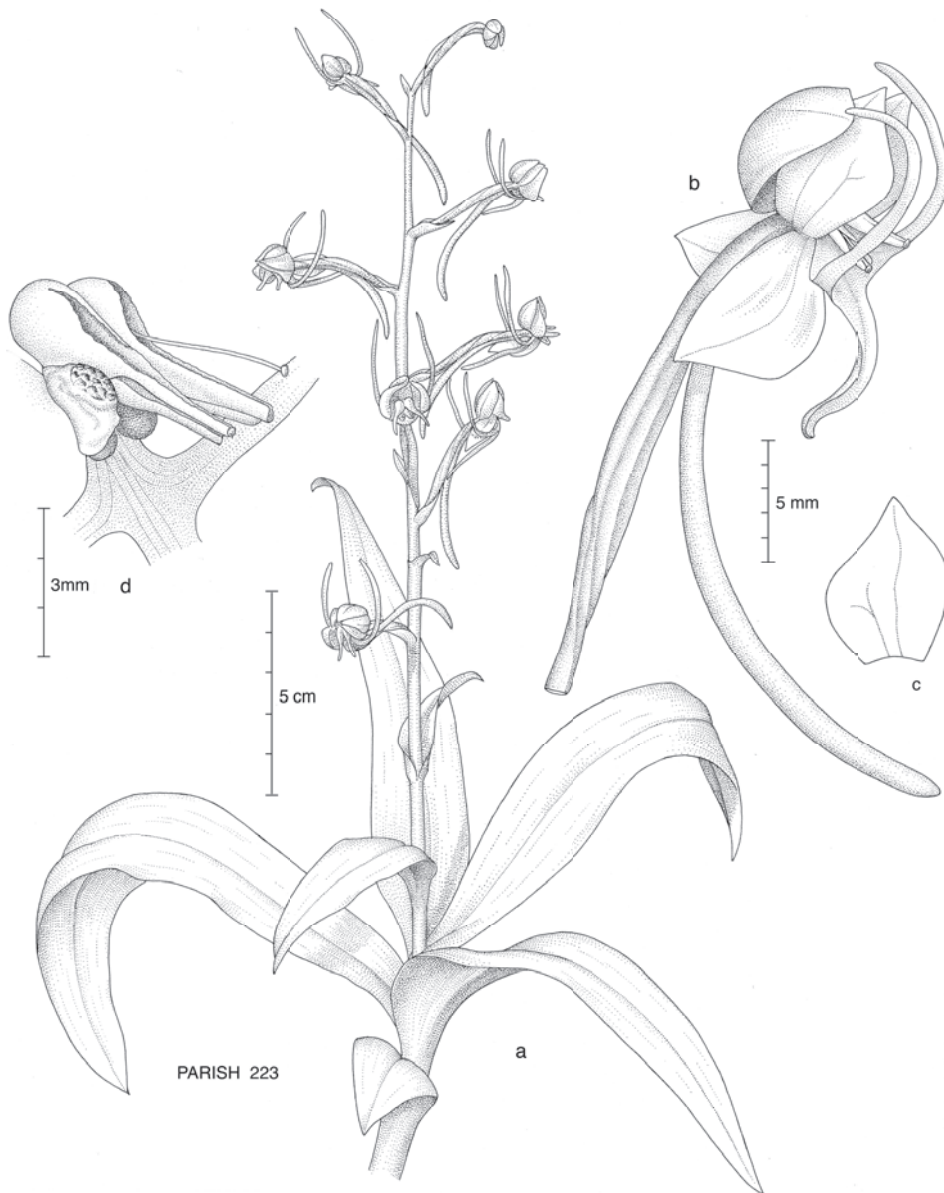


Figure 15. *Habenaria vidua* E.C.Parish & Rchb.f.: a. plant; b. flower; c. petal; d. gynostemium. All from one of the type specimens. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* (24–)38–68 cm tall. *Cataphylls* 2–3, tubular, sheathing, enveloping the stem base to 7 cm high, upper with a blade to 1.5 by 1 cm. *Leaves* (2–)3–5(–6), spreading, cauline and in a cluster in the basal third of the stem, oblong-ovate to ovate-elliptic, acute, mucronate, (9–)15–24 by (1.9–)2.5–4(–5.7) cm, shortly petiolate, with an obscure pale semi-translucent border, margins often papillose. *Bract-like leaves* 7–15, erect, narrowly lanceolate, acuminate, 0.8–3.1(–6) cm long, not or very shortly sheathing at the base, often with a pale semi-translucent border, margins shortly glandular-hairy. *Inflorescences* lax, many-flowered; rachis (3–)9–23 cm long, sometimes with scattered papillae; floral bracts narrowly lanceolate, acuminate, 6.5–11(–15) by 2–3.9 mm, margins shortly glandular-hairy. *Flowers* 7–13 mm across; pale green. *Ovary* (including pedicel) 12–21 mm long. *Sepals* rounded to subacute; median sepal erect, ovate-lanceolate to broadly elliptic, concave, (2.8–)4.3–5 by 2.2–3(–4.2) mm; lateral sepals reflexed, slightly obliquely ovate, (3–)3.5–5 by 1.6–1.8(–2) mm. *Petals* erect, forming a hood together with the median sepal, oblong-elliptic, obtuse, 3–4(–5) by 1–2.3 mm. *Lip* 4–11 by ca 4 mm, deeply 3-lobed to 1–2 mm from the base; midlobe oblong to lorate, 3–5(–6.5) by 1–1.5 mm; side-lobes linear, 4–10.5 by 0.3–0.9 mm, deflexed; spur cylindric, (15–)17–25 mm long, longer than the pedicel plus the ovary. *Gynostemium* 2–3 mm long, anther canals short, stigmas ca 1 mm long, central rostellum lobe with a small conical callus at the base behind the spur entrance, lateral rostellum lobes short and broad. *Fruit* elliptic-fusiform, 13.5–14.7 mm long, 3.1–4.6 mm in diameter, with a short apical beak up to 2.6 mm long.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, *Bunchuai* 946 (**BKF**); idem., *Maxwell* 89-1309 (**CMU**); idem., *Maxwell* 95-860 (**BKF**, **ScCMU**, **ScCMU** [s]); Doi Suthep, *Thai-Danish Botanical Studies* 4980 (**C** [s]); idem., *Thai-Danish Botanical Studies* 4993 (**C** [s]); idem., *Dixen* s.n. (**AAU**); idem., *Maxwell* 89-1076 (**CMU**); idem., *Sørensen et al.* 4980 (**C**); idem., *Sørensen et al.* 4993 (**BKF**, **C**, **L**); Mae Rim, *Indhamusika* 040 (**QBG** [s]); idem., *Watthana* 2454 (**QBG** [s]); Chiang Rai [Doi Hang, *Garrett* 206 (**BKF**, **C**, **C** [s], **K**); Lampang [Pakbok, *Pumicong* 503 (**QBG**, **QBG** [s]); Sukhothai [Khao Luang Ram Kam Heng, *Suksathan* s.n. (**QBG** [s] 29398)]; Kamphaeng Phet [Klong Laan, *Watthana* 1506 (**QBG**, **QBG** [s])]; NORTH-EASTERN: Loei [*Thaithong* 1426 (**BCU** [s])]; EASTERN: Chaityaphum [Phu Khieo, *Seidenfaden & Smitinand* 8179 (**C** [s])]; SOUTH-WESTERN: Kanchanaburi [Wang Po, *Kasem* 650 (**BK**); Huai Bankao, v. *Beusekom et al.* 3530 (**BKF**, **C**, **C** [s], **L**); CENTRAL: Saraburi [Ban Nong Bua, *Kerr* 0648 (**BK**, **C**, **K**); idem., *Put* 1139 (**BK**, **C**, **K**); idem., *Winit* s.n. (**BKF** SN077028)]; SOUTH-EASTERN: Chon Buri [Sriracha District, *Maxwell* 75-1059 (**AAU**, **BK**, **L**); Khao Khiew, *Thorut* 196 (**BCU**, **BCU** [s]); WITHOUT LOCALITY: *illegible* s.n. (**K** H2007/02483-52); Nanakorn *et al.* 9608 (**QBG**) [26 collections seen].

Distribution.— Pakistan and India to S China (Yunnan).

Ecology.— Found in various forest types, including evergreen, deciduous forest with teak, mixed deciduous forest and bamboo forest, and also collected in thorn-scrub; 100–1050 m altitude. Reported over granite and shale. Flowering: (Aug.–)Sept.–Dec.

Conservation.— Widespread but scattered throughout Thailand, but apparently absent from the extreme north-eastern and eastern parts and from the peninsula. IUCN red list category 'Least Concern' (IUCN, 2001).

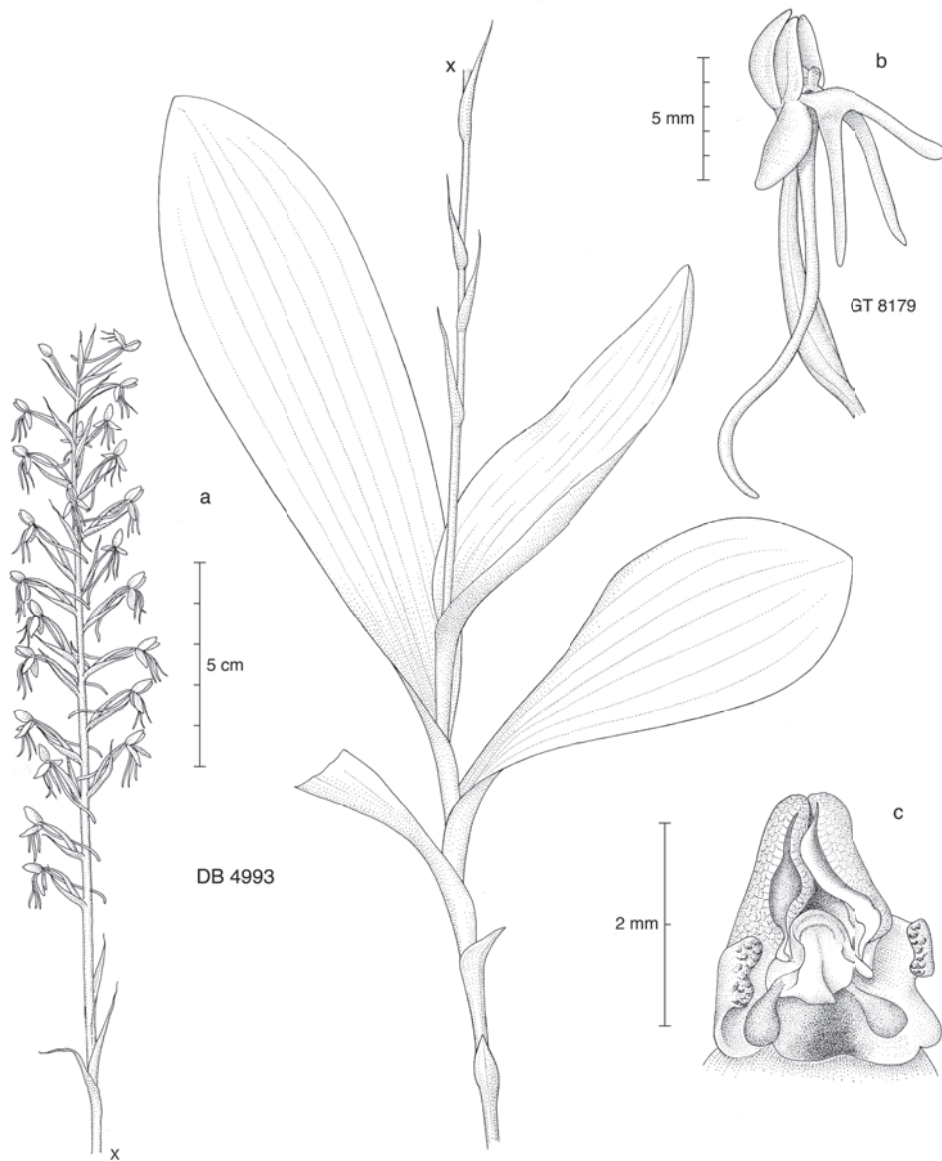


Figure 16. *Habenaria furcifera* Lindl.: a. plant; b. flower; c. gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Illustrations.— Seidenf., Dansk Bot. Ark. 31(3): fig. 72a–c. 1977; present paper: fig. 16a–c.

Notes.— Important diagnostic features of the species are the robust habit with several large cauline leaves, the lax and usually fairly long inflorescence, the green flowers with equally 3-lobed lips with deflexed side-lobes and the thin lip spurs which are longer than the ovaries.

**29. *Habenaria khasiana*** Hook.f., Fl. Brit. India 6: 151. 1890; Seidenf., Dansk Bot. Ark. 31(3): 118. 1977; Opera Bot. 114: 67. 1992. Replaced synonym: *Habenaria graminea* Lindl., Gen. Sp. Orchid. Pl.: 318. 1835. nom. illeg. *Platanthera linifolia* Lindl. in Wallich, Numer. List 7041. 1832. nomen. Type: India, Sylhet, Wallich s.n., Wall. Cat. 7041 (?holotype **K-W**).— *Habenaria graminifolia* Gagnep., Bull. Soc. Bot. France 78: 70. 1931; Seidenf. & Smitinand, Orchids Thailand: 31. 1959. Types: ?Laos, Mekong, Thorel 2312 (syntype **P!**); Cambodia, Poilane 15473 (syntype **P!**); Vietnam, Pierre s.n. (syntype **P!**); Cambodia, Geoffrey 490 (syntype **P!**). Fig. 17.

Terrestrial, deciduous, glabrous. *Stems* (7–)13–23(–30) cm tall. *Cataphylls* 1–3, tubular, sheathing, uppermost with a blade to 0.5 by 0.3 cm. *Leaves* 3–5, erect or suberect, both radical and cauline but clustered near the base of the stem, grass-like, narrowly linear-oblong, acute, mucronate, 2–8(–11) by 0.15–0.4 cm, with entire margins, sometimes rolled-in. *Bract-like leaves* 2–7(–9), erect, lanceolate, acuminate, (0.3–)0.6–1.4(–2) cm long, sheathing or not, margins entire. *Inflorescences* lax, (3–)6–10-flowered; rachis 2–10 cm long; floral bracts broadly lanceolate, acuminate, 3–6(–8) by 2–3 mm, much shorter than the pedicel plus the ovary, margins entire. *Flowers* 10–15 mm across (excluding the lip side-lobes); green or greenish yellow, lip sometimes brownish yellow, anther recorded as white; once reported as scented. *Ovary* (including pedicel) (7–)10–11.5 mm long. *Sepals* rounded to subacute, 3-veined; median sepal erect, elliptic, (3–)3.6–6 by 2.2–4.5 mm; lateral sepals spreading, elongate-ovate, 3.5–7 by 1.7–2.2(–3) mm, united at the base with the petals and the lip. *Petals* suberect, cohering with the median sepal, slender triangular, subacute, 1-veined, 3.8–8 by 1–1.8 mm, longer than the sepals. *Lip* 6–9 mm long, deeply 3-lobed from the base, all lobes filiform, 0.5–0.8 mm wide; midlobe 4–9 mm long; side-lobes 11–35 mm long, much longer than the midlobe; spur cylindric, 6–15 mm long, sometimes thickened in the apical half. *Gynostemium* ca 2 mm long, anther canals ca 0.5 mm long, stigmas 1.5–2.5 mm long.

Thailand.— NORTHERN: Chiang Rai [Khunkorn Waterfall Forest Park, Boonkerd *et al.* KK 790 (**BCU** [s])]; NORTH-EASTERN: Loei [Dee 322 (**BKF**, **C**, **C** [s], **K**, **P**); Smitinand 1865 (**BKF**, **C**); Sakon Nakhon [Phu Phan National Park, Suddee 820 (**BKF** [s]); *idem.*, Thammatawon 88 (**KKU** [s])]; EASTERN: Si Sa Ket [Kantaralak District, Maxwell 76-519 (**AAU**, **BK**, **L**); Ubon Ratchathani [Pho Sai District, Suddee 790 (**BKF** [s])]; SOUTH-EASTERN: Prachin Buri [Chermisiriwatthana 1806 (**BK**); Thaithong 753 (**BCU** [s])]; Chanthaburi [Makham, Smitinand 3510 (**BKF**, **C**); Trat [Larsen *et al.* 32411 (**AAU**, **BKF**, **C**, **C** [s], **K**, **L**, **P**, **SING**); WITHOUT LOCALITY: Comber 1706 (**K**); Maxwell 94-975 (**ScCMU** [s]) [13 collections seen].

Distribution.— NE India and Indochina.



Ecology.— In wet sandy and rocky soil in open dipterocarp forest, in open pine forest and savanna; from sea level to about 1300 m altitude. Flowering: July–Sept.(–Nov.).

Conservation.— Thirteen collections were examined from the northern, north-eastern, eastern and south-eastern parts of the country, some of them situated in national parks and forest parks. This species is a small herb and is probably frequently overlooked. IUCN red list category ‘Least Concern’ (IUCN, 2001).

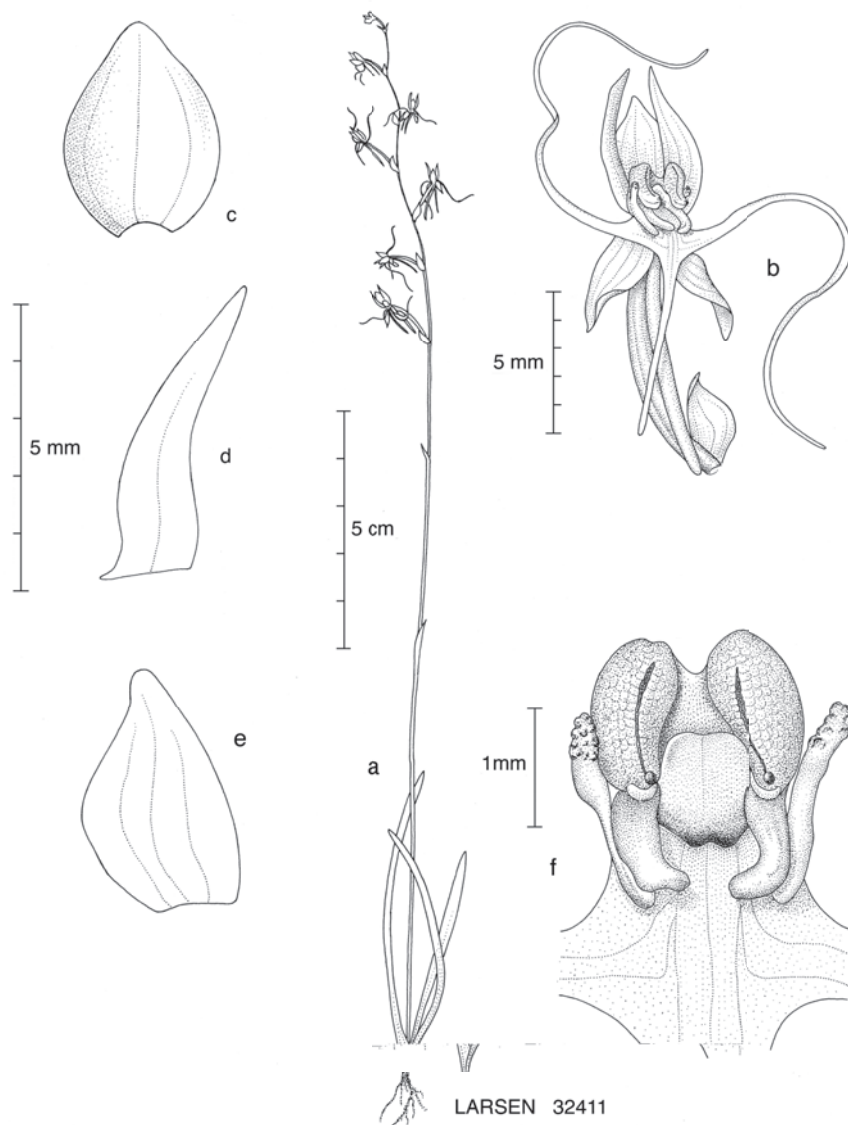


Figure 17. *Habenaria khasiana* Hook.f.: a. plant; b. flower; c. median sepal; d. petal; e. lateral sepal; f. gynostemium. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 22. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 73a–f. 1977; present paper: fig. 17a–f.

Notes.— This species is very distinct with its grass-like leaves and the small green flowers with long thread-like lip side-lobes.

**30. *Habenaria viridiflora*** (Rottler ex Sw.) Lindl., *Gen. Sp. Orchid. Pl.*: 319. 1835; Seidenf., *Dansk Bot. Ark.* 31(3): 118. 1977; *Opera Bot.* 114: 67. 1992; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009). *Orchis viridiflora* Rottler ex Sw., *Kongl. Vetensk. Acad. Nya Handl.* 21: 206. 1800. Type: India, Deccan, Rottler s.n. (holotype **C!**).— *Habenaria tenuis* Griff., *Calcutta J. Nat. Hist.* 4: 379. 1844. Type: India, Serampore, Griffith s.n. (not known). Fig. 18–19.

Terrestrial, deciduous, glabrous. *Stems* (23–)40–45 cm tall. *Cataphylls* 1–2, tubular, sheathing, enveloping the stem to 3 cm high; uppermost sometimes with a blade to 1 by 0.4 cm. *Leaves* 2–4, spreading, basal, narrowly lanceolate, acute or subacute, (5.5–)7–11 by 0.5–0.85 cm, with or without a pale semi-translucent border. *Bract-like leaves* 1–7, erect, narrowly lanceolate, acuminate, 0.7–4.5 cm long, not sheathing, sometimes with obscure pale and semi-translucent border, margins entire or serrate. *Inflorescences* lax, ca 12–many-flowered; rachis 8.5–24 cm long; floral bracts lanceolate, acuminate, (3.5–)5–8 by 1–2 mm, much shorter than the pedicel plus the ovary, margins entire. *Flowers* 4.8–7 mm across; green or yellow-green. *Ovary* 4.2–7.7 mm long, distinct from the 1.5–3.5 mm long pedicel. *Sepals* subacute, 3-veined; median sepal erect, suborbicular, 2–3.5 by 1.6–2.5 mm; lateral sepals spreading, ovate to slightly obliquely ovate, 3–4.4 by (1.8–)2–3.5 mm. *Petals* erect, forming a hood with the median sepal, triangular to triangular-ovate, subacute or obtuse, 1-veined, 2–3.8 by 0.5–1.5 mm. *Lip* 4.5–9 mm long, 3-lobed from just above the base; midlobe oblong, sides curved down, 2.9–5 by 0.8–1 mm; side-lobes spreading, narrowly oblong, acute, 3.5–6 by 0.4–1.2 mm, slightly longer than the midlobe; spur cylindric, 15–21 mm long. *Gynostemium* 1–1.5 mm long, anther reflexed, anther canals insignificant, in typical specimens of the examined Thai material to 0.5 mm long, straight, stigmas to 2 mm long. *Fruit* with a short 3 mm long stalk, elliptic-fusiform, 12.8 mm long, 2.9 mm in diameter, apically not beaked. [this description does not include the doubtful specimen Suksathan 3579].

Thailand.— ? NORTHERN: Chiang Mai [Doi Chiang Dao, *Suksathan* 3579 (uncertain, see below) (**QBG** [s])]; NORTH-EASTERN: Sakon Nakhon [Phu Phan National Park, *Auemporn* 31/1999 (**KKU** [s])]; idem., *Thammatawon* 89 (**KKU** [s])]; EASTERN: Chaityaphum [Phu Khieo, *Seidenfaden & Smitinand* 8123 (**C** [s])]; Si Sa Ket [Khun Han, *Maknoi* 287 (**QBG**)]; SOUTH-EASTERN: Prachin Buri [*Thaithong* 474 (**BCU** [s])]; WITHOUT LOCALITY: *Thaithong* 1261 (**BCU** [s]) [7 collections seen, 1 of them uncertain].

Distribution.— India and Sri Lanka to S China (Guangxi).

Ecology.— Largely not known, usually growing terrestrially in damp areas, in one collection reported as common in rice fields. A doubtful specimen was found as a lithophyte on a limestone cliff. Flowering: July–Sept.

Conservation.— Only seven collections from scattered localities mainly in the north-east, east and south-east and one unknown locality have been seen. IUCN red list

category 'Vulnerable' based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Dansk Bot. Ark. 31(3): fig. 74a–g. 1977; present paper: figs. 18a–g, 19.

Notes.— This species also has narrow leaves and small green flowers but differs from *Habenaria khasiana* in the lip side-lobes which are oblong (as opposed to thread-like) and only slightly longer than the midlobe.

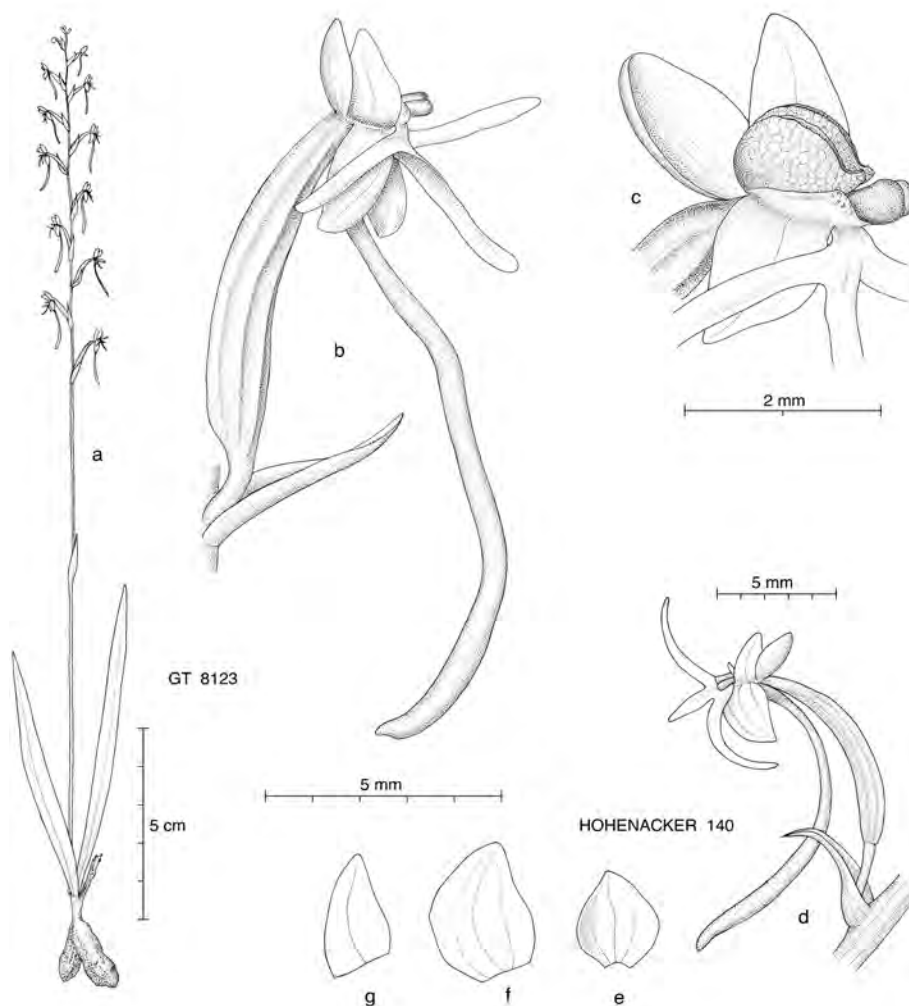


Figure 18. *Habenaria viridiflora* (Rottler ex Sw.) Lindl.: a. plant; b. d. flower; c. gynostemium; e. median sepal; f. lateral sepal; g. petal. d.–g. from an Indian plant. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

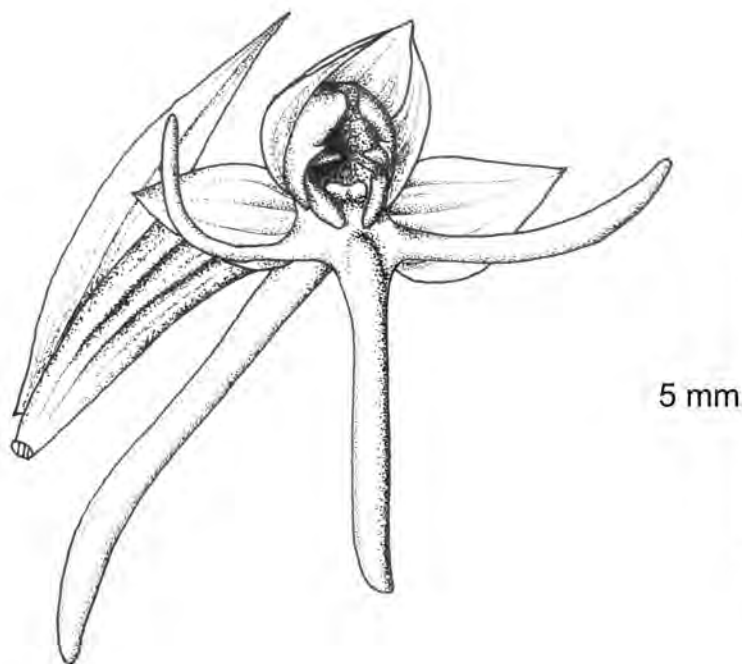


Figure 19. *Habenaria* cf. *viridiflora* (Rottler ex Sw.) Lindl.: flower. From *Suksathan* 3579. Drawn by Colin Teo.

Seidenfaden (1977: 114) pointed out that his newly described *Habenaria tonkinensis* Seidenf. resembles *H. viridiflora* in a number of characters, and suggested that the two species have been confused in the past in a few cases (particularly in some collections from Indochina). The clearest distinguishing character between the two taxa is the shape of the petals which are triangular to triangular-ovate in *H. viridiflora* but oblong-linear in *H. tonkinensis*.

There appears to be variation in the length of the anther canals. While they are very short and insignificant in the Thai material examined in the present study (about 0.5 mm long), they appear to be more prominent in Indian material (see Wight, 1852).

The specimen *Suksathan* 3579 (QBG [s]!), collected on a limestone cliff in Chiang Mai Province, is similar to *Habenaria viridiflora* in most vegetative and floral characters but differs by having somewhat wider leaves (to 1.1 cm wide; as opposed to 0.5–0.85 cm wide in typical *H. viridiflora*); comparatively long floral bracts (longer than the pedicel plus the ovary; as opposed to much shorter); an ovary which is not distinct from the pedicel (as opposed to distinct from it); slightly larger flowers (sepals and petals 3.5–5.9 mm long, as opposed to 2–4.4 mm); a shorter spur (9–12.5 mm long, as opposed to 15–21 mm long); a longer gynostemium (2.1–2.3 mm long, as opposed to 1–1.5 mm long); and longer anther canals (0.6–0.8 mm long, as opposed to 0.5 mm) (however, the length of the anther canals of *H. viridiflora* generally seems to be the subject of variation as pointed out above). Also the lithophytic habitat of this specimen is unusual, as typical plants of *H. viridiflora* are terrestrial. The shorter stem and the fewer-flowered inflorescence of the

specimen could well be a consequence of its rocky habitat with its difficult nutrient and water supply. Most of the differences of the collection *Suksathan* 3579 from the typical Thai specimens of *H. viridiflora* are not major and therefore it is here interpreted as an aberrant specimen of *H. viridiflora*, while realising that future work on more material may possibly show that it is distinct and should be separated into a new species.

**31. *Habenaria hastata*** Seidenf., Opera Bot. 124: 12. 1995. Type: Thailand, Tak, Ban Na Gorge, Mae Ping, 17 Oct. 1911, in mixed jungle, *Kerr* 288 (holotype **K!**).

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* 13–15 cm tall. *Cataphylls* 2–3, tubular, sheathing, enveloping the stem below the leaves to 6 cm high. *Leaves* 2–4, cauline and scattered in the upper stem half, spreading, lanceolate-elliptic, acute, 2–5.5 by 0.7–1 cm. *Bract-like leaves* absent. *Inflorescences* lax, 4–5-flowered; rachis 1.6–3(–5) cm long, slightly denticulate; floral bracts lanceolate, acuminate, as long as or slightly longer than the ovary, 10–14 by 1.8–3(–4.5) mm, margins shortly glandular-hairy. *Flowers* 6.9–7.6 mm across; green. *Ovary* (including pedicel) 8–9 mm long. *Sepals* broadly lanceolate, acute; median sepal erect, hooded, 3.9–5 by ca 3 mm, with a crenate laminate median keel on the dorsal side; lateral sepals with pronounced mucros, 3.5–5 by 1.6–2 mm. *Petals* suberect, obliquely triangular, acute, 2.5–3.5 by ca 1 mm, with a minute lobe on the distal side. *Lip* 5–8 mm long, hastately 3-lobed, without any ornaments, all lobes linear-lanceolate and acute to acuminate; midlobe 3.2–6 mm long; side-lobes subulate, 1.5–3 mm long, much shorter than the midlobe; spur cylindric, stout, obtuse, 4–5 mm long, about half as long as the ovary. *Gynostemium* 2–2.7 mm long, anther canals ca 0.3 mm long, straight, stigmas very close (or united ?).

Thailand.—NORTHERN: Nan [Tham Sakoen National Park, *Pumicong* 417 (**QBG**, **QBG** [s])]; Tak [Ban Na Gorge, *Kerr* 288 (holotype **K**)] [2 collections seen].

Distribution.—Endemic.

Ecology.—Found in evergreen or mixed hill forest; one collection from 1070 m altitude. Flowering: Sept. and Oct.

Conservation.—Only known from two localities in northern Thailand. Listed in a book on threatened plants of Thailand (Suddee, 2005: 130). IUCN red list category ‘Endangered’ (Santisuk *et al.*, 2006: 210).

Illustrations.—Seidenf., Opera Bot. 124: fig. 3a–f. 1995.

Notes.—*Habenaria hastata* is very distinct in its small plant size, the broad leaves, the few-flowered inflorescence, the mucronate spreading lateral sepals and the close (or merged ?) stigmas (Seidenfaden, 1995: 13). The species is only known from the type collection and a second collection made recently in Nan Province (both in northern Thailand).

**32. *Habenaria rumphii*** (Brongn.) Lindl., Gen. Sp. Orchid. Pl.: 320. 1835; Seidenf., Dansk Bot. Ark. 31(3): 122. 1977; Opera Bot. 114: 67. 1992; Comber, Orchids Java: 64. 1990; Orchids Sumatra: 101. 2001.—*Platanthera rumphii* Brongn. in L.I. Duperrey, Voy. Monde: 194. 1834. Iconotype: Rumphius’ Herb. Amb. VI, p. 118, t. 54.—*Habenaria acuiifera* auct. non Wall. ex Lindl.: Smitinand, Nat. Hist. Bull. Siam Soc. 20: 58. 1961. Fig. 20.



var. **rumphii**

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* (15–)23–36(–48) cm tall. *Cataphylls* 1–2, tubular, sheathing, enveloping the stem to 5 cm high; uppermost sometimes with a blade to 1 cm long, acute, with a distinct pale semi-translucent border. *Leaves* 2–4, spreading, cauline and scattered in the lower stem half, linear or narrowly lanceolate-oblong, acute, mucronate, 5–12 by 0.4–1(–1.5) cm, with a pale semi-translucent border. *Bract-like leaves* 6–13, erect or spreading, lanceolate, acuminate, 1–5.5 cm long, not or only shortly sheathing, with an obscure or more rarely prominent pale semi-translucent border, margins minutely papillose-denticulate or shortly glandular-hairy. *Inflorescences* dense, 10–30-flowered; rachis 1.5–3.5(–4) cm long; floral bracts narrowly linear-lanceolate, elongate-acuminate, 10–25 by 1.5–2.2 mm, margins sometimes shortly glandular-hairy. *Flowers* 8–11 mm across; white, yellow or brown; one record from Loei Province reported as purple. *Ovary* (including pedicel) 9–16(–20) mm long. *Sepals* rounded, 3-veined; median sepal erect, elongate elliptic, 3–5 by 1.8–3.5 mm; lateral sepals reflexed backwards and upwards, slightly obliquely elliptic-ovate, 4–6(–7) by 2.8–3.5(–3.8) mm. *Petals* erect, forming a hood with the median sepal, triangular-oblong, obtuse, 3-veined, 3.3–5.5 by 0.9–2 mm. *Lip* 6–10 mm long, deeply 3-lobed from near the base, with a collar around the spur entrance; midlobe attenuate, 5–9 by 0.6–1.6 mm; side-lobes attenuate, 3–5.5 by 0.5–0.7 mm, shorter than the midlobe; spur cylindric, (4.3–)5–13 mm long, shorter than the ovary, thickened in the upper third. *Gynostemium* 2–2.5 mm long; anther canals short, lateral rostellum lobes more or less enlarged. *Fruit* sessile, elliptic-fusiform, 10.4–11.5 mm long, 2.4–3.6 mm in diameter, without an apical beak.

Thailand.— NORTH-EASTERN: Phetchabun [Thung Salaeng Luang National Park, *Kerr* 0946 (**C**, **K**); Loei [Phu Kradueng National Park, *Chantaranothai et al.* 90/93 (**K**, **KKU**); idem., *Prayad* 1079 (**BK**); idem., *Phusomsaeng et al.* 108 (**BKF**); idem., *Santisuk* 516 (**BKF**); idem., *Smitinand et al.* 6120 (**BKF**); idem., *Charoenphol et al.* 4809 (**AAU**, **K**); idem., *Dee* 140 (**BKF**, **P**); idem., *Dee* 320 (**BKF**, **P**); idem., *Dee* 385 (**BKF**, **C** [s], **K**); idem., *Prayad* 2085 (**BK**); idem., *Sleumer* 4760 (**C**, **K**, **L**); idem., *Smitinand* 6120 (**C**, **K**); idem., *Phusomsaeng et al.* 67 (**C**, **BKF**); idem., *S. P. et al.* 108 (**C**, **C** [s]); ? idem., ‘native collector’ 155 (**P**); ? idem., *Seidenfaden & Smitinand* 3140 (**C** [s])]; EASTERN: Chaiphaphum [Thung Kra Mang, *Larsen et al.* 31613 (**AAU**, **B**, **BKF**, **C** [s], **K**, **L**); no exact locality, *Kitichate* 202 (**BCU** [s])]; Si Sa Ket [*Maxwell* 76-542 (**AAU**, **BK**, **L**)]; SOUTH-WESTERN: Phetchaburi [*Marcen* 2772 (**C** [s])]; SOUTH-EASTERN: Prachin Buri or Sa Kao [Umpai 653 (**BK**)]; Prachin Buri [Watana, *Put* 1915 (**BK**, **C** [s], **K**); no exact locality, *Seidenfaden & Smitinand* 9566 (**C** [s]); idem., *Songkakul* 32 (**BKF** [s]); idem., *Thaithong* 468 (**BCU** [s]); ? idem., *Thaithong* 132 (**BCU**); idem., *Tiptabiankarn* 2105 (**Suan Luang** [s])]; PENINSULAR: Krabi [Watana, *Kerr* 0223 (**K**)]; WITHOUT LOCALITY: *BCU* s.n. (**BCU** [s] 008923); *Comber* 1704 (**K** [s]); *Larsen* 4809 (**C** [s]); *Thaithong* 274 (**BCU** [s]); *Tiptabiankarn* 1195 (**Suan Luang** [s]); without collector (**BCU** [s]) [34 collections seen, 3 of them uncertain].

Distribution.— Widespread from Indochina through the whole of Malesia as far east as New Guinea and Queensland (Australia).

Ecology.— This is a rather common species in wet or marshy places in open grassy

ground and pine savanna; 50–1300 m altitude. Flowering: (July–)Aug.–Oct.(–Dec.).

Conservation.— Widespread but scattered throughout most of Thailand, though not recorded in the north. IUCN red list category ‘Least Concern’ (IUCN, 2001).

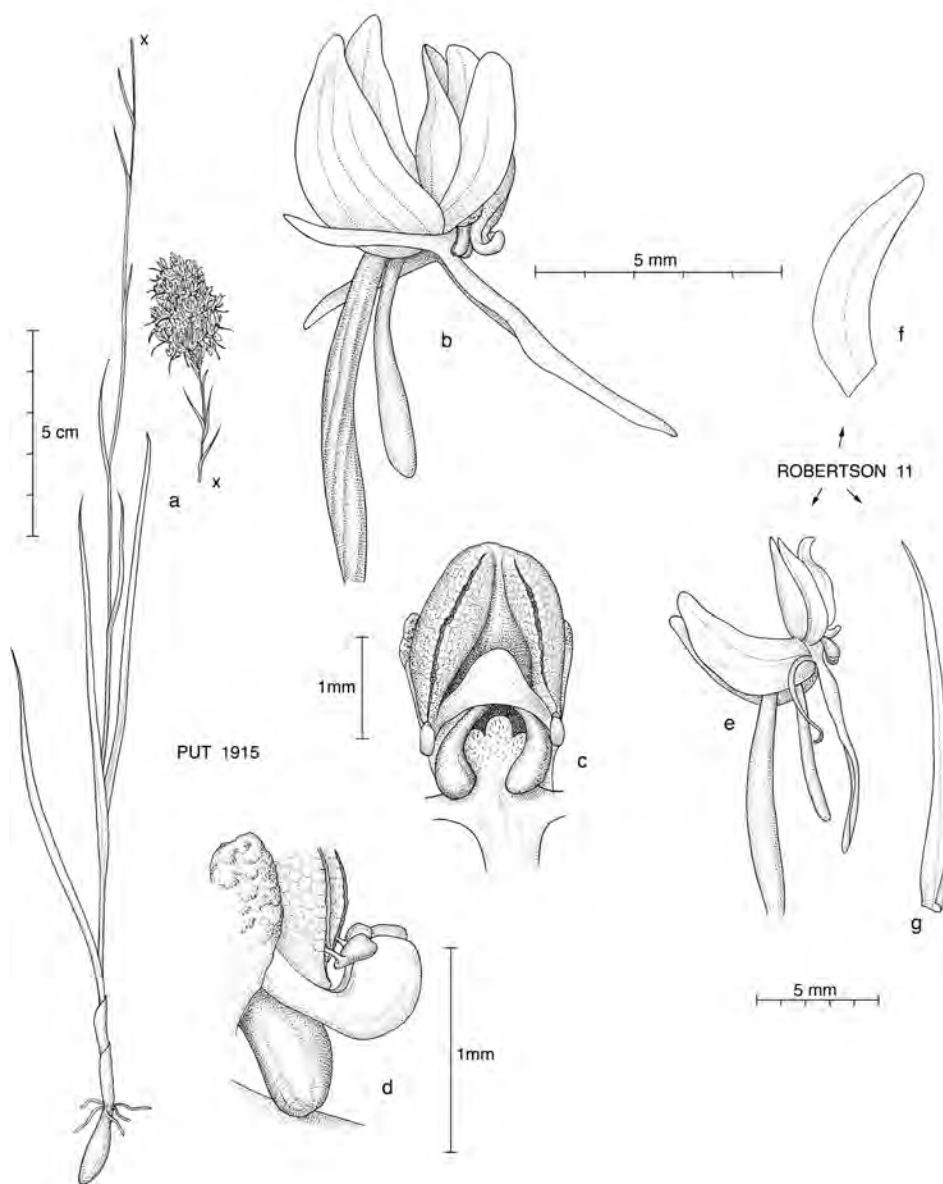


Figure 20. *Habenaria rumphii* (Brongn.) Lindl.: a. plant; b. e. flower; c. gynostemium; d. lower front part of gynostemium in side view; f. petal; g. floral bract. e.–g. from an Indonesian plant. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

Illustrations.— Seidenf., Dansk Bot. Ark. 31(3): fig. 75a–g. 1977; present paper: fig. 20a–g.

Notes.— *Habenaria rumphii* is very similar to *H. acuiifera* but is easily distinguished by its anther with short anther canals. The species is also well-characterised by its short and dense inflorescences and the strongly reflexed lateral sepals.

Photographs apparently illustrating this species have been seen from Ubon Ratchathani (eastern Thailand) during the present study. Although no actual specimen from this province has been examined the occurrence of this species would be quite natural given its occurrence in the neighbouring province Si Sa Ket.

Only the typical variety is found in Thailand, while *Habenaria rumphii* var. *meraukensii* J.J.Sm. with purple flowers is known from New Guinea.

**33. *Habenaria marginata*** Colebr. in W.J.Hooker, Exot. Fl.: t. 136. 1824; Seidenf., Dansk Bot. Ark. 31(3): 122. 1977; Pearce & Cribb, Fl. Bhutan 3(3): 150. 2002; Chen *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009).— *Platanthera marginata* (Colebr.) Lindl. in Wallich, Numer. List: 7038. 1832. Type: India, introduced by accident into the Calcutta Botanic Garden, *Colebrooke* 179 (holotype **K**).— *Habenaria promensis* Lindl., Gen. Sp. Orchid. Pl.: 320. 1835. Type: Myanmar, Mt Prome, *Wallich* s.n., Wall. Cat. 7033 (holotype **K-LINDL** [*fide* Pearce & Cribb]; isotype **K-W**).— *Habenaria fusifera* Hook.f., Fl. Brit. India 6: 147. 1890. Type: India, Travancore, Annamally Hills, *Beddome* s.n. (holotype **CAL**).— *Habenaria flavescens* Hook.f., Fl. Brit. India 6: 150. 1890.— *Habenaria marginata* var. *flavescens* (Hook.f.) T.Cooke, Fl. Bombay 2: 721. 1907. Type: India, Concan, *Law* 298 (holotype **K-LINDL!** [*fide* Pearce & Cribb]).— *Habenaria aurantiaca* Rolfe ex Downie, Bull. Misc. Inform. Kew 1925: 418. 1925; Seidenf. & Smitinand, Orchids Thailand: 28. 1959. Type: Thailand, paddy fields at the foot of Doi Suthep, 26 Nov. 1912, *Kerr* 125 (holotype **K!**).

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* (10–)13–25 cm tall. *Cataphylls* 1–2, tubular, sheathing, enveloping the lower 4 cm of the stem. *Leaves* 3–7, spreading, cauline and scattered in the lower or middle part of the stem, lanceolate-oblong, acute, 3–9 by 0.8–1.6 cm, with a distinct pale border. *Bract-like leaves* 2–5, lanceolate, acuminate, 1.4–3.5 cm long, minutely denticulate or ciliate on the margins, with a distinct semi-translucent pale border. *Inflorescences* dense or semi-dense, 2–20-flowered; rachis 1.6–6 cm long; floral bracts ovate-lanceolate, acuminate, 9–15(–26) by 2.5–4 mm, minutely denticulate on the margins. *Flowers* 9–13 mm across; orange-yellow or pale yellow, gynostemium cream, pollinia light brown. *Ovary* (including pedicel) (10–)12–15 mm long, smooth. *Sepals* obtuse to subacute, 3-veined; median sepal erect, suborbicular to broadly elliptic, 5.2–7 by 4.5–5 mm; lateral sepals narrowly ovate, basally extensively united with the lip claw and the petals, 6.9–10 by 2.5–4 mm. *Petals* erect, falcately triangular, curved towards the median sepal and forming a hood with it, obtuse, 2-veined, 4.7–7 by 3.5–5 mm. *Lip* 9–16 mm long, deeply 3-lobed to 3–5 mm from the base, lobes linear to oblong; midlobe (6.5–)6.7–10(–13.8) by (1.5–)2–2.5 mm, margins curved downwards; side-lobes 6–8.3 by 1–1.7 mm; spur cylindric and apically clavate, 7–11 mm long, somewhat geniculate in the middle. *Gynostemium* 2.5–3 mm long, anther canals ca 0.6 mm long, stigmas ca 2.5 mm long.

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, *Kerr* 125 (holotype of *Habenaria aurantiaca* **K**); idem., *Kerr* s.n. (**K** H2006/10478-70); idem., *Seidenfaden & Smitinand* 3016 (**C** [s]); Mae Rim, *Watthana* 1357 (**QBG** [s]); no exact locality, *Smitinand* 7583 (**BKF**); Lampang [Chaehom, *Panatkool* 412 (**ScCMU**, **ScCMU** [s]); Phrae [Mae Tang, *Indhamusika* 36 (**QBG** [s]); no exact locality, *Winit* 1437 (**BKF**, **K**); WITHOUT LOCALITY: *Thaithong* 1276 (**BCU** [s]) [9 collections seen].

Distribution.— Pakistan and India to S China (Yunnan).

Ecology.— Found in degraded deciduous forest and also in old rice field bunds; 190–1100 m altitude. Reported over sandstone. Flowering: Sept.–Oct.

Conservation.— Nine collections in the north have been seen, a few of which are situated inside national parks giving the species a certain amount of protection. IUCN red list category 'Near Threatened' (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 19a–c. 1959 [as *Habenaria aurantiaca*]; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 78a–e. 1977.

Notes.— This is an uncommon species with dense or semi-dense inflorescences of yellow to orange flowers with equally 3-lobed lips. The variation in the arrangement of the leaves is considerable ranging from subradical to scattered in the same population (see Seidenfaden, 1977: 125).

**34. *Habenaria avana*** Hook.f., *Fl. Brit. India* 6: 148. 1890; Seidenf., *Dansk Bot. Ark.* 31(3): 122. 1977. Type: Myanmar, Ava, *Burney* s.n. (holotype **CAL**; **K** drawing seen).

Terrestrial, deciduous, apparently glabrous. *Stems* 25–30 cm tall. *Cataphylls* few, tubular, sheathing, upper on our Thai specimen with a small blade. *Leaves* 4–7, spreading, cauline and scattered all along the stem, lanceolate-oblong, acute, to 11.5 by 1.5 cm, becoming shorter towards the upper part of the stem. *Bract-like leaves* absent. *Inflorescences* dense, many-flowered; rachis ca 9.5 cm long; floral bracts narrowly ovate-lanceolate, acuminate, the lower slightly longer than the flowers, to 25 mm long. *Flowers* ca 15 mm across; white. *Ovary* (including pedicel) ca 12 mm long, smooth. *Sepals* obtuse to subacute, 3-veined; median sepal erect, suborbicular to broadly elliptic, 7–7.8 by ca 4 mm; lateral sepals narrowly ovate, basally extensively united with the lip and the petals, 6.4–8 by 3.3–4 mm. *Petals* erect, falcately triangular, cohering with the median sepal, obtuse, 1-veined, ca 6 by 3.9 mm. *Lip* 10–16 mm long, deeply 3-lobed to ca 4.5 mm from the base, lobes linear to oblong; midlobe 5.5–10 by 1.6–1.8 mm, margins curved down; side-lobes 5.8–6.3 by ca 0.5 mm; spur cylindric and apically clavate, 7.1–8 mm long, slightly geniculate in the middle. *Gynostemium* 2.7–2.8 mm long, anther canals ca 0.5 mm long, stigmas ca 2.5 mm long.

Thailand.— NORTHERN: Chiang Mai [Omkoi, *Seidenfaden & Smitinand* 8152 (**C** [s])] [1 collection seen].

Distribution.— Myanmar.

Ecology.— The single Thai collection was made in an old rice field at 800 m altitude. The date of flowering is not known.

Conservation.— A single Thai record of this poorly understood species from Myanmar is known. No comment on the size of the population in Omkoi was made by Seidenfaden (1977), and consequently it is not possible to assess the status of the species in Thailand properly. However, it was listed in a book on threatened plants of Thailand (Suddee, 2005: 129). IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., Dansk Bot. Ark. 31 (3): fig. 77a–e. 1977.

Notes.— As pointed out by Seidenfaden (1977) the flowers of *Habenaria avana* differ from those of *H. marginata* merely in their colouring (white in *H. avana*, orange-yellow in *H. marginata*). There appear to be differences in the leaf arrangement, as the leaves of *H. marginata* seem to be mostly scattered in the middle or basal part of the stem, while the leaves of the single Thai specimen of *H. avana* are scattered all along it. However, the differences are only slight and the variation within *H. marginata* is extensive (see above). Future studies will have to show whether the distinction between the two species can indeed be upheld.

**35. *Habenaria mandersii*** Collett & Hemsl., J. Linn. Soc., Bot. 28: 133. 1890; Seidenf., Dansk Bot. Ark. 31(3): 126. 1977; Opera Bot. 114: 67. 1992; Kurzweil, Gardens’ Bull. Singapore 60 (1). 55. 2008.— *Kraenzlinorchis mandersii* (Collett & Hemsl.) Szlach., Orchidee (Hamburg) 55: 58. 2004. Type: Upper Myanmar, Shan Hills, 1889, ?*Manders* s.n. (lectotype **K**, designated here, barcode K000247450!).

Terrestrial, deciduous, almost entirely glabrous but bract margins sometimes hairy. *Stems* 29–55 cm tall. *Cataphylls* 2–3, tubular, sheathing, enveloping the stem base to 2.5 cm high, uppermost often with a small blade. *Leaves* 4–5, cauline and scattered or clustered in the lower part of the stem, elliptic-lanceolate, acute to subacute, mucronate, 5–12 by 1.2–2.3 cm, with papillose margins. *Bract-like leaves* 8–10, lanceolate or lanceolate-elliptic, acuminate, 2.2–6 cm long, smooth or papillose on the surface, margins denticulate or papillose. *Inflorescences* lax or semi-dense, few-flowered; rachis 4–10 cm long; floral bracts lanceolate, acute or acuminate, 20–25 by 3–6 mm, slightly longer than the pedicel plus the ovary, margins elongate-papillose to shortly glandular-hairy. *Flowers* to 19 mm across; white. *Ovary* (including pedicel) 15–22 mm long, papillose, curved, beak narrow. *Sepals* elliptic-ovate, subacute to obtuse, 3-veined; median sepal erect, 6.5–10.5 by 3.5–5.5 mm; lateral sepals obliquely spreading, 6.8–11 by 3–4.6 mm, their bases united with the petals and the lip. *Petals* oblong or elliptic-lanceolate, subacute or obtuse, 1- or 3-veined, 7–11.5 by 1.5–2 mm. *Lip* 8–16.5 by 2.5–3 mm, unlobed, oblong-spathulate, obtuse, normally widest in its upper part, with involute margins, with a prominent erect tongue in front of the entrance of the spur, this tongue with obscure rounded outgrowths on the sides (but not with prominent teeth!), the laminate flange in the middle of this tongue very prominent and occupying most of its length, apex of the tongue entire or somewhat emarginate; spur cylindric, (28–)30–38(–47) mm long, slightly clavate, with obtuse apex. *Gynostemium* 3–4 mm long, anther with a prominent terminal connective process, anther canals 3–5 mm long, curved or angled upwards, stigmas 4–5 mm long, curved upwards.



Thailand.— NORTHERN: Chiang Mai [Omkoi, *Pumicong* 386 (**QBG**, **QBG** [s], **SING**); idem., *Suksathan* 2898 (**QBG**, **C** [s])]; ? Sukhothai [Srichalieng, *Kasem* 260 (**BK**)]; NORTH-EASTERN: Kalasin [Phu Sing, *Sakol* 3490 (**BK**)]; EASTERN: Ubon Ratchathani [Pho Sai District, *Suddee* 801 (**BKF** [s])]; SOUTH EASTERN: unspecified: *Thaithong* 504 (**BCU**, **BCU** [s]); Prachin Buri [*Kasem* 475 (**BK**); ? *Ubolcholakhate* s.n. (**BCU** [s])]; WITHOUT LOCALITY: *Thaithong* 772 (**BCU** [s]); *Tiptabiankarn* 6856 (**Suan Luang** [s]) [10 collections seen, 2 of them uncertain].

Distribution.— Myanmar and Indochina.

Ecology.— Found in dry deciduous dipterocarp forest or open pine-oak forest, once found in a boggy area in a forest clearing; 280–1025 m altitude. Sometimes reported on lateritic soil. Flowering: Aug.–Nov.

Conservation.— Ten collections in the north, north-east, east and south-east have been seen. As suggested below, the species was probably sometimes mistaken for *Habenaria hosseusii*. IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 80a–c. 1977; *Opera Bot.* 114: fig. 34a–e. 1992.

Notes.— *Habenaria mandersii*, *H. dentiostroata* and *H. hosseusii* form a distinct group, well-characterised by their entire and oblong-lorate lip, which is widest in its upper part, and the tongue of the lip which is positioned in front of the spur entrance. A comparison of the floral characters of the three species was given by Kurzweil (2008).

*Habenaria mandersii* was only recently recorded in Thailand (Kurzweil, 2008) but is known in both Myanmar and Indochina. It is here assumed that it was in the past mistaken for a short-spurred form of *H. hosseusii* although it is quite distinct from it in fine details of the tongue in front of the spur entrance. In *H. mandersii* the lateral teeth of this tongue are reduced to obscure round bulges, and in addition this species exhibits a large laminate flange on the tongue (which is short in *H. hosseusii*).

**36. *Habenaria dentiostroata*** Tang & F.T.Wang, *Bull. Fan Mem. Inst. Biol.* 7: 137. 1936; Seidenf., *Dansk Bot. Ark.* 31(3): 126. 1977; *Opera Bot.* 114: 67. 1992.— *Kraenzlinorchis dentiostroata* (Tang & F.T.Wang) Szlach., *Orchidee* (Hamburg) 55: 58. 2004. Type: Myanmar, Taung Gyigon Reserve, Meiktila, 2200 ft., 7 Oct. 1929, *Tha Myaing* 263 (holotype **K!**).— *Habenaria hosseusii* auct. non Schltr.: Kerr, *Nat. Hist. Bull. Siam Soc.* 23: 188. 1969.

Terrestrial, deciduous, glabrous except for the bract margins and midribs. *Stems* 35–50 cm tall, terete below and several-angled above. *Leaves* 3–8, cauline and scattered or clustered in the lower stem portion, lanceolate-elliptic, acute or subacute, mucronate, 5.2–7 by 1–1.4 cm. *Bract-like leaves* 4–8, lanceolate, acuminate, 2.8–3 cm long, elongate-papillose or glandular-hairy on the margins. *Inflorescences* lax to semi-dense, to 11-flowered; rachis several-angled, 7–10 cm long; floral bracts lanceolate, acuminate, 25–30 by 4–4.5 mm, longer than the pedicel plus the ovary, elongate-papillose to shortly glandular-hairy on the midrib and on the margins. *Flowers* 21–23.5 mm across; colour not known. *Ovary* (including pedicel) ca 23 mm long, ribbed, minutely papillose, with narrow beak of ca 7 mm. *Sepals* ovate-lanceolate, subacute, 3-veined; median sepal apparently

reflexed, 9.7–11.3 by ca 5.5 mm; lateral sepals spreading, oblique, 10–11.3 by 4–5.5 mm, basally united with the petals and the lip. *Petals* lorate, obtuse or subacute, 3-veined, 11–12.5 by 2.5–2.8 mm. *Lip* 18–20 by 2.6–3 mm, entire, obtuse, oblong-spathulate, widest in its upper part, edges rolled inwards (at least in spirit-preserved material), with a ca 3 mm long tongue in front of the spur entrance, this tongue with triangular teeth on the sides, the longitudinal flange in the middle of the tongue a minute round bulge, apex of tongue bilobed; spur cylindric, to 70 mm long, slightly clavate, apex obtuse. *Gynostemium* ca 4.5 mm long, anther canals 6–7 mm long, curved or geniculately angled upwards, auricles raised and ca 1 mm in diameter, stigmatic processes about 6 mm long, bent upwards.

? Thailand.— Bought at a market in Bangkok [*Thaithong* 768 (BCU [s])] [1 collection with uncertain origin seen].

Distribution.— Myanmar and Indochina.

Ecology.— Not known. Flowering: Oct.

Conservation.— Origin unknown. IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 80d–e. 1977; *Opera Bot.* 114: fig. 35a–b. 1992.

Notes.— The occurrence of this species in Thailand is very uncertain. A plant was bought at the Weekend Market in Bangkok (*Thaithong* 768, BCU [s]!) but it is not known whether it actually came from somewhere in Thailand or was brought over the borders from Myanmar or Laos.

*Habenaria dentiostriata* is very similar to *H. mandersii* and *H. hosseusii*. It shares with *H. hosseusii* the prominent lateral teeth of the tongue of the lip base (which are absent in *H. mandersii*), differing merely in the retuse or bilobulate apex of the tongue. Although *H. dentiostriata* was treated as distinct by Seidenfaden (1977) it is possible that a future study of the *H. hosseusii* group may show that it should be treated as conspecific with *H. hosseusii*.

**37. *Habenaria hosseusii*** Schltr., *Repert. Spec. Nov. Regni Veg.* 2: 81. 1906; Seidenf. & Smitinand, *Orchids Thailand*: 22, 725. 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): 130. 1977.— *Kraenzlinorchis hosseusii* (Schltr.) Szlach., *Orchidee* (Hamburg) 55: 58. 2004. Type: Thailand, summit of Wang Chao, 3 Oct. 1904, *Hosseus* 77 (holotype B†; lectotype K, designated here, K000364327!; isoelectotypes BM!, P!).— non *Habenaria hosseusii* auct. Schltr.: Kerr, *Nat. Hist. Bull. Siam Soc.* 23: 188. 1969 (= *H. dentiostriata* Tang & F.T.Wang). Fig. 21.

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* (27–)32–56(–74) cm tall. *Cataphylls* 2–4, tubular, sheathing, enveloping the stem base to 7 cm high; uppermost often with a blade to 2.6 by 1.6 cm. *Leaves* 3–9, spreading, cauline and scattered in the lower stem portion, lanceolate-elliptic, acute, mucronate, (3–)6–16 by (0.8–)1–2.2(–2.8) cm, entire or elongate-papillose on the margins. *Bract-like leaves* 3–10, suberect to spreading, lanceolate-elliptic, acuminate, occasionally dry at the flowering time (?), (2.2–)2.5–5(–8) cm long, not or scarcely sheathing at the base, shortly glandular-

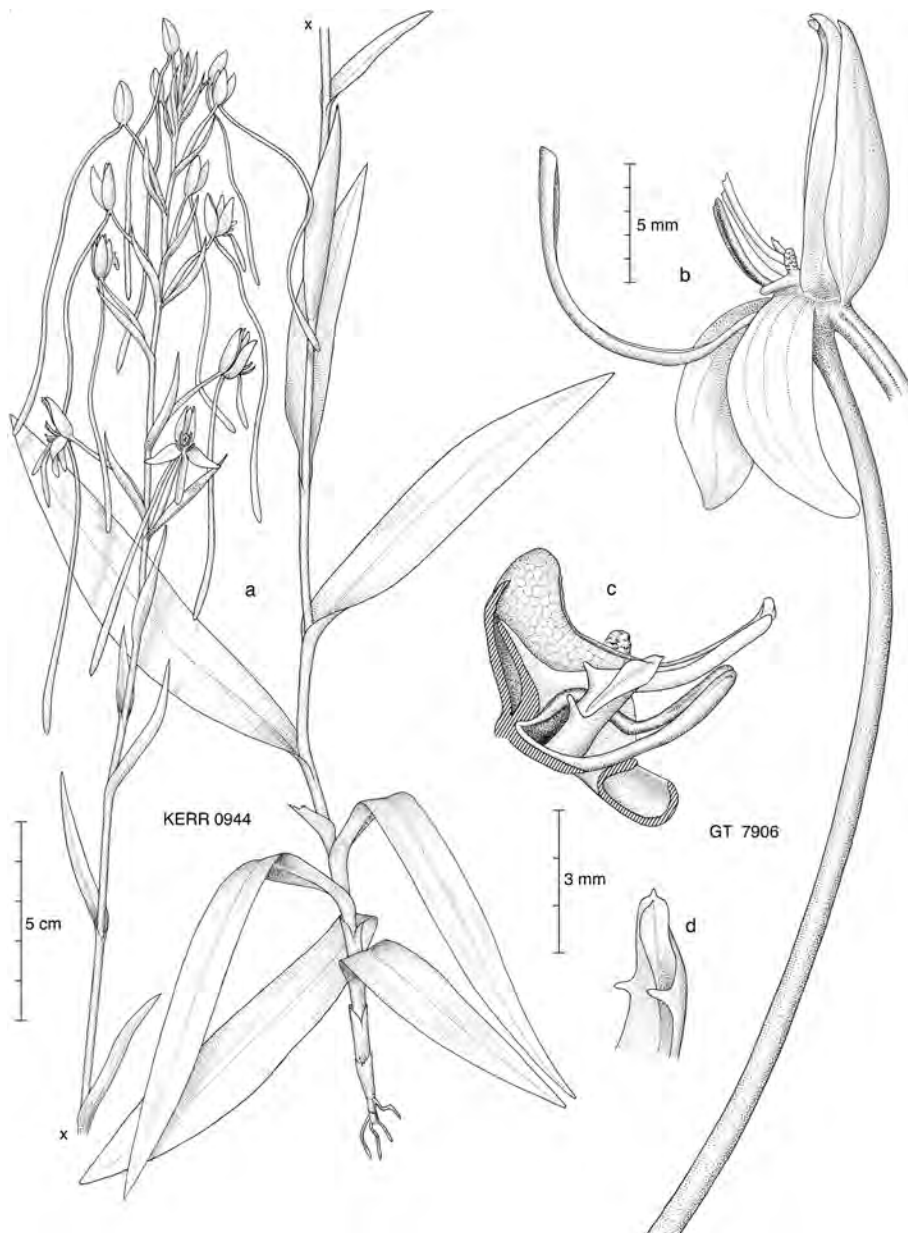


Figure 21. *Habenaria hosseusii* Schltr.: a. plant; b. flower; c. section through gynostemium; d. tongue at the lip base. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

hairy on the margins. *Inflorescences* lax, (4–)8–15-flowered; rachis (3–)4–18 cm long; floral bracts lanceolate, acuminate, (12–)19–30(–40) by 3–5(–6) mm, shorter or longer than the pedicel plus the ovary, shortly glandular-hairy on the margins. *Flowers* 15–25 mm across; white, distal parts of tepals and spur sometimes greenish, gynostemium white, anther yellow. *Ovary* (including pedicel) 21–26(–30) mm long, often papillose, pedicel sometimes pronounced, 1–2 mm long. *Sepals* oblong-elliptic, subacute or obtuse, 3–5-veined from the base; median sepal erect, 8.5–12(–14) by 4–5(–6) mm, sometimes denticulate on the margins; lateral sepals spreading, oblique, similar in size. *Petals* erect, forming a hood with the median sepal, oblong, obtuse, 8.5–12.2(–14) by 1.5–2(–2.6) mm. *Lip* 10–17(–24) by 1–2(–3.5) mm, entire, oblong-spathulate, widest in its upper part, with a 2–3 mm long tongue in front of the spur entrance, laminate flange in the middle of the raised tongue small, the sides of this tongue with two small teeth, apex of tongue obtuse or mucronate; spur cylindric, (48–)60–100 mm long, thickened in the distal quarter. *Gynostemium* 3–4 mm long; anther canals and stigmatic processes 3–5 mm long.

Thailand.— NORTHERN: Mae Hong Son [Mae Sariang, *Larsen et al.* 2226 (**AAU**, **BKF**); idem., *Larsen et al.* 2321 (**AAU**, **BKF**, **L**, **P**); idem., *Prayad* 310 (**BK**)]; Chiang Mai [Doi Suthep, *Maxwell* 88-1071 (**BKF**, **CMU**); idem., *Seidenfaden & Smitinand* 2759 (**C** [s]); Mae Rim, *Srisanga* 2182 (**QBG**); Ob Luang, *Maxwell* 96-1316 (**ScCMU**, **ScCMU** [s]); idem., *Seidenfaden & Smitinand* 3008 (**C** [s]); idem., *Sørensen et al.* 5256 (**BKF**, **C**); Doi Inthanon National Park, *Phengklai et al.* 6563 (**BKF**); Mek Hia, *Kerr* 196 (**K**); Mae Soi Valley, *Maxwell* 91-805 (**ScCMU**, **ScCMU** [s], **P**); Lamphun [Doi Khun Tan National Park, *Maxwell* 94-945 (**ScCMU**, **ScCMU** [s], **L**); Tak [Wang Chao, *Hosseus* 77 (lectotype **K**, isoelectotypes **BM**, **P**); Umphang, *Keratikorkol* 388 (**QBG** [s]); Mussoe, *Seidenfaden & Smitinand* 7906 (**C** [s]); no exact locality, *Worachat* 47 (**KKU** [s]); Kamphaeng Phet [Khao Hua Mot, *Kerr* 473 (**BK**, **C**, **K**, **L**)]; NORTH-EASTERN: Phetchabun [Thung Salaeng Luang National Park, *Kerr* 0944 (**BK**, **C**, **K**)]; Sakon Nakhon [Phu Phan National Park, *Auemporn* 15/1999 (**KKU** [s]); idem., *KKU* 878 (**KKU** [s])]; EASTERN: Buri Ram [Ban Kruat, *Murata et al.* T 37485 (**BKF**); no exact locality, *Murata et al.* T 37399 (**BKF**, **L**)]; SOUTH-WESTERN: Uthai Thani [*Phengklai* 3992 (**BKF**)]; Phetchaburi [Huai Sai, *Puudjaa & Cholkulchana* 663 (**BKF**, **BKF** [s])] [25 collections seen].

Distribution.— Endemic.

Ecology.— Found in open deciduous forest, in secondary and grazed forest and in swampland; 50–900 m altitude. Reported over limestone, granite or shale. Flowering: (June–)July–Sept.(–Nov.).

Conservation.— Widespread in northern Thailand, and recorded also in the north-eastern, eastern and south-western region. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 14a–e. 1959; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 81a–d. 1977; present paper: fig. 21a–d.

Notes.— *Habenaria hosseusii* is quite common in the northern and eastern parts of Thailand. It is very close to *H. dentirostrata* with its lateral teeth on the tongue in front of the spur entrance, differing mainly in the shape of the tongue-apex (see above).

**38. *Habenaria reniformis*** (D.Don) Hook.f., Fl. Brit. India 6: 152. 1890; Seidenf., Dansk Bot. Ark. 31(3): 132. 1977; Opera Bot. 114: 67. 1992; Comber, Orchids Sumatra: 101. 2001; Chen *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009). — *Listera reniformis* D.Don, Prodr. Fl. Nepal.: 28. 1825. — *Neottia reniformis* (D.Don) Spreng., Syst. Veg. 3: 707. 1826. — *Herminium reniforme* (D.Don) Lindl. in Wallich, Numer. List: 7067. 1832. — *Aopla reniformis* (D.Don) Lindl., Edwards's Bot. Reg. 20: t. 1701. 1835. Type: Nepal, Wallich s.n., Wall. Cat. 7067 (?holotype **K**, drawing seen). — *Habenaria clovisii* Gagnep., Bull. Soc. Bot. France 78: 68. 1931; Seidenf., Bot. Tidsskr. 68: 42. 1973. Types: Cambodia, Stung-treng, 1866–1868, Thorel 2143 (syntype **P!**), Vietnam, Prenh, near Dalat, Evrard 1480 (syntype not found).

Terrestrial or epilithic, deciduous, glabrous. *Stems* (4.5–)10–19 cm tall. *Cataphylls* 1–2, tubular, enveloping the stem to 1 cm high; uppermost with a blade to 0.5 cm long. *Leaves* 2–4, adpressed to the substrate, radical, ovate to elliptic, somewhat cordate at the base, acute, mucronate, 1.4–4 by 1–1.4 cm, margins entire. *Bract-like leaves* (1–)4–9, suberect to spreading, narrowly lanceolate, acuminate, 0.5–1.8 cm long, margins entire, not or only shortly sheathing at the base. *Inflorescences* lax, (1–)3–7-flowered; rachis 3–5 cm long; floral bracts ovate-lanceolate, acuminate, 7–10 by 1.5–3 mm, shorter than the pedicel plus the ovary. *Flowers* 6.5–9 mm across; brownish or yellow-green. *Ovary* (including pedicel) 8–15 mm long. *Sepals* elliptic-lanceolate, rounded to subacute, 3-veined; median sepal erect, elliptic-ovate, 3.5–4(–4.5) by 1.5–3 mm; lateral sepals spreading, ovate-elliptic, 3.5–4(–4.5) by 1.7–3.4 mm. *Petals* elliptic-lanceolate to falcately linear-triangular, subacute or obtuse, forming a hood with the median sepal, 3-veined, 3.5–4.5 by 0.8–1.6 mm. *Lip* 4.5–10 mm long, deeply 3-lobed almost to the base; midlobe linear, (3.7–)5–9 by 0.2–0.3(–0.7) mm; side-lobes linear-filiform, 6–29 by 0.1–0.3 mm; spur cylindric, in the examined Thai specimens 5–7.6 mm long but outside our area often much shorter, forwards-curved, clavate in the distal half. *Gynostemium* 1–2.3 mm long, anther canals insignificant, stigmas ca 2 mm long, spreading. *Fruit* sessile, elliptic-fusiform, about 9.5 mm long, 3 mm in diameter, with a short apical beak to 1 mm long.

Thailand.— ? NORTHERN: Chiang Mai [Mae Taeng, Kerr s.n. (**K** H2007/02483-75)]; SOUTH-WESTERN: Kanchanaburi [Sai Yok, v. Beusekom *et al.* 3972 (**BKF**, **C**, **C** [s], **L**)]; PENINSULAR: Phangnga [Rue-see Cave, Thaithong 1802 (**BCU**)] [3 collections seen, 1 of them uncertain].

Distribution.— India to Indochina and S China, also in Sumatra.

Ecology.— Found in moist places in bamboo thicket and in cracks in limestone, also collected in secondary, fire-damaged evergreen scrubland; 150–825 m altitude. Reported over sandstone or limestone. Flowering: Aug. and Nov.

Conservation.— Known from only three widely scattered localities. Small plants that are easily overlooked. IUCN red list category 'Endangered' based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Bot. Tidsskr. 68: fig. 3a–d. 1973; Dansk Bot. Ark. 31(3): fig. 85a–d. 1977.

Notes.— This and the following five species *Habenaria humidicola*, *H. porphyricola*,



*H. humistrata*, *H. siamensis* and *H. poilanei* form a group of similar and probably closely related species which share the slender habit, the (1–)2–4 radical leaves which are adpressed to or spreading just above the substrate and their small or medium-sized flowers with simple petals and 3-lobed lips. *H. anomaliflora* shares the habit and the radical leaves which are adpressed to the substrate but differs by having flowers with a subactinomorphic perianth. It has been suggested that this species is a constant abnormality (Kurzweil *et al.*, 2009). Another similar species in the group is the Indian *H. diphylla* (Nimmo) Dalzell, which is possibly conspecific with our *H. humistrata* (Seidenfaden, 1977). A taxonomic revision of the species complex over its entire distribution range is not yet available.

**39. *Habenaria humidicola*** Rolfe, Bull. Misc. Inform. Kew 1896: 202. 1896. Seidenf., Opera Bot. 114: 68. 1992; Chen *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009). Type: China, Zhejiang, Ningpo Mts., in damp places in the shade of rocks, *Faber* 200 (holotype ?**HK**).

Terrestrial, deciduous, glabrous. *Stems* 21.5 cm tall. *Leaves* 4, radical and spreading just above the soil surface, elongate-ovate to elliptic, subacute or acute, 4–7 by 1.2–2.2 cm. *Bract-like leaves* 7, erect or suberect, narrowly lanceolate, acuminate, 1.2–2 cm long. *Inflorescences* lax, 13-flowered; rachis 8 cm long; floral bracts ovate-lanceolate, acuminate, lowermost 11 by 3.3 mm long. *Flowers* ca 9 mm across; light green. *Ovary* (including pedicel) ca 11 mm long. *Sepals* ovate or ovate-elliptic, rounded to subacute; median sepal erect, ca 3.8 by 3 mm, with three prominent thickened veins; lateral sepals spreading, ca 4.3 by 2.2 mm. *Petals* linear, slightly curved forwards, forming a hood with the median sepal, subacute or obtuse, ca 4.2 by 0.9 mm. *Lip* ca 6 mm long, 3-lobed to the base; midlobe linear, ca 5 by 0.7 mm; side-lobes linear-filiform, ca 7 by 0.4 mm; spur cylindric or slightly clavate in the middle, pendent, 7–8 mm long. *Gynostemium* ca 1.8 mm long, anther with a moderately wide connective between the thecae, anther canals insignificant, stigmas ca 1.5 mm long, spreading.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, *Tripetch* s.n. (**QBG** [s])] [1 collection seen].

Distribution.— S China.

Ecology.— The only Thai specimen known was found growing in humus in a limestone area at ca 1600 m altitude. Flowering: Aug.

Conservation.— In Thailand this species is currently known from a single population, and its national conservation status can therefore not be assessed properly. Small plants that are easily overlooked. IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., Opera Bot. 114: fig. 36a–b. 1992.

Notes.— This is a new record for Thailand. The species is very close to *Habenaria reniformis* as already pointed out by Seidenfaden (1977).

**40. *Habenaria porphyricola*** Schltr., Repert. Spec. Nov. Regni Veg. 2: 82. 1906; Seidenf. & Smitinand, Orchids Thailand: 36, 727. 1959–1965; Seidenf., Bot. Tidsskr. 68: 41. 1973; Dansk Bot. Ark. 31(3): 132. 1977. Type: Thailand, Wang Chao, 3 Oct. 1904, *Hosseus*

53 (holotype **B**†; lectotype **P**, designated here, barcode P00439684!).— non *Habenaria porphyricola* auct. Schltr.: Kerr, Nat. Hist. Bull. Siam Soc. 23: 188. 1969 (= *H. dentata* (Sw.) Schltr.)

Terrestrial, deciduous, glabrous. *Stems* (10–)16–23 cm tall. *Leaves* 2–3, radical, adpressed to the substrate, ovate-acute, sometimes cordate at the base, (2–)2.3–6 by 1.3–3 cm. *Bract-like leaves* (3–)4–6, erect with spreading tip, narrowly lanceolate, acuminate, 0.8–2.5 cm long, largely sheathing, the upper denticulate or papillose on the margins. *Inflorescences* lax, (1–)2–5-flowered; rachis 2–6.5 cm long; floral bracts ovate-lanceolate, acuminate, 7–12 by 3–4(–5) mm, shorter than the pedicel plus the ovary, denticulate or papillose on the margins. *Flowers* 13–14 mm across; lateral sepals and petals pale greenish, lip and proximal spur half white, distal spur half light green. *Ovary* (including pedicel) 13–15(–17) mm long, ribs denticulate or papillose. *Sepals* rounded to subacute, 3-veined, minutely denticulate on the margins; median sepal erect, broadly ovate with a slightly drawn out short tip, 4.9–7 by 3.3–4.5 mm; lateral sepals spreading, ovate-elliptic, 6–9 by 2.8–3.3(–4) mm. *Petals* erect, forming a hood with the median sepal, falcately linear-triangular, acute, 5–6.5(–2) by 1–1.6(–2) mm. *Lip* 9–11 mm long, deeply 3-lobed to near the base; midlobe linear, 7–10 by 0.6–1.5 mm; side-lobes narrowly lanceolate, spreading, 5–12(–14) by 1–2 mm; spur cylindric, 15–25 mm long, longer than the pedicel plus the ovary, clavate in the upper half. *Gynostemium* ca 2.7 mm long, anther canals 1–1.5 mm long, stigma processes 3–4.5 mm long, about three to five times longer than the anther canals.

Thailand.— NORTHERN: Chiang Mai [Mae Chaem, without collector 9567 (**C** [s] vial 411)]; Lamphun [Doi Khun Tan National Park, *Maxwell* 94-1047 (**BKF**, **ScCMU**, **ScCMU** [s], **L**)]; Tak [Wang Chao, *Hosseus* 53 (lectotype **P**)] [3 collections seen].

Distribution.— Endemic.

Ecology.— Found in dipterocarp-oak forest; 130–700 m altitude. Reported over shale. Flowering: Sept.

Conservation.— Three collections from the north have been seen. Small plants that are easily overlooked. IUCN red list category ‘Endangered’ based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Bot. Tidsskr. 68: fig. 1a–f. 1973; Dansk Bot. Ark. 31(3): fig. 84a–f. 1977.

Notes.— This is a very poorly known species, recorded only three times so far. The most obvious character differentiating this species from all others in the group are the long spurs and the long stigma lobes which are about three to five times longer than the anther canals.

**41. *Habenaria humistrata*** Rolfe ex Downie, Bull. Misc. Inform. Kew 1925: 419. 1925; Seidenf. & Smitinand, Orchids Thailand: 29. 1959; Seidenf., Bot. Tidsskr. 68: 42. 1973; Dansk Bot. Ark. 31(3): 131. 1977. Type: Thailand, Chiang Mai, Doi Suthep, open deciduous jungle among grass, 450–1050 m, 29 Aug. 1901, *Kerr* 194 (holotype **K**!; isotypes **BM**, **C**!, **L**!, **P**!).— *Habenaria siamensis* auct. non Schltr.: Seidenf. & Smitinand, Orchids Thailand: 30 pp., 726. 1959–1965. Fig. 22.

Terrestrial, deciduous, glabrous. *Stems* 10–25(–29) cm tall. *Cataphyll* 1, tubular, sheathing, enveloping the stem to 0.5 cm high. *Leaves* (1–)2–3, radical, adpressed to the substrate, orbicular or ovate, slightly mucronate, 1.4–2.3(–5) by (1.1–)1.8–2.8 cm, margins sometimes pale and semi-translucent. *Bract-like leaves* 1–3(–5), erect, narrowly lanceolate, acuminate, (0.7–)0.9–1.4 cm long, not or only shortly sheathing. *Inflorescences* lax, (1–)2–10-flowered; rachis 1–10(–15) cm long; floral bracts ovate-lanceolate, acuminate, (4–)6.8–11 by 2–3.5 mm, much shorter than the pedicel plus the ovary. *Flowers* 8–15 mm across (excluding the lip lobes); sepals greenish brown or green, lateral sepal inside whitish, petals light green, bases of sepals and petals sometimes white, lip green and white, stigma lobes black. *Ovary* (including pedicel) 13–16 mm long, erect and close to the rachis. *Sepals* obtuse or subacute, margins sometimes denticulate; median sepal erect, broadly elliptic, (4.5–)5–6.5(–6.8) by 3–5.5 mm; lateral sepals spreading, ovate-elliptic, 5.2–6(–8) by 3–4 mm. *Petals* erect, cohering with the median sepal, falcately linear-triangular, subacute, 5.2–7 by 1–2 mm, basally united with the lip. *Lip* 8–13 mm long, deeply 3-lobed nearly to the base; midlobe linear, 6.8–9(–12) by ca 0.5 mm; side-lobes linear-filiform, forming a right angle with the midlobe, 10–20(–25) by 0.3–0.4 mm; spur normally cylindric, rarely strongly clavate, mostly 4.8–8(–9) mm long, shorter than the pedicel plus the ovary. *Gynostemium* 3–3.3 mm long, anther thecae separated by a wide connective, lateral rostellum arms tapering, stigmas ca 2 mm long.

Thailand.—NORTHERN: Mae Hong Son [Mae Sariang, *Pumicong* 394 (**QBG**, **QBG** [s], **SING**); idem., *Pumicong* 398 (**QBG**, **QBG** [s]); Ban Rak Thai, *Suksathan* 4257 (**QBG** [s]); Huai Hei, *Triboun* 439 (l) (**BK** [s]); Chiang Mai [Doi Suthep, *Kerr* 194 (holotype **K**, isotypes **C**, **L**, **P**); idem., *Kerr* 350 (**C**, **K**); idem., *Nanakorn et al.* 12635 (**QBG** [s]); idem., *Seidenfaden & Smitinand* 2806 (**C** [s]); idem., *Seidenfaden & Smitinand* 3007 (**C** [s]); idem., *Seidenfaden & Smitinand* 3021 (**C** [s]); idem., *Seidenfaden & Smitinand* 3028 (**C** [s]); idem., *Sørensen et al.* 3908 (**C**); idem., *Sørensen et al.* 5110 (**BKF**, **C**); *Sørensen et al.* 5125b (**BKF**); Mae Rim, *Pumicong* 360 (**QBG** [s]); idem., *Pumicong* 361 (**QBG**, **QBG** [s]); ? Mae Taeng, *Kerr* s.n. (**C** [s] vial 152); Chiang Dao, *Maxwell* 89-1095 (**CMU**); Muang, *Maxwell* 88-1038 (**BKF**, **CMU**, **L**); San Kam Phaeng District, *Maxwell* 96-1191 (**ScCMU**, **ScCMU** [s], **L**); no exact locality, *Maxwell* 78-1038 (**L**); NORTH-EASTERN: Loei [Phu Ruea National Park, *Thammatawon* 161 (**KKU** [s]); idem., *Thammatawon* 166 (**KKU** [s]); Sakon Nakhon [Phu Phan National Park, *Thammatawon* 40 (**KKU** [s]); EASTERN: Chaiyaphum [Pa Hin Ngam National Park, *Suddee* 164 (**BCU** [s]); no exact locality, *Thaithong* 759 (**BCU** [s]); Ubon Ratchathani [Pha Taem, *Boonjaras* 5 (**BCU**); CENTRAL: Nakhon Nayok [Khao Yai National Park, *Maxwell* 00-351 (**ScCMU** [s])] [28 collections seen, 1 of them uncertain].

Distribution.—Endemic.

Ecology.—Locally common in humous or sandy soil in deciduous dipterocarp-oak forest, evergreen hill forest and pine forest; 190–1200 m altitude. According to collector's notes it is found over granite or shale. Flowering: June–Sept.(–Oct.).

Conservation.—The species is known from a large number of collections made in northern, north-eastern, eastern and central Thailand and does not appear to be particularly rare, although it was listed in a book on threatened plants of Thailand (Suddee, 2005: 130). Several of the known localities are situated in national parks. Moreover, the species

may have been frequently overlooked given the small plant size. IUCN red list category 'Least Concern' (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 21a–e. 1959; Seidenf., *Bot. Tidsskr.* 68: fig. 2a–b. 1973; *Dansk Bot. Ark.* 31(3): fig. 83a–d. 1977; present paper: fig. 22a–b.

Notes.— This species has small basal leaves adpressed to the ground and small greenish and white flowers. Its obvious characters are the erect ovaries resulting in the position of the flowers close to the rachis (and consequently a narrow inflorescence) and the lip side-lobes which are forming a right angle with the midlobe, both of which are differentiating characters from *Habenaria siamensis*. Also the gynostemium is different from that of *H. siamensis*, in that its thecae are separated by a widened connective.

The collection *Triboun* 439 (l) (BK!) is somewhat aberrant with its strongly clavate spur which is about 1.5 mm thick.

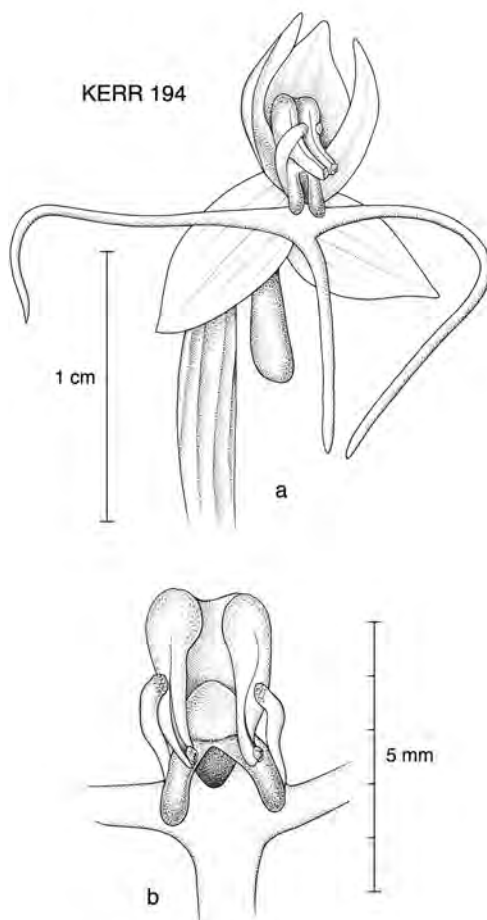


Figure 22. *Habenaria humistrata* Rolfe ex Downie: a. flower; b. gynostemium. All from the type specimen. Reproduced with permission from the University of Copenhagen, drawn by Kai Olsen.

**42. *Habenaria siamensis*** Schltr., Repert. Spec. Nov. Regni Veg. 2: 82. 1906; Seidenf. & Smitinand, Orchids Thailand: 30. 1959; Seidenf., Dansk Bot. Ark. 31(3): 130. 1977; Chen *et al.*, Fl. China 25. In prep. (internet draft version, accessed 27 April 2009). Type: Thailand, Wang Chao, 5 Oct. 1904, *Hosseus* 52 (holotype **B†**; lectotype **K**, designated here, barcode K000364316!; isoelectotypes **AMES**, **BM!**, **L!**).

Terrestrial, deciduous, glabrous except for the bract margins. *Stems* 8–12.5 cm tall. *Leaves* 2(–3), radical, adpressed to the substrate, broadly ovate-lanceolate to cordate, mucronate, 1.9–3(–4.8) by 1.5–2.1(–2.4) cm, margins sometimes pale and semi-translucent. *Bract-like leaves* 3–4, suberect, narrowly lanceolate, acuminate, 0.8–2 cm long, only shortly sheathing at the base, margins entire or shortly glandular-hairy; lowest bract-like leaf sometimes foliaceous, to 4 by 1.5 cm. *Inflorescences* lax, 2–9-flowered; rachis 1–5 cm long; floral bracts ovate-lanceolate, acuminate, 7–13 by 2.2–3 mm, shorter than the pedicel plus the ovary, margins shortly glandular-hairy. *Flowers* to 15 mm across (excluding lip); greenish yellow or white. *Ovary* (including pedicel) 11–17 mm long, patent. *Sepals* rounded to subacute; median sepal erect, broadly elliptic, 5.8–7 by 3–5 mm; lateral sepals spreading, ovate-elliptic, 6.5–7(–8) by 2.5–3(–3.7) mm. *Petals* erect, falcately triangular, subacute, 6–7 by 1.8–3 mm. *Lip* 11–12 mm long, 3-lobed almost to the base, sometimes with lateral auricles in the basal portion; midlobe linear, 7–11 by ca 0.6 mm; side-lobes linear-filiform, forming an acute angle with the midlobe, (11–)15–16(–18) by ca 0.3 mm; spur cylindric, 7–12.5 mm long, thickened in its upper half, usually shorter than the pedicel plus the ovary. *Gynostemium* 1.5–3 mm long, thecae adjacent, auricles rather high, lateral rostellum lobes short, bent upwards and widening towards a broadly truncate apex.

Thailand.—NORTHERN: Chiang Mai [Mae Chaem, *Kerr* 488 (**BK**, **K**); Tak [Wang Chao, *Hosseus* 52 (lectotype **K**; isoelectotypes **BM**, **L**); NORTH-EASTERN: Sakon Nakhon [Kusuman, *Pooma et al.* 2593 (**L**); no exact locality, *Thaithong* 890 (**BCU** [s]); WITHOUT LOCALITY: Nanakorn *et al.* 12129 (**QBG** [s]) [5 collections seen].

Distribution.—S China (Guizhou).

Ecology.—Found in grassy places in evergreen forest; 170–1500 m altitude. Flowering: Aug.

Conservation.—Known from only four widely scattered localities in northern and north-eastern Thailand plus an unknown one. It was listed in a book on threatened plants of Thailand (Suddee, 2005: 130). Small plants that are easily overlooked. IUCN red list category ‘Endangered’ based on geographic range and decline (B2a,b(iii); IUCN, 2001) (see also Santisuk *et al.*, 2006).

Illustrations.—Seidenf., Dansk Bot. Ark. 31(3): fig. 82a–c. 1977.

Notes.—This is a rare species with small basal leaves adpressed to the ground and small greenish yellow or white flowers. It can easily be distinguished from *Habenaria humistrata* by the patent ovaries (and consequently wider inflorescences) and by the lip side-lobes which form an acute angle with the midlobe. Also the structure of the gynostemium is different with its adjacent thecae and the short lateral rostellum lobes that are bent upwards and are widening towards their truncate apex.



The collection *Kerr* 488 (**K!**) was apparently identified as *Habenaria porphyricola* in error by Seidenfaden (November 1975); it is clearly *H. siamensis* and was also listed as such in a later publication (Seidenfaden, 1977).

*Habenaria siamensis* was considered endemic to Thailand, but its occurrence has recently been reported in China (Chen *et al.*, Fl. China 25. In prep. Internet draft version) which is an interesting range extension. While the relevant specimen has not been seen for the present study, the description in the Flora of China clearly fits the species although the flowers of the Chinese plants are slightly larger than those of the Thai specimens.

**43. cf. *Habenaria poilanei*** Gagnep., Bull. Soc. Bot. France 78: 73. 1931; Seidenf., Opera Bot. 114: 68. 1992. Type: Vietnam, Cana, Phanrang, *Poilane* 12451 (syntype **P!**); Vietnam, Cana, *Evrard* 2421 (syntype **P!**).

Terrestrial, deciduous, glabrous. *Stems* 15–20 cm tall. *Leaves* 2, radical, spreading just above the soil surface, elongate-ovate to elliptic, subacute, unequal in size, 6–8 by 3–5 cm. *Bract-like leaves* 3, spreading or erect, narrowly lanceolate, acute, to 1.5 cm long. *Inflorescences* lax and rather wide, 5-flowered; rachis 3–5 cm long; floral bracts ovate-lanceolate, acuminate, ca 8 by 3.4 mm. *Flowers* to 14 mm across; white with green median sepal and spur. *Ovary* (including pedicel) patent, ca 17 mm long. *Sepals* subacute; median sepal erect, ovate, outside with 3 rather pronounced veins, 4.5–5 by ca 3.3 mm; lateral sepals spreading, ovate-elliptic, ca 6.3 by 4 mm. *Petals* forming a hood with the median sepal, lorate-spathulate, obtuse, ca 5 by 1.7 mm. *Lip* ca 7.5 mm long, 3-lobed almost to the base; midlobe linear, ca 6.5 by 0.6 mm; side-lobes linear, upwards-curved, base forming a right angle with the midlobe, ca 5 by 0.8 mm; spur pendent, ca 14 mm long, strongly clavate in the upper half. *Gynostemium* ca 2.8 mm long, anther canals ca 1 mm long, stigmas ca 1 mm long.

Thailand [1 collection seen].— SOUTH-EASTERN: Rayong [Khao Chamao National Park, *Tripetch* 005 (**QBG [s]**)].

Distribution.— Laos and Vietnam.

Ecology.— The single specimen that was available for study was collected in an open area in soil among granite rocks; ca 100 m altitude. Flowering in May.

Conservation.— In Thailand currently known from a single population found in a national park. Small plants that are easily overlooked. Proposed IUCN red list category ‘Data Deficient’ (IUCN, 2001).

Illustrations.— Seidenf., Opera Bot. 114: fig. 36a–b. 1992.

Notes.— The plant does not match any species currently known in Thailand but fits the concept of the Indochinese *Habenaria poilanei* Gagnep. rather well. However, the Thai plant is more slender and has fewer flowers than the type collection of *H. poilanei*, and also the orientation of the lip side-lobes differs. The species is generally similar to *H. humistrata* but has patent ovaries and mostly larger flowers (Seidenfaden, 1977: 134). If the identification is confirmed this would be a new record for Thailand.

**44. *Habenaria anomaliflora*** Kurzweil & Chantanaorrapint, Gardens' Bull. Singapore 60(2): 373. 2009. Type: Thailand, Nakhon Nayok Province, Khao Yai National Park, Mo Sing To Reservoir, 14°25'N, 101°21'E, 25 Sep. 2005, *Buakhlai* 158 (holotype **PSU [s]**; isotypes **BCU!**, **BKF!**).— *Habenaria* sp., Kerr, Nat. Hist. Bull. Siam Soc. 23: 187. 1969; Seidenf., Opera Bot. 114: 68, in obs. 1992.

Terrestrial, deciduous, glabrous. *Stems* 16–25 cm tall. *Cataphylls* few, tubular, sheathing. *Leaves* 2, radical, adpressed to the soil, orbicular or ovate, acute, mucronate, 2–4 by 1.6–3.8 cm, one leaf larger than the other. *Bract-like leaves* 3–6, erect but spreading in their upper part, narrowly lanceolate, acuminate, 0.9–1.2 cm long, shortly sheathing in the basal part. *Inflorescences* lax, (1–)5–8-flowered; rachis 4–8.1 cm long; floral bracts ovate-lanceolate, acuminate, 6.6–11 by 2.2–4 mm, shorter than the ovaries plus the pedicel. *Flowers* 4–8 mm across, subactinomorphic with subequal sepals, petals and lip, without a spur; sepals, petals and lip greenish on the outside, inside of petals and lip white, gynostemium dark green; sepals, petals and lip ovate-lanceolate, acute or subacute, with three or five prominent dark veins, margins entire, median surface papillate in their upper part; flowers rarely opening up fully. *Ovary* (including pedicel) 10–14.5 mm long. *Sepals*: median sepal 5.6–7 by 2.2–5 mm, lateral sepals 5.5–6.5 by 2–3 mm. *Petals* 4.9–6.5 by 1.8–2.8 mm. *Lip* 4.5–6.5 by 2–3.5 mm. *Gynostemium* 1.5–2 mm long, with two prominent 3-lobed organs, one of them probably representing the anther with its laterally protruding anther canals, the other probably representing the rostellum, stigmas stout, clavate-globular, curved forwards. *Fruit* fusiform, 12–15 by 2.5–3 mm.

Thailand.— CENTRAL: Nakhon Nayok [Khao Yai National Park, *Buakhlai* 158 (holotype **PSU [s]**, isotypes **BCU**, **BKF**); idem., *Maxwell* 00-351 (**BKF**, **ScCMU**, **L**); idem., *Tripetch* A03 (**QBG [s]**)] [3 collections seen].

Distribution.— Laos.

Ecology.— In secondary, fire-damaged evergreen forest or scrubland over sandstone, sometimes locally common; 700–825 m altitude. Flowering: Aug.–Oct.

Conservation.— Only three collections from central Thailand are known. Small plants that are easily overlooked. IUCN red list category 'Endangered' based on geographic range and decline (B2a,b(iii); IUCN, 2001).

Illustrations.— Seidenf., Opera Bot. 114: fig. 37Ba–d. 1992 [as *Habenaria* sp., Kerr 2681]; Kurzweil *et al.*, Gardens' Bull. Singapore 60 (2): fig. 1, t. 1. 2009.

Notes.— *Habenaria anomaliflora* resembles *H. humistrata*, *H. siamensis*, *H. porphyricola* and *H. reniformis* in its habit with the 2–3 small leaves adpressed to the ground but differs by having subactinomorphic and spurless flowers. The gynostemium of the species is unlike that of any other related orchid and appears to be strongly reduced in all of its organs. It has been suggested that *H. anomaliflora* is a *Habenaria*-like monstrosity (Seidenfaden, 1992). As this suspected abnormality is known from four collections (three from Thailand, one from Laos) and is apparently constant in its appearance it was described as a distinct species.

Interestingly, the species was once found growing in the same population together with *Habenaria humistrata* (collected under the same number, *Maxwell* 00-351, ScCMU

[s]!). This could suggest that *H. anomaliflora* is an abnormal form of the latter species, but could equally well also imply that the colony of plants was a mixed population of two different species.

Apparently also found in Phu Ruea National Park in Loei Province (Tripetch, pers. comm.).

**45. *Habenaria carnea*** Weathers, Gard. Chron. 1891 (2): 729. 1891; Seidenf. & Smitinand, Orchids Thailand: 43, 727. 1959–1965; Seidenf., Dansk Bot. Ark. 31(3): 137. 1977; Seidenf. & Wood, Orchids Penins. Malaysia & Singapore: 116. 1992.— *Smithanthus carnea* (Weathers) Szlach. & Marg., Orchidee (Hamburg) 55: 174. 2004. Type: Thailand, Nakhon Si Thammarat, Thung Song, Aug. 1930 [cultivated in Bangkok], *Kerr* 0852 (neotype **C!**, designated here).— ?*Habenaria carnea* var. *concolor* Ridl., Bot. J. Linn. Soc. 32: 412. 1896. Type: Thailand, Phuket, ‘native dealers’ (not found).— *Habenaria clavaeformis* Klinge, Trudy Imp. S.-Peterburgsk. Bot. Sada 17 (1): 138. 1898. Type not known.— ?*Habenaria carnea* var. *minor* Ridl., Mat. Fl. Malayan Penins. 1: 227. 1907. Types: Peninsular Malaysia, Langkawi, without collector and number (syntype not found); Thailand, Terutao, *Curtis* 2104 (syntype not found).

Normally epilithic, deciduous, glabrous except for the petal margins and the lip. *Stems* (5–)11–25 cm tall, smooth or papillose. *Cataphylls* 2–3, tubular and partly sheathing with free apical portion, to 5 cm long. *Leaves* 2–4, spreading, basal, lanceolate, acute or acuminate, mucronate, 5.5–9 by 1.9–4.2 cm, green with white or whitish-green spots. *Bract-like leaves* 3–7, suberect to spreading, lanceolate, acuminate, base sheathing, (0.8–)1.2–2(–2.2) cm long, margins and sometimes also midrib papillose; lowest sometimes larger and foliaceous, to 5 by 1.7 cm. *Inflorescences* lax, 2–10(–15)-flowered; rachis 2–3 cm long, often papillose; floral bracts lanceolate, acute or acuminate, 10–13 by 10–12 mm, much shorter than the pedicel plus the ovary, margins papillose. *Flowers* to 22 mm wide and 30 mm long; pink or rarely white, lip apex sometimes pink in white flowers. *Ovary* (including pedicel) (19.4–)22–28 mm long, papillose. *Sepals* rounded to subacute; median sepal erect, narrowly ovate to elliptic, 6–10 by 3–6 mm, sometimes papillose on the median vein; lateral sepals spreading, ovate, 8–10.5 by 6–10 mm. *Petals* erect, cohering with the median sepal, broadly ovate, with one or two veins branching just above the base, 6–9 by 4–6 mm, front margins sometimes minutely glandular-hairy. *Lip* 18–30 mm long, 3-lobed, almost always shortly hairy on the upper surface and on the margins; midlobe obovate or spatulate, (10–)22–25 by (10–)12–15 mm, apically deeply incised, often with a small lobule in the incision; side-lobes flabellate, entire, (9–)18–20 by 7–8 mm; spur cylindric and widened in the upper half, 35–43(–55) mm long. *Gynostemium* 3.5–4.5 mm long, anther canals ca 4 mm long, central rostellum lobe prominent and longer than the anther, auricles prominent and raising above the anther canals.

Thailand.— NORTH-EASTERN: Sakon Nakhon [Phu Phan National Park, *Worachat* 271 (**KKU** [s])]; PENINSULAR: Surat Thani [Khao Lang Tao, *Smitinand* & *Sleumer* 1292 (**BKF**, **K**, **L**, **SING**); Chaewlan Dam, *Triboun et al.* 670 (l) (**BK** [s])]; Phangnga [*Ubolcholakhate* 332 (**AAU**)]; Nakhon Si Thammarat [Thung Song, *Kerr* 0852 (neotype **C**); idem., *Rabil* 122 (**C**, **K**)]; Trang [Khao Wang, *Rabil* 336 (**K**); Khao Chong, *Phengklai* & *Fukuoka* 10017 (**Suan Luang**)]; Satun [La-ngu, *Phengklai et al.* 12133 (**BKF**); no

exact locality, *Thaithong* 752 (**BCU** [s]); WITHOUT LOCALITY: *Pumicong* 489 (**QBG** [s]); *Thammatawon* 117 (**KKU** [s]) [12 collections seen].

Distribution.— Peninsular Malaysia.

Ecology.— Occasionally found on limestone rocks in hill evergreen forest; normally at low altitudes. Flowering: July–Sept.(–Oct.).

Conservation.— Twelve collections mainly from Peninsular Thailand have been seen. The plants are potentially threatened by collection for commercial purposes as they are horticulturally desirable. IUCN red list category ‘Near Threatened’ (IUCN, 2001).

Illustrations.— Seidenf., *Dansk Bot. Ark.* 31(3): fig. 87a–c. 1977; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: fig. 49e–g. 1992.

Notes.— This and the following species *Habenaria rhodocheila* share a massive central rostellum lobe and a 3-lobed lip with wide lobes. Unlike in the other Thai *Habenaria* species the flowers of *H. rhodocheila* and *H. carnea* are rather brightly coloured (pink or white in *H. carnea*; red, orange, pink or yellow in *H. rhodocheila*). *H. carnea* is easily distinguished from the much more common *H. rhodocheila* by its ovate petals. Also the auricles which are raised above the anther canals are a distinct feature of *H. carnea*.

The collection *Worachat* 271 (**KKU** [s]!) is said to come from Phu Phan National Park in Sakon Nakhon Province (north-eastern Thailand) which is an interesting disjunction.

The distribution cited in the original description, ‘a native of Singapore’, is probably erroneous as, in Peninsular Malaysia, this species is currently only known from Langkawi and further north (which is about 700 km away).

**46. *Habenaria rhodocheila*** Hance, *Ann. Sci. Nat., Bot.*, V, 5: 243. 1856; Seidenf. & Smitinand, *Orchids Thailand*: 22, 725. 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): 134. 1977; *Opera Bot.* 114: 69. 1992; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: 113. 1992; Pridgeon *et al.*, *Gen. Orchid.* 2: t. 97. 2001; Chen *et al.*, *Fl. China* 25. In prep. (internet draft version, accessed 27 April 2009).— *Smithanthe rhodocheila* (Hance) Szlach. & Marg., *Orchidee* (Hamburg) 55: 174. 2004. Type: SE China, Kwangtung, North River, Canton, *Sampson* s.n. (holotype **BM**).— *Habenaria pusilla* Rchb.f., *Otia Bot. Hamburg.*: 33. 1878. Type: Cambodia, Phu Quoc, *Godefroy* s.n. (holotype ?**K**).— *Habenaria militaris* Rchb.f., *Gard. Chron.*, n.s., 26: 518. 1886. Type: Vietnam, *Regnier* s.n. (not found).— *Habenaria xanthocheila* Ridl., *J. Linn. Soc., Bot.* 32: 411. 1896. Type: Pulau Betong, Penang, Malaysia, *Curtis* s.n. (holotype **SING**!).— *Habenaria erichmichaelii* Christenson, *Orchids* 72: 136. 2003, **synon. nov.** Type: Indochina [imported from Thailand], without precise locality, flowering in cultivation, July 2002, HOC-498 (holotype **K**, not located). Fig. 23.

#### subsp. ***rhodocheila***

Mostly terrestrial or epilithic, deciduous, glabrous. *Stems* (10–)16–25(–42) cm tall, smooth or elongate-papillose. *Cataphylls* 2–3, tubular, sheathing, enveloping the stem to 5(–9) cm high, uppermost with a blade to 1.5 by 0.8 cm. *Leaves* (2–)4–5(–7), spreading, cauline and scattered in the lower stem half, lanceolate-oblong, acute, mucronate, 4–17(–24) by (0.6–)1–1.9(–3.8) cm, green or rarely with greyish-green

mottling, sometimes with reddish margin, margins sometimes papillose. *Bract-like leaves* 2–8(–11), mostly suberect, lanceolate, acuminate, 1.8–4(–8) cm long, basally sheathing, often membranous, margins papillose; the lower 1–3 sometimes foliaceous and spreading. *Inflorescences* lax, (1–)2–10(–20)-flowered; rachis (1–)2–6 cm long, mostly papillose, green or light pinkish; floral bracts ovate-lanceolate, acuminate, (7.5–)15–22(–30) by 4–6(–7) mm, margins sometimes reddish or minutely denticulate. *Flowers* (20–)22–35 mm across; red, orange, pink or yellow, also reported as sepals and petals greenish with red lip, lateral sepals sometimes whitish green, petals once reported as green, spur whitish brown or orange and rarely light maroon, reddish green or orange, gynostemium orange, reddish or whitish-yellow, pollinia orange, rostellum and stigma processes whitish-yellow or red; flowers once reported as slightly scented. *Ovary* (including pedicel) 19–32 mm long, smooth, sometimes orange- or brownish-tinged. *Sepals* subacute; median sepal erect, broadly elliptic, (6–)7–9(–15) by 6–7(–10) mm; lateral sepals slightly obliquely ovate, reflexed, (5.5–)8–12 by 3.5–6 mm, sometimes partly rolled-in, basally united with the lip. *Petals* erect, forming a hood with the median sepal, elliptic-lorate, subacute, 1-veined, 6–7.8(–13) by 1.5–2.2(–3) mm, sometimes with a pronounced rounded apical lobe on the front side. *Lip* (16–)18–27(–35) by (12–)14–23 mm, 3-lobed with a claw 2–5(–8) mm long, somewhat papillose, with a collar in front of the spur entrance; midlobe spatulate, 9–14(–19) by (7.5–)9–13(–19) mm, apically bifid with the incision normally 3–5(–7) mm deep, apical incision sometimes with a minute lobule; side-lobes flabellate, mostly oblong-ovate, (9–)11–13(–21) by 4–6.3(–9) mm; spur cylindric, (30–)35–45(–50) mm long, sometimes thickened apically. *Gynostemium* 3–5 mm long, anther canals 4–8 mm long, anther with an apical connective process, central rostellum lobe prominent and longer than the anther; auricles small and insignificant. *Fruit* elliptic-fusiform, 28.1–38 mm long, 4–5.2 mm in diameter, with a short stalk up to 6 mm long and an apical beak of about 3 mm.

Thailand (selected specimens only).—NORTHERN: Mae Hong Son [Doi Pui, *Larsen et al.* 46815 (**AAU**, **BKF**, **SING**); Pang Mapha, *Srisanga & Puff* 1063 (**QBG**); Chiang Mai [Doi Chiang Dao, *Garrett* 1003 (**BKF**, **K**); Mae Rim, *Nanakorn et al.* 1316 (**QBG**); Mueang, *Nanakorn et al.* 4658 (**QBG**); Omkoi, *Petrmitr* 473 (**ScCMU**, **ScCMU** [s]); Doi Inthanon, *Shunsuke Tsugaru* T 61846 (**BKF**); Nan [Sri Naan National Park, *Maxwell* 04-349 (**ScCMU**, **ScCMU** [s]); Sapan Waterfall, *Srisanga* 1585 (**QBG**); Lamphun [Doi Khun Tan National Park, *Maxwell* 94-1054 (**ScCMU**, **ScCMU** [s]); Lampang [Chae Son National Park, *Maxwell* 95-532 (**ScCMU**, **ScCMU** [s]); Doi Luang National Park, *Maxwell* 97-917 (**BKF**, **ScCMU**, **ScCMU** [s]); NORTH-EASTERN: Phetchabun [Thung Salaeng Luang National Park, *Seidenfaden & Smitinand* 5376 (**C** [s]); Loei [Phu Kradueng National Park, *Adisai* 825 (**BK**); Na Haew, *Nanakorn et al.* 9477 (**QBG**); Phu Ruea National Park, *Worachat* 180 (**KKU** [s]); Phu Luang National Park, *Phusomsaeng & Bunchuai* 2 (**BKF**, **K**, **L**); Nong Khai [Tambon Nong Dern, *Nielsen et al.* 1615 (**BKF**); Sakon Nakhon [Phu Phan National Park, *Thammatawon* 94 (**KKU** [s]); Nakhon Phanom [Banpang, *Krachai* 375 (**KKU**); Mukdahan [Huai Huat National Park, *Pooma et al.* 2550 (**BKF**, **BKF** [s]); idem., *Pooma et al.* 2571 (**L**); EASTERN: Chaiyaphum [Phu Khieo, *Larsen et al.* 31322 (**AAU**, **C**); Pa Hin Ngam National Park, *Suddee* 116 (**BCU**, **BCU** [s]); Nakhon Ratchasima [Pak Thong Chai, *Charoenphol et al.* 4530 (**AAU**); Khao Yai National Park, v. *Beusekom & Charoenphol* 1797 (**AAU**, **BKF**, **C**, **L**, **P**); SOUTH-



WESTERN: Kanchanaburi [Huai Ban Kao, *Geesinck & Phengklai* 6113 (**AAU**, **BKF**, **C**, **C** [s], **L**, **P**); Thong Pha Phum, *Maxwell* 73-144 (**AAU**, **BK**)]; Kanchanaburi [Thung Kang Yang, *Larsen* 10555 (**C** [s])]; CENTRAL: Nakhon Nayok [Khao Yai National Park, *Boonkongchart* 159 (**BKF**, **ScCMU**, **ScCMU** [s])]; Wang Ta Krai, *Robinson* K243 (**K** [s]); Muang District, *Maxwell* 72-365 (**BK**)]; SOUTH-EASTERN: Prachin Buri [*Thaithong* 139 (**BCU**)]; Chanthaburi [*Bunnak* 503 (**BKF**, **C**)]; Trat [Ko Chang, *Kerr* 0176 (**BK**, **C**, **K**, **L**)]; Ta Sen falls, *Larsen et al.* 32365 (**AAU**, **C**)]; PENINSULAR: Ranong [Ngaw Waterfall Forest Reserve, *Fukuoka & Nanakorn* T 35881 (**BKF**)]; Phangnga [Klong Naka Wildlife Sanctuary, *WN* 726 (**BKF**)]; Nakhon Si Thammarat [Khiriwong, *Bunnak* 752 (**BKF**, **C**)]; Khao Luang National Park, *Maxwell* 84-492 (**BKF**, **PSU**)]; Khao Rum, *Smith* 533 (**C**, **K**, **L**)]; Thap Chang, *Seidenfaden & Smitinand* 6395 (**C** [s]); Lan Saka District, *Santisuk & BN* 320 (**BKF**)]; Phattalung [Tha Mot, *Larsen et al.* 44166 (**AAU**, **SING**)]; Plai Wan Falls, *Pedersen* 41608 (**AAU**)]; Trang [Khao Chong, *Pedersen* 41379 (**AAU**)] [93 collections seen, 1 of them uncertain].

Distribution.— Myanmar to SE China, also Peninsular Malaysia and the Philippines.

Ecology.— This species is common on open wet ground or as a lithophyte on the floor of evergreen or mixed deciduous forest, often found alongside streams and near waterfalls; once reported as an epiphyte on a moss-covered tree 5 m over a river; frequently also found in grassy pine forest or in bamboo-rich forest, also reported in dry dipterocarp forest. The most common altitudinal range is from 200–900 m, but individual collections have been made as low as 1.5 m and as high as 1300 m altitude. Limestone, sandstone, shale or granite have been reported as the bedrock. Flowering: (June–)July–Jan.(–Feb.).

Conservation.— Widespread and common throughout Thailand. The plants are horticulturally desirable and are therefore potentially threatened by collection for commercial purposes. IUCN red list category ‘Least Concern’ (IUCN, 2001).

Illustrations.— Seidenf. & Smitinand, *Orchids Thailand*: fig. 15, t. XXXII (3787). 1959–1965; Seidenf., *Dansk Bot. Ark.* 31(3): fig. 86a–d. 1977; Seidenf. & Wood, *Orchids Penins. Malaysia & Singapore*: fig. 49a–g. 1992; Pridgeon *et al.*, *Gen. Orchid.* 2: t. 97. 2001; present paper: fig. 23a–d.

Notes.— Some of the colour forms of this variable taxon have been recognised as separate species in the past. On the basis of the flower morphology and particularly the lip structure several botanists feel that *Habenaria rhodocheila* in its present circumscription could be split into a few infrageneric taxa. After having examined a large number of collections I think that the variation is continuous, at least in Thailand, and have therefore recognised a single taxon. There do indeed seem to be a few forms but these are connected by numerous intermediate specimens.

*Habenaria rhodocheila* subsp. *philippinensis* (Ames) Christenson was recently described from the Philippines (Christenson, 1992: 90). It differs in its flower colour (green and white) but is also distinct in its petal and leaf shape.

A pink form was recently described as *Habenaria erichmichaelii* (Christenson, 2003), differing from *H. rhodocheila* in its flower and leaf colouring and in its rostellum

morphology. The differences in the leaf colouring, green with pale spots, appear to be based on an error as also the leaves of a number of other specimens of *H. rhodocheila* have pale markings. The rostellum structure of *H. erichmichaelii* could not be examined as the type specimen could not be traced, but according to the photo that was supplied with the description it does not appear to differ fundamentally from that of *H. rhodocheila*.

The specimen *Eakkachai Aod-um-pai* s.n. (BCU [s] 009192!) has an only slightly emarginate lip midlobe (depth of incision ca 0.5 mm). Also the spur of this collection is unusual, measuring 50 mm in length (as opposed to 32–45 mm in typical specimens).

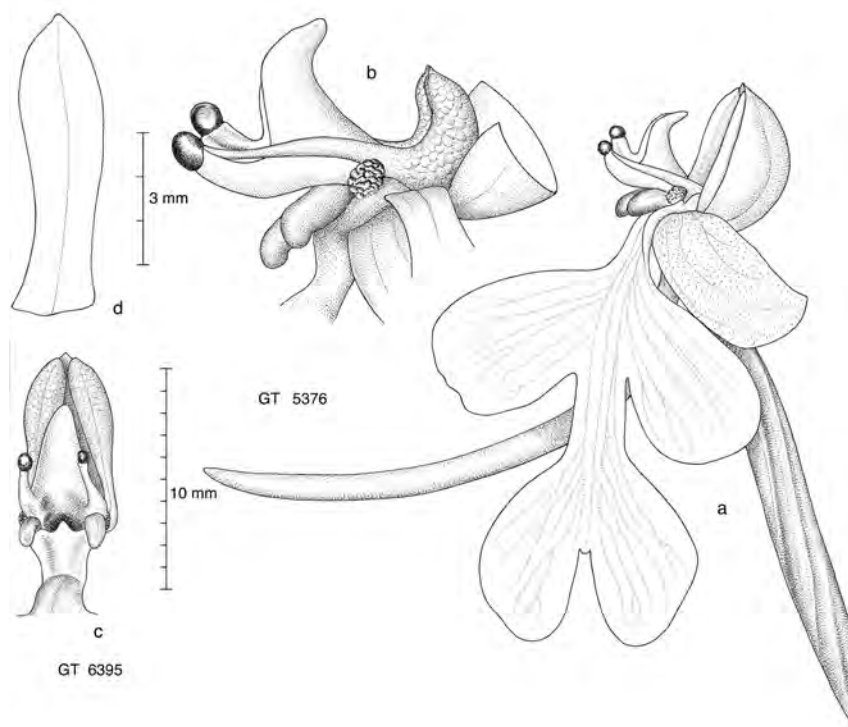


Figure 23. *Habenaria rhodocheila* Hance: a. flower; b–c. gynostemium; d. petal. Reproduced with permission from the University of Copenhagen, drawn by Poul Juul.

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## IDENTIFICATION LIST

The following list enumerates all Thai collections examined here. All species are abbreviated to the first four letters of their name, except *Habenaria rostrata* (= *rostr*), *H. rostellifera* (= *rostell*) and *H. dentirostrata* (= *dentirostr*). + indicates mixed collections. All illegible names were omitted from the list. Also specimens without collector's number are not listed, unless accompanied by a specific herbarium number.

*acui* ... *Habenaria acuiifera*  
*ampl* ... *Habenaria amplexicaulis*  
*anom* ... *Habenaria anomaliflora*  
*aust* ... *Habenaria austrosinensis*  
*avan* ... *Habenaria avana*  
*carn* ... *Habenaria carnea*  
*chlo* ... *Habenaria chlorina*  
*cili?* ... cf. *Habenaria ciliolaris*  
*comm* ... *Habenaria commelinifolia*  
*cory* ... *Habenaria corymbosa*  
*dent* ... *Habenaria dentata*  
*dentirostr* ... *Habenaria dentirostrata*  
*eros* ... *Habenaria erostrata*  
*falc* ... *Habenaria falcatopetala*  
*furc* ... *Habenaria furcifera*  
*gode* ... *Habenaria godefroyi*  
*hast* ... *Habenaria hastata*  
*holo* ... *Habenaria holotricha*  
*hoss* ... *Habenaria hosseusii*  
*humi* ... *Habenaria humistrata*  
*khas* ... *Habenaria khasiana*  
*limp* ... *Habenaria limprichtii*  
*lind* ... *Habenaria lindleyana*  
*long* ... *Habenaria longithecata*  
*luci* ... *Habenaria lucida*  
*mali* ... *Habenaria malintana*  
*mand* ... *Habenaria mandersii*  
*marg* ... *Habenaria marginata*  
*medi* ... *Habenaria medioflexa*  
*myri* ... *Habenaria myriotricha*  
*pant* ... *Habenaria pantlingiana*  
*poil?* ... cf. *Habenaria poilanei*  
*porp* ... *Habenaria porphyricola*



*refl* ... *Habenaria reflexa*  
*reni* ... *Habenaria reniformis*  
*rhod* ... *Habenaria rhodocheila*  
*rostell* ... *Habenaria rostellifera*  
*rostr* ... *Habenaria rostrata*  
*rump* ... *Habenaria rumphii*  
*siam* ... *Habenaria siamensis*  
*sten* ... *Habenaria stenopetala*  
*thai* ... *Habenaria thailandica*  
*tric* ... *Habenaria trichosantha*  
*vidu* ... *Habenaria vidua*  
*viridiflora* ... *Habenaria viridiflora*

Ach Booniti 17: *limp*; – Adisai 825: *rhod*; 864: *medi*; – Auemporn 7/1999: *chlo*; 9/1999: *rhod*; 11/1999: *luci*; 15/1999: *hoss*; 31/1999: *viridiflora*.

Bänzinger 531: *dent*; – Baramee s.n. (BCU [s] 009896): *pant*; s.n. (BCU [s] 009944): *refl*; – BCU s.n. (BCU [s] 008922): *holo*; s.n. (BCU [s] 008923): *rump*; – BKF s.n. (BKF 18288): *rostell*; – Bimpheng 895: *rhod*; – Boonjaras 5: *humi*; 112: *dent* + *luci*; 303: *rostr* + *gode*; – Boonkerd & al. KK 675: *dent*; KK 790: *khas*; KK 1042: *sten*; KK 1097: *dent*; KK s.n. (BCU 010429): *dent*; KK s.n. (BCU 010430): *mali*?; – Boonkongchart 159: *rhod*; – Buakhlai 97: *rhod*; 98: *dent*; 158: *anom*; – Bunchuai 138: *refl*; 148: *rhod*; 183: *rhod*; 946: *furc*; 1195: *dent*; – Bunnak 34: *dent*; 350: *dent*; 486: *lind*; 503: *rhod*; 530: *dent*; 752: *rhod*; – Burkill s.n. (C [s] vial 324): *refl*.

Chankaew 02: *rhod*; – Chantaranothai & al. 90/90: *rump*; 90/93: *rump*; – Charoenphol & al. 4530: *rhod*; 4809: *rump*; – Chermsiriwatthana 407: *rhod*; 788: *dent*; 1806: *khas*; – Chongko 536: *lind*; – Collins 293: *lind*; 1082: *lind*; – Comber 1607: *lind*; 1608: *acui*; 1704: *rump*; 1706: *khas*; – Cumberlege 170: *dent*; 629: *mali*; 632: *mali*; 634: *dent*; 873: *luci*; 1004: *dent*; 1199: *dent*; 1281: *lind*; 1285: *mali*.

Damapong 97: *limp*; – Damrongsak Praphat 192: *luci*; 210: *dent*; 788: *aust*; – Dee 91: *rhod*; 140: *rump*; 183: *rostell*; 320: *rump*; 322: *khas*; 324: *lind*; 336: *dent*; 351: *lind*; 385: *rump*; 555: *rhod*; 895: *rhod*; 917: *lind*; 917A: *mali*; – Din Nakkaru 155: *acui*.

Eakkachai Aod-um-pai s.n. (BCU [s] 009192): *rhod*; – Eiadthong W-5: *rostell*.

Floto 7331: *rhod*; – Franck 436: *lind*; 437: *lind*; 1473: *luci*; – Fukuoka & Nanakorn T 35881: *rhod*.

Garrett 197: *lind*; 206: *furc*; 297: *comm*; 470: *falc*; 478: *holo*; 687: *long*; 715: *limp*; 742: *rostr*; 1003: *rhod*; 1008: *rhod*; 1357: *luci*; 1475: *cory*; 1477: *cory*; – Geesinck & Phengklai 6113: *rhod*; – Geesinck & al. 5759: *thai*; – Godefroy 399: *gode*; 522: *gode*; 737: *rostell*; – Greijmans 109: *rostr*.

Haase s.n. (BM 000033439): *lind*; – Haniff & Nur 3858: *medi*; – Hansen & Smitinand 12158: *rhod*; – Hosseus 52: *siam*; 53: *porp*; 77: *hoss*.

Indhamusika 31: *pant*; 36: *marg*; 040: *furc*; 67: *dent*; 154: *mali*.

Kasem 258: *rostell*; 259: *tric*?; 260: *mand*?; 475: *mand*; 551: *lind*; 635: *dent*; 650: *furc*;

s.n. (BK SN243215): *lind*; – Keratikorkol 388: *hoss*; – Kerr 92: *limp*; 119: *dent*; 119A: *mali*; 119B: *dent*; 119C: *mali*; 119D: *mali*; 119E: *mali*; 120: *dent*; 120A: *dent*; 120B: *dent*; 121: *rostell*; 125: *marg*; 190: *luci*; 194: *humi*; 196: *hoss*; 211: *ampl*; 220A: *dent*; 220B: *dent*; 220E: *dent*; 222: *dent*; 236: *chlo*; 261: *lind*; 264: *medi*; 265: *dent*; 277: *sten*; 282: *lind*; 288: *hast*; 312: *chlo*; 324: *cory*; 332: *dent*; 350: *humi*; 353: *long*; 379: *medi*; 381: *lind*; 467: *myri*; 473: *hoss*; 488: *siam*; 494: *long*; 049: *rostell*; 049A: *rostell*; 0169: *rostr?*; 0176: *rhod*; 0191: *thai?*; 0223: *rump*; 0426: *rostell*; 0617: *rostell*; 0648: *furc*; 0650: *dent*; 0658: *dent*; 0845: *eros*; 0852: *carn*; 0875: *comm*; 0928: *cory*; 0942: *luci*; 0943: *dent*; 0944: *hoss*; 0945: *acui*; 0946: *rump*; 0947: *lind*; s.n. (K H2006/01478-116): *ampl*; s.n. (K H2006/01478-90): *dent*; s.n. (K H2006/01478-92): *dent*; s.n. (K H2006/10478-70): *marg*; s.n. (P 00411239): *lind*; s.n. (K H2007/02483-55): *luci*; s.n. (K H2007/02483-75): *reni?*; s.n. (K H2007/02483-85): *rostell*; s.n. (K H2007/02483-103): *medi*; s.n. (K H2007/02483-20): *lind*; s.n. (K H2007/02483-36): *dent*; s.n. (K H2007/02483-39): *dent*; s.n. (K H2007/02483-47): *dent*; s.n. (K H2007/02483-48): *dent*; s.n. (BK SN243202): *lind*; s.n. (BK SN243218): *luci*; s.n. (C [s] vial 150): *acui*; s.n. (C [s] vial 152): *humi?*; s.n. (C [s] vial 212): *ampl*; s.n. (C [s] vial 378): *sten*; – Khantchai 981: *vidu*; – KKU 847: *chlo*; 870: *dent*; 878: *hoss*; 905: *chlo*; 1054: *dent*; 1064: *luci*; 1435: *mali*; – Khompat KK1: *rostell*; – Kitichate 202: *rump*; – Krachai 375: *rhod*; – Kurzweil 2475: *luci*; 2476: *dent*; 2477: *lind*; 2479: *luci*; 2480: *vidu*; 2485: *vidu*; 2486: *dent*.

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Rabil 99: *rostell*; 122: *carn*; 336: *carn*; s.n. (K H2006/01478 63): *reft*; s.n. (C [s] vial 322): *reft*; – RK (= Rom Klao) 605/50: *sten*; – Robinson K243: *rhod*; K245: *luci*.

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<i>Habenaria hamigera</i> Griff.	63
<b>Habenaria hastata</b> Seidenf.	<b>72</b>
<b>Habenaria holotricha</b> Gagnep.	<b>15</b>
<b>Habenaria hosseusii</b> Schltr.	78, <b>79</b>
<i>Habenaria hosseusii</i> auct. non Schltr.: Kerr	79
<b>Habenaria humidicola</b> Rolfe	82, <b>83</b>
<b>Habenaria humistrata</b> Rolfe ex Downie	<b>84</b> , 86, 87, 88, 89
<b>Habenaria khasiana</b> Hook.f.	<b>67</b> , 70
<i>Habenaria kingii</i> Hook.f.	34
<i>Habenaria kingii</i> auct. non Hook.f.: Seidenf. & Smitinand	33, 34
<i>Habenaria latifolia</i> Lindl.	46, 49
<b>Habenaria limprichtii</b> Schltr.	<b>24</b>
<b>Habenaria lindleyana</b> Steud.	<b>46</b>
<i>Habenaria linguella</i> Lindl.	54
<b>Habenaria longithea</b> Seidenf.	<b>33</b>
<b>Habenaria lucida</b> Wall. ex Lindl.	<b>49</b>
<i>Habenaria macroptera</i> Gagnep.	46
<b>Habenaria malintana</b> (Blanco) Merr.	<b>43</b>
<b>Habenaria mandersii</b> Collett & Hemsl.	43, <b>77</b> , 79
<b>Habenaria marginata</b> Colebr.	<b>75</b> , 77
<i>Habenaria marginata</i> var. <i>flavescens</i> (Hook.f.) T.Cooke	75
<b>Habenaria medioflexa</b> Turrill	16, <b>28</b>
<i>Habenaria medioflexa</i> auct. non Turrill: Kerr	28, 30
<i>Habenaria medusa</i> Kraenzl.	16, 31
<i>Habenaria medusa</i> auct. non Kraenzl.: Seidenf.	30
<i>Habenaria militaris</i> Rchb.f.	91
<i>Habenaria murtonii</i> Hook.f.	34
<b>Habenaria myriotricha</b> Gagnep.	16, 28, <b>30</b> , 32
<i>Habenaria myriotricha</i> Gagnep. var. <i>confluens</i> Gagnep.	28
<i>Habenaria oligoschista</i> Schltr.	27
<i>Habenaria oligoschista</i> auct. non Schltr.: Seidenf. & Smitinand	24
<b>Habenaria pantlingiana</b> Kraenzl.	<b>16</b> , 19
<i>Habenaria parageniculata</i> Tang & F.T.Wang	39
<i>Habenaria pectinata</i> D.Don	27
<i>Habenaria pectinata</i> D.Don var. <i>limprichtii</i> (Schltr.) U.C. Pradhan	24, 27
<i>Habenaria pelorioides</i> E.C.Parish & Rchb.f.	43
cf. <b>Habenaria poilanei</b> Gagnep.	<b>88</b>
<i>Habenaria polytricha</i> Rolfe	16
<i>Habenaria polytricha</i> (Hook.f.) Pradhan	16
<i>Habenaria polytricha</i> auct. non Rolfe: Seidenfaden	15
<b>Habenaria porphyricola</b> Schltr.	<b>83</b> , 88, 90
<i>Habenaria porphyricola</i> auct. non Schltr.: Kerr	84
<i>Habenaria promensis</i> Lindl.	75
<i>Habenaria pusilla</i> Rchb.f.	91
<i>Habenaria recurva</i> Rolfe ex Downie	49, 51, 52
<b>Habenaria reflexa</b> Blume	33, <b>34</b> , 36, 37



<b>Habenaria reniformis</b> (D.Don) Hook.f.	82, 83, 90
<b>Habenaria rhodocheila</b> Hance subsp. <b>rhodocheila</b>	91
<i>Habenaria rhodocheila</i> subsp. <i>philippinensis</i> (Ames) Christenson	93
<i>Habenaria roseata</i> Ridl.	56, 57, 59
<b>Habenaria rostellifera</b> Rchb.f.	56, 60
<b>Habenaria rostrata</b> Wall. ex Lindl.	59, 62
<b>Habenaria rumphii</b> (Brongn.) Lindl. var. <b>rumphii</b>	72
<i>Habenaria rumphii</i> var. <i>meraukensis</i> J.J. Sm.	75
<i>Habenaria seshagiriana</i> A.N.Rao	16
<b>Habenaria siamensis</b> Schltr.	83, 86, 87, 90
<i>Habenaria siamensis</i> auct. non Schltr.: Seidenf. & Smitinand	84
<i>Habenaria singapurensis</i> Ridl.	20
<b>Habenaria stenopetala</b> Lindl.	17, 20
<i>Habenaria stenopetala</i> auct. non Lindl.: Gagnepain	19
<i>Habenaria stenopetala</i> Lindl. var. <i>polytricha</i> Hook.f.	16, 19
<i>Habenaria sutepensis</i> Rolfe ex Downie	17
<i>Habenaria tenuis</i> Griff.	69
<i>Habenaria ternatea</i> Rchb.f.	16
<b>Habenaria thailandica</b> Seidenf.	23, 24
<i>Habenaria tonkinensis</i> Seidenf.	71
<i>Habenaria trichochila</i> Rolfe ex Downie	28, 29
<b>Habenaria trichosantha</b> Lindl.	16, 31
<b>Habenaria vidua</b> E.C.Parish & Rchb.f.	62, 64
<b>Habenaria viridiflora</b> (Rottler ex Sw.) Lindl.	69
<i>Habenaria xanthocheila</i> Ridl.	91
<i>Habenaria yuana</i> Tang & F.T.Wang	27
<i>Habenaria</i> sp., Kerr 2681	89
<i>Habenaria</i> sp., Smitinand 3574	39, 41, 43
<i>Habenella lucida</i> (Wall. ex Lindl.) Szlach. & Kras-Lap.	49
<i>Herminium reniforme</i> (D.Don) Lindl.	82
<i>Kraenzlinorchis dentirostrata</i> (Tang & F.T.Wang) Szlach.	78
<i>Kraenzlinorchis hosseusii</i> (Schltr.) Szlach.	79
<i>Kraenzlinorchis malintana</i> (Blanco) Szlach.	43
<i>Kraenzlinorchis mandersii</i> (Collett & Hemsl.) Szlach.	77
<i>Kryptostoma godefroyi</i> (Rchb.f.) Olszewski & Szlach.	27
<i>Kryptostoma limprichtii</i> (Schltr.) Szlach. & Olszewski	24
<i>Listera reniformis</i> D.Don	82
<i>Medusorchis holotricha</i> (Gagnep.) Szlach.	15
<i>Neottia reniformis</i> (D.Don) Spreng.	82
<i>Ochyrorchis godefroyi</i> (Rchb.f.) Szlach.	27
<i>Ochyrorchis limprichtii</i> (Schltr.) Szlach.	24
<i>Orchis commelinifolia</i> Roxb.	32
<i>Orchis dentata</i> Sw.	39
<i>Orchis viridiflora</i> Rottler ex Sw.	69
<i>Plantaginorchis dentata</i> (Sw.) Szlach.	39
<i>Platanthera acuiifera</i> Lindl.	52

<i>Platanthera commelinifolia</i> (Roxb.) Lindl.	32
<i>Platanthera dentata</i> (Sw.) Lindl.	39
<i>Platanthera geniculata</i> (D.Don) Lindl.	39
<i>Platanthera linifolia</i> Lindl.	67
<i>Platanthera lucida</i> Lindl.	49
<i>Platanthera marginata</i> (Colebr.) Lindl.	75
<i>Platanthera rostrata</i> Lindl.	59
<i>Platanthera rumphii</i> Brongn.	72
<i>Platantheroides lucida</i> (Wall. ex Lindl.) Szlach.	49
<i>Smithanthe carnea</i> (Weathers) Szlach. & Marg.	90
<i>Smithanthe rhodocheila</i> (Hance) Szlach. & Marg.	91
<i>Thelymitra malintana</i> Blanco	43