A taxonomic revision of *Globba* subsect. *Nudae* (Zingiberaceae)

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**Abstract.** *Globba* subsect. *Nudae* K.Larsen is revised. Seven species are recognised and three names are lectotypified. A key to the species and descriptions are provided. Three new species are described and illustrated: *G. aranyaniae* Sangvir. & M.F.Newman sp. nov., *G. lithophila* Sangvir. & M.F.Newman sp. nov., and *G. macrochila* Sangvir. & M.F.Newman sp. nov. Four names based on types from Bangladesh, India and Myanmar remain doubtful. The morphological expression of andromonoecy in this group is described in detail. Provisional IUCN conservation assessments of all species are supplied.

**Keywords.** Andromonoecy, *Globba*, *Nudae*, taxonomic revision, Zingiberaceae.


**Introduction**

*Globba* L. belongs to the tribe Globbeae Meisn. of the subfamily Zingiberoideae Haask., family Zingiberaceae Martinov. This is a family of monocotyledonous plants which includes ginger, *Zingiber officinale* Roscoe, turmeric, *Curcuma longa* L. and cardamom, *Elettaria cardamomum* (L.) Maton. The order Zingiberales Griseb., to which the Zingiberaceae belong, also includes the banana family, *Musaceae* Juss., the arrowroot or prayer-plant family, *Marantaceae* R.Br. and the canna lily family, *Cannaceae* Juss.

Of the three genera of the tribe Globbeae, *Globba* is the largest (comprising about 100 species), including *Mantisia* Sims, which was placed in synonymy under *Globba* by Williams *et al.* (2004). The other two genera of the Globbeae are *Gagnepainia* K.Schum. and *Hemiorchis* Baill., which each have three species (Kress *et al.* 2002; Williams *et al.* 2004).

*Globba* occurs in Sri Lanka, India, and throughout southeast Asia as far as Australia (Leong-Škorničková & Newman 2015), though the number of native species east of Wallace’s Line is very low, perhaps only one (*G. marantina* L.). Most species are medium-sized herbs growing in semi-shaded areas as terrestrial
plants or lithophytes. The most conspicuous character which can be used to recognise a species of *Globba* is the long filament which arches over the labellum of the flower.

Various authors have tried to classify the many species into infrageneric taxa according to different concepts (Horaninow 1862; Schumann 1904; Larsen 1972; Williams et al. 2004). The number of anther appendages has always been an important character for classification at sectional rank. Morphologically, the genus was classified into three sections (Horaninow 1862; Baker 1894; Schumann 1904), as follows: (1) *G.* sect. *Globba* (formerly *G.* sect. *Marantella* (Horan.) Benth. & Hook.f. nom. illegit.) with four anther appendages; (2) *G.* sect. *Haplanthera* Horan. without anther appendages; (3) *G.* sect. *Ceratanthera* (Horan.) Petersen (G. subg. *Ceratanthera* (Horan.) K.J.Williams) with two anther appendages. *Globba* sect. *Ceratanthera*, which bears two anther appendages, was classified into three series according to the position of appendage attachment, namely *G.* series *Basicalaratae* K.Schum., *G.* series *Mediocalaratae* K.Schum. and *G.* series *Apicicalcaratae* K.Schum. This classification remained in use for over a hundred years (Horaninow 1862; Schumann 1904).

In 1972, a small change was made when *G.* sect. *Nudae* K.Larsen, comprising *G. nuda* K.Larsen alone, was added to the others (Larsen 1972). *Globba nuda* bears four anther appendages so it would formerly have been put in *G.* sect. *Globba*, but Larsen (1972) erected *G.* sect. *Nudae* on account of its unique inflorescence position, small caducous bracts, and chromosome number.

Williams et al. (2004) published the results of a molecular phylogenetic study of *Globba* and the *Globbeae* performed using internal transcribed spacer (ITS) and *trnK-matK* nucleotide sequence data. The results suggested that *Globba* should be divided into three subgenera and seven sections. Three strongly supported, monophyletic groups were newly described, namely *G.* sect. *Mantisia* (Sims) K.J.Williams, *G.* sect. *Substrigosa* K.J.Williams, and *G.* sect. *Sempervirens* K.J.Williams. In addition, *G.* (sect. *Ceratanthera*) series *Mediocalaratae* K.Schum. was transferred to *G.* (sect. *Nudae*) subsect. *Mediocalaratae* (K.Schum.) K.J.Williams (Table 1). This now leaves *G.* sect. *Nudae* comprising 26 species with two subsections, *G.* sect. *Nudae* (7 species) and *G.* subsect. *Mediocalaratae* (19 species), in which the numbers of anther appendages are four and two, respectively.

In this paper, we revise the species of *G.* subsect. *Nudae* after revisiting the type localities of most names and carefully studying living and herbarium specimens. Although the species look very much alike at first glance, we have found that many characters which have been ignored or overlooked in the past are important for species-level diagnosis. One of these is the andromonoecy occurring in *G.* sect. *Nudae* which affects species circumscription and reveals intriguing facts that allow a reinterpretation of the pollination system in these species (Sangvirotjanapat et al. 2017a, 2017b). In addition, we have plotted the distribution and made IUCN conservation assessments for each species of this subsection.

**Material and methods**

Protologues and types of the eleven names in *G.* subsect. *Nudae* were examined (IPNI 2018). Herbarium specimens at A, AAU, BK, BKF, BM, C, E, GH, HCU, IBSC, K, K-W, L, MO, P, QBG, SING, SMAO, UC, and US (herbarium codes in accordance with Thiers 2019) were studied, about 250 sheets in total. Field collections were made throughout Thailand and neighbouring countries, especially at three type localities in northern Thailand. Living specimens were studied in their natural habitat, at the Zingiberaceae nursery of Queen Sirikit Botanic Garden in Chiang Mai province, and in the living collection of the Royal Botanic Garden Edinburgh. Floral dissections and tests of morphological stability of some characters in two growing seasons were carried out at the Zingiberaceae nursery of Queen Sirikit Botanic Garden and a private nursery in Bangkok. Assessments of conservation status were carried out following IUCN guidelines (IUCN 2012). Specimen data were stored in Padme (Miller et al. 2015) and, for each species, an Excel file was generated listing the following fields for each specimen:
Table 1. Comparison of classifications using morphological characters only (Schumann 1904; Larsen 1972) and molecular and morphological characters combined (Williams et al. 2004); anther appendage numbers are in parentheses.

<table>
<thead>
<tr>
<th>Schumann (1904), Larsen (1972)</th>
<th>Williams et al. (2004)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section</td>
<td>Subgenus</td>
</tr>
<tr>
<td>G. sect. Haplanthera Horan. (0)</td>
<td>G. subg. Mantisia (Sims) K.J.Williams</td>
</tr>
<tr>
<td>G. sect. Ceratanthera (Horan.) Petersen</td>
<td>G. subg. Ceratanthera (Horan.) K.J.Williams</td>
</tr>
<tr>
<td>G. sect. Globba (4)</td>
<td>G. sect. Mediocalcaratae (K.Schum.) K.J.Williams (2)</td>
</tr>
</tbody>
</table>

Species name, collector, collection number, collection date, herbarium code, locality, latitude, longitude, altitude. These data were imported into QGIS v. 2.18.20. (QGIS Development Team 2018) and used to produce the distribution maps. Larger symbols on the maps indicate type specimens.

Results

Globba subsect. Nudae

Class Magnoliopsida Brongn.
Order Zingiberales Griseb.
Family Zingiberaceae Martinov
Genus Globba L.
Section Nudae K.Larsen
Subsection Nudae K.Larsen

General morphology

The main distinguishing characteristics of G. subsect. Nudae are the lax conical inflorescence and flowers with four anther appendages. These differentiate this subsection clearly from G. sect. Globba and G. sect. Sempervirens, which also have four anther appendages, but have dense inflorescences with colourful, persistent bracts.

Description

Clump-forming herbs (10–)40–80 cm tall, rarely to 1.5 m, leaning, with inflorescence turned upright. Bladeless leaf sheaths 3–5; ligule truncate to bilobed, glabrous or ciliate, light green with white margin; blades 5–11, oblong, elliptic or ovate, base obliquely obtuse, cuneate, apex acuminate to caudate, glabrous or strigose, sometimes with a grey patch or silver striate above, pubescent below. Inflorescence erect, lax, conical; peduncle 1–5(15) cm long; rachis green, glabrous or pubescent; bracts and bracteoles
caducous or persistent, oblong, elliptic, deltoid, 5–12 mm long, glabrous or pubescent, apex acute, green; cincinni numerous, lax or crowded; pedicel 0–5 mm long. Flowers 2.8–3.8 cm long; ovary 3–4 mm long, ellipsoidal, green (♀), ridged; calyx 3–5 mm long, infundibuliform, with lobes acute to acuminate, ciliate, green or yellow-green; floral tube 9–16 mm long, yellow-orange, pubescent, dorsal and lateral corolla lobes 6–7.5 mm long, elliptic, hooded, yellow, orange, orange-green; lateral staminodes 6–8 × 5–7 mm, triangular, bilobed, yellow-orange, self-coloured, rarely (G. aranyaniae Sangvir. & M.F.Newman sp. nov.) with red or brown spot at centre, base truncate, apex round, acute or obtuse; nectary tube 3–6 mm long; filament 23–30 mm long, yellow or yellow-orange; anther 1–2 mm long with 4 appendages, connective tissue, crest, and appendages orange, semi-translucent, crest ca 1 mm long (shorter in ♂), truncate; ♀ appendages ca 3 mm long, acuminate, bifid, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♂ appendages 3–4 mm long, acuminate, bifid to halfway, upper pair only slightly bigger than lower. Fruits 2.5–27 × 1–10 mm, ellipsoid or almost globose, longitudinally or shallow ridged, topped with persistent calyx. Bulbils produced at base of peduncle or tip of cincinni or protruding from leaf sheaths, spindle-shaped or obovate, tissue corky, producing one shoot.

Habitat
The substrate and ecological surroundings are found to relate to plant size. Plants in G. subsect. Nudae are mostly middle-sized, about 50–100 cm tall. Occasionally G. expansa Wall. ex Horan., found in mixed evergreen montane forest, can grow to 1.5 m tall while G. lithophila Sangvir. & M.F.Newman sp. nov., which grows on limestone, is a miniature plant, only 10 cm tall. The most variable species is G. insectifera Ridl., which is large or small depending on the conditions of the dry or the rainy season which determine the production of inflorescence shoots or leafy shoots.

Rhizome
Small, globose, about 3–5 cm in diameter. In one growing season, 5–8 rhizomes can be produced in a moniliform arrangement. The root tubers are spindle-shaped or elongate and function in food storage during the dormant period.

Leafy shoots
Pseudostem consisting of enfolded leaf sheaths. At the base there are 3–5 bladeless sheaths which are usually darker. The ligule is membranaceous, truncate to bilobed, light green with paler or white margin. Normally, ligules of this subsection do not vary greatly but, in the case of G. lancangensis Y.Y.Qian, the ligule appears node-like by embracing the axis of the leafy stem. This is a diagnostic difference between G. lancangensis Y.Y.Qian and G. insectifera Ridl. All leaf blades are arranged distichously, the lowest one smallest then becoming larger towards the apex. A few species have silver striations along the midrib, for instance G. expansa Wall ex Horan. and G. lithophila sp. nov. There is almost always an indumentum on both sides of the leaf blade which may be dense on the midrib and veins above but more evenly spread below. It should be noted that G. expansa Wall. ex Horan. is the sole species having a glabrous blade above. Globba flagellaris K.Larsen is unique as horizontal shoots protrude from the rhizome at an early stage, looking like flagella. This characteristic is reflected in its specific epithet (Larsen 1977).

Inflorescence
Terminally produced (♀ on a leafless shoot in G. insectifera), erect, and lax. The overall shape is conical consisting of many cincinni arranged spirally. The main rachis and cincinni elongate greatly during flowering. The lowest cincinnus is the longest one becoming shorter toward top of inflorescence. The rachis is rather short when it is young then may elongate with age. Bulbils may be produced on the
Fig. 1. Cincinnus morphology in *G.* subsect. *Nudae* K.Larsen. A. Lax cincinni (M.F. Newman 2561 leg.). B. Crowded cincinnus (S. Sangvirotjanapat 642 leg.). C. Seeds (M.F. Newman 2561 leg.); the area in the inset is indicated by a white arrow. D. Bulbils (M.F. Newman 2561 leg.). Drawings and photographs: S. Sangvirotjanapat.
rachis at the end of the period of growth. The cincinni are held at nearly 90° to the rachis and are subtended by green, glabrous or pubescent bracts which are very small and caducous, rarely seen on herbarium specimens. The flowers are produced in two rows at the apex of the cincinni, each flower subtended by a bracteole which is usually the same shape as the bract. We recognise two morphological types of cincinnus, lax and crowded, which can be distinguished by the bracteole and flower scars on the cincinni. Lax cincinni may be elongate with a very short pedicel (e.g., *G. expansa*, Fig. 1A) while crowded cincinni may have long pedicels closely packed (e.g., *G. flagellaris* and *G. lithophila* sp. nov., Fig. 1B).

Species in this subsection are often misidentified because they show considerable similarity of habit and inflorescence structures. The flowers, bracts and bracteoles also easily fall so most herbarium specimens look alike. In this study, the most taxonomically informative character in the key to species is the crowded or lax cincinni. This character is effective and consistent when examining herbarium specimens without flowers but with good details on their labels. There is only one species, *G. aranyaniae* sp. nov. that shows both cincinnus types but their distribution areas do not overlap.

**Flower**

For reliable identification to species, the flower must be seen. Flower colour seems to be a variable character while, on the other hand, the yellow and orange tone of flowers in this subsection is clearly different and useful for classification in many cases. A red or brown spot on the labellum is quite common in other groups of *Globba* but, in *G. subsect. Nudae*, *G. aranyaniae* sp. nov. is unique in having a spot (Fig. 2A).

**Andromonoecy**

Monoecy is rare in the Zingiberaceae, having been reported in only a few species. *Siphonochilus aethiopicus* (Schweinf.) B.L.Burtt, an African ginger, shows gynomonoecy in which hermaphrodite and female flowers are produced on the same plant (Gordon-Gray *et al.* 1989), while *Alpinia* sect. *Monopleura* K.Schum. and *Alpinia* sect. *Myriocrater* K.Schum. are considered andronomoecious with hermaphrodite and male flowers on the same plant (Burtt & Smith 1972). Our investigations of the reproductive biology of *G. subsect. Nudae* (Sangvirojtanaprat *et al.* 2017b) show that andromonoecy occurs as a synapomorphic character of both subsections. The hermaphrodite (♀) and functionally male (♂) flowers are in the same inflorescence but on separate cincinni, ♀ flowers arising only on the two to four proximal cincinni. The fact that two floral types occur together has great taxonomic relevance because it has led earlier authors to recognise the flower types as different species. The differences of morphology between the floral types are highlighted below with an asterisk (*) and shown in Fig. 3.

**Floral size**

The ♂ flower is smaller than the ♀ flower and has a shorter floral tube.

**Ovary and ovules**

These are strikingly dissimilar between the floral types. The ovary of the ♀ flower is well developed, ellipsoid and longitudinally ridged with fully developed ovules inside. By contrast, the ♂ flower has a greatly reduced ovary about 1 mm long with aborted ovules inside.

**Calyx**

Infundibuliform, trilobed, two of the lobes smaller than the other, with acute or acuminate lobes.
Epigynous nectaries or stylodes
All species of *Globba* have two linear epigynous nectaries above the ovary. Nectar is secreted into the floral tube towards the nectar tube.

*Floral tube*
A narrow tube, about 1 mm in diameter. The outer surface is pubescent. Within an inflorescence, the ♀ flower has a longer and more sharply curved floral tube than the ♂ flower.

Dorsal and lateral corolla lobes
Hooded, elliptic, oblong or obovate, the dorsal one slightly bigger than the laterals. At anthesis, the lateral corolla lobes are usually concealed by the lateral staminodes or labellum but, in *G. lithophila*
sp. nov., the lateral staminodes are rather narrow so the lateral corolla lobes can be seen clearly. The outer surface of the lobes is slightly pubescent and the colour is the same as the other parts but green tinted.

**Lateral staminodes**

All gingers possess staminodes derived from stamens. The tribe Globbeae is characterised by its free lateral staminodes and labellum. As for *Globba*, the lateral staminodes are attached above the lateral corolla lobes and are conspicuous, flat and patent. The shape can be oblong or obovate. All these differ from other sections in which the lateral staminodes are not as prominent.

**Nectar tube and labellum**

We consider the labellum of *Globba* to be made up of two parts. The nectar tube is connected to the floral tube but the cavity inside it is larger. Along one side, it is fused to the filament. This tube holds the nectar and is the channel for the style to reach the tip of the flower. The apex of the nectar tube expands and reflexes to form the labellum which is always triangular, bilobed. The labellum is slightly thicker and

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**Fig. 3.** Parts of the hermaphrodite and functionally male flowers. A. ♀ flower. B. ♂ flower. C. Anther appendages of ♀ flower. D. Anther appendages of ♂ flower. Drawing: S. Sangvirotjanapat from M.F. Newman 2561 leg. (*G. expansa* Wall. ex Horan.).
darker than the other floral organs. In pollination, it serves as a landing platform and the spot may be a nectar guide indicating the position of the nectar tube where the pollinator reward is found.

Filament
Long and arching with a groove for the style in the lower part. In this paper, the measurement of the filament is calculated from the point of fusion with the nectar tube to the anther sac. This makes the length seem longer than is noted in the literature. Traditionally, only the part of the filament which extends from the labellum is measured. An approximate conversion can be made by adding or subtracting the length of the nectar tube.

Anther
Consisting of two thecae, each with loculicidal dehiscence along its entire length.

Anther appendages*
Both floral types have four-appendaged flowers. The appendages of this subsection consist of an upper and a lower pair of triangular appendages. They are fused at the base while the tips are completely free from each other. Consequently, the number of appendages when looking at the base is two while, at the tip, it is four. The ♀ flower has larger appendages which occupy the whole length of the anther. The appendages are deeply bifid, and the upper pair is decurrent to the crest (Fig. 3C). The appendages of the ♂ flower are split half-way with their bases fused together like a swallow’s tail. The anther crest is much less prominent in the ♂ flower than in the ♀ flower (Fig. 3D). This difference in size was first mentioned by Smith (1988) but she noted that the smaller crest may have been an effect of dehydration.

Style
Filiform, as long as the flower, the tip near the stigma held in position by the anther thecae.

Stigma*
In the ♀ flower, bigger and completely full of stigmatic fluid to promote germination of pollen tubes.

Fruit
Ellipsoid and ridged in G. subsect. Nudae, except in G. lancangensis which has nearly globose and shallowly ridged fruits. The apex of the fruit in Globba always bears a persistent calyx.

Seed
Brown, globose to ovate, about 2–3 mm in diameter with a praemorse aril attached at the hilum. The surface is hairy (Fig. 1C and Fig. 7G). There are no seed characters which allow the species of this subsection to be differentiated.

Bulbil
A vegetative propagule, produced late in the growing season, before the plant goes dormant in the dry season (Fig. 1D). Generally, it is a corky tissue with one shoot but G. flagellaris, which grows in moist areas, has a prolonged shoot and the corky part is scarcely visible (Fig. 7K).

Key to the species
1. Flowers lax; bracteoles caducous .................................................................2
   – Flowers crowded at tip of cincinni; bracteoles usually persistent on cincinni, packed with pedicels ....5
2. Flower yellow-orange; labellum with red or brown spot at centre; limestone bedrock near streams. ........................... \textit{G. aranyaniae} Sangvir. & M.F.Newman sp. nov.
   - Flower pure orange, bright yellow or primrose; labellum without spot; evergreen forest or open areas in dipterocarp forest .................................................................3

3. Lateral staminodes oblong to narrowly obovate, 11–13 × 3–5 mm, yellowish orange; leafy stem to 150 cm; leaf glabrous above ........................... \textit{G. expansa} Wall. ex Horan.
   - Lateral staminodes obovate, ca 20 × 11 mm, bright yellow or primrose; leafy stem to 80 cm; leaf strigulose above .................................................................4

4. Flower lemon or bright yellow; bracts deltoid, 0.5–4 × 1–2 mm; fruit ellipsoid, longitudinally ridged; leaf sheaths smooth along the leafy stem; inflorescences produced on separate shoots and at tip of leafy shoots .............................. \textit{G. insectifera} Ridley.
   - Flower primrose or pale yellow; bracts lanceolate, 1.5–7 × 1–2 mm; fruit almost globose, shallowly ridged; leaf sheaths node-like along the leafy stem; inflorescences only produced at tip of leafy shoots ................................................................. \textit{G. lancangensis} Y.Y.Qian

5. Flower yellow-orange; labellum with red or brown spot at centre; lateral staminodes obliquely obovate ........................... \textit{G. aranyaniae} Sangvir. & M.F.Newman sp. nov.
   - Flower pure orange; labellum without spot; lateral staminodes oblong or obliquely obovate ...6

6. Lateral corolla lobes easily seen; lateral staminodes oblong, to 5 mm wide; lithophyte in small pockets of soil over limestone .............................. \textit{G. lithophila} Sangvir. & M.F.Newman sp. nov.
   - Lateral corolla lobes covered by labellum or lateral staminodes; lateral staminodes broad, obovate, 5–9 mm wide; terrestrial ................................. \textit{G. macrochila} Sangvir. & M.F.Newman sp. nov.

7. Labellum as long as lateral staminodes, 10–12 mm long; inflorescence 10–30 × 7–18 cm; growing in wet areas; flagella produced .............................. \textit{G. flagellaris} K.Larsen
   - Labellum longer than lateral staminodes, 19–20 mm long; inflorescence 5–11 × 5–12 cm; growing in somewhat dry areas or bamboo forest; without flagella ................................................................. \textit{G. macrochila} Sangvir. & M.F.Newman sp. nov.

\textit{Globba aranyaniae} Sangvir. & M.F.Newman sp. nov.
\texttt{urn:lsid:ipni.org:names:77195003-1}
\texttt{Figs 2A, 4–6}

\textbf{Diagnosis}

The main distinguishing character within \textit{G.} subsect. \textit{Nudae} is the red or brown spot on the labellum. Laotian and northern Thai populations resemble \textit{G. flagellaris} and \textit{G. macrochila} sp. nov. by their condensed cincinni, and orange-toned flowers with rather broad lateral staminodes (> 5 mm). Central and eastern Thai populations resemble \textit{G. expansa} by their lax cincinni, orange-toned flowers, and ellipsoid fruits.

\textbf{Etymology}

The epithet ‘aranyaniae’ derives from ‘Aranyani’ who is a princess in the myth relating to the name of the type locality, Pha Nang Khoy (‘Cave of the Lady who Waits’).
Type material

Holotype
THAILAND • Phrae, Rong Kwang, Tham Pha Nang Khoi; 18°22′9″ N, 100°21′16″ E; 350 m a.s.l.; 15 Sep. 1999; P. Srisanga and C. Puff 1075 leg.; QBG.

Isotype
THAILAND • Same data as for the holotype; E00726636; E.

Fig. 6. Distribution range of *G. aranyaniae* Sangvir. & M.F.Newman sp. nov. (circles), *G. flagellaris* K.Larsen (squares), *G. lithophila* Sangvir. & M.F.Newman sp. nov. (triangles), *G. macrochila* Sangvir. & M.F.Newman sp. nov. (stars). The type locality of each species is indicated by a bigger symbol.
Other material examined


Description

Clump-forming herb, 40–80 cm tall, stems leaning with inflorescence turned upright. Leaf sheaths ca 3, bladeless; ligule 2–5 mm long, light green with white margin, bilobed, ciliate; blades 6–9, 7.5–16 × 2.5–4.5 cm, elliptic, plicate, base obliquely obtuse, apex acuminate, strigose along veins above, otherwise glabrous. Inflorescence 7–15 × 5.5–13 cm, lax, conical; peduncle 2–5 cm long; rachis green, glabrous; bracts caducous; bracteoles 2–10 mm long, persistent, elliptic, glabrous but for a few strigillose hairs at apex, light green; cincinni 1–10 cm long, flowers condensed at tip or lax; pedicel to 5 mm. Flowers 3–3.8 cm long; ovary ellipsoid, ca 4 mm long, green (♂), ridged; calyx ca 4 mm long, infundibuliform, lobes acuminate, ciliate, green; floral tube ca 13 mm long, yellow-orange, dorsal and lateral corolla lobes 5–7 × 3 mm, elliptic, hooded, orange-green; lateral staminodes 14–16 × 6–8 mm, obliquely obovate, yellow-orange, apex round; labellum 6–8 × 5–7 mm, triangular, bilobed, yellow-orange with red or brown spot at centre (flowers of pure colour, without a spot occur rarely in natural populations), base truncate, apex round, nectar tube ca 5 mm long; filament 26–28 mm long, yellow-orange; anther ca 1.5 mm long, connective tissue, crest, and appendages orange, semi-translucent, crest truncate, ca 1 mm long (shorter in ♀); ♀ appendages ca 3 mm long, acuminate, bifid, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♀ appendages ca 3 mm long, acuminate, bifid to halfway, upper pair only slightly bigger than lower. Fruit 17–18 × 4–6 mm, ellipsoid, longitudinally ridged. Bulbils produced at base of peduncle or tip of cincinni or protruding from leaf sheaths, obovate, tissue corky, producing one shoot.

Distribution and habitat

Laos and Thailand, at 100–700 m a.s.l., on limestone in mixed evergreen forest or near streams.

Conservation status

Least Concern. This species occurs in protected areas and suitable habitats across its range. In recent years, no major threat to this species has been reported so it is of Least Concern.

Notes

This species grows on limestone bedrock from the Louangphabang range to the Sankamphaeng range. It is the only species in G. subsect. Nudae with a spot on the labellum, which varies from red to brown. The
vegetative parts of this species vary between the two main distribution areas. In Laotian and northern Thai populations, the inflorescences consist of condensed cincinni packed with bracteoles and pedicels at the tip of each cincinnus, and bulbils produced at the base of the peduncle, while, in central and eastern Thai populations, the cincinni are more elongate, and the bulbils are usually produced at the tip of the cincinni or protrude from the leaf sheaths. In eastern Thailand, the plants are found in more humid places so there may be an ecological difference between the populations but the floral morphology is very uniform, especially the diagnostic characters, namely the spot on the labellum and broad lateral staminodes.

**Globba expansa** Wall. ex Horan.

Figs 2B, 7A–G, 8

**Prodromus Monographiae Scitaminearum Additis Nonnullis de Phytographia, de Monocotyleis et Orchideis**: 19 (Horaninow 1862).

**Synonyms**


**Type material**

- **Lectotype** (designated here)
  MYANMAR • Mon State, Attaran, banks of Attaran River; 5 Sep. 1826; N. Wallich 6536C leg.; K-W.

**Other material examined**

MYANMAR • Ava, Irrawaddy River; 5 Sep. 1826; N. Wallich 6536A leg.; K-W.

Fig. 8. Distribution range of *G. expansa* Wall. ex Horan. The type locality is indicated by a bigger symbol.


**Description**

Herb (25–)45–150 cm tall, clump-forming, leaning with inflorescence turning upright. Leaf sheaths ca 3, bladeless; ligule 1–6 mm long, truncate to bilobed, glabrous to pubescent, light green with white margin; blades 6–9, 10–29 × 1.7–9 cm, elliptic, usually glaucous, sometimes with grey patch along midrib above, base cuneate or obliquely rounded, apex acuminate to caudate, adpressed pubescent below, otherwise glabrous. Inflorescence 10–27 × 6.5–17 cm, lax, conical; peduncle to 3 cm long; rachis green, glabrous; bracts and bracteoles to 10 mm long, caducous, elliptic, glabrous to minutely pubescent, green; cincinni 1–12 cm, elongate, flowers lax on cincinnus; pedicel 1–2 mm. Flowers 3.4–3.6 cm long; ovary ca 4 mm long (♂), ellipsoid, ridged, glabrous, green; calyx ca 4 mm long, pubescent, green, lobes acuminate, margins sparsely pubescent; floral tube 9–14 mm long, minutely pubescent, yellowish orange, dorsal and lateral corolla lobes 6–7.5 × 3–4 mm, hooded, the dorsal one slightly larger, orange-green; lateral staminodes 11–13 × 3–5 mm, oblong to narrowly obovate, yellowish orange, apex round; labellum 11–12 × 4–5 mm, triangular, bilobed, yellowish orange, spot absent, base truncate, apex round, nectar tube 3–5 mm long; filament 26–28 mm, minutely pubescent, orange; anther ca 1 mm long, connective tissue, crest and appendages orange, semi-translucent, crest ca 1 mm long, truncate (shorter in ♀); ♀ appendages ca 3 mm long, acuminate, bifid, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♀ appendages ca 3 mm long, acuminate, bifid to halfway, upper pair only slightly bigger than lower. Fruit to 2.7 × 1 cm, ellipsoid, longitudinally ridged, green. Bulbils occasional, subtended by sterile bracts below lowest cincinnus, spindle-shaped, tissue corky.
Distribution and habitat
Myanmar, Laos, Thailand, 174–1350 m a.s.l., growing in mixed evergreen forest along the trail under semi shade. Usually found as dense clump.

Conservation status
Least Concern. The species occurs in a number of protected areas across its range. The species is grown in ex situ collections at two botanic Gardens (BGCI 2018).

Notes
Globba expansa is the most common species in this subsection, growing widely in northern Myanmar, Thailand, and Laos. Usually found in evergreen forest or deciduous forest, it is easily noticed by its large inflorescence with bright orange flowers on elongate cincinni. As its distribution is wide, this species has been described twice from Myanmar and Thailand. Type specimens and living specimens at the type locality of G. yeatsiana were compared. In the case of G. expansa from Myanmar, Wallich’s specimens no. 6536 are in good condition, especially no. 6536C which has a male flower attached to the sheet. As for G. yeatsiana from Thailand, type specimens were studied alongside living plants found predominantly at 800–1000 m a.s.l. in evergreen forest of Doi Suthep-Pui. Both specimens shared the same morphological characteristics, such as oblong to narrowly obovate lateral staminodes, labellum shape, anther appendage shape, and floral part ratio. As a result, G. yeatsiana is placed in synonymy under the earlier name, G. expansa.

Globba flagellaris K. Larsen
Figs 2C, 6, 7H–K


Type material
Holotype
THAILAND • Mae Hong Son, Doi Pui; 19°13′0″ N, 98°2′0″ E; 800 m a.s.l.; 23 Sep. 1995; K. Larsen, S.S. Larsen, C. Tange and D. Sookchaloem 46843 leg.; AAU.

Isotypes
THAILAND • Same data as for the holotype; MO, L, K.

Other material examined

Description
Herb (20–)50–100 cm tall with erect, flattened, leafy stems and prostrate, leafless stems running ca 75 cm along the ground to produce bulbils which take root. Leaf sheaths 3–5 bladeless; ligule 5–6 mm long, truncate to bilobed, glabrous to minutely ciliate; blades 6–8, 15–20 × (3.5–) 6–8 cm, usually broadly elliptic, sometimes narrowly so, base cuneate to decurrent, apex caudate, glabrous, petiole
2–5 mm long. Inflorescence 10–30 × 7–18 cm, lax, conical, elongating greatly at anthesis; peduncle to 15 cm long; rachis glabrous; bracts 3–12 mm long, caducous, bracteoles persistent, triangular, glabrous to minutely pubescent; cincinns 3.5–15 cm long; pedicel to 6 mm long. Flowers 3.3–3.6 cm long, ovary and calyx green, the rest pure orange; ovary ca 3 mm long (♂), ellipsoid, ridged; calyx 3–5 mm long, infundibuliform, lobes acuminate, margins sparsely pubescent; floral tube ca 15 mm long, minutely pubescent, dorsal and lateral corolla lobes 6–7.5 × 3–4 mm, hooded, the dorsal one slightly larger, the lateral lobes usually concealed by the lateral staminodes; lateral staminodes 12–15 × 5–9 mm, obovate, usually very large, apex round; labellum triangular, 10–12 mm long, bilobed for ½ its length, spot absent, base truncate, apex obtuse, nectar tube ca 4.5 mm long; filament ca 27 mm long, minutely pubescent; anther 1–2 mm long, connective tissue, crest and appendages orange, semi-translucent, crest ca 1 mm long (shorter in ♂), truncate; ♀ appendages ca 3 mm long, acuminate, bifid, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♂ appendages ca 3 mm long, acuminate, bifid to halfway, upper pair only slightly bigger than lower. Fruit 20–27 × 8–10 mm, ellipsoid, triangular in cross section, longitudinally ridged, green. Bulbils occasional, subtended by sterile bracts below lowest cincinnus, spindle-shaped with prolonged shoot, tissue coryck; also on flagellate stems.

Distribution and habitat
Chiang Mai, Mae Hong Son, and Nan provinces, Thailand, 450–1100 m a.s.l. It grows in dense populations in rather moist areas, often near streams.

Conservation status
Least Concern. *Globba flagellaris* has a small area AOO of 32 km² and EOO of 5619 km², suggesting a status of Vulnerable. As it grows in protected areas, however, as well as *ex situ* in Queen Sirikit Botanic Garden, it is therefore of Least Concern.

*Globba insectifera* Ridl.
Figs 2D, 9A–D, 10

*Journal of the Straits Branch of the Royal Asiatic Society* 49: 42 (Ridley 1908).

Synonyms


Type material
Lectotype (designated by Turner 2000)
MYANMAR • Shan State, Shan Hills; W. Micholitz 783 leg.; SING.

Other material examined

**Fig. 10.** Distribution range of *G. insectifera* Ridl. (circles) and *G. lancangensis* Q.Q.Yian (triangles). The type locality of each species is indicated by a bigger symbol.
Description

Herb 25–120 cm tall, leafy shoot leaning, with inflorescence turned upright. Leaf sheaths ca 3, bladeless; ligule 2–4 mm long, truncate or shallowly bilobed, sparsely pubescent, light green; blade 5–11, 5.5–18 × 0.6–3.5 cm, sessile, oblong to elliptic, base obliquely cuneate, apex acuminate, puberulous below, strigose above. Inflorescences, 5.5–15 × 4–12 cm, produced on separate, leafless shoots in April to early May, then on leafy shoots in July and August, lax, conical, sometimes secund; peduncle ca 3 cm long; rachis light green, pubescent; bracts and bracteoles 0.5–2 mm long, caducous, deltoid to lanceolate, glabrous to pubescent, apex acute, light green; cincinni 4–12, 1.5–5.5 cm long; pedicel ca 1 mm long. Flowers 3.4–3.8 cm long, lemon or bright yellow; ovary c. 3 mm long (♂), ellipsoid; calyx 4 mm long, infundibuliform, lobed acute, yellow-green; floral tube ca 10 mm long, dorsal and lateral corolla lobes 6–7 mm long, hooded, elliptic, yellow; lateral staminodes 18–20 × 9–11 mm, obovate, usually very large, apex acute to obtuse, bright yellow; labellum 12–14 × 4–5 mm, triangular, bilobed, spot absent, base truncate, apex round, nectar tube ca 8 mm long, yellow-orange; filament 26–28 mm long; anther ca 2 mm long, connective tissue and crest and appendages bright yellow-orange, semi-translucent, crest c. 1 mm long (shorter in ♂), truncate; ♂ appendages ca 3 mm long, acuminate, bifid to halfway, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♀ appendages ca 4 mm long, acuminate, bifid to halfway, upper pair only slightly bigger than lower. Fruit to 2.5 × 1 cm, ellipsoid, longitudinally ridged, green. Bulbils occasional, subtended by sterile bracts below lowest cincinnus, spindle-shaped, tissue corky.

Distribution and habitat

Myanmar and Thailand, 240–1500 m a.s.l. Common in dipterocarp or grass forest in open areas. The plants grow over large areas but not covering the ground densely.

Conservation status

Least Concern. Globba insectifera is fairly widespread in Thailand and Myanmar with an extent of occurrence of 77 052 km². Threats to the species are mostly localized and are not of major concern. In addition, many populations grow in national parks so the species is assessed as Least Concern.

Notes

The growth pattern of G. insectifera from the dry to the rainy season was monitored at Doi Suthep-Pui, Chiang Mai province, Thailand, and the results showed that this species produces inflorescences twice a year. The first inflorescences appear in the middle of summer (April to early May) with only very small leaflets at the base. Later, inflorescences are produced terminally on the leafy shoots during the rainy season following the normal pattern of this genus. This information is useful for taxonomic treatment of this species.

Specimens collected in the dry season have been described twice as G. insectifera and G. nuda. Ridley’s specimen grew spontaneously from plants collected in the Shan state, Myanmar, labelled as “Paphiopedilum bellatulum” and cultivated in Singapore Botanic Gardens. Ridley mentioned that this species had an inflorescence shoot and that its flower looked like a butterfly because of its large lateral staminodes. This species was lectotypified by Turner (2000) on a colour illustration deposited at Singapore Botanic Garden which we have seen. The other name, G. nuda, was described from Doi Suthep-Pui, Chiang Mai province, Thailand. Larsen diagnosed this species by its inflorescence shoot which had no leaves, giving it the specific epithet ‘nuda’, meaning without leaves. Larsen did not mention G. insectifera. We have seen the holotype of G. nuda at AAU and other specimens from Thailand. Furthermore, we have visited Doi Suthep-Pui which is the type locality of G. nuda.
As for specimens growing in the rainy season, Craib (1912) described G. kerrii from Doi Suthep-Pui which he diagnosed by its wide lateral staminodes. One of the isotype sheets at E (E00097476 and E00097477), which we have seen, has an inflorescence shoot remaining at the base of the plant. This was not mentioned in the protologue but it gives strong support for the placement of G. kerrii and G. nuda in synonymy under G. insectifera (Fig. 9A–D).

**Globba lancangensis** Y.Y. Qian

*Figs 9E, 10*


**Type material**

**Holotype**

CHINA • Yunnan, Lancang Lahuzu Zizhixian, Lancang; 1200 m a.s.l.; 16 Oct. 1984; Y.Y. Qian 2255 leg.; SMAO.

**Isotype**

CHINA • Same data as for the holotype; IBSC.

**Other material examined**


**Description**

Herb 60–80 cm tall. Leaf sheaths ca 4, bladeless, leaf sheaths appearing node-like along the leafy stem; ligule ca 2 mm long, truncate or shallowly bilobed, sparsely pubescent, light green; blades 6–10, 6.5–13 × 2.5–3 cm, sessile, oblong to narrowly elliptic, base obliquely cuneate, apex acuminate, puberulent above and below. Inflorescence, 10–20 × 5–7 cm, lax, conical sometimes secund; peduncle 1.5–3 cm long; rachis light green, minutely pubescent; bracts and bracteoles 1.5–7 × 1–2 mm, caducous, narrowly elliptic, apex acute, pubescent, light green; cincinni 5–9(–14), 1.5–6.5 cm long; pedicel ca 1 mm long. Flowers ca 3 cm long, primrose or pale yellow; ovary ca 3 mm long (♀), ellipsoid; calyx ca 4 mm long, infundibuliform, lobes acute; floral tube 12–16 mm long, dorsal and lateral corolla lobes to 6 mm long, hooded, elliptic; lateral staminodes 11–13 × 5–7 mm, obovate, apex round, pale yellow; labelllum 10–13 × 4–5 mm, triangular, bilobed, spot absent, base truncate, apex round, nectar tube ca 4 mm long; filament ca 23 mm long; anther ca 2 mm long, connective tissue, crest and appendages yellow-orange, semi-translucent, crest ca 1 mm long (shorter in ♂), truncate; ♂ appendages ca 3 mm long, acuminate, bifid, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♀ appendages ca 3 mm long, acuminate, bifid, upper pair only slightly bigger than lower. Fruit 7–10 × 5–7 mm, almost globose, shallowly ridged, green. Bulbils not seen.

**Distribution and habitat**

China (Yunnan), 1080–1350 m a.s.l.

**Conservation status**

Least Concern. Although *G. lancangensis* has a small AOO of 20 km² and EOO of 1897 km², this species occurs in the Xishuangbanna Biosphere Reserve. It may also occur in the adjoining Nam Ha
reserve in Lao PDR. Surveys should be carried out to see if the species occurs in this area. The species is also in \textit{ex situ} cultivation at one botanical garden (BGCI 2018).

\textbf{Notes}

\textit{Globba lancangensis} is endemic in China. It is similar to \textit{G. insectifera} in its habit, broad lateral staminodes, and labellum shape but differs by its fruit shape, the form of the leafy stem and the colour of the lateral staminodes.

\textit{Globba lithophila} Sangvir. \& M.F.Newman sp. nov.  
\texttt{urn:lsid:ipni.org:names:77195004-1}  
Figs 2E, 6, 11–12

\textbf{Diagnosis}

Similar to \textit{G. flagellaris} and \textit{G. macrochila} sp. nov. in its condensed cincinni and bright orange flowers, but differing from them by its clearly visible lateral corolla lobes, oblong and patent lateral staminodes, smaller size and ecological requirements, being found only in pockets of soil in cracks in limestone.

\textbf{Etymology}

From the Greek `lithos' (stone) and `phila' (loving), reflecting its limestone habitat.

\textbf{Type material}

\textbf{Holotype}
THAILAND • Mae Hong Son, Pang Mapha, Tham Lot; 675 m a.s.l.; 7 Aug. 1999; J.F. Maxwell 99–109 leg.; BKF.

\textbf{Isotype}
THAILAND • Same data as for the holotype; A.

\textbf{Other material examined}

\textbf{Description}

Herb 10–60 cm tall, growing in small pockets of rock or on soil near cliffs. Leaf sheaths ca 3, bladeless; ligule 2–5 mm long, bilobed, glabrous to minutely pubescent, light green with white margin; blades 5–6(–10), 8.7–18 × 5.5–6 cm, sessile, elliptic to narrowly ovate, base obliquely cuneate, apex acuminate, pubescent along midrib above, dark green sometimes with silver striations along midrib above, pubescent to sericeous below. Inflorescence 7–13 × 3–9 cm, lax, conical; peduncle ca 1 cm long; rachis light green with sparse hairs; bracts 2–5 × 1–1.5 mm, caducous, oblong, glabrous or pubescent, light green; cincinni 5–16, 0.5–4.7 cm long, flowers condensed at tip of cincinnus and arranged in two rows; pedicel 1–3 cm long, pubescent; bracteoles 1–4 × 0.5–2 mm, persistent, triangular, apex acute, mucronate, sparsely pubescent, green with paler margin. Flowers 2.8–3.2 cm long, ovary and calyx green, the rest
pure orange; ovary 1–4 mm long (♂), ellipsoid, ridged; calyx 4 mm long, infundibuliform, lobes acute; floral tube 12–14 mm long, minutely pubescent, dorsal and lateral corolla lobes 6–7 × 2–3 mm, hooded, elliptic, the lateral lobes easily seen; lateral staminodes ca 11 × 4.5 mm, patent, oblong, apex round or shallowly bilobed; labellum 7–8 × 4–5 mm, triangular, bilobed, spot absent, apex round to truncate, nectar tube ca 4.5 mm long; filament 23–26 mm long; anther 1–2 mm long, connective tissue, crest and appendages orange, semi-translucent, crest ca 1 mm long (shorter in ♂), truncate; ♂ appendages ca 2 mm long, acuminate, bifid, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♂ appendages ca 2 mm long, acuminate, bifid to halfway, upper pair only slightly bigger than lower. Fruit 10–15 × 5–6 mm, triangular, longitudinally ridged. Bulbils not seen.

**Distribution and habitat**

Thailand, 450–800 m a.s.l., only found in small pockets of soil in or very near limestone.

**Conservation status**

Least Concern. *Globba lithophila* sp. nov. has a small AOO of 28 km² and EOO of 2600 km², suggesting a status of Endangered but it grows in Lum Nam Pai Wildlife Sanctuary as well as ex situ in Queen Sirikit Botanic Garden so it is of Least Concern. It is a lithophyte which makes it sensitive to environmental factors so good management of protected areas is important to keep it in its natural habitat.

**Notes**

*Globba lithophila* sp. nov. has been compared closely to *G. flagellaris*, with which it is sympatric in north Thailand. Both species were cultivated in the same place at the Zingiberaceae nursery of Queen Sirikit Botanic Garden under controlled conditions. After two years of growth, the vegetative parts of the plants were larger than those of wild plants, while the floral parts and ratios of sizes remained the same. We conclude that these are two separate species and that *G. lithophila* sp. nov. is not merely a part of the variation of *G. flagellaris*.

*Globba macrochila* Sangvir. & M.F.Newman sp. nov.

*Diagnosis*

Similar to *G. flagellaris* in its bright orange flowers, but differing by its much longer labellum, 19–20 mm long (vs short labellum, 10–12 mm long) and growing in dry areas (vs moist areas).

*Etymology*

Greek, ‘*macros*’ (large) and ‘*-chila*’ (-lipped), referring to its long labellum.

*Type material*

**Holotype**

THAILAND • Kanchanaburi, Sai Yok; 30 Jul. 1928; Put 1779 leg.; BK.

**Isotypes**

THAILAND • Same data as for the holotype; C, K, P.

**Other material examined**

MAYNMAR – Mawlamyine • Kyauk Ta Lon Pagoda, 13½ miles from Moulmein on Ye road; 21 Jul. 1958; H.S. McKee 6319 leg.; K.


Description

Herb, 25–60 cm tall, clump-forming, growing in rather dry areas, leaning, with upright inflorescence. Leaf sheaths 3–5, bladeless; ligule 2–5 mm long, bilobed or truncate, pubescent or glabrous, light green with white margin; blades 5–10, 5–15.5 × 1.3–2.5 cm, elliptic to ovate, base obliquely obtuse, apex acuminate, strigose along veins above, otherwise glabrous; petiole, if present, to 1 cm. Inflorescence 5–11 × 5–12 cm, lax, conical; peduncle 1–2 cm long; rachis glabrous; bracts caducous, bracteoles 2–10 mm long, persistent, elliptic, apex and margin pubescent; cincinni 1–7 cm long; pedicel to 6 mm. Flowers 3.0–3.6 cm long, ovary and calyx green, the rest pure orange; ovary ca 4 mm long (♂), ellipsoid, ridged; calyx 3–5 mm long, infundibuliform, lobes acuminate; floral tube 9–11 mm long, dorsal and lateral corolla lobes ca 6 × 3 mm, hooded, elliptic; lateral staminodes 12–14 × 7–8 mm, obovate, apex acute; labellum 19–20 × 4–7 mm, triangular, bilobed, spot absent, base truncate, apex obtuse, nectar tube ca 6 mm long; filament ca 30 mm; anther ca 1.5 mm long, connective tissue, crest and appendages orange, semi-translucent, crest ca 1 mm long (shorter in ♀), truncate; ♀ appendages ca 3 mm long, acuminate, bifid, upper pair bigger, decurrent to connective tissue and crest, lower pair smaller; ♂ appendages ca 3 mm long, acuminate, bifid, to halfway, upper pair only slightly bigger than lower. Fruit ellipsoid, longitudinally ridged, green. Bulbils produced at peduncle and cincinni, ellipsoid, tissue corky.

Distribution and habitat

Myanmar and Thailand, 100–350 m a.s.l., in rather dry forest.

Conservation status

Least Concern. Although this species has a small AOO of 32 km², the populations in Kanchanaburi province, where this species is commonest, are found in several protected areas. It is also grown in Queen Sirikit Botanic Garden.

Notes

Usually found in somewhat dry areas, such as bamboo forest. The labellum is remarkable, being longer than the lateral staminodes. It always covers the lateral corolla lobes. Plants were cultivated under more humid test conditions in Bangkok to find out the stability of the morphological characters. After growing for one season, the environmental factors affected only vegetative structures, i.e., leafy stem size, inflorescence size but did not influence the ratios of the floral parts.
**Doubtful species of Globba subsect. Nudae**

*Globba pauciflora* King ex Baker

*Flora of British India* 6: 205 (Baker 1890).

**Type material**

**Syntype**
INDIA • Andaman Island; 1884; King’s collector 376 leg.; K.

**Distribution and habitat**
Only known from the type locality.

**Notes**
This species is close to *G. expansa* in its habit and flower, but differs by its ovate leaves and rather small inflorescence.

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*Globba rahmanii* Yusuf


**Type material**

**Holotype**
BANGLADESH • Chittagong, Khagrachari, Dighinala, Dighinala-Marissha road, Teentila; 30 Aug. 1997; M.A. Rahman 1878 leg.; HCU.

**Isotype**
THAILAND • Same data as for the holotype; K.

**Distribution and habitat**
Only known from the type locality.

**Notes**
The information given in the protologue does not allow the status of this species to be decided. No type specimen deposited at Kew was found. In overall appearance, it resembles *G. flagellaris* by its habit and broad lateral staminodes.

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*Globba subscaposa* Collett & Hemsl.


**Holotype**
MYANMAR • Shan State; 1210–1520 m a.s.l.; 1888; H. Collett s.n. leg.; K.

**Distribution and habitat**
Only known from the type locality, collected in 1888 in Myanmar, Shan State, 1210–1520 m a.s.l., said to be common above 1200 m a.s.l. throughout the southern Shan Hills.
Notes
Collett & Hemsley placed *G. subscaposa* in *G. sect. Ceratanthera* (Horan.) Petersen because it has two anther appendages but the description in the protologue and the appearance of the type convince us that it belongs in *G. subsect. Nudae*. Dissection of a flower on the type shows that it is morphologically similar to *G. insectifera* by the shape of the anther appendages of a functionally male flower and its broad lateral staminodes but it differs by its rather clump-forming habit (not tending to grow as solitary shoots), and densely villous indumentum on the leafy stem and inflorescence (vs glabrous to minutely pubescent).

Discussion
Of the fourteen validly published species names in *G. subsect. Nudae*, seven are accepted while three are placed in synonymy. The characteristics, distribution ranges and habitats of these species have been clarified and a key to their determination has been provided. Four doubtful species cannot be further defined until exploration at their type localities can be carried out.

This research confirms that andromonoecy is a synapomorphy uniting *G. subsect. Nudae* and *G. subsect. Mediocalcaratae* and supports the most recent infrageneric classification of *Globba* (Williams et al. 2004). Importantly, our morphological study has also clarified a point which has been greatly misunderstood in relation to *G. subsect. Nudae* in earlier taxonomic accounts. This is the fact that all the flowers on a few lowermost cincinni of the inflorescences are hermaphrodite while all the later flowers have an undeveloped ovary and are functionally male. Earlier taxonomists have mistaken the hermaphrodite and male flowers for flowers of different taxa. For instance, in the *Flora of British India* (Baker 1890), *G. subscaposa* was classified in *G. sect. Ceratanthera* which has two anther appendages. After study of the type specimen at Kew, we suppose that Baker saw only functionally male flowers in which the anther appendages are bilobed only to about half their length (Fig. 3D) and, in this way, he thought there were two of them rather than four. Similarly, in *Das Pflanzenreich* (Schumann 1904), two species of *G. subsect. Nudae*, *G. subscaposa*, and *G. platystachys* Baker, were classified into *G. sect. Ceratanthera*.

Recent research on the development of anther appendages in *Globba* has shown that six appendages occur in *G. subg. Globba* (Cao et al. 2018). In *G. sect. Nudae* and *G. sect. Sempervirens*, *G. siamensis* (Hems.) Hems., *G. propingua* Ridl., and *G. atrosanguinea* Teijsm. & Binn. were found to have a pair smaller appendages inserted between the large ones, as a result of fragmentation in development. *Globba* sect. *Nudae* was the only section in *G. subg. Globba* in which six appendages were not found. Our results above confirm this finding.

The centre of diversity of this subsection is in the monsoon area of mainland Southeast Asia, especially in mountain ranges. The Isthmus of Kra, which runs between Nakhon Nayok province in Thailand and the Nicobar islands in the Andaman sea and is an important phytogeographic barrier in this area (Parnell 2013), forms the southernmost extent of distribution of *G. subsect. Nudae*. The western border may extend to the Western Ghats in India if *G. platystachya* is confirmed to belong in the subsection. This is of particular interest in the cases of *G. platystachya* and *G. pauciflora*, which are separated from the main distribution area of the subsection, in Karnataka State and the Andaman Islands, respectively. *Globba* subsect. *Nudae* and the other sections of *G. subg. Globba* occur either north or south of the Isthmus of Kra but *G. subsect. Mediocalcaratae* is the exception to this rule. Members of *G. subsect. Mediocalcaratae* occur both north and south of the Isthmus of Kra (Williams et al. 2004). To gain an understanding of the factors governing distribution and to complete our knowledge of species distributions in *G. sect. Nudae*, *G. subsect. Mediocalcaratae* needs to be revised.
All species are assessed as of least concern using IUCN conservation status criteria, although some species have a small area of area of occupancy (AOO) and extent of occurrence (EOO) suggesting a higher degree of threat. These grow in protected areas and botanical gardens so the threats to them are thought not to be serious in the immediate future.

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