

A REVISION OF *PARABOEA* (*GESNERIACEAE*)

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The genus *Paraboea* Ridl. (*Gesneriaceae*) is revised. It is found in Bangladesh, Bhutan, Burma, Cambodia, southern China, India (Assam), Indonesia (Sumatra, Java, Borneo, Sulawesi), Laos, Malaysia (Peninsular and Borneo), Philippines, Thailand and Vietnam, mostly from limestone habitats. Eighty-nine species and five varieties are recognised.

Four new species and one new variety are described: *Paraboea apiensis* Z.R.Xu, *Paraboea argentea* Z.R.Xu, *Paraboea graniticola* Z.R.Xu, *Paraboea paraprimumoides* Z.R.Xu and *Paraboea harroviana* var. *ovata* Z.R.Xu. In addition two taxa are highlighted as possible new species but are not described here due to insufficient material. The treatment includes one new combination for a species, *Paraboea harroviana* (Craib) Z.R.Xu, one new combination for a variety, *Paraboea schefferi* var. *ambigua* (C.B.Clarke) Z.R.Xu, one new status for a variety, *Paraboea rufescens* var. *tomentosa* (Barnett) Z.R.Xu, and one new name, *Paraboea primuloides* Z.R.Xu. Fifty-one line drawings are included. A key is presented and all taxa are described. Preliminary conservation assessments are given.

Keywords. *Gesneriaceae*, *Paraboea*, taxonomic revision.

INTRODUCTION

Paraboea (C.B.Clarke) Ridl. was first published by Clarke as a section, *Didymocarpus* sect. *Paraboea* C.B.Clarke (1883), and was raised to generic level by Ridley (1905). *Paraboea* was distinguished from an allied genus, *Boea* Lam., by a carpological character: valves of the capsule were straight in *Paraboea*, while those in *Boea* were twisted. A revision of *Boea* and allied genera by Burt (1984) abandoned the above generic delimitation and circumscribed the two genera based on a difference in indumentum: an indumentum of simple straight hairs in *Boea* and an indumentum of interwoven arachnoid-like hairs in *Paraboea*. The revision fundamentally changed the content of the two genera, resulting in a relocation of the majority of species of *Boea* to *Paraboea*. Further discussion on generic delimitation in the *Boea* group (*Boea*, *Paraboea* and *Trisepalum* – including several other genera reduced to synonymy) can be found in Burt (1984).

This paper is a continuation of an earlier work on *Paraboea* (Xu & Burt, 1991) in which several new taxa were described. It is based on an examination of a total of about 670 herbarium collections with more than 2000 sheets from herbaria all over

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the world. The purpose of this paper is to delimit the taxa, provide a key to identify them, provide a full synonymy, describe each taxon and provide conservation assessments of all taxa. What is now also needed is a thorough phylogenetic analysis of the genus to examine relationships between the species and the relationships of *Paraboea* to other genera, and indeed, whether *Paraboea* is a monophyletic group as we have assumed here. Preliminary molecular phylogenetic studies do suggest that *Paraboea* and *Trisepalum* together form a monophyletic group but as yet there is no resolution to whether the two genera are distinct or not (M. Möller, pers. comm.). However, this lack of a phylogenetic resolution does not need to delay the fundamental practice of taxonomy which is to delimit and describe species.

Paraboea is found in southern China, northeastern India and the eastern Himalayas, Burma, Thailand, Cambodia, Laos, Vietnam, Malaysia, Philippines and Indonesia as far east as Sulawesi (Fig. 1). Much of this distribution coincides with a poor specimen collection density (Johns, 1995; Middleton, 2003). Consequently many of the taxa included in this revision are known from only one or very few specimens. This inevitably leads to decisions being based on insufficient information, and any use of this work must bear this in mind – there will almost certainly be taxa which we have misinterpreted. We hope, however, that this revision will encourage further exploration of the regions concerned and more targeted collecting of limestone areas where the majority of *Paraboea* species are found. But, for the time being, we have based our species concept on discontinuities in morphological characters and, where there is some doubt as to whether taxa should be recognised due to inadequate material, we have taken the geographical distributions into account. In addition it is very likely that there are many taxa yet to be discovered, particularly in underexplored limestone areas such as in Laos, Vietnam and Kalimantan.

This paper has been completed in two distinct periods – the majority of the work was done before 1993 by the first author, under the supervision of the second and third authors, and it was then updated and extensively revised by the first and fourth authors in 2007. This work pattern will explain why not all recently collected material is included in the revision although all recently published taxa have been checked and incorporated into the work. Although we acknowledge that in an ideal world all of the recent material should have been included we believe that it is now important that this revision be published to provide a useful benchmark for further taxonomic study on this genus. We have, however, attempted to check the more recent material from particularly poorly known areas.

In this work 89 species and five varieties of *Paraboea* are recognised, which include four new species, one new variety, one new combination for a species, one new combination for a variety, one new status for a variety and a new name.

MORPHOLOGY

The genus is rather diverse in morphology, showing differences in habit, the indumentum, the inflorescence and the capsule. We have found inflorescence

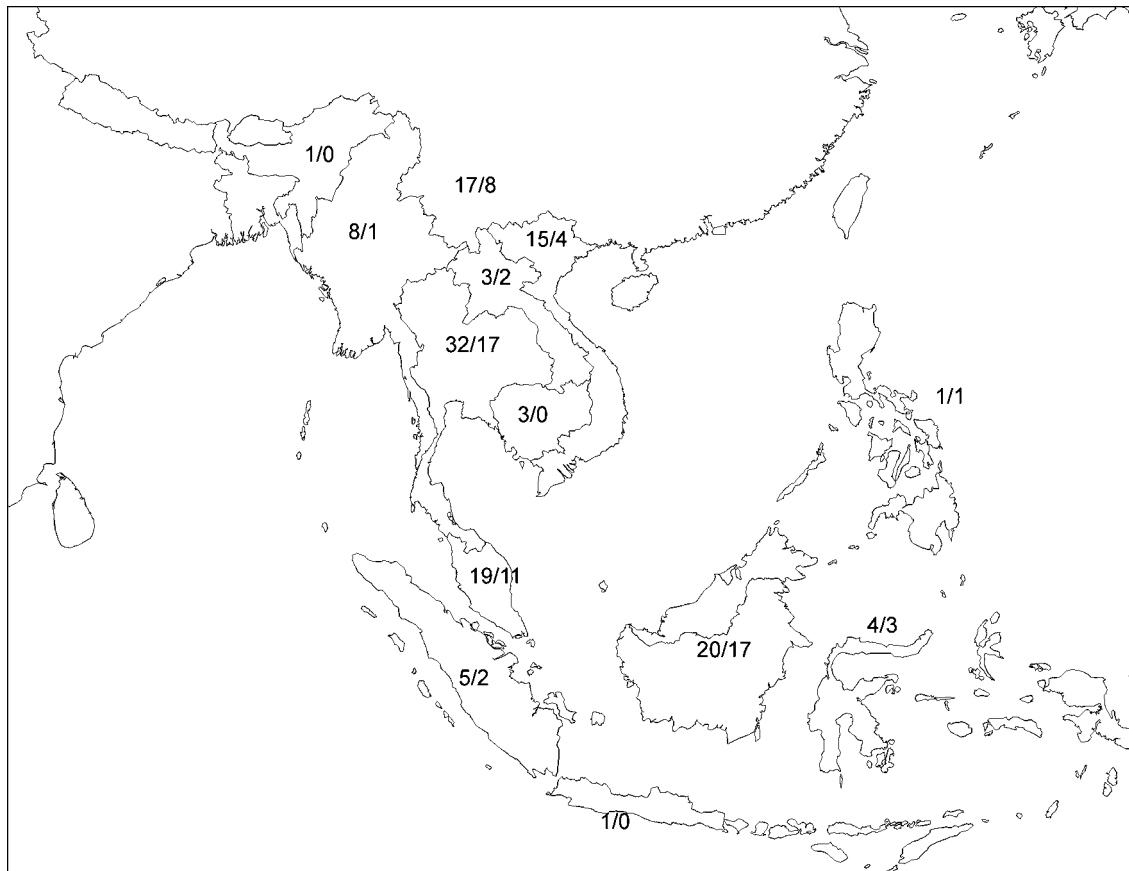


FIG. 1. Distribution of *Paraboea* species. In each case the first number is the total number of species in the country or on the island (in Malesia) and the second number is the number of endemic species in the same region. Varieties are included under species and species with additional questionable distributions are counted as having specimens found in those areas (see discussions under the relevant species). *Paraboea speciosa* is not included as its provenance is unknown. The number given for northeastern India also includes Bhutan and Bangladesh.

structure to be extremely important in identifying species and it will be interesting to see whether it proves to be phylogenetically informative once a molecular phylogeny of the group is available.

Habit: Rosette vs. Cauline with extended internodes

A rosulate habit (rosette-forming) means that the plants do not possess a stem and all the leaves are basal. A cauline habit means that the plants possess a stem with clear internodes. The rosulate habit and cauline habit may be confused with each other in vegetative growth, for a rosette may be formed by greatly reducing the length of internodes on the stem from the cauline habit. However, in association with inflorescence patterns this confusion may be clarified. A true rosette is generally associated with axillary cymes and the plant has a vegetative terminal bud that will continually grow to produce a polycarpic individual. Species with the cauline habit may also bear an inflorescence of axillary cymes and be polycarpic, but species with a terminal panicle never have a true rosette even though the stem may be very short. These individuals are monocarpic.

Thus, a rosulate habit may not be qualitatively different from a cauline habit, but a rosette + axillary cyme is qualitatively different from cauline habit + terminal panicle.

Leaf phyllotaxis: Opposite vs. Whorled vs. Alternate

For the most part these three alternative leaf arrangements are clearly distinguishable from each other. Opposite leaf arrangement is the most common in the genus and is associated with both terminal panicles and axillary cymes, and rosulate and cauline habits. Species with whorled leaves almost always have a terminal panicle with only two exceptions (*Paraboea divaricata* and *P. elegans* with subterminal cymes) and all these species occur only in tropical Malaysia and Indonesia. This group of species are also similar in habit, in flowers and in fruits. However, even though *Paraboea divaricata* and *P. elegans* have whorled leaves they have a similar habit, corolla, stamen and gynoecium to those species with a subterminal cymose inflorescence. *Paraboea divaricata* is closer to *P. patens*, and *P. elegans* to *P. minor* (see discussions under those species). Alternate leaf arrangement is uncommon in this genus. This leaf arrangement is more often associated with axillary cymes, although *P. lancifolia* has a terminal panicle. The three leaf arrangements have no intermediate types.

Inflorescences: Terminal panicle vs. Axillary cymes vs. Subterminal cymes

The basic unit in the *Gesneriaceae* inflorescence is the pair-flower system (for further explanation see Weber, 1973, 1982, 2004). The basic difference between a terminal panicle and an axillary cyme is that the terminal bud in an individual that has

a terminal panicle will be aborted when the panicle matures while the terminal bud in an individual that has axillary cymes will continue vegetative growth after the flowering season.

Terminal panicle inflorescence. The flowering stem is a direct extension of the plant stem (or the stem of a branch); the cymes in a panicle are arranged in a continual sequence, generally the lower the larger, and every node of the flowering stem usually bears at least one cyme that consists of at least one pair-flower. The leaves in the flowering stem have the same shape and texture as the vegetative leaves.

Axillary cyme inflorescence. There is no flowering stem and the stalk of a cyme is the peduncle. A plant could have several cymes in a flowering season arranged irregularly along the stem with possibly empty leaf axils in the flowering region. The 'leaves' in the cyme, i.e. the bracts, generally have a different shape and texture to the vegetative leaves. In general, the cyme has only two primary branches opposite to each other at the apex of the peduncle. Between the two primary branches there is usually a pair-flower unit. However, in some species (*Paraboea clarkei*, *P. brunnes-cens*), a subordinate primary branch may develop from just below the two primary branches, and subordinate branches may also develop within the secondary branches. Some species, such as *Paraboea mahaxayana* and *P. crassifolia*, develop more than one cyme from a single axil.

In addition to the above two basic patterns of inflorescence, we recognise a third pattern of inflorescence, *Subterminal cymose inflorescence*. In a subterminal cymose inflorescence, the individual plant bears the cymes in the uppermost axils, and the terminal bud, which is a vegetative bud, is aborted after the cymes develop. This may, or may not, produce a monocarpic individual. When the growth is monocarpic (e.g. *Paraboea harroviana*, *P. argentea*) subsequent vegetative growth arises from basal buds near the ground or even from rhizomes. When it is non-monocarpic subsequent vegetative growth may resume from the axillary buds below the subterminal cymes. Both patterns may occur in single species. Although this type of inflorescence may seem similar to the terminal panicle the inflorescences never do appear paniculate.

Understanding these three patterns of inflorescence is important. In the family as a whole the axillary cyme is the most common inflorescence type. Almost all the New World *Gesneriaceae* possess this type of inflorescence, while in the Old World the three types of inflorescence exist with the terminal panicle the least common.

Fruit: Spirally twisted fruit vs. Non-twisted fruit

In the mature fruit there are two patterns of capsule development: (i) the valves of the capsule spirally twist along the longitudinal axis of the capsule; and (ii) the valves of the capsule are straight. In those that twist the valves may twist around the longitudinal axis more than five times in some long capsules (e.g. *Paraboea*

verticillata, *P. treubii*, *P. paniculata* – capsules > 4 cm long), while in some relatively short capsules (e.g. *Paraboea mahaxayana* – capsule < 1 cm long), the valves do not manage a complete turn in their twist. Regardless of whether the capsule is long or short it is easy to distinguish twisting from non-twisting.

Burt (1984) suggested that fruit twisting was not a reliable character. However, we now believe that the twisting pattern of capsules is a reliable character. In general, the valves of twisted capsules begin to twist at an early stage in the development of the fruit; the ovary itself is always straight. The development of the twisting pattern is generally completed when the young fruit reaches its full length but before the full diameter is attained. Therefore, the twisting pattern is fully developed before the fruit and the seeds are mature. It has also been ascertained that the environment plays no part in whether the capsule twists or not; the twisting is always consistent within a species. In some species the dehisced valves of the fruit may appear to twist even if the fruit itself was straight so the twisting or otherwise of the fruit should be identified before the capsule is open.

More studies are needed to investigate the development of the twist in order to understand why the plants develop such a character. It is assumed that the twisting of the valves is a mechanism for more efficient seed release. For *Paraboea* and *Boea* species we may presume that the dry habitat of the limestone substrates on which most species are found may be a factor in the selection of a twisting capsule but the same character is also found in many *Streptocarpus* species and these are not found in such dry conditions.

All *Paraboea* species with a terminal panicle have twisted capsules, while all *Paraboea* species with non-twisted capsules have axillary cymes. However, not all species with axillary cymes have non-twisted capsules.

Indumentum: Matted vs. Arachnoid vs. Simple long pubescence vs. Pubescent vs. Multi-branched (pubescent) hair vs. Glandular and sessile glands

The indumentum is an important diagnostic character for the genus (Burt, 1984) and the different types of indumentum can be diagnostic for species (Fig. 2).

Matted indumentum. In Burt (1984) this indumentum is described as arachnoid indumentum or arachnoid tomentum. We have chosen not to use the term ‘arachnoid indumentum’ for this type of indumentum because ‘arachnoid’ suggests ‘spider-web-like’, a very loose cover of thin hairs. This kind of indumentum, however, is a layer of matted cashmere-wool-like hair. The hair, while very densely appressed, is very thin, curled, and interwoven. Under the scanning electron microscope we can seldom identify a hair from its base to its end and the hairs often branch throughout their length. A hair is generally multicellular. The indumentum exists in almost all *Paraboea* species with very few exceptions (e.g. *Paraboea vulpina*) and is primarily located on the lower surface of the leaf. However, it may spread throughout an individual plant except for on the flower. This indumentum is described in the key and the descriptions of taxa in this paper as

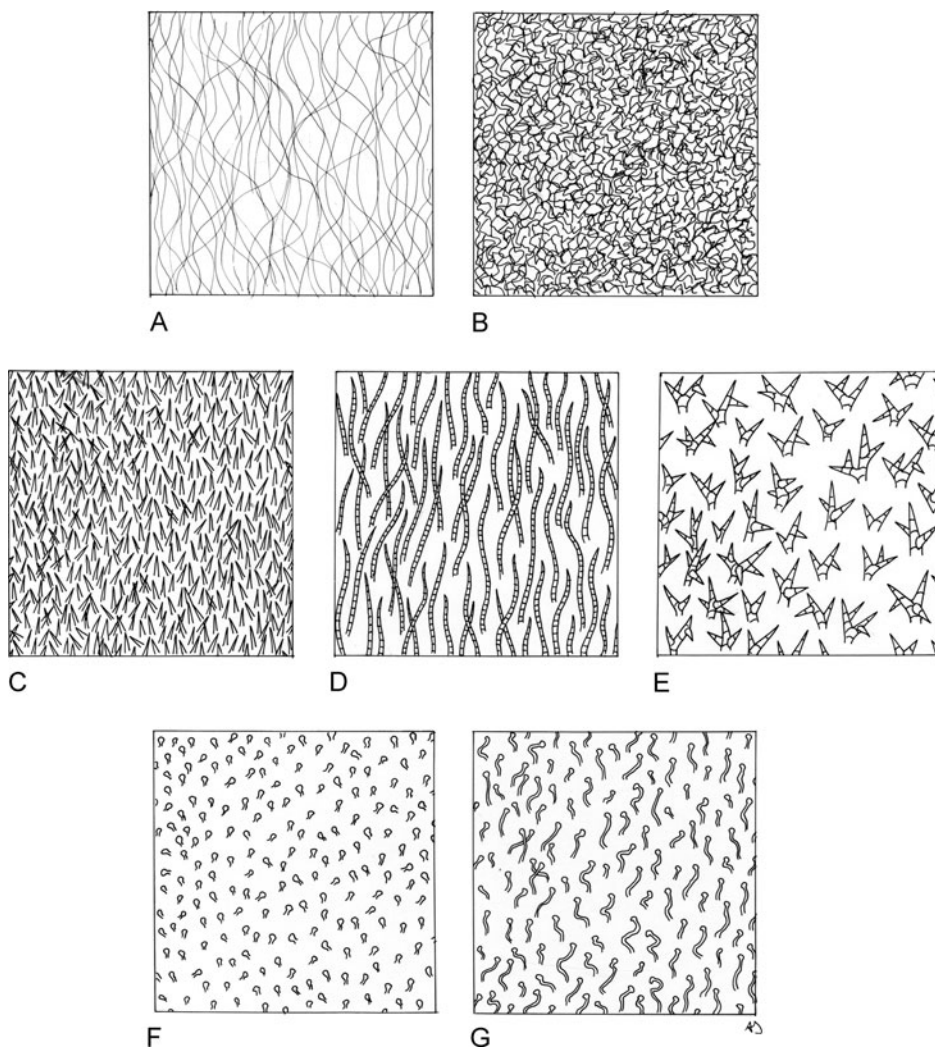


FIG. 2. Indumentum types in *Paraboea*. A, arachnoid; B, matted; C, simple pubescence; D, simple long pubescence; E, multi-branched hairs; F, sessile glands; G, glandular hairs. See text for further details.

a *matted indumentum*. The indumentum is also found in many other genera in *Gesneriaceae*, for example *Oreocharis*, *Hemiboea*, *Didymocarpus*, *Trisepalum*, *Ornithoboea*, *Rhytidophyllum*, etc.

Arachnoid indumentum. This is a spider-web-like indumentum. The hairs are very thin and loosely interwoven with each other. It is distinct from the matted indumentum in that it never forms a dense layer. When individual hairs are examined under the scanning electron microscope both the matted indumentum

and arachnoid indumentum are seen to be formed from the same kind of hairs, although the hairs may appear thinner in the arachnoid indumentum. The arachnoid indumentum is less common in the genus. A typical example is *Paraboea amplifolia*.

Simple long pubescence. This is similar to the pubescent indumentum (see below). It is of relatively thick, simple (unbranched) and multicellular hairs but is considerably longer than the simple pubescence and of many cells. It may also be tomentose. This type of indumentum is characteristic for *Boea* Comm. ex Lam. but a few species of *Paraboea* also possess it (*Paraboea ferruginea*, *P. laxa*, *P. vulpina*, *P. tarutaensis*, *P. scabriflora*). It is found on the leaves and stems but rarely on the fertile parts.

Burt (1984) redefined *Paraboea* and *Boea* based on the difference between a *matted indumentum* and a *long (unbranched or simple) pubescent indumentum*. These two types of hair are qualitatively different. Plants that possess a matted indumentum are found almost exclusively from limestone substrates, and those with a long (unbranched) pubescent indumentum seem to have no preference for substrate. It is possible that the existence of a matted indumentum on the lower leaf surface provides a mechanism to survive in a dry environment because this dense layer of hairs covers the stomata on the lower leaf surface and reduces water loss by transpiration.

Pubescent indumentum. This is composed of short, stiff, pointed hairs. The hairs are much thicker than those of the *matted* and *arachnoid* indumentums. The indumentum is often almost invisible but can be felt with the fingers. The hairs are generally of 2–3 cells and the top cell is often pointed. The pubescent indumentum may be found on the upper surface of the leaf, more often than not, under some arachnoid covering. It is almost never found on the lower surface of the leaf.

Multi-branched hairs. The *multi-branched hair* is relatively long, stiff, thick hair with many branches which are visible even under the naked eye. Some multi-branched hairs have a long stalk, i.e. the hair always branches some distance from the base, and some do not have a long stalk. The stalk is generally multicellular and the branches are more often multicellular than single-cellular. This kind of hair can be found on the leaves and the stems. Only *Paraboea vulpina* and *P. tarutaensis* possess this kind of indumentum. Because it is so rare, unless otherwise noted below, its absence is to be assumed in the descriptions.

Glandular hairs and sessile glands. *Glandular hairs* have a stalk that can be of single or multiple cells. *Sessile glands* do not possess a stalk. These two kinds of indumentum usually occur in the inflorescence although are rarely also found on the leaves. Many species possess glands but they are not of good diagnostic value.

Colour of the indumentum. For identifying species the colour of the indumentum may be useful. The indumentum colour used in the key and in the descriptions refers to dried herbarium specimens, not the colour in fresh plants.

INFRAGENERIC CLASSIFICATION

No sectional or infrageneric treatment is offered here for it would be too early to do so, the necessary phylogenetic research having not yet been carried out. However, there is a great deal of morphological variation in the genus and there are recognisable groups of species. We list representative species of these groups here as a marker for future research and a guide to sampling for phylogenetic studies.

Paraboea clarkei – species with straight capsule valves and a spreading inflorescence of axillary cymes [*Paraboea* sect. *Paraboea* C.B. Clarke (1883)]; also e.g. *P. vulpina*, *P. laxa*.

Paraboea capitata – species with straight capsule valves and a congested capitate inflorescence of axillary cymes [*Paraboea* sect. *Breviflores* Ridl. (1905)]; also e.g. *P. ferruginea*, *P. bakeri*, *P. bintangensis*, *P. burttii*.

Paraboea incudicarpa – with single-celled capsules of straight valves, persistent large bracts and subterminal cymes; this is likely a species of *Hemiboea* (see discussion under that species).

Paraboea multiflora – species with erect and separate farinose anthers, cymes axillary, capsules twisted, habit rosulate, ovary and style clearly demarcated from each other [*Paraboea* sect. *Caulescentes* Fritsch (1894)]; also e.g. *P. evrardii*.

Paraboea sinensis – species with subterminal cymes, large obovate bracts and sepals, twisted capsules, ovary and style not clearly demarcated from each other.

Paraboea swinhoei – species with a terminal panicle, opposite leaves, campanulate corolla with a short tube and indistinct limb, twisted capsules.

Paraboea martinii – species with a terminal panicle, opposite leaves, corolla with a large swollen tube and a distinct limb, filaments with a bearded knee, capsules twisted; also e.g. *P. paramartinii*, *P. glutinosa*, *P. thorelii*.

Paraboea verticillata – species with a terminal panicle, leaves in whorls of 3–6, campanulate corolla with a short tube and a distinct limb, capsules twisted. This is a rather natural group of tropical species; e.g. *P. treubii*, *P. paniculata*, *P. nervosissima*, *P. havilandii*.

Paraboea harroviana – species with subterminal cymes, opposite leaves, campanulate corolla with a short tube and a distinct limb, capsules twisted; also e.g. *P. cochinchinensis*, *P. prolixa*, *P. pubicorolla*.

Paraboea dictyoneura – species with axillary cymes, rosulate habit, corolla with a large swollen tube and a distinct limb, capsules twisted; also e.g. *P. rufescens*, *P. crassifolia*, *P. neurophylla*, *P. hainanensis*, *P. mahaxayana*.

IUCN CONSERVATION ASSESSMENTS

Providing accurate IUCN conservation assessments (IUCN, 2001) for all *Paraboea* species, although highly desirable, is difficult given that so many species are known from only few specimens in undercollected areas. However, given that so many *Paraboea* species are only known from karst limestone, a habitat endangered throughout East and Southeast Asia due to overexploitation, particularly for cement production (see Clements *et al.*, 2006), it is imperative that the conservation status of these species should be assessed and an appropriate Red List Category assigned even if this will need to be revised later once more accurate data can be gathered. In doing this we have made a number of assumptions. Firstly we assume that species known only from the type or very few specimens really are confined to the area in which they were collected. We acknowledge this is rather a presumption in much of the region, given the low levels of collecting density for many countries (see Middleton, 2003). Secondly we assume that karst limestone habitats throughout the region are threatened (Clements *et al.*, 2006), unless we have specific information that a particular site is in a well-protected national park or other protected area. Lastly we assume that when the plant is known only from the type collection or from very few collections all collected from the same site its extent of occurrence (see IUCN, 2001 for definitions) is < 100 km². The default category for this then becomes Critically Endangered (CR B1ab(ii,iii,v)) to reflect this limited extent of occurrence, the single location, and the continuing decline in the area of occupancy, the area, extent and quality of habitat, and the number of mature individuals, the declines being inferred from the reductions in karst limestone. The status of Endangered (EN) has been given to a number of taxa which are known from localities additional to the type locality, each with a further explanation there, but the threats given above are also assumed to apply.

The following Red List Category abbreviations are used in the accounts below: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; LC = Least Concern; and DD = Data Deficient.

THE SPECIMENS

Geographic coordinates presented in square brackets below have been elucidated from the locality information on the specimen. This distinguishes them from coordinates recorded by the collector. In most cases collectors did not record coordinates, and firmly establishing coordinates for all specimens is not always possible. When there are multiple collections from the same locality the coordinates are given only once. Also, without the help of local people or geographical experts it is easy to misinterpret locality information. We are grateful to the following people for help with locality information: J. E. Vidal (Cambodia, Laos, Vietnam); S. K. Yap (Sabah, Sarawak); R. Kiew (Sabah, Sarawak, Peninsular Malaysia); Halijah Ibrahim (Peninsular Malaysia); J. H. Chou (Taiwan); B. Tan (Philippines); J. F. Maxwell and P. Triboun (Thailand).

For Chinese localities we have given the Pinyin transliteration of the name to include the tones used (tones 1 to 4) in square brackets; for example ‘Yunfou [Yun2fu2]’ where ‘Yun2fu2’ is the Pinyin transliteration with tone indicators.

About 670 collections representing more than 2000 sheets from all of the major herbaria in Asia, Europe and North America were examined.

SYSTEMATIC TREATMENT

Paraboea (C.B.Clarke) Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 4, 63 (1905); Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 422 (1984). – *Didymocarpus* sect. *Paraboea* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5: 105 (1883). – *Roettlera* sect. *Paraboea* (C.B.Clarke) Fritsch in Engl. & Prantl, Nat. Pflanzenfam. 4(3B): 148 (1894). – *Paraboea* sect. *Euparaboea* Ridl., Fl. Malay Penins. 2: 528 (1923). – Type species: *Paraboea clarkei* B.L.Burtt, designated by Burtt (1948: 56).

Boea sect. *Caulescentes* Fritsch in Engl. & Prantl, Nat. Pflanzenfam. 4(3B): 150 (1894). – Type species: *Boea multiflora* R.Br., designated by Burtt (1954: 194).

Paraboea sect. *Breviflores* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 64 (1905). – Type species: *Paraboea capitata* Ridl., lectotype designated by Burtt (1984: 422).

Chlamydoboea Stapf, Bull. Misc. Inform. Kew 1913: 354 (1913). – Type species: *Chlamydoboea sinensis* (Oliv.) Stapf.

Buxiphyllum W.T.Wang & C.Z.Gao, Bull. Bot. Res., Harbin 1: 36 (1981). – Type species: *Buxiphyllum velutinum* W.T.Wang & C.Z.Gao.

Rosulate or caulescent perennial herbs, often woody at the base, sometimes with straggling woody branches, occasionally monocarpic, young stems at least woolly. *Leaves* opposite, whorled, or alternately arranged; upper surface glabrous, thinly arachnoid or matted, often glabrescent, or with scabrous hairs; lower surface mostly with a densely matted indumentum, sometimes with hairs of other types (see above). *Inflorescence* axillary, subterminal or terminal, with pair-flowered cymes. *Calyx* equally divided almost to base into 5 lobes. *Corolla* obliquely campanulate or with a short tube and flat limb, clearly to weakly bilabiate, white, blue or violet. *Stamens* 2, inserted in the corolla tube; filaments usually thick; anthers robust, bright yellow; staminodes present or not apparent. *Ovary* more or less cylindrical, distinct or not from the style; stigma usually small, terminal. *Fruit* a capsule, dehiscent along both margins or only one, straight or spirally twisted, usually cylindrical or slightly flattened, occasionally short with a hump on the upper side at the base.

Distribution. Eighty-nine species and six varieties from Bangladesh, Bhutan, Burma, Cambodia, China, northeastern India, western Indonesia as far as Sulawesi, Laos, Malaysia, Philippines, Thailand and Vietnam.

Key to the species

- 1a. Capsule not spirally twisted _____ 2
 1b. Capsule spirally twisted _____ 31
- 2a. Inflorescence of subterminal cymes, seemingly terminal and capitate; capsules horizontally triangulate, short, c.10 mm long, swollen to 4 mm deep near base, held on stiff erect pedicels, and dehiscent along the upper suture [Thailand] _____ **39. P. indicarpa**
- 2b. Inflorescence of axillary cymes; capsule \pm cylindric or ovoid _____ 3
- 3a. Leaves with multi-branched hairs _____ 4
 3b. Leaves without multi-branched hairs _____ 5
- 4a. Leaves beneath with multi-branched hairs only; petiole 2–8 cm long [Peninsular Thailand, Peninsular Malaysia] _____ **89. P. vulpina**
- 4b. Leaves beneath with multi-branched hairs and a matted indumentum; petiole < 2 cm long [Peninsular Thailand: Tarutao Island] _____ **80. P. tarutaoensis**
- 5a. Leaves densely to very sparsely pubescent above in addition to any arachnoid covering _____ 6
 5b. Leaves not pubescent above or only with arachnoid covering _____ 18
- 6a. Inflorescence appearing capitate or umbellate _____ 7
 6b. Inflorescence of large or small cymes _____ 11
- 7a. Capsule shorter than calyx; plant with a pubescence of long simple ferrugineous hairs, especially on petiole and inflorescence, or with a matted indumentum _____ 8
 7b. Capsule > 3 times as long as calyx; plant with a matted indumentum _____ 9
- 8a. Plant with a pubescence of long simple ferrugineous hairs, especially on petiole and inflorescence [Peninsular Malaysia: Langkawi] _____ **26. P. ferruginea**
- 8b. Plant without such a pubescence but with a matted indumentum [Peninsular Malaysia: Pahang] _____ **5. P. bakeri**
- 9a. Sepals obovate, c.6 \times 4.5 mm [Peninsular Thailand] _____ **11. P. burttii** [see also **76. P. speciosa**, the available material of which is inadequate to properly key out]
- 9b. Sepals ovate or narrowly ovate, < 3 mm long _____ 10
- 10a. Leaf blade \pm ovate, widely cuneate to subcordate at base [Peninsular Malaysia] _____ **14a. P. capitata** var. **capitata**
- 10b. Leaf blade narrowly obovate, gradually narrowed at base [Peninsular Malaysia] _____ **14b. P. capitata** var. **oblongifolia**
- 11a. Inflorescence large and lax with > 4 bifurcations, usually longer than the leaves, subordinate primary branches developed _____ 12
 11b. Inflorescence few-flowered with \leq 2 bifurcations, from much shorter to much longer than the leaf, without subordinate primary branches _____ 13

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- 12a. Plants truly rosulate; leaves with a long pubescence on upper surface; petiole indistinct, bearing no wings [Peninsular Malaysia: Langkawi; Peninsular Thailand?] _____ **43. *P. laxa***
- 12b. Plants rosulate when young and later a woody stem developing; leaves without a long pubescence; petiole distinct, bearing 2 wings in the lower half [Borneo: Sarawak] _____ **17. *P. clarkei***
- 13a. Whole plant, even the inflorescence, covered by a true arachnoid indumentum; leaf blade up to 28 × 13 cm [Peninsular Thailand] _____ **2. *P. amplifolia***
- 13b. Plant without a true arachnoid indumentum or this absent from most of inflorescence; leaf blade up to 18 × 9 cm but usually much smaller _____ 14
- 14a. Capsule as long as or shorter than calyx; capsule glabrous [West Borneo] _____ **55. *P. minuta***
- 14b. Capsule > 4 times as long as calyx; capsule glabrous or with minute glands _ 15
- 15a. Capsule with minute glands; leaves minutely pubescent above [Peninsular Malaysia, Peninsular Thailand] _____ **70. *P. regularis***
- 15b. Capsule glabrous; leaves densely lanate or with a dense matted indumentum above, at least when young _____ 16
- 16a. Stems with distinct internodes; inflorescence ≤ 5-flowered; corolla c.10 mm across [China] _____ **34. *P. guilinensis***
- 16b. Stems with leaves crowded, without distinct internodes; inflorescence > 5-flowered; corolla > 10 mm across _____ 17
- 17a. Leaves 5–18 cm long; peduncle glabrous [Borneo] ____ **62. *P. paraprimumoides***
- 17b. Leaves 3–5 cm long; peduncle with a matted indumentum [Borneo] _____ **66. *P. primuloides***
- 18a. Inflorescence capitate [Peninsular Malaysia] ____ **14b. *P. capitata* var. *oblongifolia***
- 18b. Inflorescence cymose or laxly umbelliform _____ 19
- 19a. The first pair of bracts at the apex of peduncle large, 13 × 9 mm; capsule 1.4–1.5 cm long, < 3 times as long as calyx when this is persistent [Peninsular Malaysia] _____ **8. *P. bintangensis***
- 19b. The first pair of bracts at the apex of peduncle not so distinct; capsule 0.6–4 cm long, ≥ 3 times as long as calyx when this is persistent _____ 20
- 20a. Leaf blade base peltate (rarely with some leaves on plant not peltate) ____ 21
- 20b. Leaf blade base not peltate _____ 22
- 21a. Leaf blades 1–4 cm long, margin entire [China] _____ **27. *P. filipes***
- 21b. Leaf blades 6–33.5 cm long, margin irregularly crenate-serrate [China] _____ **65. *P. peltifolia***
- 22a. Leaf blade base cordate _____ 23
- 22b. Leaf blade base attenuate to truncate _____ 25

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- 23a. Peduncle with stalked glands (sometimes partially covered with other indumentum) [Philippines] _____ **47. *P. luzoniensis***
- 23b. Peduncle without glands or with sessile glands [Borneo] _____ 24
- 24a. Leaves > 15 cm long; inflorescence < 15-flowered _____
 _____ **74b. *P. schefferi* var. *ambigua***
- 24b. Leaves < 10 cm long; inflorescence > 15-flowered _____ **44. *P. leopoldii***
- 25a. Inflorescence to 2.5 cm long; leaf blades 1.5–2.5 cm long [China] _____
 _____ **87. *P. velutina***
- 25b. Inflorescence 8–30 cm long; leaf blades 2.7–28 cm long _____ 26
- 26a. Corolla \geq 10 mm across _____ 27
- 26b. Corolla < 10 mm across _____ 29
- 27a. Peduncle with stalked glands (sometimes partially covered with other indumentum) [Philippines] _____ **47. *P. luzoniensis***
- 27b. Peduncle without glands or with sessile glands _____ 28
- 28a. Rosulate herb with basal leaves [China] _____ **59. *P. nutans***
- 28b. Sometimes appearing rosulate but leaves crowded at the ends of decumbent or erect stems [Sumatra] _____ **46. *P. leuserensis***
- 29a. Lower surface of the leaf blade with whitish loose wool, more densely so on the veins and veinlets, making them conspicuously reticulate [Sumatra] _____
 _____ **20. *P. detergibilis***
- 29b. Leaves without woolly reticulate veins _____ 30
- 30a. Leaf blade 3–7.5 cm long, base rounded [Sulawesi] _____ **53. *P. minahassae***
- 30b. Leaf blade 10–15 cm long, base cuneate [Borneo] _____
 _____ **74a. *P. schefferi* var. *schefferi***
- 31a. Inflorescence a terminal panicle with a distinct flowering stem (e.g. Fig. 7), this possibly quite short¹ _____ 32
- 31b. Inflorescence of subterminal (e.g. Fig. 44) or axillary cymes (e.g. Fig. 17) with no leaves on flowering stem _____ 58
- 32a. Leaves alternate; calyx lobes c.8 mm long [Peninsular Thailand: Tarutao Island] _____ **42. *P. lancifolia***
- 32b. Leaves opposite or in whorls of 3–6; calyx lobe length various _____ 33
- 33a. Leaves opposite _____ 34
- 33b. Leaves in whorls of 3 or more _____ 40
- 34a. The lowest pair of fertile leaves on the flowering stem of similar size to the closest vegetative leaves _____ 35

¹ See also *Paraboea argentea* which could be mistaken for having a terminal panicle.

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- 34b. The lowest pair of fertile leaves on the flowering stem of much reduced size, less than half the size of the vegetative leaves _____ 36
- 35a. Plants with obvious internodes between the leaves; the lowest pair of axillary cymes from leaves well above ground; leaf blade \pm rounded at base [China, Vietnam, Thailand, Philippines, Indonesia] _____ **79. *P. swinhoei***
- 35b. Plants seemingly rosulate; the lowest pair of axillary cymes from basal leaves; leaf blade attenuate [China, Burma, Vietnam] _____ **32. *P. glutinosa***
- 36a. Leaves with a distinct pubescence above _____ 37
- 36b. Leaves without a distinct pubescence above _____ 38
- 37a. Plants with a distinct stem; inflorescence bearing a distinct matted indumentum and the calyx glabrous [Sarawak] _____ **6. *P. banyengiana***
- 37b. Plants seemingly rosulate; inflorescence bearing no distinct matted indumentum but glandular pubescence, also on the calyx [Laos] _____ **81. *P. thorelii***
- 38a. Petiole 0.5–2 cm long [Borneo] _____ **23. *P. effusa***
- 38b. Petiole 3–13 cm long _____ 39
- 39a. Inflorescence glabrous; matted indumentum only on the veins below [China] _____ **61. *P. paramartinii***
- 39b. Inflorescence with a matted indumentum or a glandular pubescence up to the calyx; matted indumentum evenly covering the whole lower leaf surface [China] _____ **50. *P. martinii***
- 40a. Flowering part of main flowering stem relatively short, less than half the length of the lowermost pair of axillary cymes [Sarawak] _____ **77. *P. speluncarum***
- 40b. Flowering stem longer than the lowermost pair of axillary cymes _____ 41
- 41a. Ovary with a minute glandular pubescence which is \pm retained on the capsule _____ 42
- 41b. Ovary and capsule glabrous _____ 45
- 42a. Lateral veins on lower leaf surface prominent, spreading at almost right-angles, up to 45 pairs; leaves glabrous above [Peninsular Malaysia] _____ **57. *P. nervosissima***
- 42b. Lateral veins not so conspicuous, \pm ascending, < 25 pairs; leaves pubescent or with some arachnoid covering above _____ 43
- 43a. Calyx with a matted indumentum; the lowest axillary cymes < 5 cm long [Southeast Borneo] _____ **40. *P. kalimantanensis***
- 43b. Calyx with a glandular pubescence; the lowest axillary cymes > 10 cm long _____ 44
- 44a. Inflorescence, pedicel, calyx, ovary and capsule with a ferruginous glandular pubescence; leaf blade persistently arachnoid above [Peninsular Malaysia, Sumatra] _____ **60. *P. paniculata***

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- 44b. Inflorescence covered with a matted indumentum; calyx, ovary and capsule with minute sessile glands [Peninsular Malaysia] _____ **12. P. caerulescens**
- 45a. Upper leaf surface with a dense pubescence which is also often covered by some arachnoid indumentum _____ 46
- 45b. Upper leaf surface without a pubescence under the arachnoid covering _____ 53
- 46a. Leaf blade rounded to truncate at base; petiole > 1.5 cm long, about half as long as blade [Sabah] _____ **48. P. madaiensis**
- 46b. Leaf blade attenuate to cuneate at base; petiole not so distinct, much less than half the length of the blade _____ 47
- 47a. Axillary cymes short, not spreading _____ 48
- 47b. Axillary cymes long and rather spreading _____ 50
- 48a. Leaf blades with > 10 pairs of lateral veins [Peninsular Malaysia] _____ **9. P. brachycarpa**
- 48b. Leaf blades with < 10 pairs of lateral veins _____ 49
- 49a. All lobes of corolla \geq 3 mm; flowering stem 10–30 cm long [Borneo] _____ **72. P. sabahensis**
- 49b. All lobes except middle lobe of lower lip of corolla < 2.5 mm long; flowering stem 6–12(–20) cm long [Sulawesi] _____ **45. P. leporina**
- 50a. Leaf blade < 3 times as long as wide; lower leaf surface with a silvery loose woolly indumentum [Borneo] _____ **13. P. candidissima**
- 50b. Leaf blade \geq 4 times as long as wide; lower leaf surface with a brownish to greyish \pm appressed indumentum _____ 51
- 51a. Calyx without a matted indumentum, only pubescent to glabrous [Sulawesi] _____ **51. P. mataensis**
- 51b. Calyx with a matted indumentum _____ 52
- 52a. Lateral veins dense, 20–40 pairs; lower leaf surface with an orange-brown matted indumentum [Sumatra – for those specimens of this species possessing these characters] _____ **83. P. treubii**
- 52b. Lateral veins sparse, < 20 pairs; lower leaf surface with a greyish matted indumentum [Borneo] _____ **38. P. havilandii**
- 53a. Calyx glabrous, or rarely with only a persistent arachnoid covering _____ 54
- 53b. Calyx with a matted indumentum _____ 56
- 54a. Leaf blades rounded to shallowly cordate at very base, narrowly elliptic-oblong, 25–30 \times 5–7 cm; up to 3.3 m tall [Sarawak] _____ **3. P. apiensis**
- 54b. Leaf blades attenuate at base, narrowly elliptic, 5–30 \times 1.5–7 cm; to 1 m tall _____ 55
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- 55a. Leaf blades $10\text{--}30 \times 3.5\text{--}7$ cm, indumentum on lower surface yellowish or brownish [Borneo] _____ **23. *P. effusa***
- 55b. Leaf blades $2\text{--}6.5(-12) \times 0.6\text{--}3(-5.2)$ cm, indumentum on lower surface whitish [Borneo] _____ **52. *P. meiophylla***
- 56a. Petiole conspicuously swollen at base; upper leaf surface with persistent arachnoid indumentum [Borneo] _____ **7. *P. berouwensis***
- 56b. Petiole not conspicuously swollen at base; upper leaf surface glabrous or with a loose arachnoid indumentum _____ 57
- 57a. Leaf blades usually $4.5\text{--}13 \times 1.5\text{--}3.5$ cm with a whitish matted indumentum on the lower surface; axillary cymes < 10 cm long [Peninsular Malaysia] _____ **88. *P. verticillata***
- 57b. Leaf blades $20\text{--}35 \times 3.5\text{--}7.5$ cm with a yellowish to greyish matted indumentum on the lower surface; axillary cymes $10\text{--}30$ cm long [Peninsular Malaysia, Sumatra, Borneo] _____ **83. *P. treubii***
- 58a. Leaves in whorls of 3 or more _____ 59
- 58b. Leaves opposite or alternate or in a rosette _____ 60
- 59a. Plants \pm rosulate; leaves $15\text{--}25 \times 6\text{--}9$ cm, upper surface densely pubescent; fruit $1\text{--}2$ cm long [Peninsular Malaysia] _____ **22. *P. divaricata***
- 59b. Plants with a distinct stem with clear internodes; leaves $4\text{--}9 \times 1.5\text{--}4$ cm, upper surface only with arachnoid covering; fruit $2\text{--}3$ cm long [Peninsular Malaysia, Peninsular Thailand] _____ **24. *P. elegans***
- 60a. Leaves alternate or congested at top of a woody stem _____ 61
- 60b. Leaves opposite or in a rosette at ground level _____ 64
- 61a. Inflorescence of a single flower [possibly an extremely reduced cyme] [Peninsular Thailand] _____ **85. *P. uniflora***
- 61b. Inflorescence a cyme or a cymose system of many flowers _____ 62
- 62a. Leaves alternate on a stem with short internodes; calyx relatively long, more than half as long as the capsule [Peninsular Malaysia] _____ **78. *P. suffruticosa***
- 62b. Leaves crowded at top of a woody stem without clear internodes; calyx relatively short, less than half as long as the capsule _____ 63
- 63a. The matted indumentum on leaves brownish and appressed [Peninsular Thailand] _____ **69. *P. rabilii***
- 63b. The matted indumentum on leaves whitish and loose [Peninsular Malaysia] _____ **41. *P. lanata***
- 64a. The primary bracts (on top of a peduncle) \pm rounded, distinct and large, \pm embracing the inflorescence when young _____ 65
- 64b. The primary bracts \pm ovate or narrowly so, small and indistinct, not embracing the inflorescence when young _____ 72

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- 65a. Inflorescence monochasial [Thailand] _____ **28. P. glabra**
- 65b. Inflorescence dichasial, a true cyme _____ 66
- 66a. Bracts glabrous, membranous _____ 67
- 66b. Bracts with an indumentum, papery or leaf-like _____ 68
- 67a. Stems with distinct internodes; inflorescence a subterminal cyme; sepals > 5 mm long [China, Vietnam, Burma, Thailand?] _____ **75. P. sinensis**
- 67b. Leaves from a rosette; inflorescence axillary from basal leaves; sepals < 2 mm long [Thailand] _____ **30. P. glabrisepala**
- 68a. Inflorescence with glandular hairs but without a matted or woolly indumentum; lower leaf surface hairy on veins only [Thailand] _____ **31. P. glanduliflora**
- 68b. Inflorescence with a matted or woolly indumentum, but no glandular hairs; lower leaf surface with an evenly distributed indumentum _____ 69
- 69a. Stem and lower leaf surface with a loose woolly indumentum (a combination of a long pubescence and a matted indumentum) [Sumatra] _____ **73. P. scabriflora**
- 69b. Stem and lower leaf surface with an appressed matted indumentum but without a long pubescence _____ 70
- 70a. Terminal bud aborting after the flowering season; inflorescence subterminal on an elongating stem with distinct internodes [Southern China, northern Vietnam] _____ **84. P. umbellata**
- 70b. Terminal bud continuing its growth after a flowering season; inflorescence in the axil of rosulate leaves _____ 71
- 71a. The primary and secondary branches of a cyme not developed and so the inflorescence appearing capitate [China] _____ **71a. P. rufescens** var. **rufescens**
- 71b. The primary and secondary branches of a cyme clearly developed thereby making the inflorescence cymose [Thailand] _____ **71b. P. rufescens** var. **tomentosa**
- 72a. Ovary and capsule with minute sessile glands, or a glandular pubescence, or a matted indumentum _____ 73
- 72b. Ovary and capsule glabrous _____ 77
- 73a. Ovary and capsule with minute \pm greenish sessile glands; anthers with minute \pm yellowish or greenish sessile glands; leaves crowded at top of a short stem or in a rosette _____ 74
- 73b. Ovary and capsule with a dark brown glandular pubescence or a greyish matted indumentum; anthers glabrous; leaves clearly opposite and the stem with distinct internodes _____ 76
- 74a. Leaves with a distinct pubescence above; corolla blue [Vietnam] **25. P. evrardii**
- 74b. Leaves with or without an indistinct pubescence above; corolla white or in rare cases light purple _____ 75

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- 75a. Plants rosulate; calyx without a ferruginous pubescence [China, north-eastern India, Bangladesh, Bhutan, Burma, Thailand, Laos, Vietnam] _____
 _____ **56a. *P. multiflora* var. *multiflora***
- 75b. Leaves congested at top of the stem; calyx with a ferruginous pubescence [Thailand] _____
 _____ **56b. *P. multiflora* var. *caulescens***
- 76a. Inflorescence, ovary and capsule with a greyish matted indumentum; leaf blade without a pubescence above or only with an arachnoid covering [Peninsular Thailand, Peninsular Malaysia] _____ **1. *P. acutifolia***
- 76b. Inflorescence, ovary and capsule with a dark brown glandular pubescence; leaf blade pubescent above [Peninsular Thailand] _____ **86. *P. variopila***
- 77a. Leaves basal, rosulate; inflorescence a cyme from basal leaves _____ 78
- 77b. Leaves on a distinct stem, usually stem with internodes, leaves mostly distinctly spaced but occasionally clustered; inflorescence a subterminal cyme from axils near the terminal bud _____ 84
- 78a. Leaf petiole distinct and almost as long as the blade _____ 79
- 78b. Leaf petiole indistinct or very short _____ 80
- 79a. Leaves drying brown; subordinate branches of a cyme developing [Thailand] _____ **10. *P. brunnescens***
- 79b. Leaves drying green; subordinate branches of a cyme not seen [Thailand] _____ **29. *P. glabriflora***
- 80a. Capsule \geq 3 cm long _____ 81
- 80b. Capsule $<$ 2 cm long _____ 82
- 81a. Veinlets on the lower leaf surface almost invisible [China: Hainan Island] _____ **35. *P. hainanensis***
- 81b. Veinlets on the lower leaf surface conspicuously reticulate [China, Vietnam] _____ **21. *P. dictyoneura***
- 82a. Cymes 2–5 from an axil; peduncle slender, 0.5–1 mm in diameter; capsule c.5–20 mm long [Laos] _____ **49. *P. mahaxayana***
- 82b. Cymes 1–2 from an axil; peduncles stout, at least 1.5 mm in diameter; capsule c.2 cm long _____ 83
- 83a. Leaves \pm attenuate at base; filaments with strongly swollen knees [China: Hubei, Sichuan, Guizhou and Yunnan] _____ **19. *P. crassifolia***
- 83b. Leaves \pm rounded at base; filaments without knees [Burma, China] _____
 _____ **58. *P. neurophylla***
- 84a. Petiole $>$ 10 cm long and with a wing down each side $>$ 3 mm wide [Thailand] _____ **16. *P. chiangdaoensis***
- 84b. Petiole mostly $<$ 10 cm long, if longer than 10 cm then petiole wing $<$ 1 mm wide _____ 85

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- 85a. Petiole \geq 10 cm long [Vietnam] _____ **33. *P. graniticola***
85b. Petiole < 8 cm long _____ 86
- 86a. Corolla with a glandular pubescence outside; inflorescence glabrous [Thailand, Vietnam?] _____ **68. *P. pubicorolla***
86b. Corolla glabrous outside; inflorescence glabrous or with an indumentum _ 87
- 87a. Peduncle < 1.5 mm in diameter when mature _____ 88
87b. Peduncle c.2–5 mm in diameter when mature _____ 91
- 88a. Inflorescence glabrous [Vietnam] _____ 89
88b. Inflorescence pubescent, sometimes glabrescent when older [Thailand, Malaysia] _____ 90
- 89a. Petiole to 5 cm long; inflorescence > 15 cm long; leaves rather clustered [Vietnam] _____ **18. *P. cochinchinensis***
89b. Petiole to 1.7 cm long; inflorescence < 15 cm long; leaves not clustered [Vietnam] _____ **36. *P. halongensis***
- 90a. Corolla white; fruit < 1 cm long [Peninsular Malaysia] _____ **63. *P. parviflora***
90b. Corolla blue; fruit 2–2.5 cm long [Thailand] _____ **54. *P. minor***
- 91a. Leaves sparsely to densely pubescent above _____ 92
91b. Leaves glabrous above _____ 94
- 92a. Inflorescence \leq 10 cm long [China] _____ **15. *P. changjiangensis***
92b. Inflorescence > 10 cm long [Thailand] _____ 93
- 93a. Inflorescence \geq 30 cm long; leaves clustered in a rosette on a short stem [Thailand] _____ **64. *P. patens***
93b. Inflorescence < 30 cm long; leaves not clustered, internodes 1–7 cm long [Thailand] _____ **82. *P. trachyphylla***
- 94a. Capsule \leq 1.5 cm long [Burma] _____ **67. *P. proluxa***
94b. Capsule > 2 cm long [Thailand to Vietnam] _____ 95
- 95a. Individuals producing an extended flowering stem from which numerous axillary cymes develop to give the whole inflorescence the appearance of a terminal panicle; plants with silvery matted indumentum on leaves and inflorescences [Thailand] _____ **4. *P. argentea***
95b. Individuals with only 2 subterminal cymes, and so the inflorescence not having the appearance of a terminal panicle; plants with brownish to greyish matted indumentum [Cambodia, Thailand, Vietnam] _____ 96
- 96a. Leaf blade ovate, rounded at the apex [Thailand, Vietnam] _____ **37b. *P. harroviana* var. *ovata***
96b. Leaf blade elliptic, acute at the apex [Cambodia, Thailand, Vietnam] _____ **37a. *P. harroviana* var. *harroviana***

1. *Paraboea acutifolia* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 423 (1984). – *Boea acutifolia* Ridl., J. Linn. Soc., Bot. 32: 519 (1896). – Type: Peninsular Malaysia, Kedah, Pulau Langkawi, Gua Chinta [06°20'N 99°48'E], iii 1892 (fr), *Curtis* 2791 (lecto K, designated here; iso SING). **Fig. 3.**

Perennial caulescent herb; stem woody, c.30 cm tall, 0.7 cm in diameter, with a brownish orange matted indumentum when young, greyish when older; internodes c.1 cm long. *Leaves* opposite, sessile (or with a very short petiole), blade elliptic or narrowly so, or more or less obovate, oblique or not, 9–28 × 2–7 cm, c.3–5 times as long as wide, apex acute, base long-attenuate, margin entire, sometimes inconspicuously serrulate, upper surface with some arachnoid hairs above and some calcium-excretions (volcano-like) or glabrous, lower surface with a brownish orange matted indumentum; veins smooth above, raised beneath, lateral veins c.10–15 pairs, tertiary venation invisible. *Inflorescence* subterminal, cymose, c.10–20 cm long, many-flowered, rather spreading, with a greyish matted indumentum except for the glabrous corolla, stamens and gynoecium; the two primary branches forked from the peduncle without further bifurcations but monochasially extending into a rather long racemose branch; peduncle up to 8.5 cm long with indistinct narrowly ovate bracts; pedicels very short, c.2 mm long, pedicel bracts sepal-like. *Calyx* c.3 mm long, 5-lobed, lobes narrowly ovate, with a matted indumentum outside, glabrous inside. *Corolla* pink or white, lobes possibly with a violet vertical stripe, 6 mm long, 8 mm across when fully open, glabrous outside and inside; tube very short, 1–2 mm long, limb 2-lipped; upper lip 2-lobed, lobes ovate, c.5 × 4 mm, lower lip 3-lobed, middle lobe similar to lateral lobes, wide-ovate, c.5 × 5–6 mm. *Anthers* suborbicular, c.3 × 4 mm, apex turned towards the gynoecium, coherent with each other, opening along the median line, basifixed, glabrous; filaments inserted at c.1 mm from the corolla base with a free part c.1.5 mm long, slightly curved, glabrous. *Gynoecium* c.7 mm long; ovary ovoid, c.3 × 1 mm, with a matted indumentum; style distinguishable from ovary, glabrous, curving to make the stigma incline towards the anthers. *Fruit* a linear capsule, c.1.5 cm long, spirally twisted, with a greyish matted indumentum.

Distribution. Thailand and Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats. It is, however, included in Pooma (2005) as threatened in Thailand.

Additional specimens examined. MALAYSIA. **Kedah:** Langkawi Islands, P. Dayang Bunting, N end [06°17'N 99°50'E], 28 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1755 (E); P. Langgun, Langkawi, 17 xii 1974 (fr), *M.M.J. van Balgooy* 2227 (L); Pulau Langkawi, N. Gua [06°20'N 99°48'E], 30 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1777 (E); Langkawi, Pulau Ledi (Lidi?), ix 1914 (lv), *M. Haniff* 1076 (K). **Perlis:** Bukit Bintang VJR, Rocky hillside [06°32'E 100°12'N], 12 viii 1974 (fl), *Y.C. Chan* 21762 (K, KEP); Bintang Forest Reserve [06°33'N 100°11'E], 26 iv



FIG. 3. *Paraboea acutifolia* (Ridl.) B.L.Burt. A, habit; B, infructescence.

1962 (fr), *B.L. Burt & P.J.B. Woods* 1736 (E); Kaki Bukit hills [06°38'N 99°13'E], 25 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1722 (E); Bukit Wang Tangga [06°39'N 100°12'E], 20 xi 1929 (fr), *M.R. Henderson* SFN 23014 (L).

THAILAND. **Songkhla:** Kao Roop Chang, Padang Besar, District Sadao [06°55'N 100°24'E], 100 m, 24 viii 1986 (fl), *J.F. Maxwell* 86-599 (A); Boriphat waterfall, Rattaphum District [07°04'N 100°08'E], 20 viii 1973 (fl), *T. Smitinand* 11935 (A, BKF). **Phatthalung:** Khao Phu Khao Yah, 07°40'N 99°50'E, 100 m, 26 x 1993, *Larsen et al.* 44044 (AAU). **Trang:** Kaowang (Kao Ulang), Sikao District [07°45'N 99°26'E], 3 viii 1929 (fl), *Rabil* 331 (ABD, E).

This species is characterised by a matted indumentum on the ovary that is retained on the capsule, unique in the whole genus. The excretion of calcium onto the upper leaf surface in many, but not all, specimens is also noteworthy. *Paraboea acutifolia* is similar to *P. variopila* in inflorescence structure but the latter has glandular hairs rather than a matted indumentum on the ovary and the capsule.

2. *Paraboea amplifolia* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 1 (1991). – Type: Thailand, Nakawn Sritamarat [Nakhon Sri Thammarat], Kao Chem (Chim), Tunglung (Tungsong) [08°20'N 99°40'E], on rocks, 20 vii 1929 (fl, fr), *Rabil* 123 (holo K; iso ABD, BKF, BM, E). **Fig. 4.**

Perennial rosulate herb. *Leaves* petiolate; petiole 2–10 cm long, covered with true arachnoid indumentum; blades elliptic or ovate, 15–28 × 5–13 cm, 2–2.5 times as long as wide, apex obtuse, base cuneate or narrowed, margin entire, membranous, truly arachnoid on both sides, under the arachnoid indumentum with white minute pubescence on the upper surface; veins obscure above, delicately raised beneath, lateral veins c.10 pairs, tertiary venation delicate. *Inflorescence* axillary cymose, 9–12 × 2–5 cm, few-flowered, completely covered by a loose arachnoid indumentum, even the branches of the inflorescence being webbed together by this indumentum; peduncle 7–11 cm long, c.1.5 mm in diameter; pedicels c.8 mm long. *Calyx* c.5 mm long, 5-lobed to the base, lobes linear or nearly so. *Corolla* white, glabrous, c.8 mm across; tube 1.5 mm long, limb 2-lipped; upper lip 2-lobed, lobes ovate, 4 × 3 mm, lower lip 3-lobed, lobes of a similar size to the upper lip lobes. *Stamens* glabrous, anthers transversely ellipsoid, c.3.5 × 1.5 mm, coherent with each other, opening in the centre of the anther locules, dorsifixed, apex turning (c.90°) towards the gynoecium; filaments c.1.5 mm long. *Fruit* ovoid, 0.5 cm long, 2 mm in diameter, not twisted, 4-valved when open. *Seeds* compressed, ovoid, 0.35 × 0.2 mm.

Distribution. Peninsular Thailand. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction. This species was also included in Pooma (2005) as threatened in Thailand.

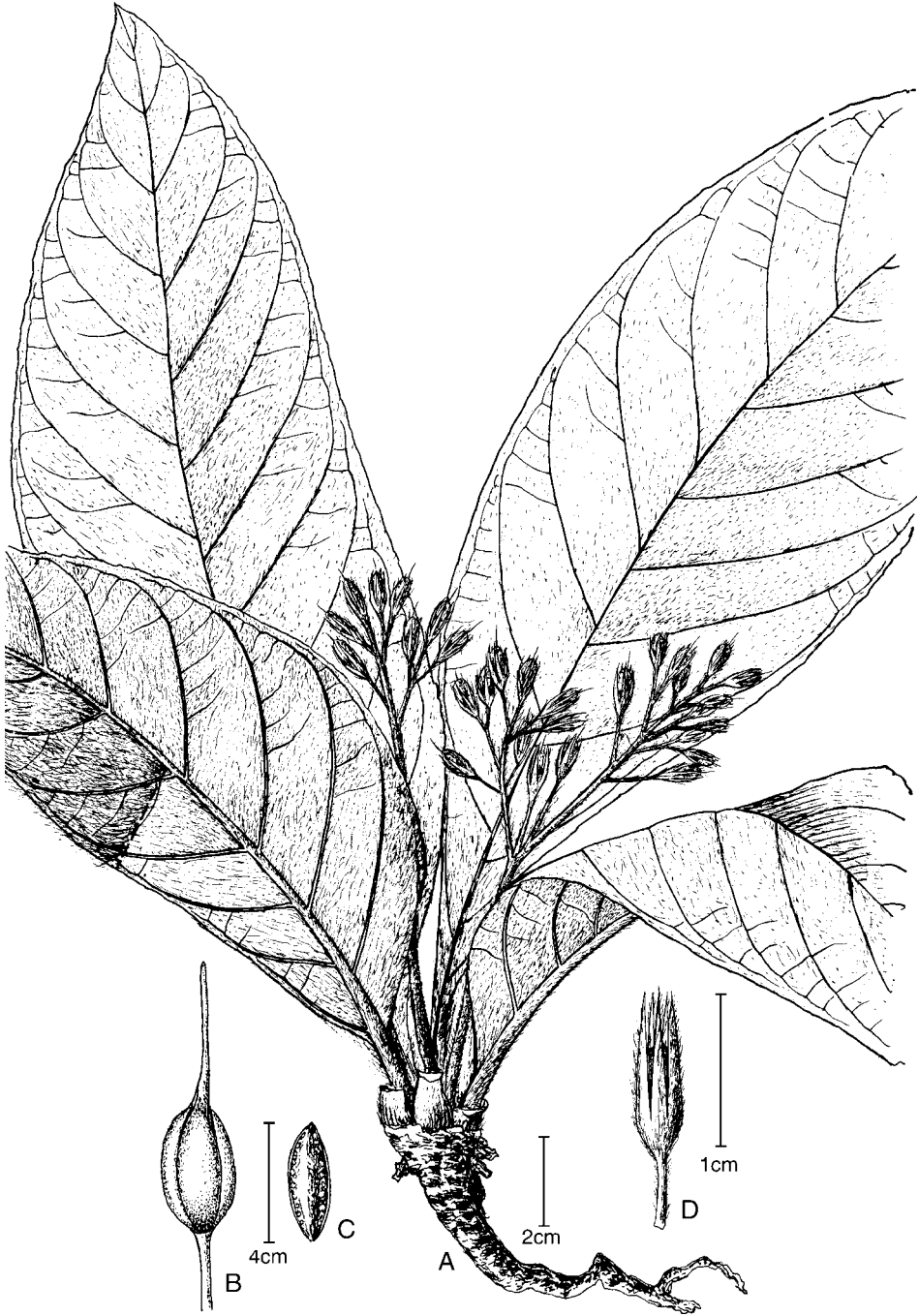


FIG. 4. *Paraboea amplifolia* Z.R.Xu & B.L.Burtt. A, habit; B, fruit; C, seed; D, calyx.

This species is unique in *Paraboea* by possessing a true arachnoid indumentum covering the whole plant. The large and membranous dried leaves and the small non-twisted capsule are also characteristic.

3. *Paraboea apiensis* Z.R.Xu, sp. nov.

Paraboeae effusae B.L.Burtt proxima, sed inflorescentibus compactis indumentibus foliis base rotundis differt. – Type: Malaysia, Sarawak, Baram District, Ulu Melinau Tutoh, Gunong Api, NE flank of mountain 04°07'N 115°15'E, limestone cliff, 3200 ft (c.950 m), 2 x 1971 (fl, fr-juv), *J.A.R. Anderson* S30906 (holo L; iso K, SAR).

Shrub up to 3.3 m tall. *Leaves* in whorls of 3, sessile, elliptic-oblong, 25–30 × 5–7 cm, apex acute, very base rounded to shallowly cordate, margin entire, upper surface arachnoid and then glabrescent, lower surface with a yellowish matted indumentum; veins smooth above, raised beneath; lateral veins c.25 pairs, more or less curved-ascending, tertiary venation hardly visible. *Inflorescence* a large terminal panicle, with a matted indumentum throughout except on the flower; flowering stem with ridges, c.50 cm long, the basal internodes c.10 cm long, usually 3 cymes from each node; floral leaves similar in shape and texture to the vegetative leaves but reducing in size upward; cymes with c.20 flowers, peduncle c.6 cm long, bracts ovate, c.6 mm long; pedicels c.10 mm long. *Calyx* 5-lobed to the base, glabrous, lobes narrowly ovate, c.2.5 × 1 mm. *Corolla* pale purple, glabrous, c.15 mm across when fully open; tube c.4 mm long, limb remarkably 2-lipped; upper lip c.7 × 14 mm, 2-lobed, lobes wide-ovate, c.6 × 7 mm, lower lip wide-obovate, c.10 × 12 mm, 3-lobed, middle lobe exceeding the lateral lobes, c.3 mm, oblong-obovate, c.4 × 3 mm. *Stamens* 2, staminodes 3, c.0.2 mm long; anthers yellow, transversely ellipsoid, c.2 × 5 mm, coherent with each other at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments inserted at the corolla base with a free part c.4 mm long, c.0.8 mm wide, ± verrucose. *Ovary* ovoid, c.2.5 × 1.5 mm; style c.8 mm long, 0.4 mm wide; stigma capitate, not much larger than style. *Fruit* of a twisted capsule (mature capsules not seen).

Distribution. Malaysia: Sarawak.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). The conservation assessment given reflects the fact that although this species is known from very few collections on only one mountain it is inside the Gunung Mulu National Park which is a World Heritage Site and well protected.

Additional specimens examined. MALAYSIA. **Sarawak:** Baram District, Gunung Mulu National Park, Gunong Api, 1200 m, 12 vii 1961 (fl), *J.A.R. Anderson* 4721 (K, SAR); Gunong Api, 5 ix 1970 (fl-bud), *P.F. Lehmann* S29441 (K, L, SAR).

Although *Paraboea effusa* is also found at the same locality as this species, *P. apiensis* is easily distinguished by the matted indumentum throughout the

inflorescence and the rounded to shallowly cordate leaf base. A duplicate of *Anderson* S30906 at E is apparently a different plant from the other collections listed above.

4. *Paraboea argentea* Z.R.Xu, sp. nov.

Paraboeae harrovianae proxima, sed caule florescentei extenti ad 20 cm, cymis numerosis in pseudo-paniculam, indumentis argenteis differt. – Type: Thailand, Khon Kaen, Pha Nok Khao [16°30'N 103°00'E], 400–500 m, 10 ix 1963 (fl, fr), *T. Smitinand & H. Sleumer* 1141 (holo BKF; iso C, E, L, P).

Perennial herb with an extended flowering stem up to 20 cm long in flowering individual. *Leaves* opposite, close to each other towards the base, more remote from each other in the upper part in a flowering individual, petiolate; petiole c.1–5 cm long, forming a distinct auricle with the opposite petiole at the node, with a silvery or greyish matted indumentum; blades narrowly elliptic, 2.4–7.6 × 0.8–1.8 cm, 3.6–4.2 times as long as wide, apex obtuse, base cuneate, rounded to shallowly cordate, margin ± shallowly serrate, upper surface glabrous, lower surface with a silvery or greyish matted indumentum; veins smooth above, raised beneath; lateral veins < 10 pairs, spreading, tertiary venation almost invisible. *Inflorescence* usually of 4 cymes from an elongated flowering stem, which, taken as a whole, looks like a terminal panicle; flowering stem with elongated internodes, c.3–5 cm long; axillary cymes subterminal on the flowering stem, c.10–25 cm long, many-flowered, with a distinct silvery or greyish matted indumentum throughout except on the corolla and the parts inside the corolla; peduncle c.5–15 cm long, quite robust, with bracts sometimes appearing leaflet-like with a short stalk; pedicels short, < 10 mm long, with bracts sepal-like. *Calyx* c.2.5 mm long, 5-lobed to the base, lobes narrowly ovate, c.2 × 0.7 mm, with a silvery matted indumentum outside, glabrous inside. *Corolla* c.9 mm long, 12 mm across when open; tube c.4 mm long, limb 2-lipped; upper lip 2-lobed, lower lip 3-lobed, 5 lobes of similar shape and size except the middle lobe of the lower lip which is slightly larger, widely ovate or rounded, c.3 × 4.5 mm, glabrous. *Anthers* reniform, c.1.5 × 3 mm, coherent with each other, opening towards the top of the anther, basifixed; filaments inserted at c.1.5 mm from the corolla base with a free part c.2.5 mm long; staminodes 3. *Gynoecium* longer than the corolla, c.1.5 mm wide at the ovary base; style very short, curved towards the anthers; stigma not enlarged but extremely oblique. *Fruit* linear, c.3–4 cm long, 2 mm wide, spirally twisted, glabrous. *Seeds* ellipsoid, c.0.6 × 0.2 mm.

Distribution. Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Vulnerable (VU D2). This species is currently known from only three collections but these collections are quite widely separated. It may eventually be found in limestone areas between Khon Kaen and Prachuap Khiri Khan but as it is currently known from so few localities, and

limestone areas in Thailand are often exploited for cement or subject to fires from surrounding agricultural land, it should be considered Vulnerable.

Additional specimens examined. THAILAND. **Prachuap Khiri Khan:** Klawng Warn [Khlung Wan] [12°02'N 99°34'E], 16 x 1960 (fl), *K. Chandraprasong* 63 (BKF); Pran Buri District, Khao Sam Roi Yot National Park, trail from Tham Sai to Tham Phra Yanakhon, 12°11'N 100°01'E, 110 m, 18 viii 2002, *D.J. Middleton et al.* 1180 (A, BKF, E).

This new species can be distinguished from *Paraboea harroviana* by the extended flowering stem, c.20 cm long, usually with about 4 cymes, with flowering individuals appearing as if they have a terminal panicle. In addition the very thick layer of silvery matted indumentum is distinctive. In *Paraboea harroviana* var. *harroviana* the flowering stem is much shorter and there are often only 2 cymes from opposite axils near the base.

5. *Paraboea bakeri* M.R.Hend., Gard. Bull. Straits Settl. 7: 115 (1933); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 424 (1984). – Type: Peninsular Malaysia, Pahang, Bukit Sagu c.18 miles NW of Kuantan, 300 m, in bare dry limestone, 13 x 1931 (fr), *Henderson* SFN 25094 (lecto SING, designated by Burt (1984: 424); iso K).

Perennial rosulate herb, lacking any arachnoid covering. *Leaves* congested in a rosette, with a distinct petiole when mature; petiole 2–5 cm long with a brown matted indumentum; blades more or less ovate, or in rare cases seemingly obovate, to 7.5 × 5 cm, apex rounded, base widely cuneate, margin serrate, upper surface with a dense pubescence, lower surface with a brownish matted indumentum, more densely so on the veins; veins slightly depressed above, raised beneath, lateral veins c.6 pairs, tertiary venation conspicuously reticulate. *Inflorescence* axillary, seemingly capitate due to the extremely reduced primary and secondary branches, shorter than the leaf, few-flowered, with a brown matted indumentum throughout up to the calyx; peduncle up to 4 cm long in the infructescence; bracts sepal-like; pedicels c.10–12 mm long. *Calyx* 6.5 mm long, nearly as long as capsule, 5-lobed to the base, lobes lanceolate, 5 × 1 mm, obtuse at apex, with a brown matted indumentum outside, glabrous inside. *Corolla* white, c.4 mm long, 4 mm across, minutely pubescent outside, glabrous inside; tube nearly as long as the whole corolla, limb hardly 2-lipped and lobed. *Anthers* pale yellow, transversely ellipsoid, c.1 × 2 mm, opening in the centre of the anther locules, coherent only at the apex, ± dorsifixed, glabrous; filaments 2 mm long, erect, inserted 1 mm from the corolla base; staminodes < 1 mm long. *Gynoecium* c.6.5 mm long, hairy; ovary 4.5 × 1.5 mm, smoothly passing to an indistinct style; style 0.5 mm wide; stigma not larger than style. *Fruit* a non-twisted capsule, slightly shorter than the calyx, narrowly ovoid, c.0.5 cm long, 2 mm in diameter, with a dense minute pubescence, 4-valved. *Seeds* more or less ovoid, compressed, brown when dried, 0.35 × 0.15 mm.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This species is known from only two localities, one of which, the type locality, is the site of an active cement plant. Although the extent of occurrence is clearly $< 100 \text{ km}^2$, which would justify a Critically Endangered category, the two localities reduces the threat somewhat and Endangered is a more suitable category.

Additional specimen examined. MALAYSIA. **Pahang:** Kuantan District, Gua Cheras (c.25 km NW of Kuantan) [103°20'N 03°50'E], 16 v 1987 (fr), *A. Weber* 87-0516 (WU).

This species is similar to *Paraboea regularis* in its habit and in possessing a pubescence on the upper leaf surface. However, the two species are easily distinguished by the difference in the calyx:capsule ratio – in *Paraboea regularis* it is 1:4 while in *P. bakeri* it is 1:1. Except for the pubescence on the leaves, *Paraboea bakeri* is most similar to *P. bintangensis*.

6. *Paraboea banyengiana* B.L.Burt, Bot. J. Linn. Soc. 85: 25 (1982); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 424 (1984). – Type: Sarawak, Gunung Mulu National Park, *Burt* 8316 (holo E; iso E, SAR). **Fig. 5.**

Perennial caulescent herb or semi-shrub to 1 m tall; stem woody, internodes 1.5–6 cm long, c.8 mm in diameter, with a matted indumentum when young, becoming sparse when older. *Leaves* opposite, with a petiole c.0.5–3 cm long; blades broad-elliptic, up to $22 \times 8 \text{ cm}$, apex acute, base cuneate, margin serrate, upper surface with a very sparse arachnoid indumentum which sloughs off when mature, lower surface with a matted brown indumentum; veins smooth above, raised beneath, lateral veins c.20 pairs, tertiary venation invisible. *Inflorescence* terminal, consisting of a lax cymoid panicle, with a brown matted indumentum throughout except on the flower and the upper half of the pedicel; flowering stem up to 30 cm long, the lowest internode up to 20 cm long, floral leaves much smaller than the mature vegetative leaves, up to $2.5 \times 0.8 \text{ cm}$, 2 cymes from each node; basal cymes c.12–18 cm long, many-flowered but lax, with a peduncle c.5–7 cm long; peduncle bracts narrow-oblong, c.2 times as long as calyx lobes or sometimes similar in size; pedicel bracts sepal-like or even smaller; pedicels c.10 mm long, glabrescent. *Calyx* c.2.5 mm long, 5-lobed to the base, lobes narrow-triangular, mostly glabrous. *Corolla* mauve, mostly glabrous, c.1.2 cm long, 1.2 cm across; tube c.2 mm long, limbs spreading; posterior lip 2-lobed, $0.7 \times 0.7 \text{ mm}$, divided by a sinus 3 mm deep; anterior lip $10 \times 15 \text{ mm}$, 3-lobed, the median lobe $6 \times 5 \text{ mm}$. *Stamens* 2, arising at the mouth of the tube, filaments 3 mm long, muriculate in the middle, more or less flat, straight; anthers yellow, transversely ellipsoid, $1.5 \times 5 \text{ mm}$, coherent with each other at the apex and the base, opening in the centre of the anther locules, dorsifixed. *Ovary* 5 mm long, abruptly narrowing into a style of 7 mm long, glabrous. *Fruit* a linear, spirally twisted capsule, c.1.5–2.5 cm long, glabrous. *Seeds* ellipsoid, $0.8 \times 0.2 \text{ mm}$, with a distinct brown end on one side.

Distribution. Malaysia: Sarawak.

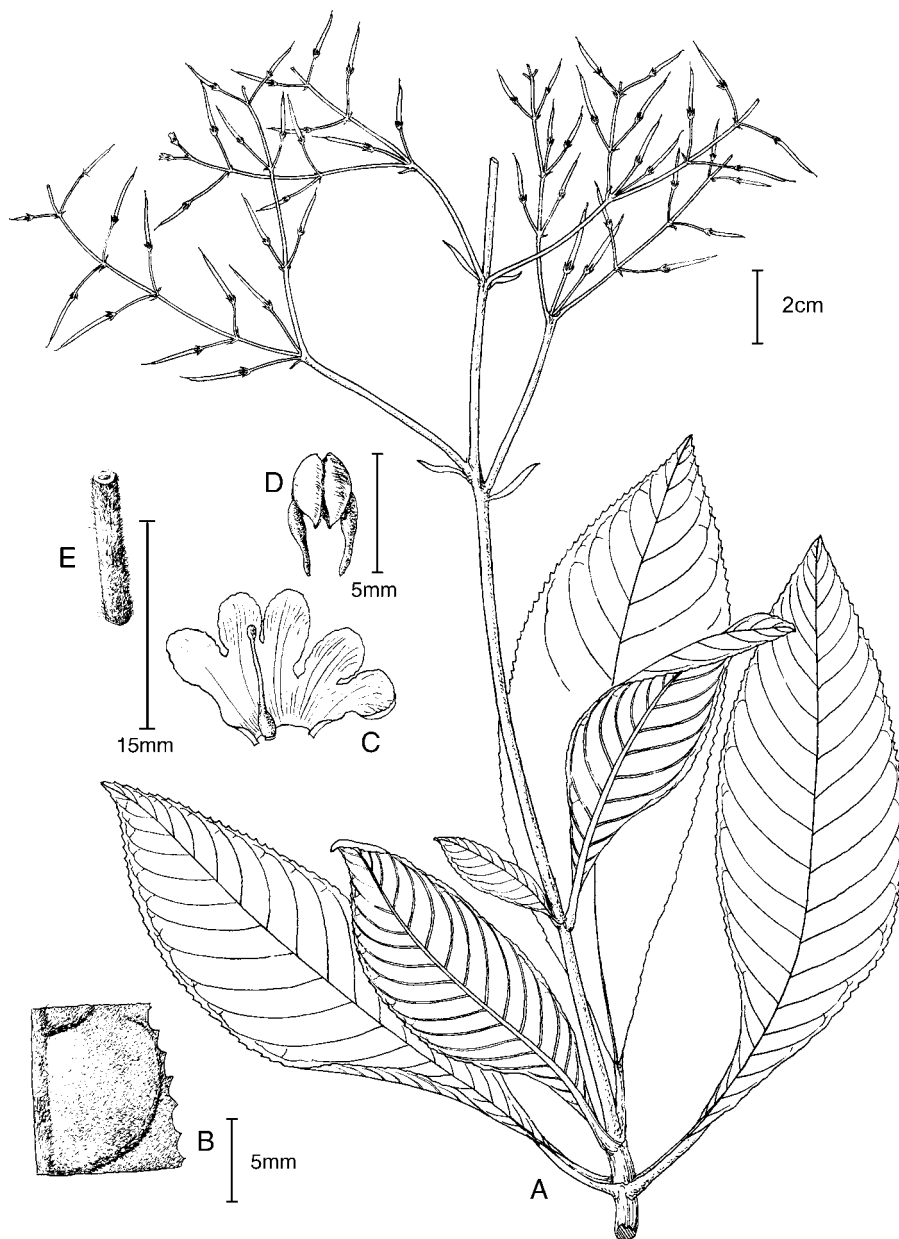


FIG. 5. *Paraboea banyengiana* B.L.Burtt. A, habit; B, leaf margin; C, corolla opened out; D, stamens; E, section of peduncle.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). The conservation assessment given reflects the fact that although this species is known from very few collections they are all from Gunung Mulu National Park which is a World Heritage Site and well protected.

Additional specimens examined. MALAYSIA. **Sarawak:** 4th Division, Baram District, Gunung Mulu National Park, West of Gua Rusa [04°02'N 114°49'E], 150 m, 20 iv 1978 (fl, fr), *G. Argent et al.* 1054 (E); Gunung Mulu National Park, NW slopes Benarat [04°02'N 114°50'E], 333 m, 18 vi 1975 (fr, fl), *B.L. Burtt* 8316 (E); Gunung Mulu National Park, Bukit Berar, S Ridge, 04°05'N 114°55'E, 200–250 m, 18 iii 1978 (fl), *I. Nielsen* 729 (SAR).

Although this species has opposite leaves it is probably related to the other tropical species that have a terminal panicle and leaves in whorls of 3–6, such as *Paraboea meiophylla* and *P. verticillata*. They all share a similar floral morphology and inflorescence structure.

7. *Paraboea berouwensis* Z.R.Xu & B.L.Burtt, *Edinburgh J. Bot.* 48: 2 (1991).

– Type: East Borneo, Kalimantan, Mt. Ilas Bunga, 600 m, limestone, 10 ix 1957 (fl, fr), *A.J.G.H. Kostermans* 13785 (holo L).

Perennial caulescent subshrub; stem quite stout, c.1 cm in diameter, internodes < 1 cm long. *Leaves* in whorls of 3, petiolate; petioles swollen at the base but not joined to each other across the node, lamina base long-attenuate and extending nearly to the base of the petiole thus the petiole not easily distinguishable from the lamina; blades narrow-elliptic, 11–15 × 22.5 cm (including the indistinct petiole), apex short-acuminate, base long-attenuate, margin more or less shallowly serrate, upper surface with some arachnoid covering but otherwise without an indumentum, lower surface with a white matted indumentum; veins obscure above, raised beneath, lateral veins c.13 pairs, tertiary venation invisible. *Inflorescence* terminal, paniculate, with a white matted indumentum throughout up to the calyx; flowering stem c.20 cm long, much thinner than the stem, c.2 mm in diameter, floral leaves up to 3.5 × 0.8 cm, reducing in size upward, 3 cymes from each node; cymes short, < 4 cm long, many-flowered, congested; pedicel c.2–5 mm long, with bracts sepal-like. *Calyx* 5-lobed to the base, with a matted indumentum outside, glabrous inside, lobes ovate or narrowly so, 1–2 mm long. *Corolla* more or less minutely pubescent outside, especially when young, c.7 × 10 mm when open; tube c.2.5 mm long, limb 2-lipped; upper lip c.5 mm long, 2-lobed, lobes ovate, c.4 × 5 mm, lower lip c.7 × 9 mm, obovate, 3-lobed, the middle one longer than the lateral lobes by c.2 mm, more or less oblong, c.3 × 2 mm. *Stamens* 2, distinct; anthers transversely ellipsoid, c.2 × 3.5 mm, apex turned towards the gynoecium, opening in the centre of the anther locules, coherent to each other at the apex and the base, dorsifixed; filaments c.2.5 mm long, inserted at the base of the corolla, flat, more or less verrucose. *Gynoecium* glabrous, c.6 mm long; ovary 1.5–2 × 0.6–0.8 mm; style c.2.5 × 0.3 mm; stigma capitate not larger than

style. *Fruit* c.1–2 cm long, 1.5 mm wide, spirally twisted, glabrous. *Seeds* ellipsoid, c.0.4 × 0.2 mm.

Distribution. Indonesia: Kalimantan. Known only from the type.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

In the morphology of the flower and inflorescence this species is similar to *Paraboea leporina* from Sulawesi but the leaves lack an indumentum below the arachnoid covering on the upper surface and the petiole is swollen at the base.

8. *Paraboea bintangensis* B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 31: 51 (1971); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 424 (1984). – Type: Malay Peninsula, Perlis, Bukit Bintang [06°35'N 100°12'E], on limestone rocks in evergreen forest, cult. from B.L. Burt & P.J.B. Woods 1737 [26 iv 1962 (fr)] in Royal Botanic Garden Edinburgh as *Cult. in E C4088* (holo E). **Fig. 6.**

Rosulate herb. *Leaves* congested in a rosette, petiolate; petiole 3–7 cm long, with a sparse matted indumentum; blades ovate, elliptic, or slightly obovate or oblong, 4–10 × 2–4.5 cm, c.2–2.5 times as long as wide, apex obtuse, base oblique, margin more or less sparsely crenate, glabrescent above, with a greyish matted indumentum beneath; veins obscure above, slightly raised beneath, lateral veins c.5 pairs, tertiary venation invisible. *Inflorescence* axillary, appearing umbelliform, c.3–8-flowered; peduncle c.5–8 cm long, with a sparse matted indumentum, the two primary bracts at the top of the peduncle leaf-like, widely ovate, c.13 × 9 mm, ± with some indumentum beneath; pedicels 10–25 mm long, glabrescent. *Calyx* 5-lobed to the base, lobes narrowly ovate, 5–7 × 1.5 mm, ± ciliate, pubescent outside, glabrous inside. *Corolla* white, c.10 mm long, 15 mm across, glabrous; tube c.2 mm long, limb 2-lipped; upper lip c.6 × 8 mm, 2 lobes ± rounded, c.5 × 6 mm, lower lip c.8 × 15 mm, middle lobes rounded, 4.5 × 5 mm, lateral lobes similar. *Anthers* yellow, widely ovate, c.2 × 3 mm, opening in the centre of the anther locules, coherent, ± dorsifixed; filaments c.2.5 mm long, swelling in upper 2/3; staminodes < 1 mm long. *Gynoecium* 17 mm long; ovary c.2.5 × 1.2 mm; style 0.5 mm wide; stigma larger than style, c.1 mm across. *Fruit* a linear non-twisted capsule, 1.4–1.5 cm long, glabrous, 4-valved when open. *Seeds* not seen.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Vulnerable (VU D2). This species is currently known from only two collections but these collections are quite widely separated. It may be found in other limestone areas but as it is currently known from only two sites that are not fully protected it should be considered Vulnerable.

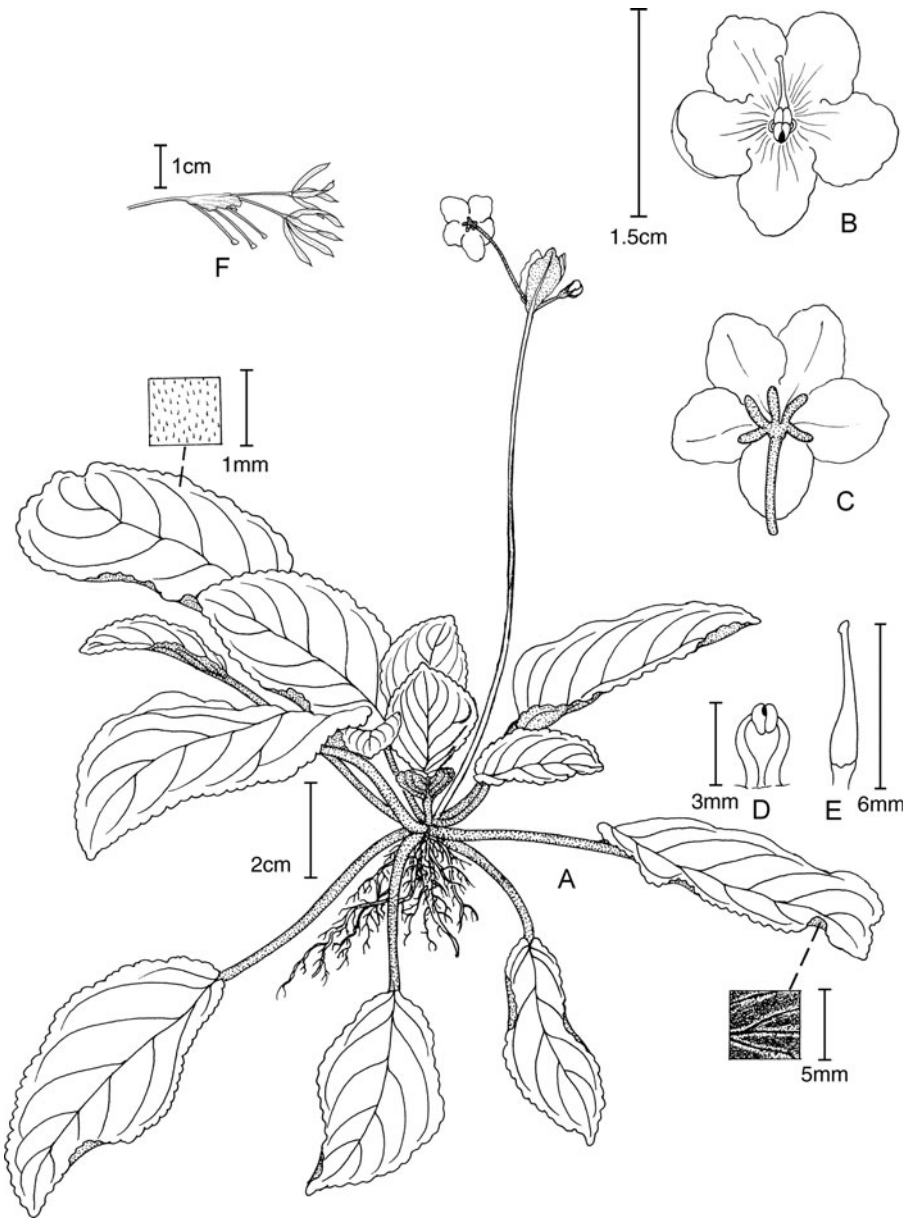


FIG. 6. *Paraboea bintangensis* B.L.Burt. A, habit; B, flower; C, flower from behind; D, stamens; E, pistil; F, dehisced fruit.

Additional specimen examined. MALAYSIA. **Kedah:** Pulau Langkawi, Bukit Terbak [06°20'N 99°48'E], 5 viii 1986 (fl, fr), *A. Weber* 86-0805 (WU).

The species is easily recognised by its two leaf-like primary bracts. The species may be related to *Paraboea bakeri* but the latter species possesses no leaf-like bracts and the upper leaf surface has a dense pubescence.

9. *Paraboea brachycarpa* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 424 (1984). – *Boea brachycarpa* Ridl., Bull. Misc. Inform. Kew 1929: 259 (1929). – Type: Malay Peninsula, Kelantan, Gua Ninik, 26 x 1927 (fr), *M.R. Henderson* SFN 19668 (lecto K, designated here; iso SING). **Fig. 7.**

Perennial caulescent herb or subshrub with a woody stem up to 30 cm long, stem with internodes up to 6 cm long, including the inflorescence up to nearly 1 m tall. *Leaves* in whorls of 3 or 4, occasionally opposite in young plants; petiole normally short and indistinct, with a brownish matted indumentum or sometimes seemingly villose; blades more or less obovate, or narrowly so, 7–20 × 2.5–6 cm, c.2–5 times as long as wide, apex with a very short acumen or obtuse or rounded, base normally long-attenuate or widely cuneate in rare cases, margin more or less serrulate, upper surface normally with a dense pubescence, rarely glabrescent, lower surface with a whitish to brownish matted indumentum; veins smooth or indistinctly visible above, raised beneath, lateral veins numerous, 16–25 pairs, tertiary venation normally reticulate. *Inflorescence* terminal paniculate, up to 80 cm long but normally very narrow, only c.4–6 cm wide, with a whitish or brownish matted indumentum throughout except on the flower; flowering stem slender or stout but always with long internodes c.10–20 cm long, pendulous, floral leaves much smaller than vegetative ones, normally 2 × 0.5 cm, 3–4 cymes from each node; cymes short, c.4 cm long, many-flowered, with a peduncle 2–3 cm long, bracts sepal-like; pedicels 2–5 mm long, with a minute pubescence covered by some matted indumentum or not. *Calyx* 1.5–2.5 mm long, 5-lobed to the base, lobes ovate or narrowly so, with a minute pubescence. *Corolla* normally glabrous, rarely with some tiny pubescence outside when in bud, c.6 mm long, 9 mm across when fully open; tube very short, limb 2-lipped; upper lip c.8 × 4 mm, with 2 lobes c.5 × 2.5 mm, lower lip c.7 × 7 mm, with 3 lobes, middle lobe c.2.5 × 2.5 mm, all 5 lobes ± rounded. *Anthers* transversely ellipsoid, c.2.5 × 5 mm, coherent with each other at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoeceum, dorsifixed; filaments inserted at c.1.5 mm from the corolla base, with a free part c.3 mm long, with a serrulate wing. *Gynoeceum* c.7 mm long; ovary ovoid, c.2.5 × 1 mm; style c.4 × 0.5 mm; stigma not distinct; all reproductive parts inside the corolla glabrous. *Fruit* short, spirally twisted, 0.6–1.5 cm long, c.1.5 mm in diameter, glabrous. *Seeds* ovoid, c.0.5 × 0.2 mm.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

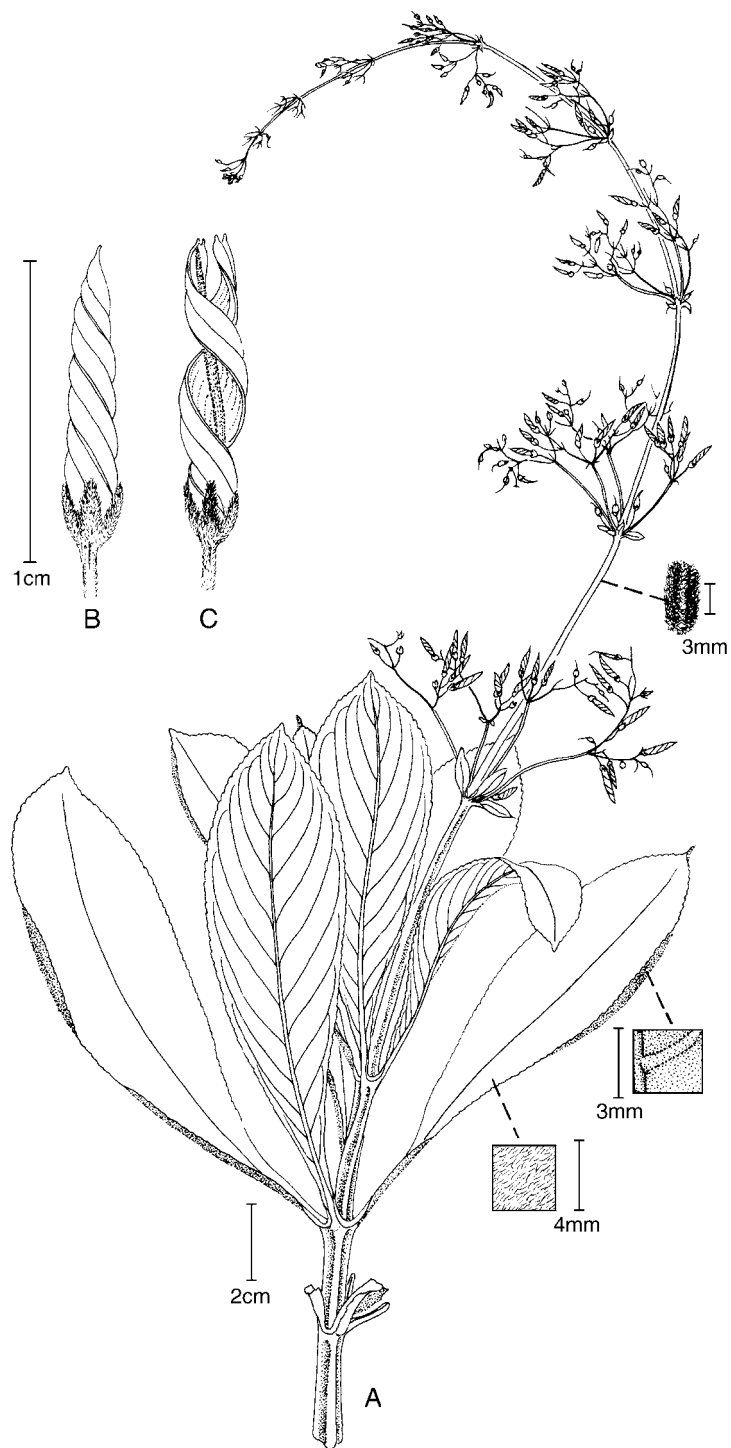


FIG. 7. *Paraboea brachycarpa* (Ridl.) B.L. Burtt. A, habit; B, fruit; C, fruit dehiscent.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. MALAYSIA. **Pahang:** Between Bentong and Karak, just away from Sungei Dua village, towards Karak [03°25'N 102°00'E], 7 x 1970 (fl), *S.C. Chin* 441 (L); Lipis district, Gua Bama (13 km NW of Kuala Lipis) [04°12'N 102°08'E], 9 v 1987 (fr), *A. Weber* 87-0508 (WU), *A. Weber* 87-0509 (WU); Lipis district, Gua Rusa (limestone area c.40 km S of Gua Musang, S of border Pahang–Kelantan), 10 v 1987 (fr), *A. Weber* 87-0510 (WU). **Kelantan:** Gua Musang [04°53'N 101°58'E], 11 viii 1971 (fl, fr), *S.C. Chin* 1409 (E); Summit of Gua Musang [04°53'N 101°58'E], 1 xi 1962 (fr), *B.C. Stone* 7449a (KLU); Gua Musang, Ulu Kelantan, 4 viii 1962 (fl), *UNESCO Limestone Exp.* 303 (SING); Gua Panjang, Ulu Kelantan [04°49'N 102°01'E], 10 viii 1962 (fl), *UNESCO Limestone Exp.* 560 (SING); Gua Panjang, Ulu Kelantan, 11 viii 1962 (fl), *UNESCO Limestone Exp.* 593 (SING); W. Kelantan, S. Nenggeri, Gua Jaya at K. Jenera [05°05'N 101°46'E], 27 vii 1967 (fr, fl), *T.C. Whitmore* 4253 (K, L).

The species is distinctive with its pendulous long panicle, very short lateral cymes, and its very short capsule. This places it in a group of tropical species, such as *Paraboea verticillata*, that have a terminal panicle and whorled leaves. Ridley (1929) mis-described the species as 'leaves opposite' and compared it with *Boea kerrii* (= *P. swinhoei*). Even in the type specimen the whorled leaf formation is clear although there is also a young plant that has a few nodes bearing opposite leaves.

The current circumscription of the species encompasses quite some variation: the habit may be caulescent or rosette-like; the upper leaf surface with or without a pubescence; and the calyx with or without some matted indumentum. The pubescence on the upper leaf surface is usually a reliable character for specific delimitation, but occasionally it is not. Most of the duplicates of the three collections recorded from Pahang (Lipis district), *A. Weber* 87-0509, 87-0510 and 87-0508, are young plants with flower buds and have no distinct pubescence on the upper leaf surface. However, one duplicate of *A. Weber* 87-0509, which was collected from a dead plant with open fruits, shows a dense pubescence on the upper leaf surface. Whether the calyx has a matted indumentum or not is another questionable character in this species. Even within a single specimen (e.g. *S.C. Chin* 1409) the calyx may or may not have a matted indumentum on the outer surface. It would appear that the flower bud is always covered by this indumentum but when the flower develops the indumentum may or may not remain.

10. *Paraboea brunnescens* B.L. Burt, Notes Roy. Bot. Gard. Edinburgh 41: 424 (1984).
– Type: Thailand, SW region, Kanchanaburi, Erawan National Park, 14°17'N 99°15'E, 400 m, evergreen forest along cascades, on limestone, 18 xi 1971, *Beusekom, Geesink, Phengkhlay & Wongwan* 3827a (holo L; iso BKF, C, K, P). There is a typographical error in the protologue where 3827a is given as 3837A.

Rosulate herb. *Leaves* oppositely congested in a rosette; petiole 2.5–12 cm long, with the same indumentum as that on the lower leaf surface; blades ovate-elliptic, 5–16 × 3–11 cm, 1.3–2.2 times as long as wide, apex obtuse, base rounded to shallowly

cordate, margin crenate or weakly so, upper surface sparsely and minutely pubescent, lower surface with a sparse dark brown matted indumentum; veins smooth above, raised beneath, lateral veins c.6 pairs, ascending at c.30° to the midrib, basal veins ascending to halfway or near to the apex of the blades. *Inflorescences* axillary, cymose, quite lax, several- to many-flowered, normally longer than the leaves, with the same indumentum as that on the lower leaf surface when young and tending to become glabrescent when older; peduncle normally 6–30 cm long, slender, c.1–2 mm in diameter, primary and secondary branches above the peduncle also relatively long; subordinate branches developing below the primary branches on top of the peduncle; bracts linear, up to 6 mm long, 2 mm wide; pedicels 5–15 mm long, very slender. *Calyx* c.1.5 mm long, 5-lobed to the base, lobes narrowly ovate, c.1 × 0.5 mm. *Corolla* white; tube c.2.5 mm long, limb c.10 mm across when open, limb 2-lipped; upper lip 2-lobed with lobes ovate, c.4 × 3.5 mm, lower lip 3-lobed with lobes of similar size and shape, c.3.5 × 3 mm. *Anthers* transversely ellipsoid, c.1.2 × 3.5 mm, coherent with each other at the apex, opening in the centre of the anther locules, apex pointing towards the gynoeceium, dorsifixed; filaments inserted at c.1 mm from the corolla base with a free part c.2 mm long. *Ovary* ovoid, c.2 × 1 mm; style distinct from the ovary, c.4 mm long, 0.2 mm in diameter; stigma much larger than style. *Fruit* a linear capsule, 1.5–2.5 cm long, c.1 mm in diameter, spirally twisted, glabrous. *Seeds* ovoid, 3 × 1.5 mm.

Distribution. Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats. This species was, however, included in Pooma (2005) as threatened in Thailand.

Additional specimens examined. THAILAND. Hard Palom, 250 m, 25 xii 1961 (fr), *K. Larsen* 8958 (C). **Kanchanaburi:** Srisawad District, Kao Monglai [14°50'N 99°00'E], 9 viii 1967 (fl), *Kasem* 541 (BKF); Sai Yok [14°15'N 99°10'E], 200 m, 2 viii 1928 (fl), *A. Marcan* 2388 (BM); *ibid.*, 2 viii 1928 (lv), *Put* 1836 (ABD, BKF, BM, K); Erawan National Park, 14°25'N 99°04'E, 300 m, 1 ix 1995, *J. Parnell et al.* 95-659 (BKF, K, TCD); Erawan Waterfall, 150 m, 10 x 1971 (fl), *G. Murata et al.* 16164 (L); Khao Salob, 19 viii 1968 (fl), *B. Nimanong & S. Phusomsaeng* 303 (BKF, L); Si Sawat [14°45'N 99°00'E], 24 viii 1968 (fl), *Prayad* 1538 (BKF); Ban Erawan, Si Sawat District [14°45'N 99°00'E], 250–330 m, 2 xi 1979 (fl), *T. Shimizu et al.* T-2146 (BKF); Erawan National Park, Si Sawat District, 100–300 m, 3 xi 1979 (fr), *T. Shimizu et al.* T-21555 (BKF, L). **Mae Hong Son:** Kun Yuam District [18°15'N 98°00'E], 600–700 m, 9 v 1974 (fr), *K. Larsen & Larsen* 34145 (AAU). **Sukhothai:** Near Pra Tah Due Nahm Doke So Gah Cha Nah Temple, Muang Gow District [17°00'N 99°35'E], 4 xi 1971 (fl, fr), *J.F. Maxwell* 71-666 (BKF). **Surat Thani:** Khao Yai, Samui Island [09°35'N 99°57'E], 25 vi 1966 (fr), *Sakol* 1116 (BKF).

This species is extremely similar to *Paraboea glabriflora* when one compares leaf morphology and inflorescence structure. In addition they are recorded from the same region. There are some differences between the type of *Paraboea glabriflora* and the

collections cited above: whitish indumentum vs. dark brown on the leaves; subordinate branches absent or present in the cyme. *Paraboea glabriflora* is known only from the type so fieldwork should be carried out at the type locality to help determine whether these differences are consistent enough to maintain the species or not.

11. *Paraboea burtii* Z.R.Xu, Acta Phytotax. Sin. 32: 359 (1994 [‘1993’]). – Type: Thailand, Nakhawn Srithamarat [Nakhon Sri Thammarat], Khiriwong, Khao Khi Naw [Lansaka District] [08°35’N 99°48’E], 400 m, 5 x 1957 (fr), *Bunnak* 710 (holo E) [Herb common by stream in evergreen forest, flowers bluish].

Perennial rosulate herb with or without a short stem, stem up to 15 cm long, 7 mm in diameter (in rock crevices?). *Leaves* oppositely congested in a rosette, sometimes with < 1.5 cm long internodes; petiole 4–10 cm long, with a greyish matted indumentum; blades ovate, 7–14 × 3–8 cm, 1.2–2 times as long as wide, apex obtuse, base cuneate to shallowly cordate, margin sparsely serrulate (or serrate), densely pubescent above, with a brownish orange matted indumentum beneath (in dried specimens); veins smooth above, raised beneath, lateral veins 6–10 pairs, tertiary venation inconspicuously reticulate. *Inflorescences* axillary, numerous flowers congested at top of a peduncle, appearing capitate or umbellate, with a matted indumentum throughout the inflorescence up to the calyx; peduncle 13–18 cm long (usually similar in length to the leaves); bracts numerous, subglobular, c.1.2 cm long, embracing the whole inflorescence when young [Note: ‘Bracts numerous’ is a superficial phenomenon due to the numerous flowers congested at the apex of a peduncle. Actually, each flower usually has only one bract. However, in this species, bractlets below each pedicel are not different to the two primary bracts at the top of a peduncle]; pedicels 10–15 mm long. *Flowers* c.16 mm across when open. *Calyx* 5-lobed to the base, ± with a matted indumentum outside, glabrous inside; lobes obovate, c.6 × 4.5 mm. *Corolla* glabrous, c.12 × 16 mm when open; tube c.4 mm long, limb 2-lipped; upper lip 2-lobed, lobes widely ovate, c.6 × 10 mm, lower lip 3-lobed, middle lobe obovate, 4 × 6 mm, lateral lobes widely ovate, 8 × 9 mm. *Stamens* 2, glabrous, anthers transversely ellipsoid, c.2.5 × 4 mm, the apex turned towards the gynoecium, opening in the centre of the anther locules, coherent at apex and base, dorsifixed; filaments short, inserted at the base of the corolla. *Gynoecium* glabrous, c.10 mm long; ovary ovoid, c.3 × 2 mm; style c.7 mm long; stigma slightly wider than style, c.1 × 1.3 mm. *Fruit* a linear capsule, 3–4 cm long, 1.5 mm wide, glabrous, not spirally twisted, held more or less horizontally, open along the upward valvic line. *Seeds* ovoid, c.0.4 × 0.3 mm.

Distribution. Thailand.

Habitat and ecology. Occurs on shady moist granitic outcrops under evergreen forest.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats.

Additional specimens examined. THAILAND. Province unknown: cultivated in Aberdeen, UK, 1930? (fl), *A.F.G. Kerr* 205 (K, L). **Nakhon Sri Thammarat:** Khao Luang, 08°25'N 98°40'E, 150 m, 25 x 1991 (fr), *K. Larsen et al.* 42569 (AAU); Lansagah, Gahrome Falls, Khao Luang National Park [08°30'N 99°45'E], 150 m, 14 ix 1985 (fl), *J.F. Maxwell* 85-877 (A, L, PSU); *ibid.*, 13 xii 1985 (fr), *J.F. Maxwell* 85-1101 (A, L, PSU); *ibid.*, 23 viii 1980 (fl), *P. Sirirugsa* 328 (PSU); Kao Chem, Tung Song, (local name: Dardhoi) [08°20'N 99°40'E], 20 vii 1929 (fl), *Rabil* 106 (K); *ibid.*, 20 vii 1929 (ster), *Rabil* 103 (K); Kiriwong, Kiriwong District, Khao Luang National Park [08°30'N 99°45'E], 400 m, 26 vii 1951 (fr), *T. Smitinand* 710 (BKF); Khao Rawn Nai Hawn, 27 xi 1951 (fl), *P. Suvarnakoses* 193 (BKF); Hill above Ronpibun [08°22'N 99°48'E], 100 m, 16 vii 1940 (fl), *F.K. Ward* 27460 (K). **Phatthalung:** Tamote District, Tamote Falls National Park [07°25'N 100°04'E], 175 m, 10 ix 1986 (fl), *J.F. Maxwell* 86-651 (PSU); Plai Wan Waterfall, 25 km SW of Phattalung, 07°25'N 99°55'E, 150–250 m, 19 xi 1990 (fr), *K. Larsen et al.* 41587 (AAU). **Trang:** Wam Tai, 20 km N of Trang, 11 x 1970 (fr), *C. Charoenphol et al.* 3640 (E); Bangkok, 3 ix 1930 (fl), *A.F.G. Kerr* 19745 (K).

This species is similar to *Paraboea capitata* Ridl., in their capitate inflorescences and horizontally held capsules, but *P. capitata* has no large bracts. With the distinct obovate calyx lobes this species is also similar to *Paraboea speciosa* but the latter has a different leaf texture and shape. The material for *Paraboea speciosa* is insufficient for a complete description.

The large obovate calyx lobes of this species are similar to those of *Paraboea glabra* (Ridl.) B.L.Burtt. Most of the specimens now cited under *Paraboea burttii* were previously misidentified as *P. glabra* but they differ in the twisting of the fruit in *P. glabra*.

12. *Paraboea caerulescens* (Ridl.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 425 (1984). – *Boea caerulescens* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 73 (1905). – Type: Malay Peninsula, Perak, Kinta [04°36'N 101°05'E], 130–200 m, ix 1885 (fl, fr), *King's Collector* 8276 (lecto K, designated by Burtt (1984: 425)).

Fig. 8.

Perennial caulescent subshrub; stem woody, 30–50 cm tall, up to 1 cm in diameter, internodes normally 1 cm long, with a white or greyish matted indumentum and later glabrescent. *Leaves* in whorls of 3 or 4, sessile, narrow-elliptic to somewhat obovate, c.12–20 × (2–)3–6 cm, 2.5 times as long as wide, apex acute or acuminate, base angustate or nearly so, margin entire, upper surface pubescent or glabrous, lower surface with a white or tawny dense matted indumentum; veins smooth above, raised beneath, lateral veins c.12 pairs, tertiary venation invisible. *Inflorescence* terminal panicle, with a white or greyish matted indumentum except on the flower; flowering stem 30–70 cm long, the most basal internodes elongated, c.12 cm long, floral leaves intermediate to caulescent leaves, gradually reducing in size upward, 3 or 4 cymes from each node; cymes 12 cm long or less, many-flowered, peduncle bracts narrow-ovate, c.8 × 3 mm, pedicel bracts sepal-like; pedicels 5–15 mm long. *Flowers* with minute capitate pubescence on the calyx, the young corolla outside and the gynoecium, but glabrous on the stamens. *Calyx* 3–4 mm long, 5-lobed, lobes ovate or narrowly so. *Corolla* pale mauve-blue or violet, c.1 cm long, 1 cm across;

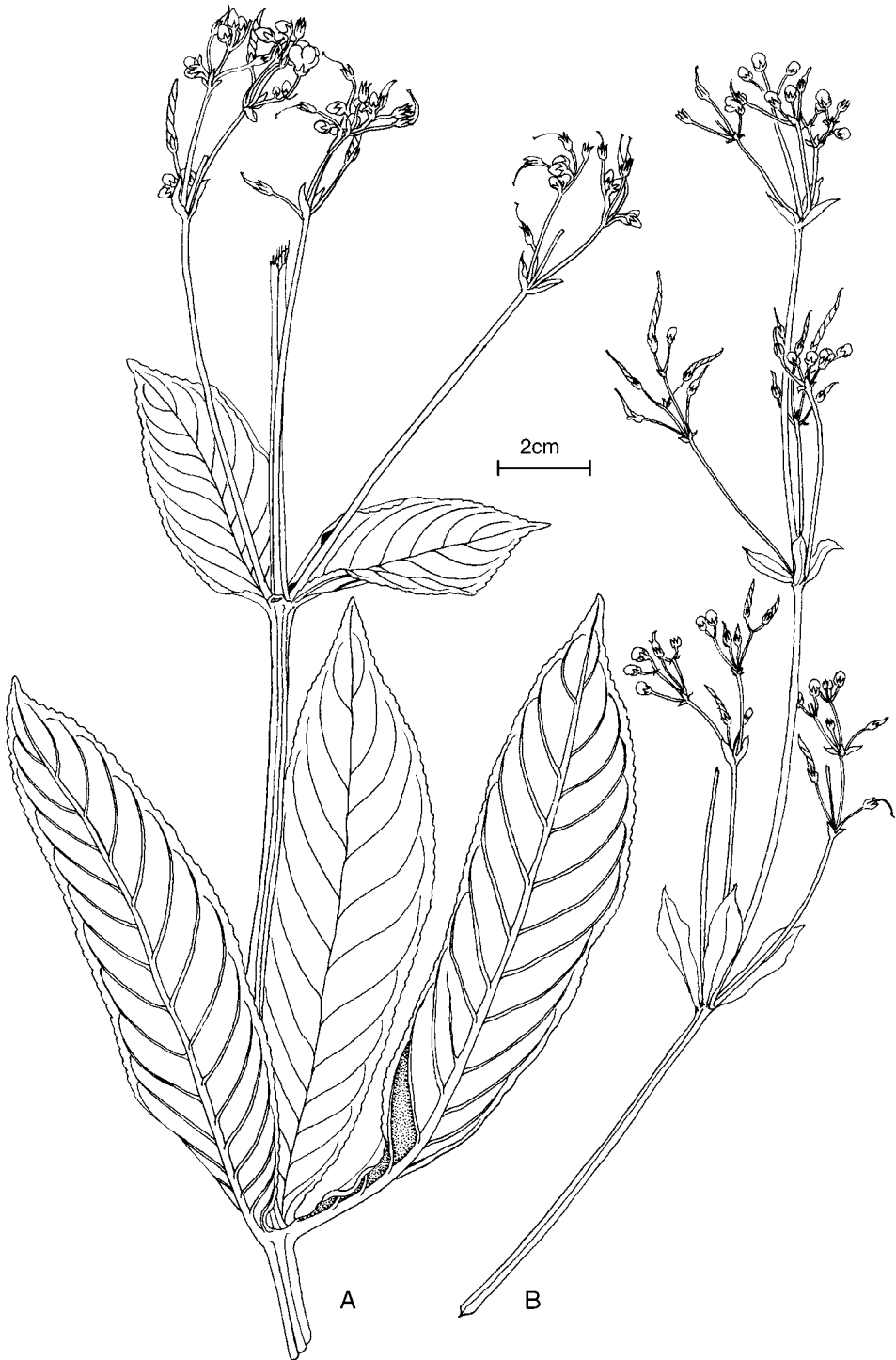


FIG. 8. *Paraboea caerulescens* (Ridl.) B.L.Burt. A, habit; B, continuation of inflorescence.

tube 3–3.5 mm long, limb 2-lipped; upper lip 3 mm long, 2-lobed, lobes wide-ovate, c.3 × 4.5 mm, lower lip 8.5 mm long, 3-lobed, middle lobe rounded, c.3 × 4 mm, lateral lobes wide-ovate, c.2 × 4 mm. *Anthers* yellow, transversely ellipsoid, c.2.5 × 5 mm, coherent with each other, opening in the centre of the anther locules, apex pointing towards the gynoecium, dorsifixed by the filaments; filaments inserted at the corolla base with the free part c.3 mm long, crenate on the margin. *Gynoecium* c.7.5 mm long, 1.2 mm wide; stigma slightly larger than style. *Fruit* a spirally twisted capsule, c.1.5–3 cm long, 2 mm wide, with minute capitate pubescence. *Seeds* ellipsoid, 0.5 × 0.15 mm.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. MALAYSIA. **Perak:** i 1921 (fl, fr), *H.N. Ridley* s.n. (K); Ipoh, Gunung Panjang [04°36'N 101°08'E], 19 iv 1962 (fr), *B.L. Burtt & P.J.B. Woods* 1659 (E); 14 miles S of Ipoh just off main road to Kuala Lumpur, Gunung Kandu [04°36'N 101°05'E], 5 v 1962 (fl, fr), *B.L. Burtt & P.J.B. Woods* 1822 (E); (fl), *Cult. in E* C4912 (E); (fl), *Cult. in E* C5978 (E). **Pahang:** Bukit Cheras, near Kuantan, 170 m, 11 x 1931 (fl, fr), *M.R. Henderson* s.n. (K).

Some variation within the species has been found. The type and *B.L. Burtt & P.J.B. Woods* 1659 have a pubescent upper leaf surface. Another group of collections, such as *B.L. Burtt & P.J.B. Woods* 1822 and *H.N. Ridley* s.n. (i 1921), have no pubescence on the upper leaf surface. In addition, *M.R. Henderson* s.n. (11 x 1931) from Pahang is similar to the latter group but it has an arachnoid covering on the upper leaf surface. However, there are no other characters to separate these collections into different taxa.

This species is a large caulescent subshrub with a whorled leaf formation and a large terminal paniculate inflorescence, like a dozen other species in Borneo and Peninsular Malaysia. The minute capitate pubescence on the calyx and the fruit and the absence of a matted indumentum on the calyx are characteristic in this species. See also discussion under *Paraboea paniculata*.

13. *Paraboea candidissima* B.L.Burtt, Bot. J. Linn. Soc. 85: 26 (1982); Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 425 (1984). – Type: Sarawak, Gunung Mulu National Park [04°02'N 114°50'E], 430 m, 14 vi 1975 (fr, fl), *B.L. Burtt* 8263 (holo E (over 2 sheets); iso SAR). **Fig. 9.**

Subshrub; stem woody, elongated, straggly, with a few branches towards the base, with living leaves only towards the apex, those in the middle being withered or persisting solely as petioles, base of the stem bare, when young white lanate and then becoming rusty-brown with a thinner indumentum, internodes 0.5–3.5 cm long, up to 1 cm in diameter. *Leaves* in whorls of 3, opposite pairs occasionally

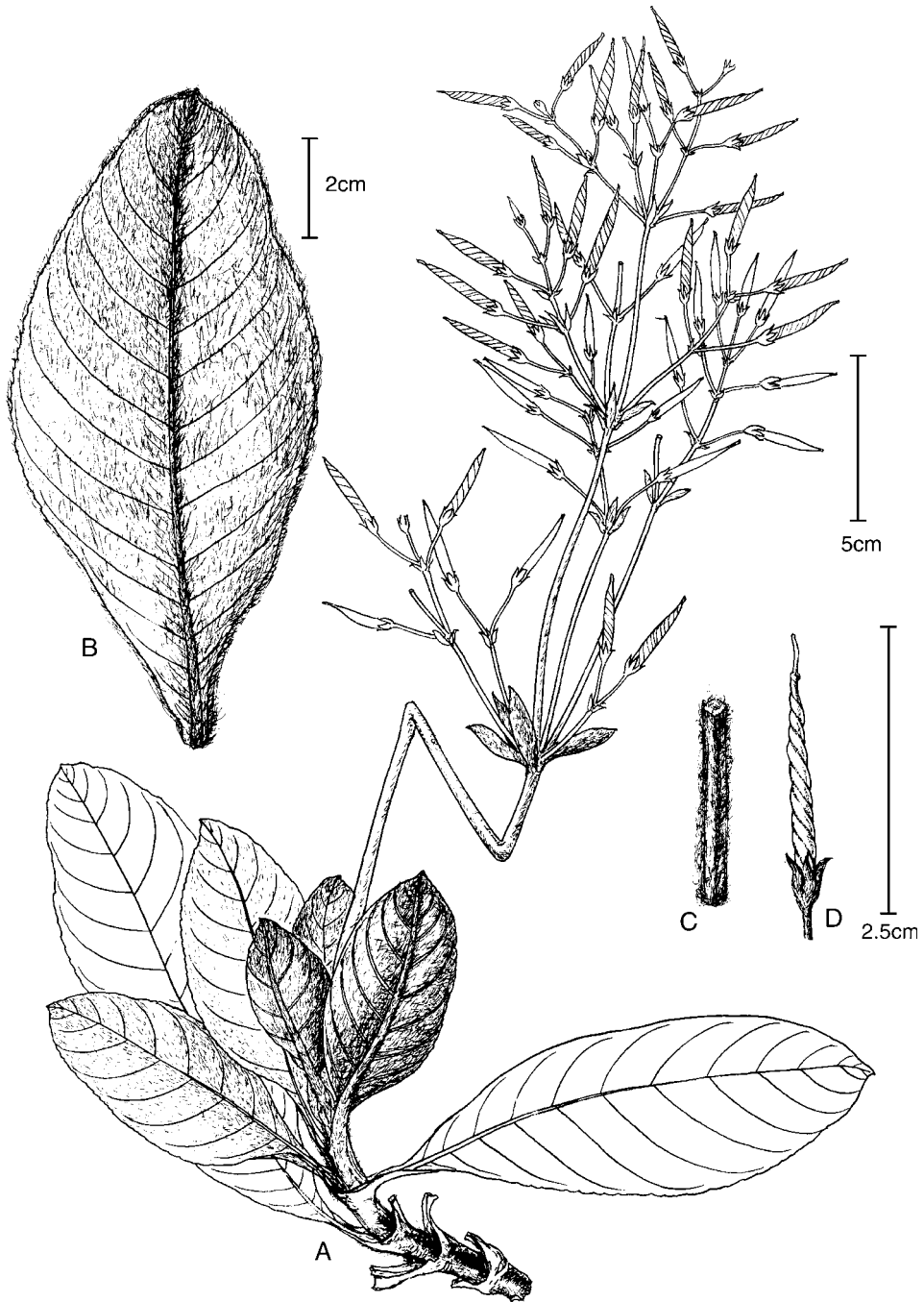


FIG. 9. *Paraboea candidissima* B.L.Burtt. A, habit; B, leaf; C, section of peduncle; D, fruit.

seen; petiole scarcely distinct from the lamina, 1.5–2 cm long (but juvenile leaves subsessile), the base subauriculate and joining across the node, with the same indumentum as the blades; blades broadly elliptic or somewhat obovate-elliptic, c.10–15 × 4–8 cm, c.2 times as long as wide, apex obtuse, base angustate, margin entire or very slightly serrulate, upper surface with a pubescence of a white arachnoideous layer, lower surface with a white lanate indumentum; veins smooth above, raised beneath, lateral veins 14–17 pairs, tertiary venation invisible. *Inflorescence* terminal paniculate, with a white lanate indumentum throughout except on the corolla, the stamens and the gynoecium; flowering stem c.35–40 cm long, basal internodes rather long, up to 15 cm long, making the inflorescence rather lax; floral leaves much smaller than cauline leaves, up to 3 × 1.5 cm (in one case 7 × 4 cm), usually 3 (and rarely 2) cymes from each node, cymes up to 20 cm long, ascending, peduncle or pedicel bracts similar to calyx lobes or indistinctive; pedicels c.10–25 mm long, in pairs. *Calyx* c.5 mm long, 5-lobed, lobes narrow-ovate, outside with a white sublanate indumentum, inside glandular. *Corolla* pale violet, the buds lightly covered with a white-arachnoid indumentum; tube 1.5 mm long, limb 2-lipped; posterior lip c.7.5 × 9 mm, rounded, 2-lobed; anterior lip 11 × 14 mm, 3-lobed with the median lobe 5 × 7 mm and the laterals 7 × 9 mm. *Stamens* arising from the mouth of the tube; filaments flat, c.4 mm long. *Ovary* 2.5 × 1.5 mm; style 5 mm long. *Fruit* a spirally twisted capsule, c.2 cm long, c.1.6 mm wide, glabrous. *Seeds* compressed, ellipsoid, 0.5 × 0.12 mm.

Distribution. Malaysia: Sarawak.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). The conservation assessment given reflects the fact that although this species is known from few collections they are all from Gunung Mulu National Park which is a World Heritage Site and well protected.

Additional specimens examined. MALAYSIA. **Sarawak:** 4th Division, Ulu Medalam District, Gunung Mulu National Park, Buda [04°02'N 114°50'E], 1000 ft (c.300 m), 25 iv 1958 (fr), *Bruenig* 10506 (E, SAR); Gunung Mulu National Park, Below G Buda, N of S Medalam, 200 m, 20 vi 1975 (fr), *B.L. Burt* 8333 (E); Gunung Mulu National Park, Benarat cliffs, S flank, facing Melinau, 24 vi 1962 (fl), *B.L. Burt* & *P.J.B. Woods* 2279 (E); Gunung Mulu National Park, Hidden Valley eastern end, 04°05'N 114°53'E, c.450 m, 6 iv 1978 (ster), *Argent et al.* 908a (E, SAR).

This species is rather distinctive amongst the tropical species that have a terminal panicle and whorled leaves by its thick lanate indumentum.

14. *Paraboea capitata* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 67 (1905); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 426 (1984). – Type: Peninsular Malaysia, Bujong Malacca, *C. Curtis* 3215 (lecto SING, designated by Burt (1984: 426); iso SING). **Fig. 10.**

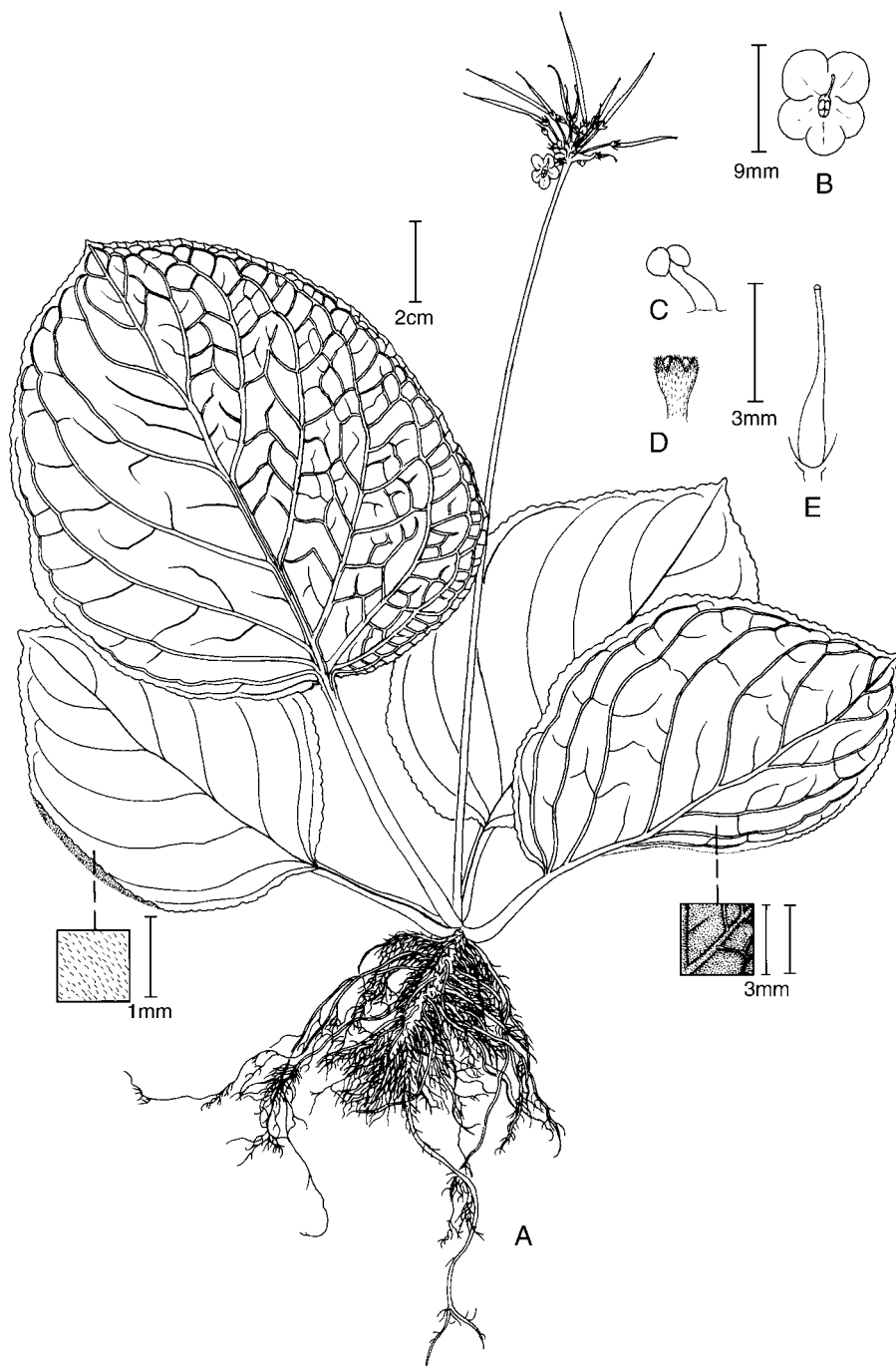


FIG. 10. *Paraboea capitata* Ridl. A, habit; B, flower; C, stamen; D, calyx; E, pistil.

Paraboea curtisii Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 70 (1905). – Type: Peninsular Malaysia, Bujong Malacca, cult. Penang, C. Curtis 3214 p.p. (lecto SING, designated by Burt (1984: 426)).

Paraboea polita Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 69 (1905). – Type: Peninsular Malaysia, Bujong Malacca, cult. Penang, C. Curtis 3214 p.p. (lecto SING, designated by Burt (1984: 426)).

14a. *Paraboea capitata* var. *capitata*

Perennial herb, sometimes with rhizome up to 10 cm long. *Leaves* opposite, congested in a rosette, petiolate; petiole c.2–7 cm long, with a brownish matted indumentum; blades more or less ovate, 5.5–19 × 5–11 cm, 1–2 times as long as wide, apex obtuse or very acute, base widely cuneate to shallowly cordate, margin shallowly crenate, upper leaf surface with a dense pubescence, lower leaf surface with a matted indumentum, appearing brownish (yellow, orange, or grey); veins smooth above, raised beneath, lateral veins c.7–10 pairs, tertiary venation reticulate. *Inflorescence* an axillary cyme, longer than the leaf, c.20 cm long, many-flowered, with a brownish matted indumentum up to the pedicels; primary and secondary branches extremely reduced in length and so flowers congested at top of the peduncle, appearing capitate; peduncle c.20 cm long; primary bracts ovate, 5–10 × 4–6 mm; pedicels c.5 mm long. *Calyx* 5-lobed to the base, lobes narrowly ovate, c.2 × 0.5 mm, with a matted indumentum outside, glabrous inside. *Corolla* white (fide J. Sinclair), c.20 mm across, glabrous; tube short, c.2 mm long, limb 2-lipped; upper lip 6 × 13 mm, 2-lobed, lower lip c.12 × 20 mm, 3-lobed. *Anthers* transversely ellipsoid, c.1.3 × 3.2 mm, opening in the centre of the anther locules; filaments 2.5 mm long, inserted at the corolla base. *Gynoecium* 8 mm long, minutely pubescent; ovary 0.8 mm wide; style long and distinct, 0.4 mm wide; stigma slightly larger than style. *Fruit* a linear non-twisted capsule, c.1.5–2.5 cm long, held almost horizontal, glabrous, opening by the upper suture (only). *Seeds* ovoid, 0.6 × 0.25 mm, brown.

Distribution. Peninsular Malaysia (and Thailand?).

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This variety has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. MALAYSIA. **Perak:** s.l., 10 ix 1929 (fl), I.H. Burkill 6276 (K); Tambun Limestone, Gunong Ginting [04°35'N 101°08'E], (ster), S. Ahmad & M. Sidek SAN581 (C); *ibid.*, 150 m, 10 iii 1971 (lv), S.C. Chin 831 (L); Ipoh, Ayer Hangat [04°36'N 101°05'E], 100 m, 21 iv 1962 (fr), B.L. Burt & P.J.B. Woods 1687 (E); Ipoh, Gunong Panjang (inside) [04°36'N 101°08'E], 19 iv 1962 (fr), B.L. Burt & P.J.B. Woods 1661 (E); Sunga Ryoh, xi 1880 (fl), H. Kunstler 978 (K); Kamuning, ii 1904 (fl, fr), H.N. Ridley 11894 (K); Sam Poh Tong Temple, 3.5 miles south of Ipoh, 25 x 1958 (fr), J. Sinclair 9870 (E). **Penang:** [05°23'N 100°16'E], 1938 (fl), McNicoll s.n. (E).

THAILAND. **Ratchaburi**: Thung Kang Yang Hills [13°30'N 99°31'E], 500 m, 6 vii 1963 (lv), K. Larsen 10536 (C).

The status of the single specimen from Thailand should be reinvestigated with better collections.

14b. *Paraboea capitata* var. *oblongifolia* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 68 (1905); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 426 (1984). – Type: Peninsular Malaysia, Perak, Sungai Siput, xii 1895, C. Curtis 3107 (lecto SING, designated by Burt (1984: 426); iso K).

This variety can be distinguished from *Paraboea capitata* var. *capitata* by the following characters: leaves more or less obovate, gradually narrowed to the base, 11–33 × 4–10 cm, 2–3.5 times as long as wide, upper leaf surface glabrous or with a sparse minute pubescence.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This variety has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. MALAYSIA. **Perak**: Ipoh, Gunong Tempurong [04°25'N 101°08'E], 266–566 m, 13 viii 1959 (fr), B. Allen & Kadim MK501 (E, L); Gunong Mesah, 13.5 miles S of Ipoh [04°27'N 101°10'E], 20 iv 1962 (fr), B.L. Burt & P.J.B. Woods 1664 (E); Gunong Mesah, 13.5 miles S of Ipoh [04°27'N 101°06'E], 20 iv 1962 (fl, fr), *Cult. in E* C4071 (E); 20 iv 1962 (fl), *Cult. in E* C5134 (E); 20 iv 1962 (fl), *Cult. in E* C4087 (E); Kuala Dipang [04°15'N 101°E], x 1894 (fl, fr), C. Curtis 3107 (K); Gunong Kandu, Kampong Pahang, E from road at K. L. 128, Ipoh 14 milestone, 5 v 1962 (fl), B.L. Burt & P.J.B. Woods 1821 (E). **Kelantan**: Bertam, Ulu Kelantan [05°09'N 102°02'E], 27 vii 1962 (fr), *UNESCO Limestone Exp.* 9 (K, L).

If there were no minute hairs on the upper leaf surface in this variety it would have been appropriate to raise it to specific rank as Burt (1984) implied. B.L. Burt & P.J.B. Woods 1664 (E) does have a glabrous upper leaf surface, but most of the other specimens examined do possess a pubescence, though much smaller and sparser than that in *Paraboea capitata* var. *capitata*.

15. *Paraboea changjiangensis* F.W.Xing & Z.X.Li, Acta Bot. Yunnan. 15(2): 121 (1993). – Type: China, Hainan, Changjiang Xian, Wang-xia, 600 m, 25 vii 1989, Z.X. Li & F.W. Xing 5134 (holo IBSC).

Perennial caulescent herb; stem 9–40 cm tall, with a dense matted indumentum. Leaves opposite, petiolate; petiole 1–2.5 cm long, with a matted indumentum; blades thickly membranous, elliptic or oblong, 2–7 × 1–3 cm, apex obtuse, base cuneate, margin obtusely dentate, densely pubescent above, with a matted indumentum beneath; veins

slightly sunken above, raised beneath, lateral veins 5–8 pairs. *Inflorescence* an axillary cyme, 5–10-flowered, longer than the leaves; peduncle 4–5 cm long, densely pubescent or glabrescent, bracts minute; pedicels 5–10 mm long, pubescent. *Calyx* 5-lobed to the base, lobes lanceolate, $1.5\text{--}2 \times 0.5\text{--}1$ mm, pubescent outside. *Corolla* pale lilac; tube 3–5 mm long, limb 2-lipped; upper lip 2-lobed, lobes ovate, $3\text{--}3.5 \times 2\text{--}2.5$ mm, apex obtuse, lower lip 3-lobed, central lobe 5 mm long, apex obtuse, lateral lobes 3×2.6 mm. *Anthers* oblong, 2–2.5 mm long; filaments 1.5–2 mm long, inserted at the corolla base. *Gynoecium* 9 mm long, glabrous; ovary oblong. *Fruit* a linear twisted capsule, 0.8–1.5 cm long, 1.5–2 mm in diameter. *Seeds* oblong or ovate, 0.4 mm long.

Distribution. China: Hainan.

Habitat and ecology. On calcareous formations.

Proposed IUCN conservation assessment. Data Deficient (DD). The taxonomic status is not entirely clear so a Data Deficient status is most appropriate.

Additional specimen examined. CHINA. **Hainan:** Changjiang Xian, Wang-xia, 600 m, 30 ix 1989, F. W. Xing 5142 (IBSC).

Further collections are necessary to see whether this species is really distinct from *Paraboea rufescens*, a species not otherwise known to occur on Hainan.

16. *Paraboea chiangdaoensis* Z.R.Xu & B.L.Burt, Edinburgh J. Bot. 48: 3 (1991).

– Type: Thailand, Chiangmai, Doi Chiangdao [Ban Chiangdao, $19^{\circ}30'N$ $99^{\circ}00'E$], 23 x 1926 (fr), *Put* 430 (holo K; iso ABD, BM). **Fig. 11.**

Perennial caulescent herb; stem c.8 mm in diameter; internodes 1–3 cm long. *Leaves* opposite, petiolate; petiole c.15 cm long, with broad wings down either side and joining across the node; blades membranous or nearly so, ovate or oblong, $20\text{--}25 \times 8\text{--}15$ cm, apex obtuse, base more or less truncate and then attenuate into the petiole wings, margin entire, minutely pubescent above, sparsely sublanate beneath, with thicker indumentum when young; veins obscure above, raised beneath, lateral veins 10–12 pairs, tertiary venation indistinctly reticulate. *Inflorescence* not seen but likely to be subterminal cymose from the bifurcations in the infructescence with 4 cymelets from the apex of the peduncle, with 2 leaflet-like bracts $c.4.5 \times 3$ cm; the cymelet in the infructescence 20 cm long, 15 cm across, many-flowered. *Flowers* not seen. *Infructescence* nearly glabrous, pedicel 1–3 cm long, slender, more or less minutely glandular, with sepal-like bracts; calyx persistent, c.2 mm long, 5-lobed to the base, lobes narrow-ovate. *Fruit* a slender capsule, c.2.5 cm long, 1.5 mm in diameter, glabrous, spirally twisted.

Distribution. Thailand. Known only from the type.

Habitat and ecology. Doi Chiang Dao is a limestone mountain.

Proposed IUCN conservation assessment. Data Deficient (DD). Doi Chiang Dao is in a large national park and the area of limestone within the park is extensive. However,



FIG. 11. *Paraboea chiangdaoensis* Z.R.Xu & B.L.Burt. A, habit and detached infructescences; B, indumentum on leaf undersurface.

the plant has only been collected once and the locality data on the specimen are not specific enough to judge if there are any threats to the particular site where this plant grows. This species was, however, included in Pooma (2005) as threatened in Thailand.

The species is easily distinguished by its large leaves, truncate leaf bases, conspicuously winged petioles, and the pubescence on the upper leaf surface.

17. *Paraboea clarkei* B.L.Burt, Kew Bull. 1948: 56 (1948); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 426 (1984). – *Didymocarpus paraboea* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5: 100 (1883). – Type: Sarawak, 1857, Lobb s.n. (holo K). **Fig. 12.**

Perennial herb with a short stem but a distinct rhizome up to 40 cm long, 1.5 cm thick, with a brownish matted indumentum throughout the plant. *Leaves* opposite, congested in the upper part of a stem, but sometimes internodes extending to 1.5 cm long; petiole short, 1–2 cm long, rarely up to 4 cm long, with 2 auriculate wings in the lower part, up to 2 cm long, 1.5 cm wide, each joined to the one on the opposite leaf at the node, with a yellowish brown matted indumentum; blades elliptic to slightly obovate, 10–25 × 4.5–14 cm, c.2 times as long as wide, apex obtuse to rounded, base more or less rounded, margin shallowly dentate, upper surface with a dense pubescence, lower surface with a yellowish brown to brown matted indumentum; veins smooth above, prominently raised beneath, lateral veins 8–12 pairs, tertiary venation reticulate. *Inflorescence* an axillary cyme, normally longer than the leaves, 15–45 cm long, up to 15 cm wide when mature, lax, many-flowered, with a yellowish brown matted indumentum throughout except for the flower; peduncle slender, 10–30 cm long, up to c.2 mm in diameter, two primary bracts narrowly triangular, up to c.1 cm long, 2.5 mm wide; pedicels 3–5 mm long, with sepal-like secondary bracts. *Flower* very small, c.3.5 mm long, 5 mm across. *Calyx* < 1 mm long, 5-lobed to the base, lobes ovate or narrowly so, glabrous outside, farinose inside. *Corolla* white or very pale mauve, c.5 mm long, 17 mm across; tube c.1.2 mm long, limb indistinctly 2-lipped; upper lip with 2 lobes, ovate, c.2 × 2 mm, lower lip with 3 lobes, ovate, c.2.5 × 2.2 mm. *Anthers* yellow, widely ovate or ± triangular, c.1.3 × 1.5 mm, almost erect, opening in the centre of the anther locules, coherent with each other; filaments c.1.5 mm long, inserted at the corolla base. *Gynoecium* c.5 mm long; ovary c.1.5 × 1.2 mm; style distinct, 3 × 0.2 mm; stigma not enlarged, all glabrous. *Fruit* a linear, small, non-twisted capsule, c.1 cm long. *Seeds* flattened, ovoid.

Distribution. Malaysia: Sarawak.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. MALAYSIA. **Sarawak:** s.l., 11 ii 1914 (fr), *Native Collector* 2553 (E, K, P, US); ii–vi 1914 (lv), *Native Collector* 2071 (US); Kuching Division, G. Umbut, Bau, 27

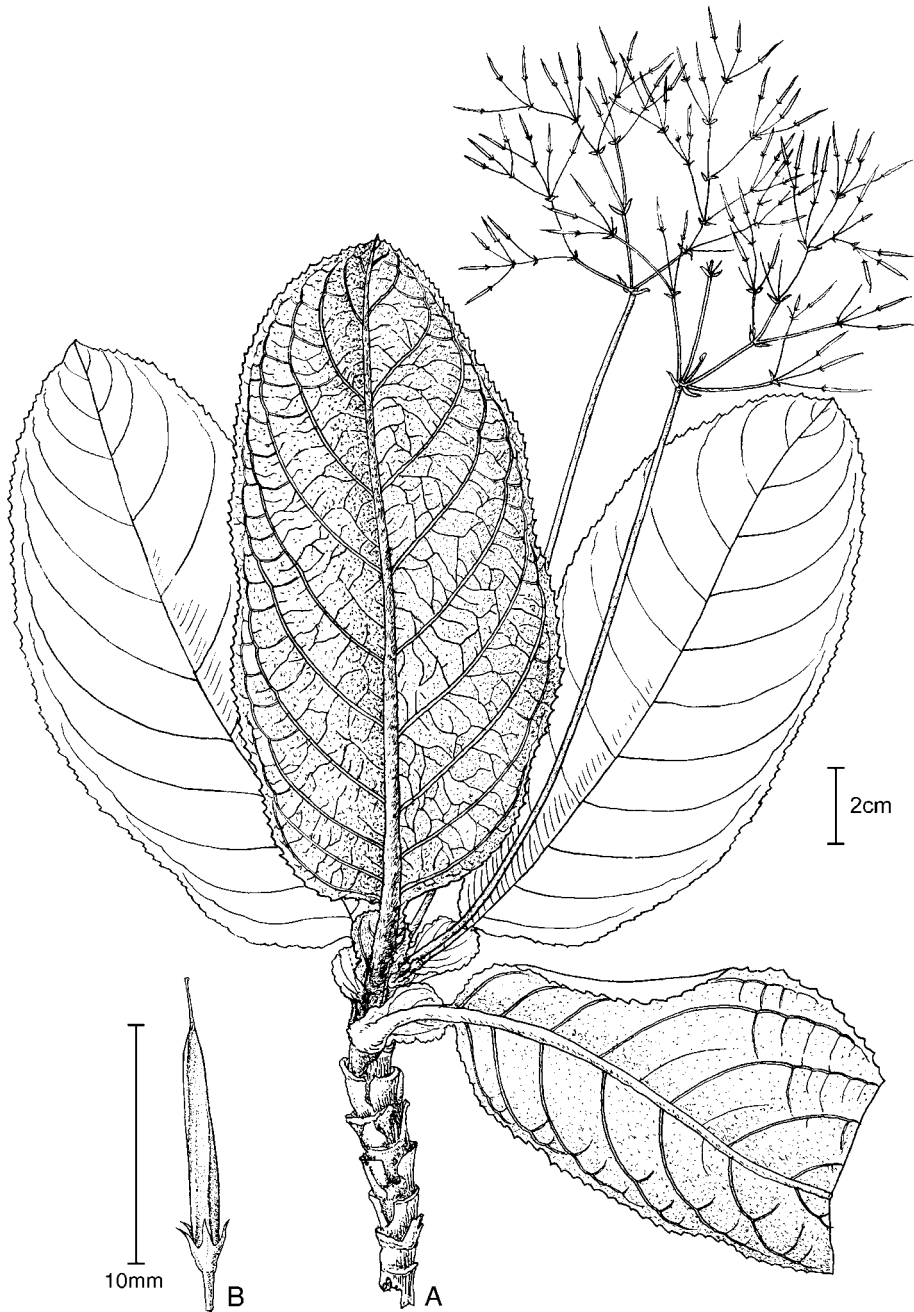


FIG. 12. *Paraboea clarkei* B.L.Burtt. A, habit; B, fruit.

iii 2002 (fr), *J. Sang et al.* SBC2577 (SAR); Gn. Krian, Bau, 21 xi 2001 (fr), *D. Malcom et al.* SBC1140 (SAR); G. Doya, Bau, 3 x 2002 (fl), *S.B. Raymond & J.J. Stephen* SBC3455 (SAR); Gunung Bar, Mambong, Penrissen, Kuching, 19 ii 1993 (fr), *L.S. Teck & Rantai* S66017 (SAR); Bau hills, south of Kuching, 10 vii 1963 (fr, fl), *F.R. Fosberg* 43831 (NY, US); Bukit Gajah, Bau, 9 ii 1999 (fl), *Jamree et al.* S82073 (SAR); River Braang, 350 m, vi 1890 (fl, fr), *G.D. Haviland* s.n. (K); 1st Division, Bau [01°45'N 110°00'E], 70 m, vi 1957 (fl, fr), *J.A.R. Anderson* 9078 (K, L, SAR); Gunong Tabal, Tai Ton, Bidi Road, Krokong Bau, 22 iii 1999 (fr), *Patsipun, Jugah et al.* S79999 (SAR); Bukit Daya, Bau, 100–250 m, 20 iv 1957 (fl), *J.A.R. Anderson* 7753 (SAR); Bau, 13 xi 1955 (fl, fr), *W.M.A. Brooke* 10771 (L); 1st Division, Bukit Mentawa, limestone hill at Teng Bukap on road to Padawan [01°10'N 109°55'E], 20 x 1979 (fl, fr), *B. Bremer & Bremer* 1697 (L, SAR); *ibid.*, at summit of limestone, 1929 (fr, fl), *Clemens & Clemens* 20590 (A, K, MO, NY, SAR); Bukit Manok, Padawan, 300 m, 1 iii 1969 (fr), *Erwin & Paul* S27413 (SAR); Gunong Braang, Padawan District, 1st Division, 7 v 1975 (fl, fr), *B.L. Burtt* 8097 (E); Gunong Regu, Padawan District, 8 v 1975 (fl, fr), *B.L. Burtt* 8104 (E); Bau District, Gunong Tabai, E of Bidi, 18 v 1975 (fr), *B.L. Burtt* 8160 (E); Bukit Serapat, 13 miles on Kuching–Simanggang road, 25 vii 1967 (fl, fr), *B.L. Burtt & Martin* 4748 (E); 1st Division, Bau, Seburan mine, 15 v 1962 (fr), *B.L. Burtt & P.J.B. Woods* 1831 (E); Bau District, Bukit Kapor, 22 v 1962 (fr), *B.L. Burtt & P.J.B. Woods* 1877 (E); 1st Division, Gunong Staat, 100–300 m, 25 v 1964 (fr), *B.L. Burtt & P.J.B. Woods* 1928 (E); 1st Division, 30 km SW of Kuching, Seburan, Bau, 500 m, 14 ix 1958 (fl), *M. Jacobs* 5474 (K, L, SAR, US); Bukit Tebong, Bau District, 1st Division, 100 m, 11 viii 1970 (fr), *P.F. Lehmann* 394 (E); 1st Division, Jambusan limestone hill, Gunong Batu, 170 m, 8 x 1977 (lv), *P.J. Martin* S39298 (E, K, KEP, SAR); Bukit Jambusan, Bau, 100 m, 26 ix 1987 (fl, fr), *Yii et al.* S50339 (SAR); Bidi Caves, 1924 (fl), *E. Mjöberg* s.n. (UC); Bukit Bidi, 40 m, 26 ix 1987 (fl), *Yii et al.* S50385 (SAR); Bidi Cave, Ulu Sarawak, xii 1932 (fl, fr), *P.W. Richards* s.n. (K); 1st Division, Jambusan, near Bau, ix 1905 (fl), *H.N. Ridley* 72438 (K); 1st Division, Bau, Base of Gunong Taiton, 9 iii 1949 (fl, fr), *J. Sinclair* 5686 (E); 4th Division, Lobang Rusa [= Gua Rusa] (deer cave), Tutoh, Baram District, NE entrance to cave [04°01'N 114°50'E], 7 x 1971 (fr), *J.A.R. Anderson* S31822 (K, SAR); Baram District, Gua Rusa, [04°02'N 114°50'E], 70 m, (fl, fr), *G. Argent & Kerby* 620 (E); 4th Division, Gunung Mulu National Park, Sungei Melinau at Batu Bungar [04°02'N 114°50'E], 29 vi 1962 (fr), *B.L. Burtt & P.J.B. Woods* 2337 (E); 4th Division, Gunung Mulu National Park, Gunong Api foothills, [04°02'N 114°51'E], 500 m, 13 ii 1966 (fl), *W.L. Chew* CWL1108 (K, L); *Cult. in E* C6030 (E); 4th Division, Gunung Mulu National Park, along Sungai Melinau from S Tutoh to Lobang Bungan, foot of Gunung Mulu, 14 iii 1964 (fl), *M. Hotta* 14405 (K).

This species is the type species for *Paraboea* (C.B. Clarke) Ridl. selected by Burtt (1984). It is distinct and characterised by the auriculate petiole and the large axillary cyme that develops subordinate branches below the two primary branches at the top of a peduncle. In Sarawak this species seems to have no close allies. It may be related to *Paraboea laxa* and *P. vulpina* from Peninsular Malaysia as these species also develop the subordinate branches in a cyme.

18. *Paraboea cochinchinensis* (C.B. Clarke) B.L. Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 427 (1984). – *Boea cochinchinensis* C.B. Clarke in A. DC. & C. DC., Monogr. Phan. 5: 143 (1883). – Type: Vietnam, Kien Giang, Montagne de Da Bac, ile de Phu Quoc [10°15'N 104°04'E], x 1878 (fr), *M.C. Godefroy-Lebeuf* 859 (holo K; iso P). **Fig. 13.**

Perennial herb with a very short stem, seemingly rosulate. *Leaves* opposite, petiolate; petiole < 5 cm long, with a matted indumentum; blades papery, ovate or elliptic, up

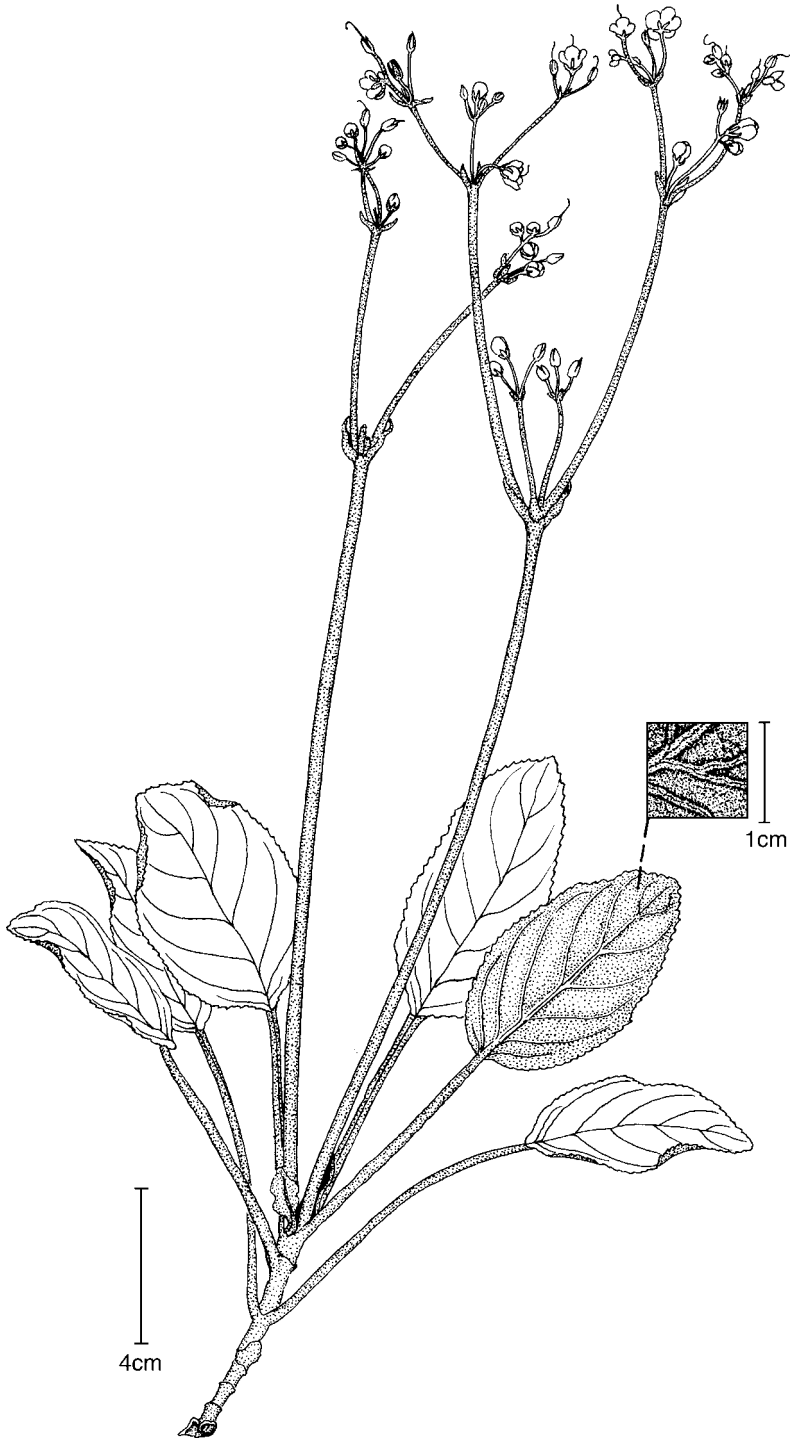


FIG. 13. *Paraboea cochinchinensis* (C.B.Clarke) B.L.Burtt.

to 8×3 cm, c.2 times as long as wide, apex obtuse, base short-angustate, margin entire, upper surface with some arachnoid covering when young and then glabrescent, lower surface with a greyish to brownish matted indumentum; veins smooth above, visible beneath, lateral veins 6–8 pairs, tertiary venation obscure. *Flowers* not seen. *Infructescence* subterminal, cymose, from axils below the apical bud, several-flowered, c.18 cm long; peduncle slender, c.9 cm long, with small ovate bracts, glabrous; pedicels rather slender, < 10 mm long; calyx persistent, 5-lobed to the base, lobes narrowly ovate, < 3 mm long, glabrous. *Fruit* a very slender capsule, c.2 cm long, open valves twisted. *Seeds* not seen.

Distribution. Vietnam. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

The type is the only material available for this specific name and the material is very poor with only two too-old cymose infructescences and without any flowers or undehisced capsules. It is difficult, therefore, to make conclusions as to its specific status and relationships with other species. It shares a subterminal inflorescence and an extremely short stem with *Paraboea pubicorolla* but the very slender peduncle and pedicels of *P. cochinchinensis* distinguishes it from that species. Although we suspect that *Paraboea cochinchinensis* may be related to *P. harroviana*, *P. prolixa* and *P. pubicorolla*, and could be conspecific with one of these, the poor type material of this species makes any taxonomic certainty impossible and further fieldwork in the type locality is necessary.

19. *Paraboea crassifolia* (Hemsl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 427 (1984). – *Boea crassifolia* Hemsl., J. Linn. Soc., Bot. 26: 233 (1890). – *Dorcoceras crassifolium* (Hemsl.) Schltr., Bot. Jahrb. 58: 259 (1923). – Type: China, Hupeh [Hubei], Ichang, Nanto [Nanjinguan, 34°47'N 111°18'E] and Mts to northward, x 1887 (fl), Henry 3960 (lecto E, first step designated by Burt (1984: 427), second step designated here; iso K, US).

Perennial rosulate herb. *Leaves* sessile, obovate, 3–16 \times 1.5–5 cm, 2–3 times as long as wide, apex rounded, base long-attenuate, margin entire or crenate, upper surface glabrous or with some remaining arachnoid indumentum, lower surface with a greyish or brown matted indumentum; veins smooth above, prominent beneath, lateral veins c.7 pairs, tertiary venation reticulate. *Inflorescence* axillary, cymose, normally longer than the leaves, 6–12 cm long, 2–5 cm wide, several-flowered, with a matted indumentum or glabrescent; peduncle 3–7 cm long, peduncle bracts and pedicel bracts sepal-like; pedicels c.10–15 mm long. *Calyx* c.2 mm long, 5-lobed, lobes narrow-oblong or ovate, mostly glabrous. *Corolla* violet with yellow patches, c.1.2 cm long, 1 cm across when fully open; tube c.7 mm long, limb 2-lipped; upper

lip c.4 mm long, 2-lobed, lobes wide-ovate, c.3.5 × 5 mm, lower lip c.6 mm long, 3-lobed, lateral lobes wide-ovate, c.5 × 6 mm, middle lobe rounded, c.3.5 × 4 mm. *Anthers* transversely ellipsoid, c.1 × 3 mm, coherent with each other, opening at each end of the anther; filaments inserted at c.4 mm from the corolla base with a free part c.3–4 mm long, strongly swelling near the base to form a knee. *Gynoecium* c.8 mm long, 1.2 mm wide at the ovary base; stigma slightly larger than style. *Fruit* a linear capsule, c.2 cm long, glabrous, spirally twisted.

Distribution. Southwest and central China.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. CHINA. 1900–1920 (lv), *J. Cavalerie* 3145 (P); 2700 m, vii 1921 (fl), *R.P. Maire* s.n. (P); 750 m, (fl), *R.P. Maire* s.n. (P). **Hubei:** iii 1889 (fl), *A. Henry* 6363 (K, P); v 1901?, *E.H. Wilson* 507 (E, NY, P, US, W); Nanto [Nan2jin1guan1] [30°45'N 111°12'E], (fl), *E.H. Wilson* 876 (E). **Sichuan:** Changjiang, Wushan Gorge [31°06'N 109°51'E], (fl), *E. Faber* 797 (K, W); Wushan Gorge, (fl), *E.H. Wilson* 1903 (E). **Yunnan:** 24 vii 1908 (fl), *F. Ducloux* 5572 (P); Loping, on limestone hills [24°52'N 104°14'E], 1200 m, 20–25 ix 1985 (fr), *Z.R. Xu* LM4988 (E, SYS).

See discussion under *Paraboea neurophylla*.

20. *Paraboea detergibilis* (C.B.Clarke) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 24: 46 (1962); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 427 (1984). – *Didymocarpus detergibilis* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5: 107 (1883). – Type: [Indonesia], Ins. Billiton [as Belitong Island, 03°00'S 107°30'E], 1876 (fl, fr), *Riedel* s.n. (holo FI; iso E).

Perennial caulescent or rosette-like herb; stem (rhizome?) reaching to more than 20 cm long (most probably trailing on the ground) with roots at the nodes, with a dense and thick layer of whitish matted indumentum. *Leaves* oppositely congested, rosette-like, or quite remotely cauline with internodes up to 6 cm long, petiolate; petiole c.2–8 cm long, with the same indumentum as that on the stem; blades ovate or narrowly so, 5–11 × 2.5–5.5 cm, c.1.5–3 times as long as wide, apex obtuse, base widely cuneate or rounded, margin entire, upper surface arachnoid when young and then glabrescent when mature, lower surface with a whitish matted indumentum especially on the veins forming a beautiful reticulate appearance; veins smooth above, raised beneath, lateral veins c.8–10 pairs. *Inflorescences* axillary, cymose, often more than one in an axil, normally longer than the leaf, 10–20 cm long, few-flowered, with some matted indumentum when young and later glabrescent; peduncles 8–18 cm long, with sepal-like bracts, glabrescent; pedicels 5–12 mm long, glabrous. *Calyx lobes* narrowly ovate, c.1.5 × 0.7 mm, glabrous outside, more or less minutely sessile-glandular inside. *Corolla* pale purple or pale blue purple, 5–6 mm across, 10 mm long; tube distinct, c.4.5 mm long, limb 2-lipped; upper lip much

smaller, 2-lobed, lobes ovate, 2×2.5 mm, lower lip 3-lobed, middle lobe ovate, $c.3.5 \times 3.5$ mm, lateral lobes $c.3.5 \times 4$ mm. *Anthers* transversely ellipsoid, $c.1.5 \times 2$ mm, opening in the centre of the anther locules, coherent with each other, dorsifixed; filaments 3 mm long, inserted at the extreme base of the corolla, curved resulting in the anthers turning towards the gynoecium. *Gynoecium* $c.3.5$ mm long; ovary 1.2 mm wide; style short or indistinct, $c.0.3$ mm wide; stigma slightly larger. *Fruit* a linear non-twisted capsule, $c.2.5$ cm long, 1.2 mm wide, glabrous. *Seeds* ellipsoid, 0.5×0.15 mm.

Distribution. Indonesia (Billiton, Bangka, west Sumatra) and Malaysia (Sarawak).

Habitat and ecology. Reported from limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. s.l., (fl), *W. Hutton* s.n. (K). INDONESIA. **Bangka:** G. Mangkol Pangkat Pinang [02°50'S 106°00'E], 200–397 m, 28 xi 1917 (fl, fr), *Buennemeyer* 2114 (L); G. Mangkol, 50 m, 9 xii 1949 (fl, fr), *A.J.G.H. Kostermans & Anta* 619 (E, K, L); *ibid.*, 23 x 1949 (fl), *A.J.G.H. Kostermans & Anta* 1246 (K, L). **Sumatra** (province unknown): Mont Gangir, (fr), *Teysmann* s.n. (L).

MALAYSIA. **Sarawak:** Path to G. Gaharu, (Endau Jelutong) between Ulu Sg. Sabal Tapang & Aping, 70th Mile, Serian/Simanggang Rd, 400 m, 10 iv 1974 (fl), *Ilias & Azagari* S35610 (SAR).

It is not difficult to recognise this species with its reticulate venation and a whitish (silvery) matted indumentum that adds to its remarkable appearance. Its affinities within the genus are obscure.

21. *Paraboea dictyoneura* (Hance) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 427 (1984) [but excluding *Boea harroviana* Craib and *Boea treubii* sensu Pellegrin in Lecomte, Fl. Indo-Chine 4: 544 (1930)]. – *Boea dictyoneura* Hance, J. Bot. 21: 169 (1883). – Type: China, Canton, Lien-chau, v 1880 (fl), *Henry* 21741 in herb. Hance (holo BM; iso K). [The collector confused the type locality by spelling the name of the provincial capital city (Canton = *Guangzhou*) to represent the province of *Guangdong*. Lien-chau (= Lianxian) is not the suburban area of the provincial capital, but is rather a county in the northern part of the province, more than 200 km from the provincial capital. The area has typical limestone landscapes.] **Fig. 14.**

Boea hancei C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5: 144 (1883). – Type: China, Canton, Lien-chau, v 1880 (fl), *Henry* 21741 in herb. Hance (holo K; iso BM). Note this is the same type collection as *Boea dictyoneura*.

Perennial rosulate herb, sometimes with a short rhizome from rock crevices, $c.10$ cm long, 7 mm in diameter. *Leaves* sessile or with a short petiole up to 3 cm long; blades narrowly obovate-elliptic, $c.7-15 \times 2-4.5$ cm, 2–3.5 times as long as wide, apex acute or obtuse, base long-attenuate to the rosette and slightly swelling at the very base, margin more or less serrulate, upper surface with some arachnoid

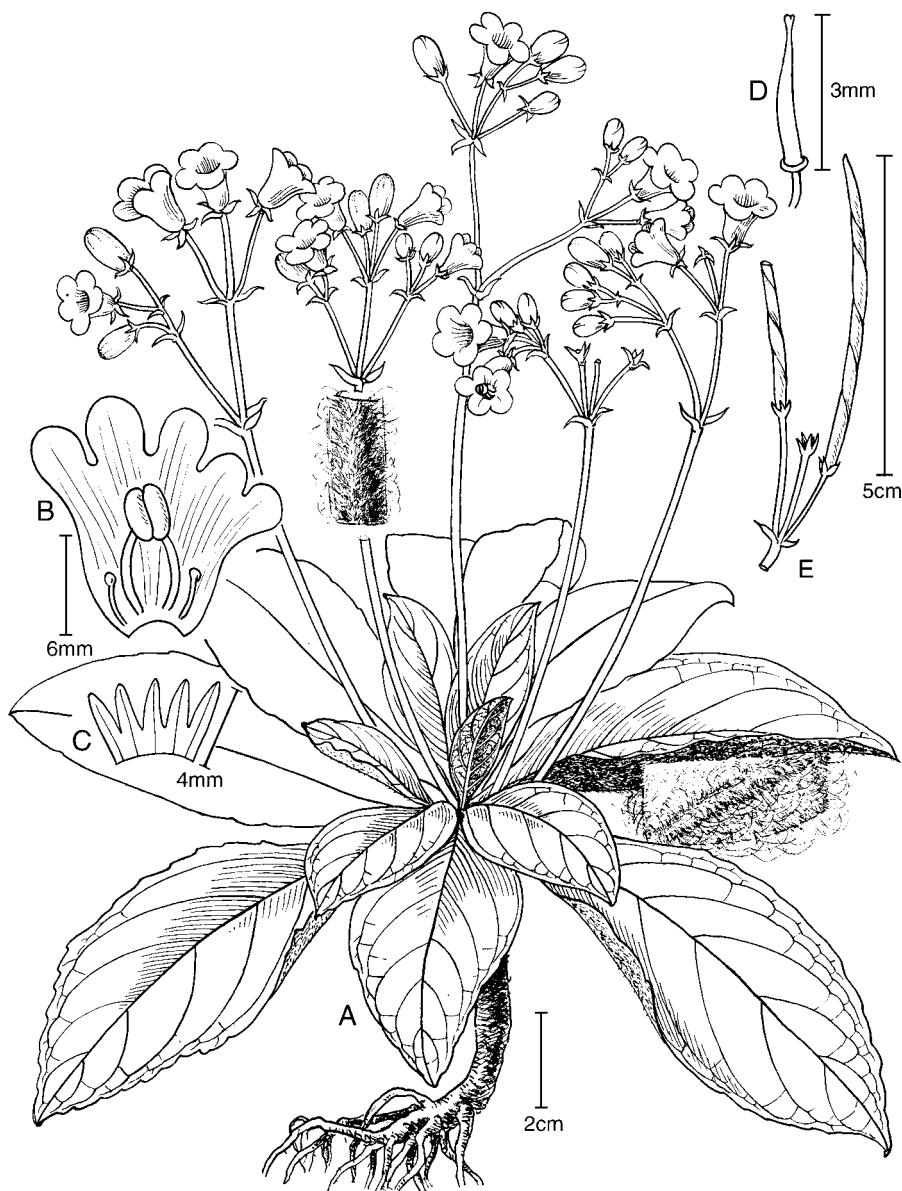


FIG. 14. *Paraboea dictyoneura* (Hance) B.L.Burtt. A, habit; B, corolla opened out; C, calyx opened out; D, pistil; E, fruits.

covering when young and then glabrescent, lower surface with a greyish matted indumentum; veins smooth above, raised beneath, lateral veins 6–10 pairs, tertiary venation conspicuously reticulate on the lower leaf surface. *Inflorescence* axillary, cymose, normally longer than the leaves, 10–15 × 4–5 cm, at first covered by

the same indumentum as that on the lower leaf surface, later glabrescent; peduncle 8–12 cm long with bracts narrowly ovate, c.5 mm long; pedicels 5–15 mm long, with bracts narrowly ovate, c.2 mm long. *Calyx* c.6 mm long, 5-lobed, lobes narrowly ovate, c.5 × 1 mm, with a matted indumentum outside and glabrous inside. *Corolla* purple, c.1.3 cm long, 1.3 cm across when fully open; tube c.6 mm long, swelling where the filaments are inserted, limb 2-lipped; upper lip 2-lobed, lobes widely ovate, c.4.5 × 5 mm, lower lip c.8 mm long, 3-lobed, the middle lobe similar in shape and size to the lateral lobes, wide-ovate, c.6 × 7.5 mm. *Anthers* transversely ellipsoid, c.2 × 3.5 mm, apex pointing towards the gynoecium, basifixed, coherent with each other; filaments inserted at the corolla base in line with the connections between the middle lobe and the two lateral lobes of the lower lip, attached at c.1 mm from the corolla base with a free part c.7 mm long, glabrous; two distinct staminodes, c.4.5 mm long, filament-like, inserted at the corolla base in line with the connection between the lower lip and the upper lip, and one indistinct staminode about half the length of the other two and much thinner, inserted at the corolla base in line with the connection between the two upper lobes. *Gynoecium* glabrous, c.10 mm long, 1 mm wide at the ovary base; stigma not much enlarged. *Fruit* a linear capsule, c.3.5–6 cm long, 2 mm wide, glabrous, slightly twisted. *Seeds* narrowly ellipsoid, c.1 × 0.3 mm.

Distribution. Northern Vietnam and southern China.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats. This species was, however, included in Pooma (2005) as threatened in Thailand.

Additional specimens examined. CHINA. **Guangdong:** Ruyuan County [24°50'N 113°20'E], 14 v 1933 (fr), *X.P. Gao* 52605 (IBSC, xero. E); Ruyuan [24°50'N 113°20'E], 16 iv 1934 (fl, fr), *S.B. Guo* 80229 (IBSC, xero. E); Yunfou [Yun2fu2] [22°58'N 110°02'E], 10 iii 1937 (fl), *Z. Huang* 40818 (IBSC); N Guangdong, 1940 (fl), *T.R. Liu* 104 (IBSC); Lian County [Lian2xian4] [24°50'N 112°25'E], 300 m, 20 vi 1984 (fr), *Nanling Survey Exp.* 121 (IBSC); Lu Tseh Tsung, Yun Fou District [Yun2fu2], 300 m, 24 i 1928 (fl), *C.T. Wuang* 496 (E).

VIETNAM. **Thanh Hoa:** Kien Khe, Mt. Ba Lam [20°40'N 105°40'E], 12 iii 1884 (fl, fr), *R.P. Bon* 2501 (P).

Burt (1984) reduced *Boea harroviana* Craib to synonymy of this species, thereby adding Thailand to the distribution of *Paraboea dictyoneura*. However, *Boea harroviana* Craib has a subterminal cymose inflorescence with a distinct stem, while *Paraboea dictyoneura* possesses a true axillary cyme from basal leaves. They are two good species.

The type material only has a young inflorescence with flower buds. However, *Liu Rutang* 104 (IBSC), with mature flowers, and *Nanling Survey Exp.* 121 (IBSC), with mature fruits, have also been collected from the type locality.

The flower of this species is similar to those of *Paraboea martinii* and related species. The corolla tube is long and unequal, swelling at the base on the ventral side, and the limb is indistinctly 2-lipped with 5 lobes of almost similar size and shape. The gynoecium is linear, without a clear distinguishable boundary between the ovary and the style. Based on the morphology of the inflorescence and the habit it is possibly related to *Paraboea crassifolia* and *P. neurophylla*.

22. *Paraboea divaricata* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 428 (1984). – *Boea divaricata* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 75 (1905).
– Type: Peninsular Malaysia, Langkawi, Ayer Hangat, xi 1901 (fr), *Curtis* 3683 (lecto SING, designated by Burt (1984: 428); iso K).

Perennial rosulate herb with a short stem c.30 cm tall. *Leaves* in crowded whorls of 3–4, sessile, elliptic or nearly so, 15–25 × 6–9 cm, 2–3 times as long as wide, apex obtuse, base long- or short-attenuate, margin serrate or serrulate, upper surface pubescent, lower surface with a sparse brown matted indumentum; veins obscure above, raised beneath, lateral veins c.10–16 pairs, tertiary venation reticulate. *Inflorescence* of subterminal cymes, c.60 cm long, 20 cm wide, with many flowers, with a sparse brown or greyish matted indumentum throughout except on the corolla and inside when young, later ± glabrescent; peduncle c.45 cm long, quite robust, 4 mm in diameter, with bracts narrowly ovate, c.1 cm long; pedicels 2–5 mm long with sepal-like bracts. *Calyx* c.1 mm long, 5-lobed to the base, lobes narrowly ovate. *Corolla* c.1 cm across when open; tube c.1.5 mm long, limb 2-lipped; upper lip wide-ovate, c.2.5 × 3 mm, 2-lobed, lower lip c.3.5 × 5 mm, 3-lobed, middle lobe slightly longer than the lateral lobes, c.1.5 × 1.8 mm. *Anthers* ellipsoid, c.1 × 2 mm, coherent with each other, dehiscent longitudinally, apex pointing upward, dorsifixed; filaments inserted nearly at the throat of the corolla with a free part c.1.5 mm long, curved. *Gynoecium* c.5 mm long; ovary clearly distinguishable from the style; stigma not larger than style. *Fruit* a linear, very delicate, capsule, c.1–2 cm long, glabrous, spirally twisted. *Seeds* ellipsoid, c.0.5 × 0.2 mm, glabrous.

Distribution. Peninsular Malaysia: Langkawi.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Vulnerable (VU D2). This species is currently only known from three collections from Langkawi. Although Ayer Hangat is a forest reserve the limestone areas of Langkawi are not fully protected and it should be considered Vulnerable.

Additional specimens examined. MALAYSIA. **Kedah:** Pulau Langkawi, N end [06°28'N 99°50'E], 30 iv 1962 (lv), *B.L. Burt & P.J.B. Woods* 1775 (E); Batu Puteh ['white rock'], Langkawi [06°20'N 99°48'E], 20 xi 1941 (fr), *E.J.H. Corner* s.n. (SING); Ayer Hangat, Langkawi [06°25'N 99°49'E], xi 1901 (fl, fr), *Cult. in K* [from *Curtis* 3683] (K).

Burt & Wood's collection (sterile, E) is from Langkawi, but Corner's collection is 'from Langkawi; near Ayer Hangat, but not flowering, and then flowering in the Bot. Gard. Penang in Oct.-Nov'. The latter specimen bears flowers and fruits.

Although this species has leaves in whorls of 3–4 and *Paraboea patens* opposite leaves, they are likely to be related as they share a similar inflorescence structure and similar flowers and capsules.

23. *Paraboea effusa* B.L.Burt, Bot. J. Linn. Soc. 85: 28 (1982); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 428 (1984). – Type: Sarawak, Gunung Mulu National Park, Gunong Api [04°02'N 114°50'E], 1000 m, 12 vi 1975 (fl, fr), *Burt* 8249 (holo E; iso E, SAR). **Fig. 15.**

Perennial caulescent subshrub; stem woody, up to 1 m tall, 1 cm in diameter, internodes short or long, 1–10 cm, with some brown matted indumentum when young and then glabrescent. *Leaves* opposite or in whorls of 3, short-petiolate; petiole 0.5–2 cm long; blades narrow-elliptic, more or less obovate, 10–30 × 3.5–7 cm, c.3–4 times as long as wide, apex acute or short-acuminate, base attenuate, margin entire, upper surface arachnoid and glabrescent, lower surface with a yellowish-white to light brown matted indumentum; veins smooth above, raised beneath, lateral veins 16–25 pairs, tertiary venation invisible. *Inflorescence* terminal paniculate, quite lax, with some arachnoid covering and matted pubescent but often glabrescent, flowers glabrous; flowering stem 25–75 cm long, the lowest internodes 2.5–20 cm long; floral leaves somewhat smaller than the vegetative leaves; 3–4 cymes from each node; cymes from lower axils up to 15 cm long, many-flowered; peduncle 6–12 cm long, peduncle bracts narrow-ovate, 5–6 mm long, pedicel bracts sepal-like; pedicel c.5–10 mm long. *Calyx* c.2 mm long, 5-lobed, lobes narrow-ovate. *Corolla* lilac, light purple or bright blue, glabrous, c.7 mm long, 10 mm across when fully open; tube 2.5 mm long, limb 2-lipped; posterior lip 2-lobed, lobes ± rounded, c.5 × 5 mm; anterior lip c.10 mm long, 3-lobed, middle lobe longer than the lateral lobes, ± rounded, lateral lobes similar in shape, c.4 × 6.5 mm. *Anthers* yellow, transversely ellipsoid, c.2 × 3.5 mm, coherent with each other at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoeceum, dorsifixed; filaments inserted at c.3 mm from the corolla base with a free part c.4 mm long. *Ovary* ovoid, distinct from the style, c.1.5 × 1 mm; style 2–5 mm long, narrower; stigma capitate, not much larger than style. *Fruit* a linear or narrowly oblong, spirally twisted capsule, 1.5–2.5 cm long, 1.2 mm wide, glabrous. *Seeds* narrowly ellipsoid, c.8 × 2 mm.

Distribution. Malaysia: Sarawak.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). The conservation assessment given reflects the fact that although this species is known from one small region that region is Gunung Mulu National Park which is a World Heritage Site and well protected.

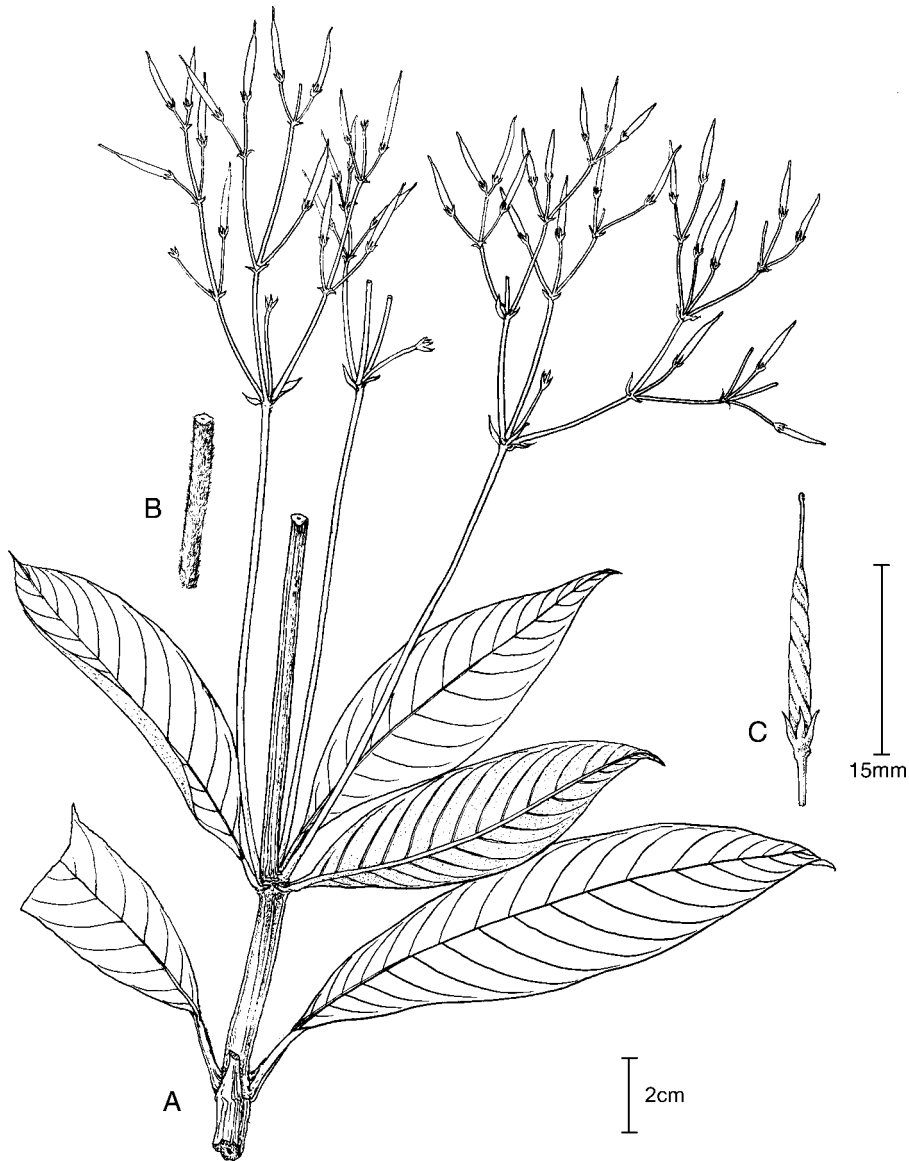


FIG. 15. *Paraboea effusa* B.L.Burt. A, habit; B, section of peduncle; C, fruit.

Additional specimens examined. MALAYSIA. **Sarawak:** 4th Division: Baram District, Gunung Mulu National Park, Melinau Gorge [04°08'N 114°54'E], 200 m, 2 xi 1977 (fl, fr), *G. Argent et al.* 651 (E, KEP); *ibid.*, 26 vi 1962 (fr), *B.L. Burt & P.J.B. Woods* 2309 (E); Limestone hills opposite Long Bala, Sungai Melinau, 200 m, 26 iii 1990 (fl), *P.C. Yii & A. Talib* S58809 (SAR); Gunung Mulu National Park, Below G. Buda, N of S. Medalam [04°02'N 114°50'E], 350 m, 21 vi 1975 (fr), *B.L. Burt* 8338 (E); Gunung Mulu National Park, Sungei Melinau, Bukit Sungei Pala, opposite base camp [04°05'N 114°50'E], 29 vi

1962 (fr), *B.L. Burt & P.J.B. Woods* 2347 (E); Gunung Mulu National Park, S. Melinau, Batu Bungar, (lv), *B.L. Burt & P.J.B. Woods* 2384 (E); Gunung Mulu National Park, G. Buda, 1000 m, 17 x 1977 (fl, fr), *P. Chai* S39903 (A, KEP, MO, SAR); Gunung Mulu National Park, Sungei Melinau [04°03'N 114°50'E], 133 m, 10 ii 1966 (fr), *W.L. Chew* 1069 (A, L); Gunung Mulu National Park, 180 m, 6 x 2001 (fl, fr), *Julaihi Lai* S86866 (SAR); Gunung Mulu National Park, Gunung Api, 890–1170 m, 29 iii 1990 (fr), *P.C. Yui & A. Talib* S58873 (SAR); near Gunung Mulu National Park, summit of limestone hills opposite Park H. Q., crevice of cliff [04°02'N 114°50'E], 23 iii 1981 (fl, fr), *J.S. Collette* 2356 (K); Gunung Mulu National Park Base Camp [04°05'N 114°54'E], 65 m, 21 i 1978 (fl, fr), *C. Hansen* 101 (E, SAR); Gunung Mulu National Park, NW of Sungai Lansat, 04°01'N 114°49'E, 15 xi 1977, *Argent et al.* 738 (E, SAR); Miri Division, Gunung Mulu National Park, 7 v 1985 (fl), *Abg. Mohtar et al.* S49645 (E); Miri Division, Sungei Tutoh, Melana Prot. For., 03°57'N 114°51'E, 600 m, 14 iv 1997 (fr), *R.M.A.P. Haegens, N. Klazenga, L.C.J. Julaihi, Rantai et al.* 337 (SAR).

Among the tropical species that have a terminal panicle and whorled leaves this species, together with *Paraboea meiophylla* and *P. apiensis*, is characterised by the glabrous calyx. The other species in this group have a matted indumentum on the calyx. *Paraboea effusa* can be distinguished from *Paraboea meiophylla* by the much larger leaves and from *P. apiensis* by the generally cuneate leaf base (see also discussion under that species).

24. *Paraboea elegans* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 428 (1984). – *Boea elegans* Ridl., J. Linn. Soc., Bot. 32: 522 (1896). – Type: Kedah, Kedah Peak (= Gunong Jerai) [05°47'N 100°27'E], vi 1893 (fr, fl), *H.N. Ridley* s.n. (lecto SING, designated by Burt (1984: 428)). **Fig. 16.**

Paraboea obovata Ridl., J. Straits Branch Roy. Asiatic Soc. 44: 71 (1905). – Type: Langkawi Isl., Gunong Chinchang (= Machinchang), ix 1890, *Curtis* s.n. (holo SING).

Perennial caulescent herb; stem up to 15 cm long, triangular when young, sometimes with a rhizome up to 15 cm long, with a whitish matted indumentum; internodes 5–40 mm long and elongating when flowering. *Leaves* in whorls of 3, sessile or petiolate (with petiole up to 6 cm long); blade narrow-elliptic, ovate or obovate, 4–9 × 1.5–4 cm, c.1.5–4 times as long as wide, apex acute or obtuse, base long-attenuate and joining across the node or widely cuneate but still with very narrow wings along the petiole to the node, margin entire, upper surface with some arachnoid covering, lower surface with a yellowish white matted indumentum; veins visible above, slightly raised beneath, lateral veins c.7 pairs, tertiary venation invisible. *Inflorescences* 1–4, subterminal, cymose, up to 30 cm long when fruiting, lax, with many flowers, with glandular pubescence on the peduncles, bracts, pedicels and calyces; peduncle stout, up to 23 cm long, with 2 narrow-ovate bracts c.2 mm long; pedicels 10–20 mm long. *Calyx* c.2 mm long, 5-lobed to the base, lobes ovate or narrowly so, c.2.3 × 1 mm. *Corolla* very pale lilac in open flower (in bud deeper lilac), with a short tube and a longer limb, c.1.7 cm across when fully open, limb not remarkably 2-lipped with 5 lobes of similar size and shape, lobes widely ovate, c.7 × 10 mm.

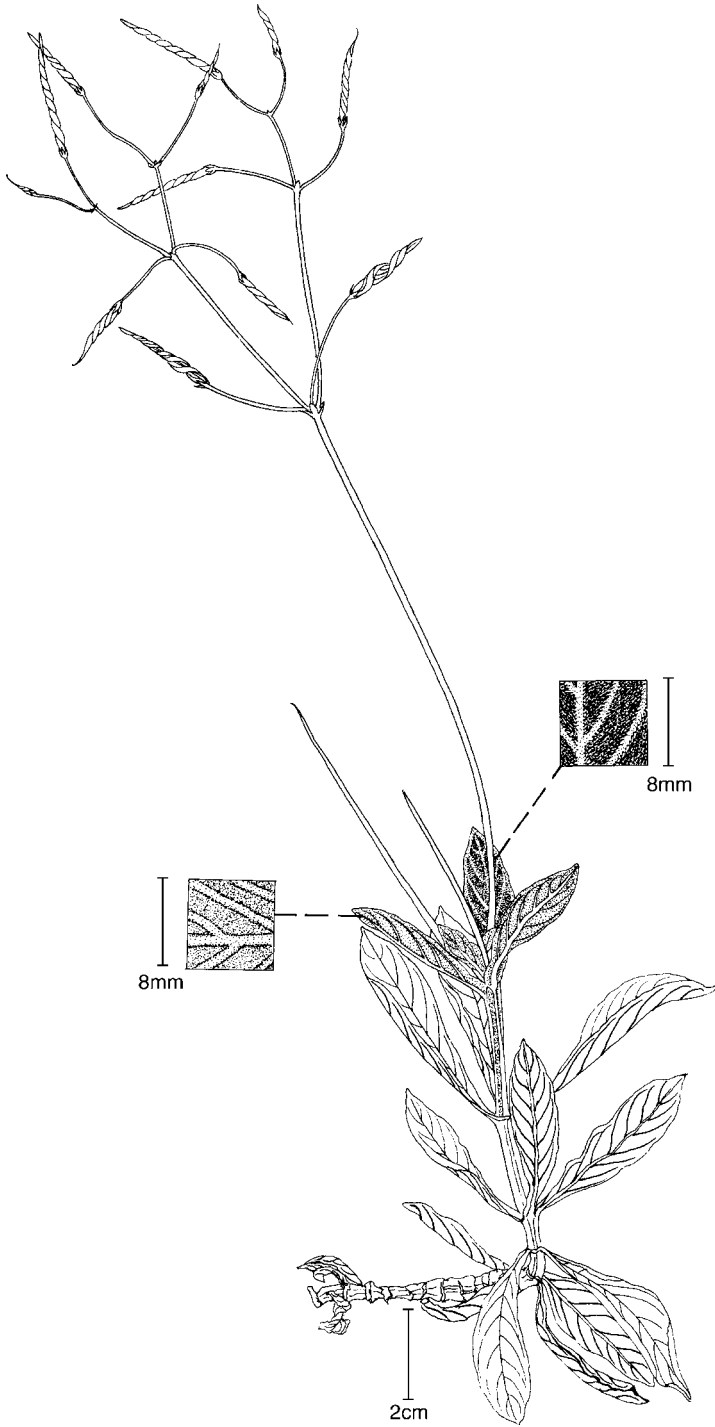


FIG. 16. *Paraboea elegans* (Ridl.) B.L.Burtt.

Anthers transversely ellipsoid, c.2 × 3.5 mm, coherent at the apex, opening in the centre of the anther locules, apex turned towards the gynoecium; filaments inserted at c.0.5 mm from the corolla base with a free part c.3 mm long. *Gynoecium* c.10 mm long, 1 mm wide at the ovary base; stigma much larger than style. *Fruit* a linear capsule, 2–3 cm long, 2 mm wide, glabrous, spirally twisted. *Seeds* narrowly ovoid, 0.5 × 0.2 mm.

Distribution. Peninsular Malaysia and Peninsular Thailand.

Habitat and ecology. On quartzite or granite outcrops.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites, some of which are in protected areas, and there are no major threats.

Additional specimens examined. MALAYSIA. **Kedah:** Kedah Peak [= G. Jerai] [05°47'N 100°27'E], 23 xii 1949 (fr), *B. Allen* s.n. (E); *ibid.*, 2 viii 1919 (fr), *M. Haniff & Mee* 4192 (K, SING); *ibid.*, 1000 m, 3 xii 1915 (fr), *H.C. Robinson & Kloss* 6062 (K); G. Jerai, 1984 (fr), *A. Weber* 84-0802 (KEP, WU); Pulau Langkawi, Gunung Machinchang [06°20'N 99°48'E], 8 viii 1986 (fr), *A. Weber* 86-0808 (WU); *ibid.*, 500 m, 1 v 1962 (fr), *B.L. Burtt & P.J.B. Woods* 1795 (E). **Selangor:** Ulu Selangor, Bukit Ulu Gombak [03°13'N 101°43'E], (fl), *KEP* 71586 (KEP).

THAILAND. **Satun:** Adang Island, Tarutao National Park [06°34'N 99°06'E], granite rocks, 300 m, 24 vi 1980 (fl, fr), *Congdon* 711 (AAU, E, PSU); Adang Island, near waterfall [Tarutao National Park], 22 x 1979 (fr), *Congdon* 87 (E).

Collections from Tarutao and Langkawi, previously *Paraboea obovata* but now reduced to synonymy (Burtt, 1971), differ from the typical sessile-leaved *P. elegans* by a distinct petiole up to 6 cm long. This species may be related to *Paraboea minor* and both are recorded from quartzite outcrops only. However, *Paraboea elegans* differs from *P. minor* in its whorled as opposed to opposite leaves.

25. *Paraboea evrardii* (Pellegr.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 428 (1984). – *Boea evrardii* Pellegr. in Lecomte, Fl. Indo-Chine 4: 550 (1930). – Type: Vietnam, Lam Dong, Pongour near Di Linh (= Djiring) (Tuyen Duc, Lam Dong) [11°41'N 108°16'E], 20 v 1929 (fl), *M. Evrard* 1177 (lecto P, designated by Burtt (1984: 428); iso E).

Perennial rosulate herb, sometimes with a rhizome up to 25 cm long, with a thick woolly indumentum. *Leaves* congested in a rosette or on an elongate rhizome, petiolate; petiole 2–4 cm long, with a woolly or matted indumentum; blades elliptic or rounded, c.5–7 × 2.5–4 cm, 1.5–2 times as long as wide, apex obtuse to rounded, base cuneate to rounded, upper surface with a distinct pubescence, lower surface with a greyish to brownish woolly (matted) indumentum; veins smooth or depressed above, raised beneath, lateral veins 5–8 pairs, more or less curved-ascending, tertiary venation indistinct or inconspicuous. *Inflorescence* axillary, cymose, rather tall but

not very spreading, c.14–25 × 2–7 cm, with few to many flowers, with a brownish woolly indumentum throughout except on the corolla and internal parts; peduncle 9–23 cm long, 1–1.5 mm in diameter, bracts indistinct; pedicels 2–10 mm long. *Calyx* 3 mm long, 5-lobed to the base; lobes ovate, 1.7 × 1.2 mm, with a brown matted indumentum outside, glabrous inside. *Corolla* blue, 10 mm across when fully open, 8 mm long; tube 2.5 mm long, pubescent outside, glabrous inside, limb 2-lipped; upper lip 2-lobed, lobes elliptic, 5 × 3 mm, lower lip 3-lobed, middle lobe larger than lateral lobes, ovate, c.5 × 5.5 mm, lateral lobes similar in size to the upper lobes. *Stamens* 2, inserted at 0.5 mm from the base of the lower lip; filaments straight, glabrous, c.1.7 × 0.5 mm; anthers yellowish farinose, ovoid, straight, not adnate to each other, c.2.2 × 1.2 mm, opening towards the top of the anther. *Ovary* greenish farinose, ovoid, 2.5 × 1 mm, with the same type of glands as on the anthers; style glabrous, c.3 × 0.3 mm; stigma a little larger than style, 0.4 mm in diameter, capitate, appearing pubescent. *Fruit* spirally twisted, 10–15 cm long, 1–2 mm in diameter. *Seeds* compressed.

Distribution. Vietnam.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. VIETNAM. **Quang Ngai:** Da Ban [14°45'N 108°43'E], 18 vi 1921 (fl, fr), *B. Hayata* 738 (P). **Ninh Thuan:** Phan Rang [11°34'N 108°59'E], vi 1909 (fl, fr), *A. C. D'Alleizette* s.n. (L); *ibid.*, 200 m, 20 viii 1922 (fl, fr), *E. Poilane* 20888 (P); Phan Rang, vallee du Song Cay [10°27'N 107°22'E], 28 ix 1940 (fl, fr), *E. Poilane* 30612 (P).

This species is part of the *Paraboea multiflora* group (see discussion under that species). When Pellegrin (1930) described *Boea multiflora* R.Br. var. *villosa*, he cited two specimens from Laos [*Thorel* 2353 (P) and *Poilane* 12188 (P)] and one specimen from Vietnam [*B. Hayata* 738 (P)] as syntypes for the varietal name. In this study we have lectotypified *Boea multiflora* var. *villosa* with *Poilane* 12188 and have removed *B. Hayata* 738 to *Paraboea evrardii*. *Hayata* 738 (P) has both white and violet flowers, rather intermediate between the Laos and Vietnamese collections. The corolla colour may not be reliable as a specific character in this genus and the status of this taxon may need to be reviewed in the future with more collections.

26. *Paraboea ferruginea* (Ridl.) Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 68 (1905); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 428 (1984). – *Boea ferruginea* Ridl., J. Linn. Soc., Bot. 32: 521 (1896). – Type: Peninsular Malaysia, Langkawi Island [c.06°20'N 99°48'E], ix 1890, *Curtis* 2566 (lecto SING, designated here; iso E).

Perennial herb, rosulate, sometimes with rhizome up to 10 cm long, with dense ferruginous long simple pubescence especially on petioles and inflorescence. *Leaves*

congested in a rosette, petiolate; petiole 2–10 cm long; blades \pm obovate, 3.5–9 \times 2.5–7.5 cm, c.1.5 times as long as wide, apex rounded to shallowly emarginate, margin \pm crenate, densely minute-pubescent above, with a ferruginous long pubescence and a brownish matted indumentum beneath; veins smooth above, raised beneath, lateral veins c.5 pairs, most of them inserted near petiole and so slightly similar to a palmate venation, tertiary venation visible. *Inflorescence* axillary, seemingly capitate, numerous flowers congested at the apex of a long peduncle, primary and secondary branches and pedicels hardly seen when in flower and pedicels extending to only 5–10 mm long in fruit, with ferruginous long pubescence on the whole inflorescence except for the fruit [the long hairs on the inside of the calyx can be as long as the calyx itself]; peduncle c.5–8 cm long, bracts sepal-like. *Corollas* not seen; calyx persistent, 6.5 mm long, 5-lobed to the base, lobes narrowly oblong. [Fide Ridley: Calyx lobes as long as the corolla. Corolla tube very short, limb explanate, not bilabiate, lobes broad obovate, obtuse, subequal and similar, white or tinted with rose. Stamens 2, short, filaments broad spatulate, thick, apex toothed, anthers conic, connate by the tips. Style no longer. Ovary conic. Stigma rounded, entire, discoid.] *Fruit* an ovoid non-twisted capsule, shorter than the calyx, 2–4 mm long, 0.8 mm wide, glabrous.

Distribution. Peninsular Malaysia: Langkawi Islands.

Habitat and ecology. Occurring in shady rocky niches on limestone substrate.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites and there are no major threats.

Additional specimens examined. MALAYSIA: **Kedah:** Langkawi Islands, P. Bumbon Besar/P. Chupak [06°17'N 99°52'E], 3 xi 1971 (fr), *J. Boey* 494 (KLU); P. Bumbon Kechil [06°20'N 99°55'E], 28 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1761 (E); P. Dayang Bunting S. end [06°13'N 99°49'E], 29 iv 1962 (lv), *B.L. Burt & P.J.B. Woods* 1762 (E); Langkawi Island [c.06°20'N 99°48'E], iv 1892, *Curtis* 2566 (K); Langkawi, xi 1901 (fl), *C. Curtis* s.n. (K); W Coast [06°21'N 99°52'E], xi 1916, *H.C. Robinson* 6223 (E?); Selat Pan Chor, forested limestone rocks near country club [06°25'N 99°43'E], 6 viii 1986 (fr), *A. Weber* 86-0806 (KEP, WU).

THAILAND. **Kanchanaburi:** Khao Pattawee [c.13°59'N 99°20'E], in crevices of limestone, 90 m, 18 xi 1961 (fr), *K. Larsen* 8311 (ABD).

This species is unique in the genus in its combination of a long pubescence with a distinct ferruginous colour and its seemingly palmate venation. The indumentum occurs throughout the whole plant and the hairs can be as long as the calyx. This species may be related to *Paraboea bakeri*. Both species have a similar habit and leaf morphology, and have the same long calyx and short capsule. The locality of the single specimen from Thailand is quite distant from the other collections and its status should be reinvestigated with better collections.

27. *Paraboea filipes* (Hance) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 429 (1984). – *Oreocharis filipes* Hance, J. Bot. 21: 166 (1883). – Type: China, Kwantung

(Guangdong), Lien-shau river (Lianjiang), near Young-tin narrows [24°50'N 112°25'E], 290 m, 12 x 1881 (fr), *B.C. Henry* in herb. Hance 22137 (holo BM).

Perennial rosulate herb, very small. *Leaves* (oppositely?) congested in a rosette, petiolate; petiole 2–6 mm long, with a whitish matted indumentum; blades obovate, 1–4 × 0.3–1.5 cm, c.2–3 times as long as wide, apex rounded, base slightly peltate and rounded, margin entire, upper surface glabrous, lower surface with a whitish matted indumentum; midrib smooth above, raised beneath; lateral veins smooth above, hardly visible beneath, c.4 pairs, tertiary venation invisible. *Inflorescence* axillary, cymose, few-flowered, longer than the leaves, c.5 cm long, primary and secondary branches not much developed, glabrous; peduncle c.4 cm long, bracts narrowly oblong-ovate, c.1 mm long; pedicel 15 mm long. *Calyx* 5-lobed to the base, lobes ovate-triangular, 2 × 0.6 mm, more or less farinose inside, outside glabrous. *Corolla* purplish, 4 mm long, 3.5 mm across, glabrous outside; tube 3 mm long, limb slightly 2-lipped; 5 lobes all similar, rounded, c.1.3 × 2 mm. *Anthers* transversely ellipsoid, c.1 × 2 mm, apex turned towards the gynoecium, dorsifixed; filaments 1.5 mm long; staminodes 0.2 mm long. *Gynoecium* 4.5 mm long; ovary 1.5 × 0.8 mm; style distinct, 3 × 0.2 mm; stigma slightly larger than style. *Fruit* a non-twisted capsule, narrowly ovoid, 0.6 cm long, 1 mm wide, glabrous.

Distribution. China: North Guangdong.

Habitat and ecology. Reported from limestone cliffs, elevation c.100–300 m.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This species is only known from two localities. Although the extent of occurrence is clearly < 100 km², which would justify a Critically Endangered category, the two localities reduces the threat somewhat and Endangered is a more suitable category.

Additional specimen examined. CHINA. **Guangdong:** Lian Xian on cliffs along the Lian River bank, 100 m, 29 x 1985 (fl), *Z. Y. Li et al.* 425 (E).

Burt (1984) has discussed the relationship between this species and *Paraboea velutina*, the only two species of this genus then known from China that have non-twisted capsules.

28. *Paraboea glabra* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 22: 311 (1958) [but excluding the cited collections except for the type]; Burt, Notes Roy. Bot. Gard. Edinburgh 41: 429 (1984). – *Boea glabra* Ridl., J. Linn. Soc., Bot. 32: 521 (1896). – Type: Thailand, Poongah, cult. Penang, *C. Curtis* 3039 (lecto K, designated by Burt (1984: 429)).

Paraboea rupestris B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 436 (1984). – Type: Thailand, Peninsular region, Surat, Khao Pak Chong, 55 km W of Surat on Tekuapa road, 100 m, herb on limestone rocks, flowers white, leaves brown below, 25 ix 1963, *Smitinand et al.* 1277 (holo E; iso BKF, K, L).

Perennial caulescent herb; stem woody, 20–50 cm long, 8 mm in diameter; internodes normally 2–5 cm long, with a dense layer of matted indumentum, so dense that it could be misunderstood for a glabrous bark (Burt, 1984). *Leaves* opposite, petiolate; petiole 2–5 cm long, swelling at the node and joining the opposite one to form a distinct auricle surrounding the node, with the same kind of indumentum as that on the stem; blades elliptic or narrowly so, 6–18 × 2.5–5.5 cm, 2–3.5 times as long as wide, apex obtuse, base cuneate or shortly angustate, margin shallowly serrate, upper surface glabrous, lower surface with a dense layer of brownish orange or greyish matted indumentum, so dense and so smooth that the surface appears glabrous; veins obscure or inconspicuously depressed above, raised beneath, lateral veins c.6 pairs. *Inflorescences* subterminal, cymose, c.20 cm long, often 2 opposite from the axils below the apical bud; flower buds congested in the young inflorescence like a capitulum and the inflorescence gradually developing into an extended one-sided cincinnus; peduncle c.10 cm long with a matted indumentum; on every fertile node of the flowering branch with only one pair-flower unit, c.10 pairs or less on a single cyme, a sterile node located in-between each of the two fertile nodes, both the fertile node and the sterile node with a narrowly ovate-oblong or slightly obovate bract, c.1 cm long, the flowering branch twisted to make the sterile bract just alternate on the opposite side to the fertile bract; pedicels c.5 mm long, more or less with a matted indumentum. *Calyx* relatively large, 6–8 mm long, 5-lobed to the base, lobes oblong-obovate, 5–7 mm long, 2–3 mm wide, apex ± truncate, with some matted indumentum outside, glabrous inside. *Corolla* white, glabrous, c.10 mm long; tube c.5 mm long, limb indistinctly 2-lipped; upper lip 2-lobed, lobes wide-ovate, c.6 × 8 mm, lower lip 3-lobed, lobes of similar shape and size. *Anthers* transversely ellipsoid, c.2.5 × 4 mm, coherent with each other at the apex, opening in the centre of the anther locules, dorsifixed, apex pointing towards the gynoeceium; filaments inserted at c.2 mm from the corolla base with a free part c.3 mm long; 2 staminodes seen, scale-like, c.1 mm long. *Gynoeceium* c.8.5 mm long, 1.8 mm wide at the ovary base; stigma slightly larger than style. Mature *fruit* not seen; young fruit a visibly twisted capsule, glabrous.

Distribution. Peninsular Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Vulnerable (VU D2). This species is currently only known from three independent collections: two from Surat Thani and one unknown. As it is currently known from so few localities and limestone areas in Thailand are often exploited for cement, or subject to fires from surrounding agricultural land, it should be considered Vulnerable. This species was also included in Pooma (2005) as threatened in Thailand.

Additional specimens examined. THAILAND. **Phangnga:** ‘Poongah’, ii 1893 (fl), C. Curtis 3039 (K). **Surat Thani:** 15 viii 1975 (fl), D. Praphat 24 (BKF, E).

When Ridley (1896) published *Boea glabra* he indicated 'Though I have seen no fruit, there can be little doubt but that this is a *Boea* [i.e. fruits twisted]'. Burtt, however, annotated a group of specimens with non-twisted capsules as *B. glabra* (= *Paraboea glabra*). These have been recognised as *Paraboea burttii* in this study. The two species, *Paraboea glabra* and *P. burttii*, not only differ in their twisted and non-twisted capsules, but also differ in their inflorescences, i.e. typical axillary capitulate cymes vs. subterminal monochasial cincinnus (cyme).

The type of Ridley's (1896) specific name is poor but its identity is clear from the subterminal cymose inflorescence and the juvenile capitulate inflorescence in which flower buds are congested and embraced by bracts. Furthermore the characteristic obtrapeziform (or oblong-obovate) calyx lobes are apparent in the young flowers. The type material of *Paraboea rupestris* has exactly the same characters and is here reduced to synonymy.

The inflorescence is unique in the whole genus. The non-branched (or non-forked) 'cyme' could have evolved from a normal dichasial (or two-forked) cyme that alternately reduced the opposite branch into a pair-flower unit. The alternate arrangement of sterile and fertile nodes implies this possibility.

Despite the similarity in the calyx lobes with *Paraboea burttii* and in the capitulum-like appearance of the young inflorescence with *P. bintangensis*, *P. glabra* is unlikely to be closely related to these two. The above two species do not possess a subterminal inflorescence which appears capitulate or umbellate and produce non-twisted fruits. It is more likely to be close to *Paraboea acutifolia*.

29. *Paraboea glabriflora* (Barnett) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 429 (1984). – *Boea glabriflora* Barnett, Nat. Hist. Bull. Siam Soc. 20: 19 (1961); Barnett, Kew Bull. 15: 252 (1961). – Type: Thailand, Surat, Ben Kawp Kep [09°09'N 99°20'E], 100 m, 16 viii 1927 (fr, fl), *A.F.G. Kerr* 13362 (lecto K, designated by Barnett, Kew Bull. 15: 252 (1961)).

Perennial rosulate herb (with a root stock c.7 cm long, fide Barnett's original description). *Leaves* opposite and congested at the apex of the root stock, petiolate; petioles 3.3–7 cm long, with some indumentum, enlarged at the base and seemingly joining each other across the stem; blades elliptic, 4.5–8 × 3.2–5 cm, 1.5–2 times as long as wide, apex rounded, base rounded or cuneate, unequal, margin crenate, chartaceous, pale greyish-green above and pale tawny below when dry, upper surface with a sparse white-pubescence, lower surface with a sparse tawny matted indumentum (more densely so on the midrib and the lateral veins); veins smooth above, raised beneath, lateral veins 5–6 pairs, tertiary venation inconspicuous. *Inflorescence* axillary from the axils below the apical bud of the rosette, dichasial, lax, many-flowered; peduncles slender, glabrous, up to 30 cm long, with two bracts at the apex, bracts slender, c.2.5 mm long, glabrous; pedicels slender, up to c.20 mm long, glabrous. *Calyx* 5-lobed to the base, lobes linear, obtuse, c.2.5–3 mm long, c.0.4 mm wide, glabrous, persistent in fruit. *Corolla* pink, c.0.5 cm long, 1.3 cm across in open

flower; tube c.2 mm long, limb 2-lipped; upper lip with 2 lobes, lobes widely ovate, c.3 × 3 mm, lower lip c.0.5 × 1 cm, 3-lobed, middle lobe c.3 × 4 mm, lateral lobes of similar size and shape. *Anthers* transversely ellipsoid, c.1 × 2.5 mm, coherent with each other at the apex, opening in the centre, dorsifixed, apex slightly turned towards the gynoecium; filaments inserted at c.0.5 mm from the corolla base with a free part c.1 mm long, flat; only 1 staminode seen, 0.5 mm long. *Ovary* ovoid, c.2 × 0.7 mm; style much more slender than the ovary, c.4.5 mm long; stigma not much larger than style. *Fruit* a slender capsule, c.3–3.5 cm long, 1 mm in diameter, glabrous, spirally twisted. *Seeds* elliptic, flat, 0.4 × 0.1 mm.

Distribution. Thailand. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Data Deficient (DD). This category has been used due to the uncertainty over the taxonomic status of this species (see note below).

The type material is not very good and since its publication no more records have been added. From the leaf morphology and the inflorescence structure this species may be conspecific with *Paraboea brunnescens* (see discussion under that species).

30. *Paraboea glabrisepala* B.L.Burt, Kew Bull. 1941: 21 (1941); Barnett, Kew Bull. 15: 255 (1961); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 429 (1984). – *Boea glabrisepala* (B.L.Burt) Barnett, Kew Bull. 15: 255 (1961). – Type: Thailand, Payap [Chiang Mai], Doi Chiengdao, 28 xiii 1935 (fl), *H.B.G. Garrett* 1001 (lecto K, first step designated by Barnett (1961: 255), second step designated here; iso K, L). **Fig. 17.**

Perennial rosulate herb. *Leaves* congested in a rosette, petiolate; petiole very long, normally 10–19 cm long, with the same indumentum as that on the lower leaf surface; blades oblong, elliptic or narrowly so, 10–21.5 × 3.5–14.2 cm, 1.5–2 times as long as wide, apex obtuse or rounded, base cuneate, truncate or sometimes slightly cordate, margin crenate, upper surface with some arachnoid covering or glabrescent, lower surface with a whitish brown matted indumentum; veins obscure or slightly depressed above, raised beneath, lateral veins c.8 pairs, tertiary venation conspicuously reticulate. *Inflorescence* axillary, cymose, with a very long peduncle normally equal to or longer than leaves; peduncle 20–40 cm long, robust, with a matted indumentum when young, then glabrescent when older, with 2 large bracts that are membranous and widely ovate, c.1.5 × 2 cm, embracing the juvenile inflorescence; primary branches 1–4 cm long, secondary ones hardly developed and so the inflorescence appearing quite congested, many-flowered, all other bracts with similar morphology to the two peduncle bracts but gradually reducing in size; pedicel normally c.5 mm long. *Calyx* exceptionally small, c.1.5 mm long, 5-lobed, lobes c.1 mm long, 1 mm wide, apex emarginate, glabrous. *Corolla* pale violet, glabrous, c.7 mm long, 6 mm across (possibly not a fully mature corolla); tube c.5 mm long, slightly swelling at the base of the lower lip, limb 2-lipped; upper lip 2-lobed, lobes

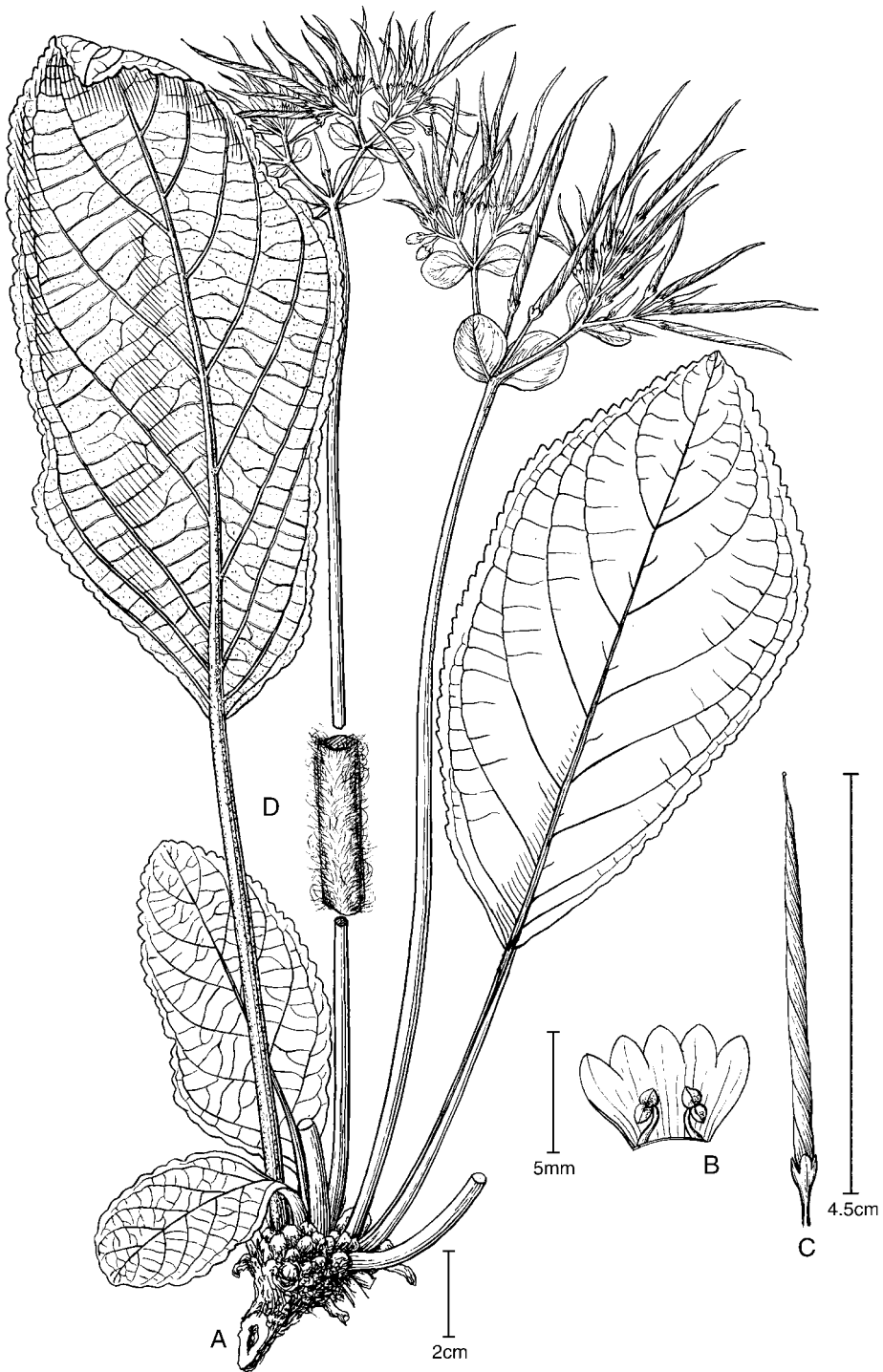


FIG. 17. *Paraboea glabrisepala* B.L.Burt. A, habit; B, corolla opened out; C, fruit; D, section of peduncle.

widely ovate, c. 2.5×3 mm, lower lip larger than the upper lip, 3-lobed, lobes similar in size to the upper lip lobes. *Anthers* transversely ellipsoid, c. 2×4 mm, coherent with each other at the apex, apertured at the upper end, apex pointing towards the gynoecium, basifixed; filaments inserted at c. 1 mm from the corolla base with a free part c. 4 mm long, exceptionally pubescent; staminodes 3, two lateral ones 2 mm long, dorsal one 0.75 mm long. *Gynoecium* c. 7–9 mm long, 1 mm wide at the ovary base; stigma not enlarged, \pm oblique. *Fruit* a linear capsule, 3.7–4.4 cm long, 1.5–2 mm in diameter, glabrous, spirally twisted. *Seeds* ellipsoid, 0.6×0.15 mm.

Distribution. Northern Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species has been collected at few sites one of them is the well-protected and extensive Doi Chiangdao National Park.

Additional specimens examined. THAILAND. **Chiangmai:** Doi Chiangdao [19°25'N 99°00'E], (fl), *K. Boonchuai* 948 (BKF); Doi Chiangdao, 680 m, 14 viii 1949 (fr), *H. B. G. Garrett* 1260 (K, L); Doi Chiangdao, north side of Doi Luang, above Sop Huay Pah Dahng-Huay Nah Lao Station, 1000 m, 8 x 1995, *J. F. Maxwell* 95-857 (L); Doi Chiangdao, east side, Pa Blawng Cave area, 575 m, 5 viii 1989, *Maxwell* 89-992 (A). **Mae Hong Son:** Doi Pui, SE of Mae Hong Son, 19°13'N 98°02'E, 800 m, 23 ix 1995 (fr), *Larsen et al.* 46840 (AAU, SING).

Burt (1941) apparently had no fruiting material but suggested that the plant had non-twisted capsules by placing it in *Paraboea* (capsules non-twisted), as then defined. He compared his species to *Paraboea capitata*. Barnett (1961) saw fruiting material with twisted capsules and so moved it to *Boea* (capsules twisted). On revising the generic concepts in *Paraboea* and *Boea*, Burt (1984) resurrected the original name. However, this species does not appear to be close to *Paraboea capitata* for it is different from the latter species in the large corolla with a long tube and short limb (vs. smaller corolla with short tube but large limb), by the pattern of anthers opening at the upper end (vs. open in the middle) and by having pubescent filaments (vs. glabrous), not to mention the capsule difference. It is possibly closer to species such as *Paraboea sinensis* and *P. glanduliflora* which also have large bracts.

31. *Paraboea glanduliflora* Barnett, Nat. Hist. Bull. Siam Soc. 20: 14 (1961); Barnett, Kew Bull. 15: 252 (1961); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 429 (1984). – Type: Thailand, Payap [Chiang Mai], Doi Chiangdao [19°25'N 99°00'E], 2000 m, 16 vii 1958 (fl), *Smitinand* 4728 (lecto E, designated by Barnett, Kew Bull. 15: 252 (1961); iso BKF). **Fig. 18.**

Perennial caulescent herb with a woody stem, 15–30 cm long, 5 mm in diameter; internode length varying from 0.5–5 cm long. *Leaves* opposite, petiolate; petiole (1–)3–7 cm long, with narrow wings joining at the node; blades elliptic or slightly obovate, 8–15 \times 5–9 cm, c. 1.5 times as long as wide, apex acute, base shortly angustate or rounded, margin serrate, upper surface pubescent, lower surface

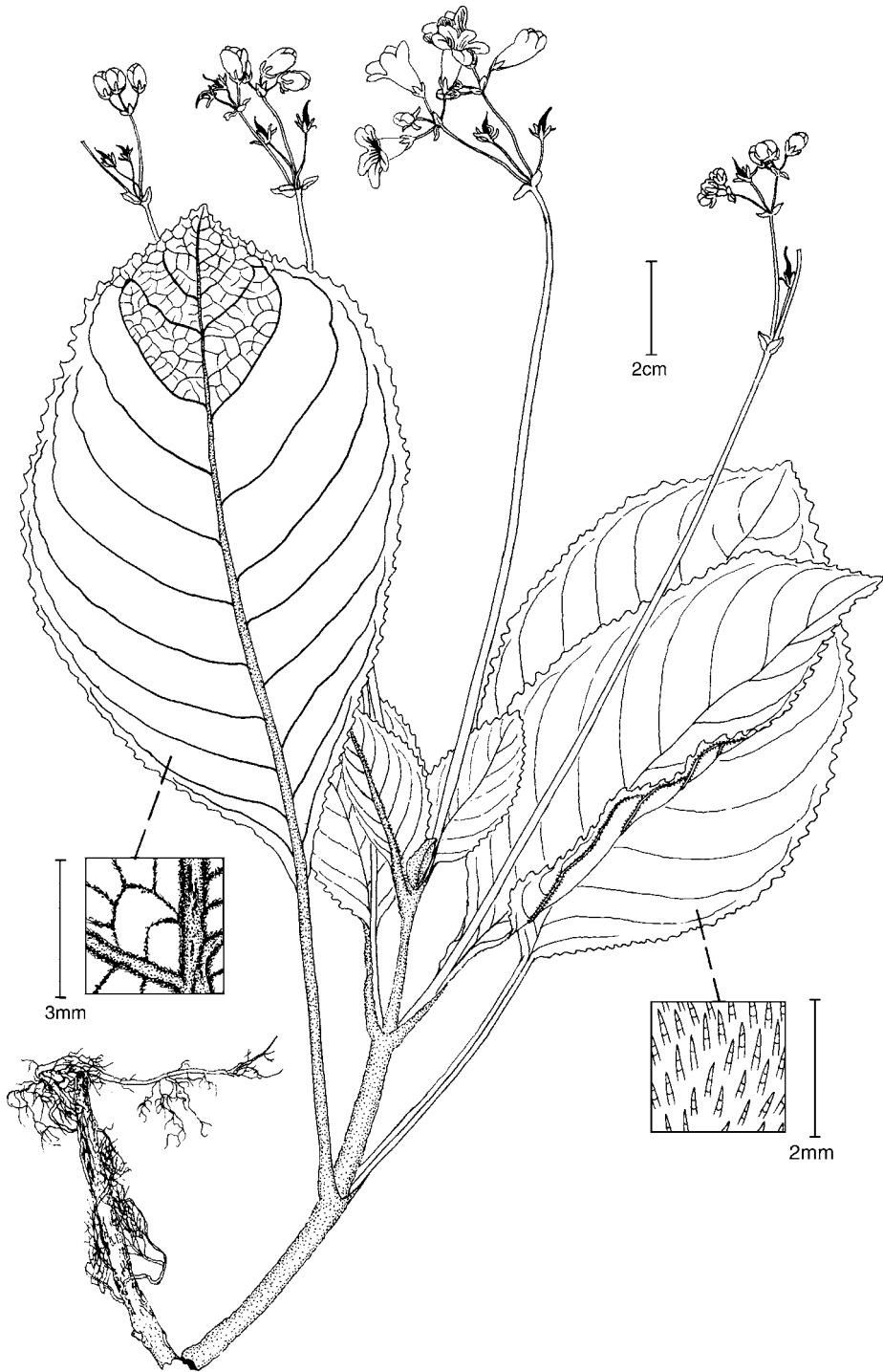


FIG. 18. *Paraboea glanduliflora* Barnett.

scabrous and with a matted indumentum on the veins; veins obscure above, raised beneath, lateral veins c.10 pairs, tertiary venation reticulate. *Inflorescences* subterminal cymose, often 2 or 4 growing in the opposite pairs of axils towards the apical bud, 15–20 cm long, c.4–5 cm wide, many-flowered; peduncle 10–15 cm long, glabrous, with 2 rounded bracts, 5 mm long, glabrous; pedicels c.5 mm long, glandular-pubescent, with bracts smaller than but of similar shape to those on the peduncle. *Calyx* 3 mm long, 5-lobed to the base, lobes narrowly oblong, c.3.5 × 1 mm, rounded at the apex, more or less glandular-pubescent outside, glabrous inside. *Corolla* pink or pinkish-purple, c.1.8 cm long, 1.2 cm across; tube c.7 mm long, 7 mm in diameter, glandular-pubescent outside, glabrous inside, limb 2-lipped; upper lip 2-lobed, lobes widely ovate, c.2.5 × 5.5 mm, lower lip c.7 mm long, 8 mm wide, 3-lobed, middle lobe rounded, c.4 × 4.5 mm, lateral lobes widely ovate, c.2 × 4.5 mm. *Anthers* transversely ellipsoid, c.1.2 × 3 mm, glabrous, coherent with each other at the apex, apertured at the upper end, basifixed, apex turned towards the gynoecium; filaments inserted at the corolla base with a free part c.6 mm long, curved to form a knee, with glandular hairs; staminodes 3, c.1 mm long, hairy. *Gynoecium* c.9 mm long, 1.2 mm wide at the base of the ovary, glabrous; style c.7 mm long, stigma oblique. *Fruit* a linear capsule, c.3–4 cm long, 1.5 mm wide, glabrous, spirally twisted. *Seeds* ellipsoid, 0.6 × 0.2 mm.

Distribution. Burma and Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species has been collected at few sites one of them is the well-protected and extensive Doi Chiangdao National Park.

Additional specimens examined. BURMA. Taunggyi [20°49'N 97°01'E], Taunggyi Reserve, 1666 m, 27 ix 1970 (fl, fr), *U. Mg Gale* 12146 (A); Taunggyi, c.1500 m, 13 viii 1934, *R. Malaise* 312 (S).

THAILAND. **Chiangmai:** Doi Chiangdao, Doi Pee [19°25'N 99°00'E], 17 xi 1963 (fr), *Adisai* 670 (BKF); Doi Chiangdao, 15 xi 1962 (fl), *K. Bunchuai* BKF47649 (BKF); Doi Chiangdao, *K. Bunchuai* 968 (BKF); Doi Chiangdao, 2000 m, xi 1962 (fr), *Cult. in E* C5138 (E); Doi Chiangdao, 1300–1900 m, 26 ix 1971 (fr), *G. Murata et al.* T-15072 (L); Doi Chiangdao, 1300–1900 m, 27 ix 1971 (fl), *G. Murata et al.* T-15185 (L); Doi Chiangdao, 30 vi 1965 (fl), *T. Smitinand et al.* 7824 (E); Doi Chiangdao, 1620 m, 24 vii 1990, *H. Banziger* 704 (L).

This species may have some affinity to *Paraboea pubicorolla*. Both have some glandular pubescence on the corolla and the same pattern of subterminal cymose inflorescences. However, the scabrous leaf surface of this species is very different to the smooth leaf surface of *Paraboea pubicorolla*. *Paraboea glanduliflora* also shares some common characters with *P. glabrisepala* in corolla shape, stamen morphology, the gynoecium and bract morphology. Barnett (1961) supposed her species to have non-twisted capsules so she placed it in *Paraboea* (with non-twisted

capsules) rather than in *Boea* (with twisted capsules). It is now known that this species has twisted capsules and now only belongs in *Paraboea* due to the recircumscription by Burt (1984). In our study we have found that all species with a subterminal cymose inflorescence possess twisted capsules rather than non-twisted capsules.

32. *Paraboea glutinosa* (Hand.-Mazz.) K. Y. Pan, Novon 7: 431 (1997). – *Boea glutinosa* Hand.-Mazz., Sinensia 7: 620 (1936). – Type: China, Kwangsi (Guangxi) ad confines prov. Kweichow (Guizhou), 8 km ad merid. pagi Nibai, 700 m, 29 vi 1928 (fl), R. C. Ching 6317 (holo WU; iso W). [The specimen label indicates ‘15 li s. of Neo Bai, border of Kweichow’. The Chinese ‘li’ is the unit for 0.5 km. Consequently, the possible locality for the type collection should be: Guangxi, on the border with Guizhou Province, 7.5 km S from Baile, c.24°44’N 106°08’E.] **Fig. 19.**

Perennial rosulate herb with a short rhizome. *Leaves* opposite, 5–10 pairs congested on the short above-ground stem, petiolate; petiole 3–7 cm long, with 2 narrow wings extending from the leaf base and joining across the node; blade elliptic or narrowly so, 10–18 × 3.5–9 cm, 1.5–4.5 times as long as wide, apex obtuse, base attenuate or short-angustate, margin entire or crenate, upper surface with some arachnoid covering or glabrescent, lower surface with a matted indumentum; veins obscure above, raised beneath, lateral veins 10–13 pairs, tertiary venation inconspicuously reticulate. *Inflorescence* a terminal panicle and axillary cymes from the basal leaves, c.40–60 × 20–40 cm, with a matted indumentum on the flowering stem and the floral leaves, more or less pubescent on peduncles and pedicels; flowering stem with long internodes (normally > 10 cm long), floral leaves similar in size and shape to vegetative leaves; the flowering stems of the axillary cymes up to 40 cm long, many-flowered; pedicels 10–30 mm long, bracts sepal-like. *Calyx* 2.5–3 mm long, 5-lobed to the base, lobes narrowly ovate, c.3 times as long as wide, glabrous or rarely with a little pubescence. *Corolla* white (or pale violet), 1–2 cm long, 0.5–1.2 cm wide, glabrous or rarely with a little pubescence; tube up to 1 cm long, slightly swelling in the middle, limb 2-lipped; posterior lip with 3 lobes, middle lobe rounded, lateral lobes widely ovate, c.3 × 3.2 mm; anterior lip with 2 lobes, wide-ovate, c.2.5 × 3.5 mm. *Stamens* 2, staminodes sometimes present; anthers transversely ellipsoid, 2.5 × 4 mm, dorsifixed, coherent with each other in the middle; filaments c.8 mm long, curved in the middle to form a knee, covered by a beard of multicellular hairs. *Gynoecium* c.7 × 1.2 mm; ovary, style and stigma not remarkably differentiated from each other; stigma capitate, slightly enlarged. *Fruit* a linear, spirally twisted capsule, c.5 cm long, c.1.5 mm wide, glabrous. *Seeds* ellipsoid, 0.6 × 0.15 mm.

Distribution. China (Guangxi, Guizhou, Yunnan), Burma [Cambodia and Vietnam, see below].

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

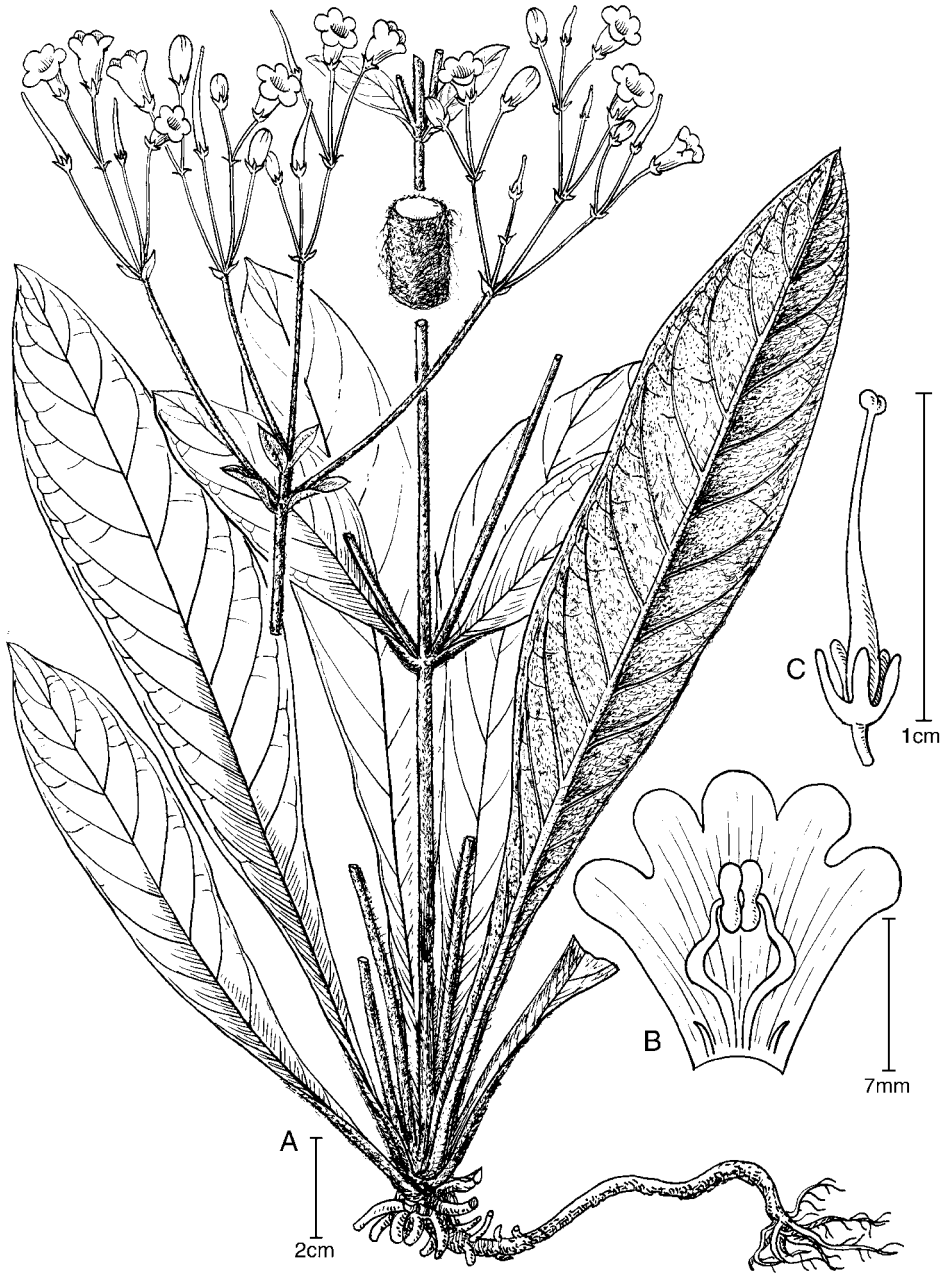


FIG. 19. *Paraboea glutinosa* (Hand.-Mazz.) K.Y.Pan. A, habit; B, corolla opened out; C, pistil and calyx.

Additional specimens examined. BURMA. Kyatoyin to Mogok [22°55'N 96°29'E], Ruby Mines District, 23 x 1912 (fr, fl), *J.H. Lace* 6273 (E).

CHINA. **Guangxi:** (fl, fr), *R.C. Ching* 6590 (NY); (fl), *Y.K. Li* 1565 (IBSC); 23 vii 1937 (fl, fr), *C. Wang* 41202 (IBSC, photo US). **Guizhou:** 29 viii 1904 (fl, fr), *J. Cavalerie* 1783 (E, syntype of *Boea martinii* H.Lév.); 1908 (lv, fr), *J. Cavalerie* 7409 (E, K); 1100 m, 6 vii 1912 (fl), *J. Esquirol* 3756 (E). **Yunnan:** Mengtze [23°35'N 103°28'E], 1898 (fl), *A. Henry* 11223 (K, NY, US).

When he described *Boea martinii* Léveillé (1914) included two collections in his citation, here treated as representing two different species. Burt (1984) lectotypified *Boea martinii* with *Martin in herb. Bodinier* 2378 and he continued to include the other material in Léveillé's citation [*J. Cavalerie* 1783 (E), from China: Guizhou, Pinfa, 26°12'N 107°04'E] in this species along with the type of *Boea glutinosa*. However, there are two species in this group and the syntype of *Boea martinii*, *J. Cavalerie* 1783, belongs to the same species as the type of *Boea glutinosa* rather than to *Boea martinii*.

The two groups of plants now represented by *Paraboea glutinosa* and *P. martinii* are remarkably different. In the latter species the flowering stem elongates up to 20 cm long from the uppermost vegetative leaf to the first axillary cyme or paniclelet and the floral leaves are much smaller than the mature vegetative leaves. In the former species the flowering stem develops no elongated internodes before the first axillary cyme or paniclelet and the first (or most basal) cymes come from basal leaves. Furthermore, the floral leaves are not appreciably different in size and shape to the normal vegetative leaves.

Collections of this species from Guangxi and Guizhou have narrow elliptic leaves > 3 times as long as wide with a long-attenuate base and without a distinct petiole. However, other collections currently included under this species name, collected from Yunnan (China) and Burma, have wider leaves < 2 times as long as wide with a wide-cuneate base and a distinct petiole [*A. Henry* 11223 (K) and *J.H. Lace* 6273 (E, K)]. They might represent an undescribed species but the current material is insufficient to establish this.

32a. *Paraboea* aff. *glutinosa*, sp. nov.?

Poilane 28717 and *Poilane* 16562 may be specimens of an undescribed species. It has the same inflorescence as that of *Paraboea glutinosa*, but the plant has an elongated stem rather than being rosulate and the leaves have a distinct reticulate venation. Although the available material is scarcely sufficient to justify a new name, the collection is described below for the convenience of recognising the same kind of plants.

Perennial caulescent herb; stem c.14 cm tall, 6 mm in diameter, internodes 1–2 cm long, with a brown matted indumentum which is later glabrescent. *Leaves* opposite, petiolate; petiole 3–8 cm long, with 2 narrow wings extending to the base and surrounding the node; blades thinly to thickly papery, ovate, 12–17 × 5–8 cm, apex

with short acumens, base widely cuneate, margin entire, upper surface with some hairs when young and later glabrous, lower surface with a brown matted indumentum; veins smooth above, raised beneath, lateral veins 10–15 pairs, tertiary venation distinctly reticulate. *Inflorescence* a terminal panicle, glabrescent; flowering stem c.30 cm long, with 2 cymes from each node, internodes up to 11 cm long, floral leaves much smaller than vegetative leaves, ovate, up to 1 × 0.5 cm, reducing in size upward; cymes < 15 cm long, many-flowered; peduncle bract scale-like, pedicel bract sepal-like; pedicel 0.6–1 cm long. *Calyx* persistent in infructescence, 2–3 mm long, 5-lobed, lobes narrow-ovate. *Flower* not seen. *Fruit* a linear spirally twisted capsule, 2.5–3.5 cm long. *Seeds* not seen.

Additional specimens examined. CAMBODIA. **Kompong Chhnang:** Phnom Chom, de Kg. Chnang, sol granitique, 1200 m, 20 i 1939 (fr), *E. Poilane* 28717 (E, P).

VIETNAM. 8.2 km de la route de Phu Qui a Kebon, on rock, 3 viii 1929 (fr), *E. Poilane* 16562 (E, P).

33. *Paraboea granitica* Z.R.Xu, sp. nov.

Paraboeae harroviana (Craib) B.L.Burt proxima sed planta caulescenta foliis valde majoribus calycibus glabris differt. – Type: [Vietnam], Dai Ding (Dai Dinh), [14°26'N 108°58'E], Nui Dai Ding pres de Dak Gley, pro. du Kontum, on granite, 21 i 1947 (fr), *E. Poilane* 32819 (holo P; iso E, P).

Perennial caulescent herb; stem 0.6–1 cm thick; internodes 1–5 cm long, with a brownish-orange matted indumentum when young then glabrescent. *Leaves* opposite, petiolate; petiole 10–14 cm, with narrow wings on both sides, enlarged at the base and embracing the stem; blades ovate or wide-ovate, 10–25 × 5.5–15 cm, 1.5 times or less as long as wide, obtuse at the apex, rounded at the base, margin entire, glabrous (or glabrescent) above, with a brownish-orange matted indumentum beneath; veins smooth or obscure above, raised beneath, lateral veins 7–10 pairs, tertiary venation reticulate. *Inflorescence* subterminal, cymose, c.50 × 20 cm in fruit, glabrous, many-flowered; peduncle c.30 cm long, c.3 mm in diameter, peduncle bracts ovate, 6 × 3 mm; pedicel 0.5–1 cm long, pedicel bracts sepal-like. *Flowers* not seen. *Calyx* in fruit 2.5–3.5 mm long, 5-lobed, lobes narrow-ovate, c.4 times as long as wide. *Fruit* a linear capsule, c.3–5 cm long, spirally twisted. *Seeds* not seen.

Distribution. Vietnam. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Data Deficient (DD). Although this species is known only from the type it is recorded as having been collected from granite rather than limestone. As the threat to the habitat is unknown a conservation assessment cannot be given.

This species is similar to *Paraboea harroviana* with which it shares a similar inflorescence. However, the leaves are much larger and the calyx is glabrous.

- 34. *Paraboea guilinensis*** L.Xu & Y.G.Wei, Acta Phytotax. Sin. 42(4): 380 (2004).
– Type: China, Guangxi, Guilin, Dabuxiang, 20 iv 1995, Y.G. Wei & S.H. Zhong 95-14 (holo IBK; iso IBK).

Perennial short caulescent herb; stem 2–10 cm long, 4–5 mm wide. *Leaves* petiolate; petiole 1.4–3 cm long, brownish lanate; blade coriaceous, obovate-elliptic or elliptic, 2.8–5.8 × 1.5–2.2 cm, apex rounded, base rounded to broadly cuneate, margin involute, denticulate, greyish-lanate above, later subglabrous, with a dense matted indumentum beneath; venation impressed above, raised beneath, 5–6 pairs of lateral veins. *Inflorescence* axillary, cymose, 3–5-flowered; peduncle 3.5–6.5 cm long, glabrous; pedicels filiform, 10–20 mm long. *Calyx* 5-lobed to the base, lobes linear-lanceolate, 1.8–2.1 × 0.5–0.7 mm, glabrous. *Corolla* bluish-purple, glabrous, 13–15 mm long, c.10 mm in diameter; tube 6–8 mm long, limb 2-lipped; upper lip 2-lobed, lobes oblong, 3.5–4.5 × 2–3 mm, lower lip 3-lobed, lobes suborbicular, 5–7 × 6–7.5 mm. *Stamens* inserted at 0.7 mm from the corolla base; filaments 4.5–5 mm long; anthers ellipsoid, 2.5 × 1.5 mm, yellow; staminodes 1.2 mm long. *Gynoecium* 6–6.5 mm long, glabrous; ovary linear, 2.8–3 mm long, 0.4 mm wide at base; style 3.2–3.5 mm long. *Fruit* linear, not twisted, 2–2.8 cm long, 2–2.4 mm wide, glabrous.

Distribution. China: Guangxi. Known only from the type.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

- 35. *Paraboea hainanensis*** (Chun) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 429 (1984). – *Boea hainanensis* Chun, Flora Hainanica 3: 526, 588 (1974). – Type: China, Hainan, Yaichow, on moist shaded rocks along streams in mountains [18°08'N 109°30'E], 24 ix 1933 (fl), H.Y. Liang 63102 (holo IBSC; iso E, NY).
Fig. 20.

Rosulate perennial herb with stout roots. *Leaves* sessile, thick-coriaceous, normally narrow-obovate, rarely narrow-elliptic, 8–10 × 2.5–3.5 cm, 2.5–4 times as long as wide, apex normally obtuse, rarely obtuse-acute, base attenuate, margin more or less crenulate, upper surface glabrous, lower surface with a reddish brown rather appressed matted indumentum, veins smooth or faintly depressed above, raised beneath. *Inflorescence* axillary, cymose, longer than the leaves, lax, several-flowered, 15–30 cm long, with the same indumentum as that on the lower leaf surface when young and glabrescent when older; peduncle relatively slender, c.12–24 cm long, bracts very small, narrow-ovate, 3 × 0.5 mm; pedicels 15–30 mm long, more or less glandular-pubescent. *Calyx* campanulate, 5-lobed to the base, lobes ovate, c.2 × 0.8 mm, glabrous. *Corolla* various shades of blue, c.12 mm long, 13 mm in diameter; tube c.4 mm long, 5 mm in diameter at the throat, limb 2-lipped; upper lip 2-lobed, lobes ovate, c.6 × 5 mm, lower lip c.1 cm long, 1.3 cm wide, 3-lobed, middle lobe

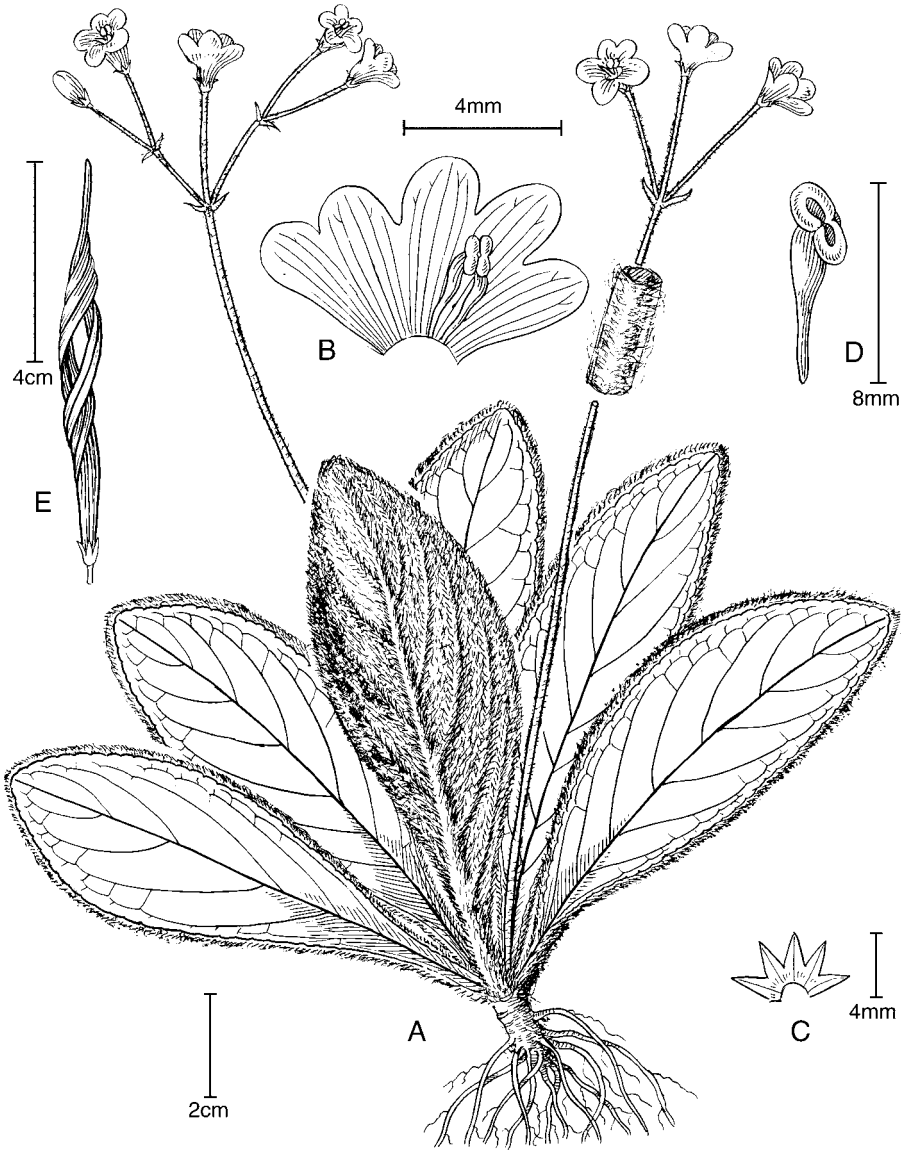


FIG. 20. *Paraboea hainanensis* (Chun) B.L.Burt. A, habit; B, corolla opened out; C, calyx opened out; D, stamen; E, fruit.

ovate, c. 5×5 mm, lateral lobes wide-ovate, c. 4×5 mm. *Anthers* transversely ellipsoid, c. 1.2×2.8 mm, coherent with each other at the apex, opening in the centre of the anther locules, dorsifixed, apex pointing towards the gynoecium; filaments inserted at c. 1 mm from the corolla base with a free part c. 6 mm long, swollen in the upper part to c. 1.5 mm wide; staminode very tiny, only 1 observed. *Gynoecium* c. 9 mm long, 1 mm wide at the ovary base; ovary without a distinguishable boundary

between the ovary and the style, with some minute pubescence; stigma much wider than style, seemingly tomentose. *Fruit* a linear capsule, 3–4.5 cm long, c.2 mm in diameter, glabrous, spirally twisted but weakly so. *Seeds* ellipsoid, 0.4 × 0.5 mm.

Distribution. China: Hainan.

Habitat and ecology. Reported as occurring on acid soil.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This species is only known from two nearby localities. Although the extent of occurrence is clearly < 100 km², which would justify a Critically Endangered category, the two localities reduces the threat somewhat and Endangered is a more suitable category.

Additional specimens examined. CHINA. **Hainan:** Ledong county [18°42'N 109°12'E], 5 vii 1936 (fl), S.K. Lau 27407 (A, IBSC); Loktung [= Ledong, i.e. Le4Dong1], 27 vii 1963 (fr), S.K. Lau 27597 (A).

In *Paraboea hainanensis* the matted indumentum on the lower leaf surface is very thick and appressed with a reddish-brown colour. This is the same as is found in *Oreocharis* Benth. The hairs are long and thick, straight, unbranched, and intermixed with very fine curved interwoven ones. The extremely swollen filament is another distinct character. The dehiscence and coherence of the anthers are the same as that found in *Paraboea brunnescens*, but the gynoeceium without a clear boundary between the style and the ovary is similar to that found in *P. dictyoneura*. In overall morphology this species is most similar to *Paraboea dictyoneura*.

36. *Paraboea halongensis* Kiew & T.H.Nguyễn, Gard. Bull. Singapore 52(1): 195 (2000). – Type: Vietnam, Ha Long Bay, *Nguyen Tien Hiep & Ruth Kiew* NTH4055 (holo HN; iso BM, E, K, LE, MO, SING).

Perennial caulescent herb, branching near base; stems with a matted indumentum, 4.5–18 cm long, c.2 mm wide. *Leaves* opposite, petiolate; petiole (6–)12–17 mm long, with a greyish matted indumentum and scattered darker larger hairs; blade lanceolate to obovate, 1.7–4.3 × 0.6–2.5 cm, apex acute, base cuneate to rounded, with short pale stiff hairs above, with a greyish matted indumentum and scattered darker larger hairs, especially on venation; lateral veins 4–5 pairs, impressed above, raised beneath. *Inflorescence* subterminal, cymose; c.3 cymes from the axils below the terminal bud, 4–6.6(–14) cm long, branches monocarpic, glabrous; peduncle 2.9–3.7(–10) cm long, c.1 mm wide, bracts c.12 × 6 mm, stalk c.4 mm long; pedicels 3–9 mm long. *Calyx* 5-lobed to the base, lobes oblong, c.2 × 1 mm, apex rounded. *Corolla* white, 8 mm long, 7–8 mm in diameter; tube slightly saccate at base; lobes all similar, rounded, c.2 × 4–5 mm. *Anthers* white, c.15 mm long; filaments pale rosy-purple, c.3–4 mm long. *Gynoeceium* white; ovary c.5 mm long; style straight, c.3 mm long; stigma capitate. *Fruit* twisted, 1.2–2 cm long, 1–1.5 mm in diameter.

Distribution. Vietnam: Quang Ninh. Known only from the type.

Habitat and ecology. 'In soil filled cracks in bare, exposed rocks near the summit of limestone islands' (Nguyen & Kiew, 2000).

Proposed IUCN conservation assessment. Least Concern (LC). Although the species is known only from the type collection, Ha Long Bay is an extensive and well-protected limestone site.

37. *Paraboea harroviana* (Craib) Z.R.Xu, **comb. nov.** – *Boea harroviana* Craib, Bull. Misc. Inform. Kew 1926: 172 (1926). – Type: Thailand, Chiangmai, Me Ping Rapids, Keng Soi [18°12'N 98°34'E], 300 m, (fr), *A.F.G. Kerr* 4629 (lecto K, designated by Burtt (1984: 427); iso ABD).

37a. *Paraboea harroviana* var. *harroviana*

Perennial herb with a short stem. *Leaves* opposite, congested, petiolate; petiole c.1–5 cm long, with a greyish to brownish matted indumentum; blades \pm elliptic, oblique, c.6–15 \times 3–6 cm, c.2.5–5 times as long as wide, apex acute, base cuneate and oblique, margin \pm shallowly serrate, upper surface glabrous, lower surface with a greyish to brownish matted indumentum; veins smooth above, raised beneath, lateral veins c.10–12 pairs, \pm curved-ascending, tertiary venation \pm reticulate. *Inflorescence* subterminal, cymose; cymes usually 2, sometimes 1, 3 or 4, from the axils below the apical bud, c.17–50 cm long, 5–8 cm wide, many-flowered, with a greyish to brownish matted indumentum throughout except on the corolla and the parts inside the corolla; peduncle c.10–20 cm long, quite robust, with two distinct bracts of various sizes; pedicels c.10 mm long, with bracts sepal-like. *Calyx* c.2.5–4 mm long, 5-lobed to the base, lobes narrowly ovate, c.2.5 \times 0.7 mm, with a matted indumentum outside, glabrous inside. *Corolla* blue, c.8.5 mm long, 10 mm across when open; tube c.3 mm long, limb not distinctly 2-lipped; upper lip with 2 lobes, lower lip with 3 lobes, 5 lobes of similar shape and size except the middle lobe of the lower lip which is slightly larger, all widely ovate, c.2.5 mm \times 3.5 mm, glabrous. *Anthers* reniform, c.1.5 \times 3 mm, coherent with each other, opening towards the top of the anther, basifixed; filaments inserted at c.1.5 mm from the corolla base with a free part c.2.5 mm long; staminodes 3; 3 triangular glands inserted at the corolla throat. *Gynoecium* longer than the corolla, c.1.2 mm wide at the ovary base; style very short, curved towards the anthers; stigma not enlarged but extremely oblique. *Fruit* very slender, c.4 cm long, 1 mm wide, spirally twisted, glabrous. *Seeds* ellipsoid, c.4 \times 1.5 mm.

Distribution. Cambodia, Thailand and Vietnam.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats.

Additional specimens examined. CAMBODIA. **Pursat:** Mont de Pursat, 1875 (fl), *Harmand* 462 (P).

THAILAND. **Chanthaburi:** [= Chantaboon] [12°40'N 102°10'E], 1936 (fl, fr), *A. Vesterdal* 7 (C). **Kanchanaburi:** Kwae Noi River Basin, near Neeckey, near Wangka [14°15'N 99°10'E], 150 m, 17 v 1946 (fl), *G. Den Hoed* 580 (A, L); between Huay Ban Kao and Kritee [15°00'N 98°50'E], 500 m, 4 vii 1973 (fl), *R. Geesink & Phengklai* 6084 (AAU, BKF, C, E, L, P); Kanburi, Sayok Falls, about 120 km NW of Kanburi [14°15'N 99°10'E], 100–150 m, 3 viii 1946 (fl), *A.J.G.H. Kostermans* 1451 (A, L, P, US); Sangklaburi District, Toong Yai Naresuan Wildlife Reserve, Lai Wo, Ban Saneh Pawng area, 300 m, 11 x 1993, *Maxwell* 93-1223 (L). **Loei:** Phu Krading [16°58'N 101°57'E], 21 viii 1949 (fl), *D. Bunpheng* 371 (BKF); Phu Krading, Sam Khae, 1100 m, 16 vii 1953 (fr), *D. Bunpheng* 663 (ABD, BKF); Phu Krading, near stream, 15 x 1967 (fl), *Prayad* 1033 (BKF); Phu Krading, 1 ix 1969 (fl), *S.P. et al.* 17 (BKF, L); Amphoe [= District] Phu Krading, 15 x 1967 (fl), *P. Sangkhachand* 1033 (L); Phu Luang [17°29'N 101°35'E], 17 ix 1966 (fr), *S. Phusomsaeng & Bunchuai* 44 (BKF); Phu Luang Wildlife Reserve, Nam Tok to Pa Paw trail, 29 ix 1990, *P. Chantaranothai et al.* 90/442 (K); interior of Nam Thop, on eastern slope of Phu Luang, 400–850 m, 7 xii 1965 (fr), *M. Tagawa et al.* T-1915 (BKF). **Petchaburi:** [13°06'N 99°57'E], 20 m, 7 xi 1926 (fl), *A.F.G. Kerr* 11067 (A, ABD, L); Khao Hong, 10 iii 1965 (fr), *Sakol* 486 (BKF). **Prachuap Khiri Khan:** Kong Wan [12°02'N 99°55'E], 20 x 1964 (fl), *C. Chermisrivathana* 110 (BKF); Ban Pu, Kuiburi [12°15'N 99°55'E], 25 xi 1964 (fl), *Adisai* 972 (BKF); Khao Nam Tok, west of Huai Yang [11°50'N 99°30'E], 100 m, 10 viii 1966 (fl), *K. Larsen et al.* 1376 (AAU); Huai Yang, 4 x 1930 (fl), *Put* 3199 (ABD, K); Huai Yang National Park, Bua Sawan waterfall area, 11°40'N 99°36'E, 320 m, 26 viii 2002, *D.J. Middleton et al.* 1356 (A, BKF). **Ratchaburi:** Khao Ngoo River area, Tawng Pa Poom District [14°45'N 99°00'E], 450 m, 4 vii 1973 (fl), *J.F. Maxwell* 73-103 (AAU, BK, BKF); Huay Lum Khao Ngoo, Si Swat District, 15 vii 1973 (fl), *S. Suthesorn* 2493 (BK). **Sakon Nakhon:** Kum Horm [17°20'N 104°10'E], 12 xii 1962 (fr), *Adisai* 229 (BKF). **Saraburi:** Hin Lap [14°30'N 101°00'E], 20 viii 1926 (fl, fr), *Put* 2426 (ABD, K).

VIETNAM. **Ba Ria-Vung Tau:** Ile Poulou Condor [08°41'N 106°37'E], (fr), *Harmand* s.n. (P).

Burt (1984) treated this specific name as a synonym of *Paraboea dictyoneura* (Hance) B.L.Burt. However, *Paraboea harroviana* has subterminal cymes, which results in monocarpic branches or individuals due to the terminal bud ceasing to grow after a flowering season, while *Paraboea dictyoneura* has true axillary cymes from rosulate leaves and the terminal bud continues to grow after the flowering season. Also, this species has 3 glands inside the corolla throat and a very oblique stigma which distinguish it from *Paraboea dictyoneura* (no glands; capitate stigma). This species belongs to a group of species related to *Paraboea cochinchinensis*, *P. argentea* and *P. pubicorolla* that have subterminal inflorescences and very oblique stigmas.

Several specimens collected from southwest Thailand (Kanchanaburi Province), *R. Geesink & C. Phengklai* 6084, *S. Suthesorn* 2493 and *A.J.G.H. Kostermans* 1451, are somewhat different from the typical specimens in their much longer and larger inflorescences but are otherwise unremarkable.

37b. *Paraboea harroviana* var. *ovata* Z.R.Xu, var. nov.

Paraboeae harrovianae var. *harrovianae* proxima, sed foliis ovatis at extremum rotundis differt. – Type: Thailand, Phetchaburi Province, Maha Sohm Nah Rahm

Temple area [17°00'N 99°35'E], overgrown temple compound, rocky outcrops in a hardwood forest, corolla deep blue, 22 viii 1971 (fl), *J.F. Maxwell* 71-503 (holo BK; iso AAU).

Boea treubii auct. non Forbes: Pellegrin in Lecomte, Fl. Indo-Chine 4: 544 (1930).

This new variety differs from the type variety in the rounded leaf apex (rather than acuminate or acute) and the ovate leaf blades (vs. more or less obovate). In general, *Paraboea harroviana* var. *harroviana* has much narrower leaf blades, c.2.5–5 times as long as wide, with an oblique base, and *Paraboea harroviana* var. *ovata* has wider leaf blades, c.1.5–2.5 times as long as wide, without an oblique base.

Distribution. Thailand and Vietnam.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Vulnerable (VU D2). This variety is currently only known from three independent collections: two from Vietnam and one from Thailand. As it is currently known from so few localities, and as limestone areas in Thailand and Vietnam are often exploited for cement or subject to fires from surrounding agricultural land, it should be considered Vulnerable.

Additional specimens examined. VIETNAM. Expedition du Dr. Harmand en Indo-Chine 1875–77, Delta du Me-Khong, Nui Cam [10°20'N 106°40'E], vi 1876 (fl), *Harmand* 547 (P). **Dong Nai:** Baria, Mt. Dinh [10°32'N 107°09'E], delta du Mekong [Baria, 10°20'N 106°40'E], vii 1867 (fl, fr), *H.L. Pierre* 4538 (A, E, GH, K, NY, P, UC, US, W).

38. *Paraboea havilandii* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 429 (1984). – *Boea havilandii* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 73 (1905). – Type: Sarawak, First Division, Gunung Braang, *G.D. Haviland* 641 (lecto K, designated by Burt (1984: 429); iso SAR?, SING). **Fig. 21.**

Boea brettiana W.W.Sm., Notes Roy. Bot. Gard. Edinburgh 8: 319 (1915). – Type: Sarawak, near Sudan, *Native Collector* 14 (lecto E, designated by Burt (1984: 430); iso E).

Perennial caulescent subshrub, some plants monocarpic; stem up to 2 m tall, 1.5(–2) cm in diameter; internodes quite short, normally 1–2 cm long, in the flowering plant the uppermost vegetative internode elongated up to 8 cm long, with a white or greyish orange matted indumentum when young, later becoming darker or paler. *Leaves* in whorls of 4, those from a single year often congested, sessile, more or less narrowly obovate-oblong, heterophyllous, smaller ones c.5–13 × 1–2.5 cm and larger ones c.18–30 × 3–5.5 cm, c.4–9 times as long as wide, apex obtuse, base almost half as wide as the widest part of the leaf, margin entire or indistinctly serrulate, upper surface with a dense pubescence with some arachnoid hairs that later shed off, lower surface with a white matted indumentum that

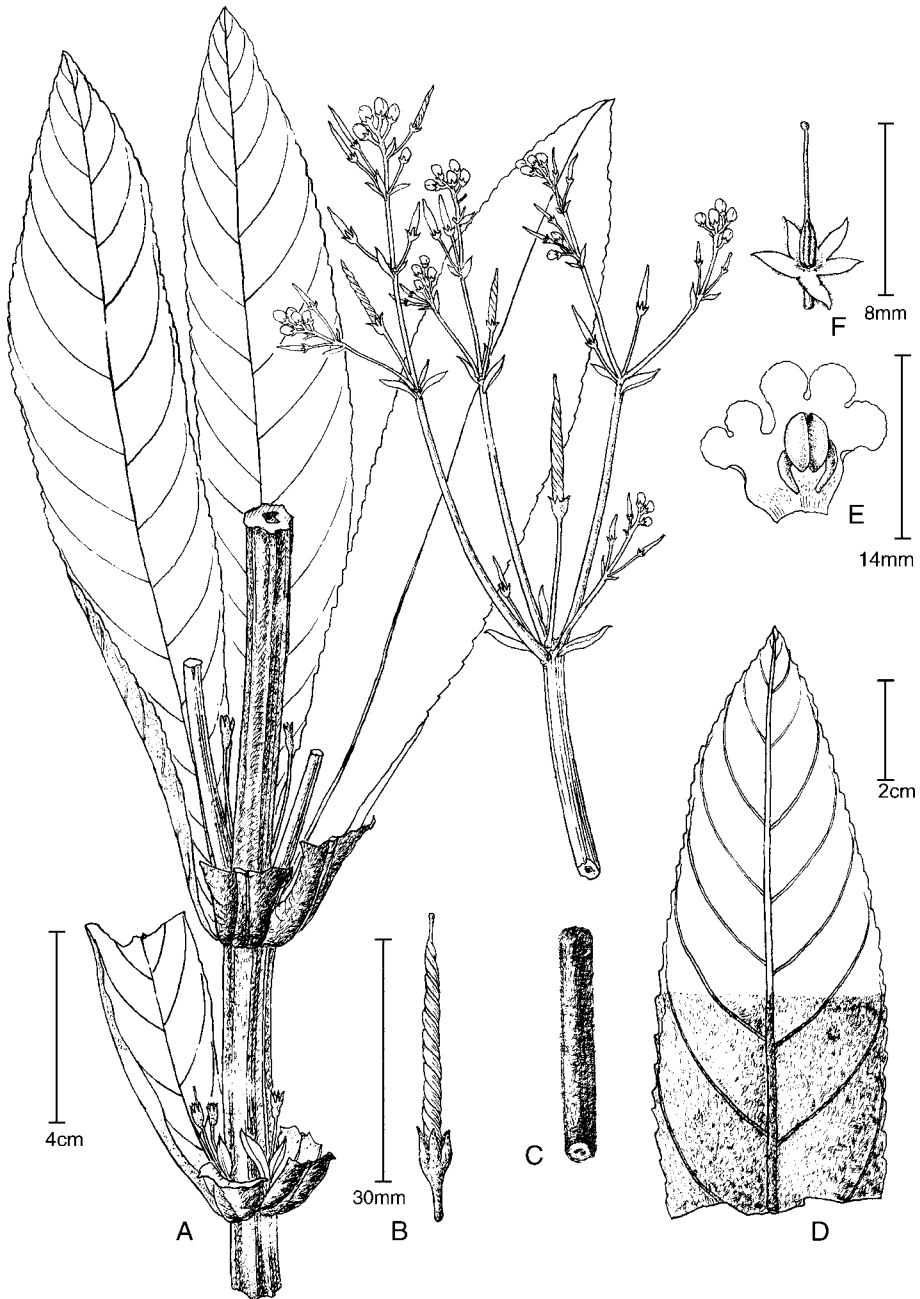


FIG. 21. *Paraboea havilandii* (Ridl.) B.L.Burtt. A, habit; B, fruit; C, section of peduncle; D, part of leaf; E, corolla opened out; F, pistil and calyx.

changes colour to yellow-orange on the veins; veins smooth above except for the slightly prominent midrib, raised beneath, lateral veins sparse (sometimes obscure), 6–20 pairs, 1–2.5 cm apart, tertiary venation invisible. *Inflorescence* terminal, paniculate, with a white or greyish matted indumentum except on the flower; flowering stem long, (20–)70 cm long, the lowest internodes up to 20 cm long, floral leaves slightly smaller than the vegetative leaves, in some cases quite a lot smaller, 4 cymes from each node; cymes short or long, 12–40 cm long, peduncle bracts narrow-ovate, up to 10×3 mm, pedicel bracts sepal-like; pedicels 2–20 mm long. *Calyx* 2–3 mm long, 5-lobed, lobes ovate, with a matted indumentum outside, glabrous inside. *Corolla* light purple, purplish white, or pale lilac, c.1 cm long, 1.2 cm across when fully open; tube c.2.5 mm long, limb 2-lipped; upper lip 5 mm long, 2-lobed, lobes wide-ovate, c. 4×4.5 mm, lower lip c.8.5 mm long, with 3 lobes, middle lobe obovate, c. 4.5×4.5 mm, lateral lobes wide-ovate, c. 3.5×5 mm. *Anthers* transversely ellipsoid, c. 2.5×5 mm, coherent at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments inserted at the corolla base with a free part c.3 mm long, crenate at the margin. *Gynoecium* c.10 mm long; ovary ovoid, c.1 mm wide; style c.7 mm long, narrower than the ovary; stigma capitate, larger than style. *Fruit* a linear or narrowly cylindrical capsule, 1.5–2.5 cm long, 1–2 mm in diameter, glabrous, spirally twisted. *Seeds* narrowly ellipsoid, 0.9×0.2 mm.

Distribution. Malaysia: Sarawak.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. MALAYSIA. **Sarawak:** s.l., 500 m, viii 1892 (fl), *G.D. Haviland* 1460 (K); Gunung Bar, Mambong, Penrissen, Kuching, 20 ii 1993 (fl, fr), *P.C. Yui & Rantai et al.* S66020 (SAR); 1st Division: Bau limestone hills, Bukit Krian, 28 v 1972 (fl), *J.A.R. Anderson* S31973 (E, SAR); *ibid.*, 29 iv 1955 (fl), *W.M.A. Brooke* 9904 (L); Bau (limestone) $[01^{\circ}45'N\ 110^{\circ}00'E]$, xii 1909 (fr), *C.J. Brooks* 1071 (L); Padawan District, Gunong Regu, 333 m, 6 v 1975 (fr, fl), *B.L. Burtt* 8088 (E); Bau District, Gunong Meraja (G Pungyang), S of Bidi, 17 v 1975 (fr, fl), *B.L. Burtt* 8152 (E); Bau, Seburan Mine, 15 v 1962 (fl), *B.L. Burtt & P.J.B. Woods* 1832 (E); Gunong Staat, between Sarawak R and Bau, 333 m, 25 v 1962 (fr, fl), *B.L. Burtt & P.J.B. Woods* 1929 (E); Bau, Bkt. Numpang, Taiton, 100 m, (fr, fl), *P. Chai & Seng* S22851 (K, L, SAR); Bidi Caves, S of Bau, 18 x 1929 (fl, fr), *Clemens & Clemens* 7627 (NY); Bau, vii 1893 (fr), *G.D. Haviland* 11724 (K); Bau, Taiton Gold Mine, limestone hill, 25 v 1976 (fl), *M. James et al.* S37196 (E, K, L, SAR); Bau District, Bukit Tebong, 100 m, 11 viii 1970 (fr), *P.F. Lehmann* 395 (E); near Sudan, 2 xi 1914 (fr, fl), *Native Collector* s.n. (E, P); Suelan, 11 ii 1914 (fl, fr), *Native Collector* 14 (P); 1st Division, (fl, fr), *Native Collector* 1373 (A, K, P, US); Bau District, (fl), *Native Collector* 399 (L); *ibid.*, ii–vi 1914 (fl, fr), *Native Collector* 2070 (P, US); 2nd Division: Bukit Sturib, next to Gunong Selabor, on base rocks of Kaoll below peak, 29 v 1975 (fr, lv), *B.L. Burtt* 8214 (E); G. Apin, Bau, 150 m, 7 xi 2001, *Donny JG et al.* SBC1367 (SAR).

This species is similar to *Paraboea treubii* and *P. verticillata*. The three species are the most common among the tropical group that have a terminal panicle inflorescence and leaves in whorls. *Paraboea havilandii* can be distinguished from the other two species by the heterophyllous leaves and the narrowly obovate-oblong leaf shape. In the other two species the leaves are not heterophyllous and are elliptic. The leaves of *Paraboea havilandii* are sessile, while the other two species have distinct petioles.

There is a specimen in SAR labelled *Haviland* 64 but from the same locality as the type material, *Haviland* 641. It is probably the same collection and, therefore, an isotype.

39. *Paraboea incudicarpa* B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 430 (1984). – Type: Thailand, Tak Province, Pha Wo [16°52'N 99°10'E], 650 m, herb on limestone rocks, common, 13 vii 1972 (fr), *Smitinand & Seidenfaden* 11629 (holo E; iso BK). **Fig. 22.**

Herb, unbranched, up to 9 cm tall. *Leaves* oppositely congested on a stem with internodes < 5 mm long, petiolate; petiole c.2–8 cm long; blades obovate-elliptic, 5–17 × 3–11 cm, c.2 times as long as wide, apex with attenuate acumen, base widely cuneate or short-angustate, margin more or less crenate, upper surface glabrescent, lower surface with some thin whitish matted indumentum or glabrescent; veins smooth above, slightly raised beneath, lateral veins c.9 pairs, tertiary venation obscure or invisible. *Infructescence* a subterminal cyme with many fruits congested in a short stout peduncle, making it appear capitate; peduncle 2–4 cm long; primary and secondary bracts similar in shape and size, numerous, widely ovate up to 1.5 cm long, 2 cm wide; pedicels rather stout, especially thickened at the apex, c.15 mm long. *Flowers* not seen. *Fruit* a short and thick triangular capsule, ± incurviform, horizontally held on top of pedicel, not twisted, 0.8–1.1 cm long and 4–5 mm wide at the base, dehiscing along the upper suture only. *Seeds* narrowly ellipsoid, c.0.5 mm long, with a long acumen on one end.

Distribution. Thailand.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)) – for threats see conservation assessment section in introduction. This species is only known from two localities. The two localities are quite far apart so a status of Severely Fragmented may have been enough to push this into the higher category of CR. However, we are not sure if the extent of occurrence or area of occupancy is low enough to justify this. Further research is clearly necessary. This species was also included in Pooma (2005) as threatened in Thailand.

Additional specimen examined. THAILAND. **Kanchanaburi:** Between Huay Ban Kao and Kritee, c.15°00'N 98°50'E, 500 m, 4 vii 1973, *R. Geesink & C. Phengklai* 6105 (L).



FIG. 22. *Paraboea incudicarpa* B.L.Burtt. A, habit; B, fruiting plant; C, fruit.

The morphology of this species is exceptional in *Paraboea*, as indicated by Burtt (1984). Even without flowers, the texture and indumentum of the leaves, the capsules and the infructescence of the type collection all present the generic characters of *Hemiboea* rather than *Paraboea*. In *Hemiboea* cymose inflorescences develop in subterminal axils (see Wang *et al.*, 1990: 287, pl. 76, fig. 4). At the end of the flowering season the terminal bud between the two subterminal cymose inflorescences is aborted. Thus, the infructescence may look like a terminal cymose inflorescence but actually comprises two subterminal cymes opposite to each other.

In some cases, the two subterminal fertile leaves that hold the two subterminal cymes may be dramatically reduced in size and join each other to form an auricle around the stem. This then makes the whole inflorescence look even more like a true terminal inflorescence with the auriculate subterminal fertile leaves appearing as terminal bracts embracing the whole inflorescence when young. However, inflorescences in *Gesneriaceae* are either a *terminal panicle* or an *axillary cyme*. Terminal cymes are not possible (see discussion about the inflorescence in the introduction of this paper). The subterminal cymose inflorescence is common throughout *Hemiboea* (Wang *et al.*, 1990: 283–302), but is rare in *Paraboea* (*P. sinensis* presents a typical example). In the subterminal inflorescence of *Hemiboea* flowers are often congested at the top of a short peduncle, thereby having a capitulate or umbellate appearance. In *Paraboea* the subterminal cymes often have distinct primary and secondary branches, thereby having a dichasial cymose appearance. In the case of *Paraboea incudicarpa*, the subterminal cymose inflorescence has the appearance of that in *Hemiboea* (see Wang *et al.*, 1990: 287, pl. 76, fig. 4).

One might also study the capsule of this species. The normal *Gesneriaceae* ovary has 2 cells with 4 placentations. But in the ovary of *Hemiboea*, as is indicated by the name, only 1 cell with 2 placentations develops (see Wang *et al.*, 1990: 287, pl. 76, fig. 10) and the other cell is generally sterile. When the capsule is mature the fertile cell is located on top of the sterile one resulting in the mature capsule opening only on one side, the upper suture, to release the seeds. In general, capsules of *Hemiboea* species are held in a spreading to horizontal position and the capsules are more or less curved into a sickle-shape with the inner curve facing upward. Thus, *Hemiboea* species can be recognised by their characteristic sickle-shaped capsules that open only along the upper suture. Although the sterile cell does not develop a rudiment can be seen in many *Hemiboea* species where a smaller tube bearing no seeds often exists below the developed cell, especially at the base of the capsule. In some rare cases the sterile cell may also partially develop and bear some seeds in the lower half of the cell. However, this cell never develops to the full length of the capsule. In *Paraboea incudicarpa* the capsule has a fully developed fertile cell on top of a partially developed sterile cell. The partially developed (sterile) cell is found at the base of the capsule. This is the capsule pattern of a *Hemiboea* species rather than of *Paraboea* species.

The flowers of *Hemiboea* and *Paraboea* are quite different. In *Hemiboea* the flowers are large, the corolla tube is long, and the lips of the limb are less well developed. In *Paraboea* the flowers are relatively smaller, the corolla tube is short, and the limb is relatively large and 2-lipped. Unfortunately the type specimen of *Paraboea incudicarpa* bears no flowers. We would suggest that *Paraboea incudicarpa* is rather a species of *Hemiboea* but we would rather await confirmation through the discovery of flowering material before transferring the name. This would make *Hemiboea* a new record for Thailand, a reasonable extension of the generic distribution given that it has about 20 species in southern China and adjacent countries.

40. *Paraboea kalimantanensis* Z.R.Xu & B.L.Burtt, *Edinburgh J. Bot.* 48: 3 (1991).

– Type: Borneo, Kalimantan Selatan, Batu Kumpai, Djaro, Muara Uja, exposed limestone rocks, 20 xi 1971 (fl, fr), *J. Dransfield & D. Saeradin* 2255 (holo L).

Monocarpic caulescent subshrub; stem woody, 25 cm long, 6 mm in diameter, internodes very short, c.5 mm long, with a tawny matted indumentum. *Leaves* in whorls of 4, sessile, narrow-obovate, 5–11 × 1–2 cm, apex obtuse, base cuneate, margin entire, upper surface densely pubescent, lower surface with a greyish-white matted indumentum except for the tawny veins; veins smooth above, raised beneath, lateral veins c.14 pairs, tertiary venation inconspicuous. *Inflorescence* terminal, paniculate, with a tawny matted indumentum except on the flower; flowering stem 45 cm long, the most basal internode c.15 cm long, floral leaves much smaller than vegetative leaves, up to 15 × 5 mm, reducing in size upward, 4 cymes from each node; cymes very short, < 5 cm long, few-flowered, peduncle bracts and pedicel bracts similar to each other, sepal-like, pedicel 3–5 mm long. *Calyx* c.3 mm long, 5-lobed to the base, lobes narrow-ovate, with a tawny matted indumentum outside, glabrous inside. *Corolla* mauve, c.3.5 mm long, c.4 mm across; tube 1.5 mm long, limb 2-lipped; upper lip 2-lobed, lobes ovate, 1.7 × 2.5 mm, lower lip 3-lobed, two lateral lobes ovate, 1.7 × 2.5 mm, middle lobe obovate, 1.7 × 1.5 mm. *Anthers* transversely ellipsoid, 2 × 4 mm, coherent with each other at the apex, apex turned towards the gynoecium, opening in the centre of the anther locules, dorsifixed by the filaments; filaments 1.7 mm long, slightly winged. *Gynoecium* c.2.5 mm long, densely capitate-pubescent; stigma capitate, not larger than style. *Fruit* a very long and delicate spirally twisted capsule, 2.5–3 cm long, 1 mm in diameter, densely capitate-pubescent when young, less so when mature. *Seeds* compressed, ovoid, 0.6 × 0.2 mm.

Distribution. Indonesia: Kalimantan.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)) – for threats see conservation assessment section in introduction. This species is only known from two locations. The two localities are quite far apart so a status of Severely Fragmented may have been enough to push this into the higher category of CR. However, we are not sure if the extent of occurrence or area of occupancy is low enough to justify this. Further research is clearly necessary.

Additional specimen examined. INDONESIA. **Kalimantan:** Central East Borneo, W. Koetai, Kombeng, 200 m, 22 xi 1925 (fl, fr), *F.H. Ender* 5171 (A, K, L).

This species is similar to *Paraboea caerulescens* (Ridl.) B.L.Burtt in sharing a dense capitate pubescence on the ovary and fruit. It is easily recognised by the very narrow panicle with very short lateral flowering branches.

41. *Paraboea lanata* (Ridl.) B.L.Burtt, *Notes Roy. Bot. Gard. Edinburgh* 41: 431 (1984). – *Boea lanata* Ridl., *J. Linn. Soc., Bot.* 32: 520 (1896). – Type: Peninsular

Malaysia, Langkawi Islands, near Dayong Bunting, on almost bare rocks [06°20'N 99°48'E], xi 1901 (fl, fr), *C. Curtis* 2569 (lecto SING, designated here; iso K). **Fig. 23.**

Perennial subshrub with a woody stem up to 50 cm long and 1.2 cm in diameter. *Leaves* in a rosette at the apex of the stem or just above ground, sessile, narrowly obovate, more or less irregular, 6–11 × 1–3.5 cm, 3–6 times as long as wide, apex obtuse or acute, base attenuate, margin entire, upper surface with a pubescence under the cover of some arachnoid indumentum, lower surface with a white lanate indumentum (looser and thicker matted indumentum); veins smooth above, slightly raised beneath, lateral veins c.7 pairs, tertiary venation invisible. *Inflorescence* axillary, cymose, longer than the leaves, 10–30 cm long, c.2–5 cm wide, several- to many-flowered, normally with < 20 flowers; peduncle 5–15 cm long, at first with the same indumentum as that on the leaves and then glabrescent, peduncle bracts up to 1.5 × 0.5 cm; pedicels c.5–10 mm long, glandular pubescent, pedicel bracts sepal-like. *Calyx* 2 mm long, 5-lobed to the base, ovate or narrowly so. *Corolla* magenta, c.1 cm long, 1 cm across; tube 3.5 mm long, limb 2-lipped; upper lip 2-lobed, lobes widely ovate, c.3 × 3.5 mm, lower lip c.6 mm long, 3-lobed, middle lobe rounded, c.3.5 × 3.5 mm, lateral lobes similar in size and shape. *Anthers* yellow, ± oblong, c.2.5 × 3.5 mm, coherent with each other at the apex and the inner surface, opening in the centre in a 'V' shape with the apex pointing towards the gynoecium, basifixed; filaments inserted at 2.5 mm from the corolla base with a free part c.2.5 mm long. *Gynoecium* c.5 mm long, 1 mm wide at the ovary base; ovary with a dense glandular pubescence; stigma slightly larger than style. *Fruit* a linear capsule, c.0.8 cm long, 1.5 mm in diameter, spirally twisted, with glandular pubescence. *Seeds* not seen.

Distribution. Peninsular Malaysia: Langkawi Islands. We are doubtful as to the label information on the Sumatra collection.

Habitat and ecology. In rock crevices or above ground on limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites, some of which are in protected areas, and there are no major threats.

Additional specimens examined. INDONESIA. **Sumatra:** ix 1914 (fl), *C.G. Matthew* s.n. (K).

MALAYSIA. **Kedah:** Langkawi: Bumbon Kechil, [06°20'N 99°55'E], 166 m, 10 xii 1960 (fr), *Alphonso & Samsuri* A.88 (E), A.89 (E); P. Dayang Bunting [06°13'N 99°49'E], 29 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1768 (E); Pulau Langkawi N end, Gua Cherita [06°25'N 99°50'E], 30 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1776 (E); Ayer Hangat, 2 v 1962 (fl), *B.L. Burt & P.J.B. Woods* 1805 (E); P. Langkawi shore SE of Kuah [06°19'N 99°52'E], 3 v 1962 (fr, fl), *B.L. Burt & P.J.B. Woods* 1810 (E); Pulau Simpang Tiga Kechil, 10 xi 1979 (lv), *B.C. Stone* 14209 (L); P. Simpang Tiga Kechil, 10 xi 1979 (lv), *B.C. Stone* 14206 (A).

Burt (1984) has a detailed description of the plant in the field. This species has a characteristic thick and silvery matted indumentum on both surfaces of the leaf.



FIG. 23. *Paraboea lanata* (Ridl.) B.L.Burtt.

42. *Paraboea lancifolia* (Ridl.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 431 (1984). – *Boea lancifolia* Ridl., Fl. Malay Penins. 2: 536 (1923). – Type: Thailand, Satun Province, Tarutao [06°50'N 99°30'E], x 1888 (fl), C. Curtis 16010 (lecto K, designated by Burtt (1984: 431)). **Fig. 24.**

Small shrub with a slender woody stem; stem c.5 mm in diameter, with a matted indumentum, brownish orange when young and later dark brown and glabrescent, internodes c.1 cm long or shorter in the vegetative stem, but longer in the flowering stem. *Leaves* alternate, without a distinct petiole; blade narrowly ovate, 10–20 × 1.5–3.7 cm, base attenuate and more or less extending along the petiole, apex acute, margin entire, upper surface with a tiny pubescence under some arachnoid covering, lower surface with a white to brownish-orange matted indumentum; veins obscure above, raised beneath, lateral veins 7–11 pairs, tertiary venation inconspicuous. *Inflorescence* a terminal panicle, with a matted indumentum throughout except for the glabrous flower; flowering stem c.15–20 cm long with internodes 1.5–3 cm long, floral leaves similar to vegetative leaves; cymes (or secondary panicles) axillary from the flowering stem, short but bearing many flowers resulting in a tight cyme; peduncle c.0.5–1.5 cm long, peduncle bracts (or primary bracts in a cyme) narrowly elliptic, c.1 cm long; pedicels short, c.5 mm long. *Calyx* very long, c.8 mm long, 5-lobed to the base, lobes very narrowly ovate, 5 times as long as wide with a distinct matted indumentum. *Corolla* glabrous, c.6 mm long and 10 mm across; tube c.2.5 mm long, limb slightly 2-lipped; upper lip 2-lobed, lobes semi-rounded, c.2.5 × 5 mm; the 3 lobes of the lower lip all wide-ovate but unequal in size with a middle lobe 2.5 × 2 mm and two lateral lobes 2.5 × 4 mm. *Anthers* transversely ellipsoid, c.1.5 × 2.5 mm, opening in the centre of the anther locules, loosely coherent at the apex and at the base, dorsifixed, apex pointing towards the gynoecium; filaments inserted at c.2 mm from the corolla base, shorter than the gynoecium. *Gynoecium* c.6 mm long; ovary ovoid, c.1.2 mm wide; stigma slightly larger than style. *Fruit* a spirally twisted capsule, narrowly ovoid, c.1 cm long, 2 mm in diameter, glabrous. *Seeds* ovoid, 0.5 × 0.25 mm.

Distribution. Peninsular Thailand: Tarutao Island.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species has been infrequently collected Tarutao is a national park and well protected.

Additional specimens examined. THAILAND. **Satum:** Tarutao Island: limestone, near the sea [06°50'N 99°30'E], 1 vii 1980 (fr, fl), *Congdon* 731 (A, AAU, E, PSU); *ibid.*, 25 iv 1981 (fr), *Congdon* 1249 (A, E); limestone bluff near Crocodile Cave on Malacca Creek [NW side of the island], 5 xi 1979 (fl), *Congdon* 129 (AAU, E, PSU); c.4 km S of the Northern Cape, 50 m, 11 i 1986 (fr), *Kurzweil* 784 (WU).

Burt (1984) cited '[Synonym: *B. lanata* auct. non Ridl.; Barnett in Fl. Siam. Enum. 3(3): 231 (1962) – quoad *Rabil* 301.]' under this species. However, *Rabil* 301 has since been described as *Paraboea rabilii* Z.R.Xu & B.L.Burt (see discussion under that species). Among the species that possess a terminal paniculate inflorescence, this species is the only one recorded with an alternate leaf arrangement. The relatively long calyx but short capsule is also remarkable for this species. In comparison, *Paraboea suffruticosa* has a similar habit, the same leaf arrangement

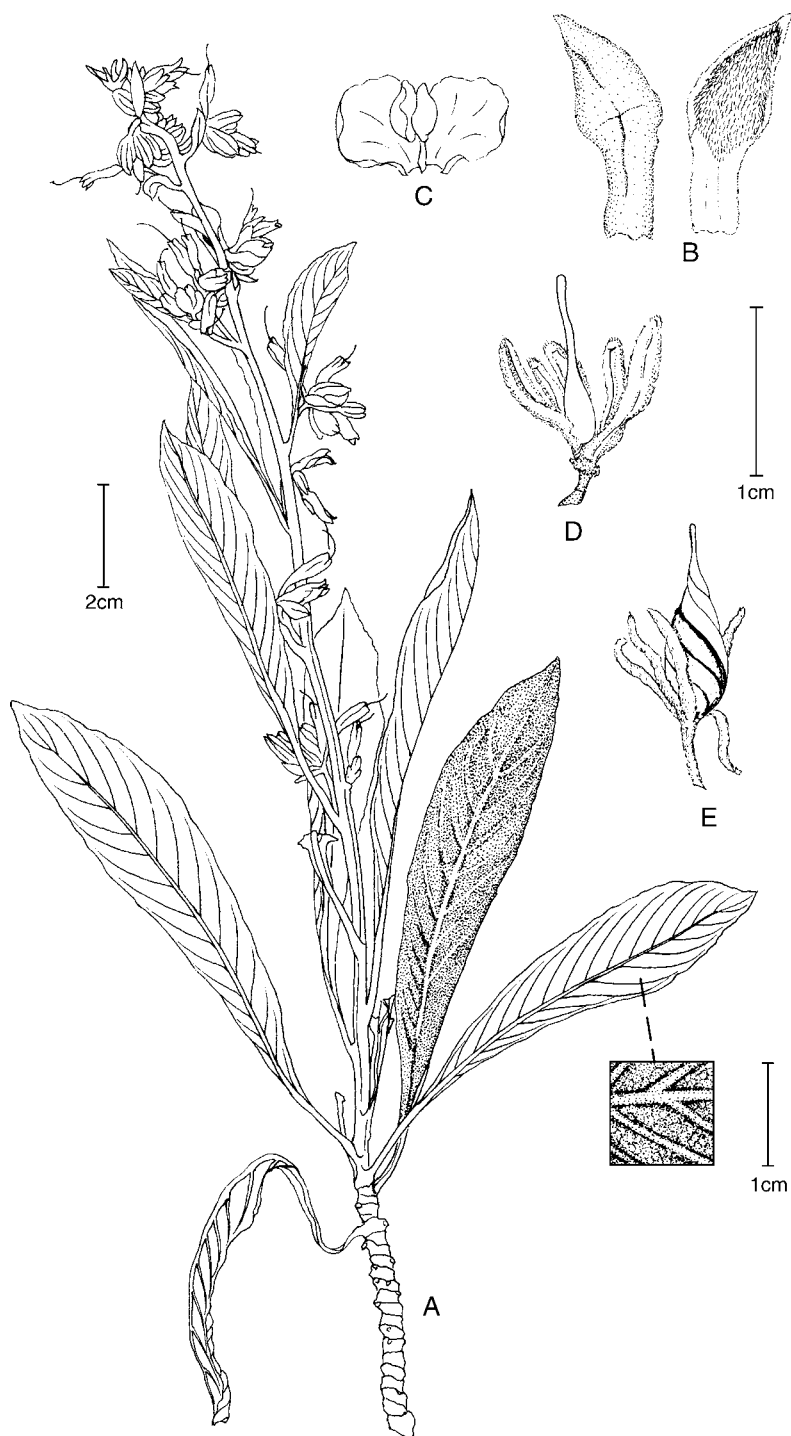


FIG. 24. *Paraboea lancifolia* (Ridl.) B.L.Burtt. A, habit; B, sepals; C, corolla opened out; D, pistil and calyx; E, fruit with persistent calyx.

and a long calyx vs. short capsule, but it has axillary inflorescences rather than a terminal panicle.

43. *Paraboea laxa* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 70 (1905); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 431 (1984). – Type: Peninsular Malaysia, Kedah, Langkawi Islands, small islands opposite to Kuah [06°20'N 99°48'E], ix 1890 (fl, fr), *C. Curtis* 2571 (lecto SING, designated by Burt (1984: 431); iso BM, K). **Fig. 25.**

Perennial herb, sometimes with a rhizome up to 7 cm long in crevices of rocks. *Leaves* congested in a rosette, base long-attenuate and so appearing petiolate for 2–3 cm long; blades obovate when mature, (5–)8–20 × 3–7 cm, 2–5 times as long as wide, apex obtuse, margin shallowly crenate to deeply but remotely toothed, upper surface with a long pubescence, lower surface with a brownish matted indumentum; veins smooth above, raised beneath, lateral veins 5–7 pairs, tertiary venation sometimes conspicuous. *Inflorescence* an axillary cyme, with > 4 bifurcations, much longer than the leaves, subordinate primary branches developed, 10–25 cm long, many-flowered and quite lax; peduncle 6–15 cm long, glabrescent, primary bracts narrowly ovate, up to 3 mm long, more or less hairy; pedicels 5–10 mm long, slender, with sepal-like bracts. *Calyx* campanulate, 5-lobed to the base, lobes ovate, c. 8 × 0.6 mm, outside glabrous, inside minutely pubescent. *Corolla* c. 12 mm across, 6 mm long; tube 2 mm long, limb 2-lipped; upper lip 2-lobed, lobes ± rounded, 3 × 5 mm, lower lip c. 5.5 × 8 mm, 3-lobed, middle lobe 3 × 4 mm, lateral lobes similar to the upper lobes. *Anthers* transversely ellipsoid, c. 1 × 2.5 mm, opening in the centre of the anther locules, coherent with each other, dorsifixed; filaments 2.5 mm long, swelling or with wide wings in the middle part, inserted at the base of the corolla. *Gynoeceium* 6.5 mm long; ovary c. 1.5 × 1.2 mm; style distinct, 0.2 mm long; stigma slightly larger than style. *Fruit* a linear non-twisted capsule, c. 1–2 cm long, 1 mm wide, glabrous, open at the upper suture (on very rare occasions the open valves may appear slightly twisted). *Seeds* ovoid, 0.4 × 0.3 mm, with a brown colour when dried.

Distribution. Peninsular Malaysia (Langkawi Island) and Thailand (see discussion below).

Habitat and ecology. Occurs on damp rocks (probably limestone according to the locality).

Proposed IUCN conservation assessment. Least Concern (LC). Although not all of Langkawi is protected the number of collections made would seem to suggest that the species is widespread on the island and there are no major threats. The collection from Thailand has not been taken into consideration for this assessment (see discussion below).

Additional specimens examined. MALAYSIA: **Kedah:** Langkawi, shore SE of Kuah, rocks above sea [06°19'N 99°52'E], 3 v 1962 (fr), *B.L. Burt & P.J.B. Woods* 1809 (E); Langkawi, main

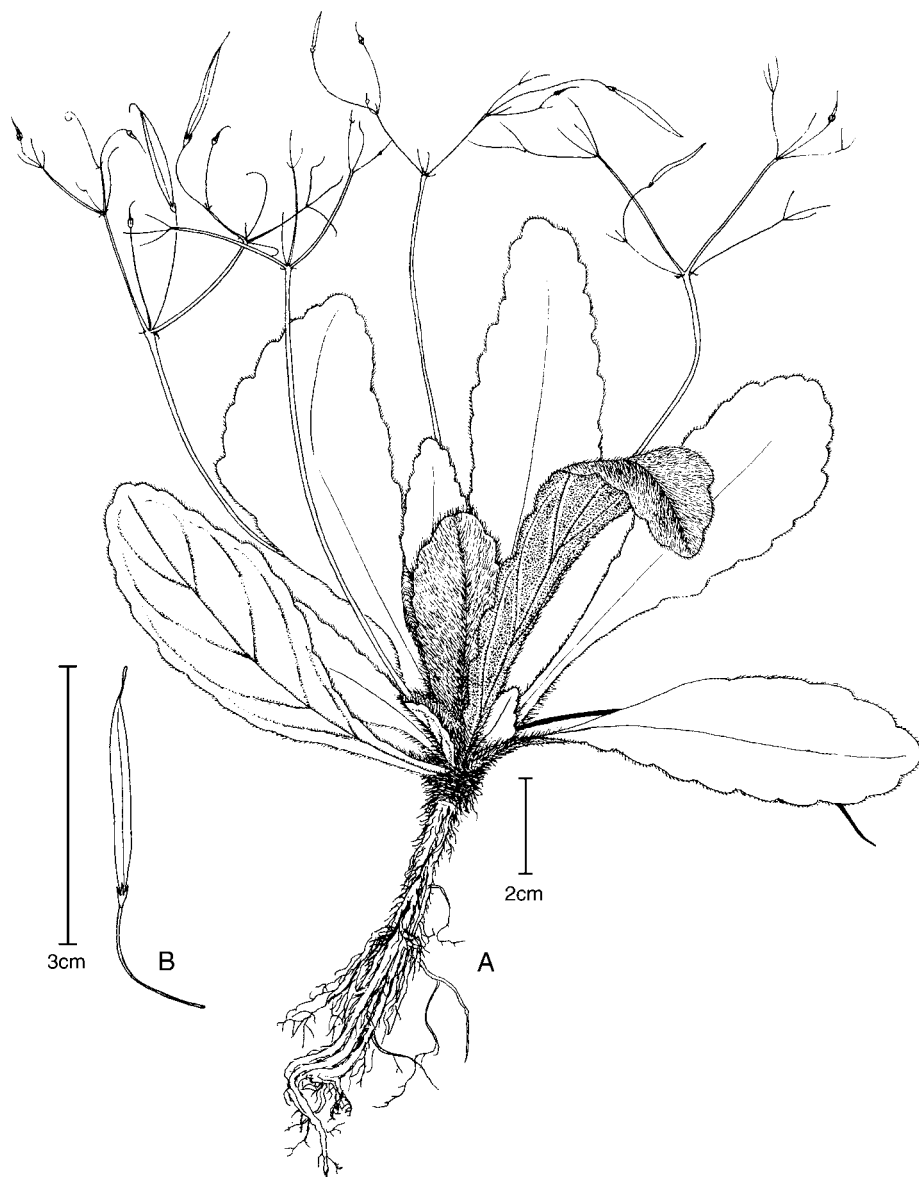


FIG. 25. *Paraboea laxa* Ridl. A, habit; B, fruit.

island to the south east, at Telok Sambar [06°19'N 99°51'E], 10 m, 6 xi 1971 (fr), *S.C. Chin* 1785 (K, L, SING); Tasek Dayang Bunting [06°13'N 99°49'E], 17 xi 1941 (fr), *E.J.H. Corner* s.n. (SING); *Cult. in E* C4063 (E, fl); Langkawi [06°20'N 99°48'E], iv 1892 (fl), *C. Curtis* 2571 (K); Kuah (Kedah) [06°19'N 99°51'E], ix 1900 (fl), *M. Haniff & C. Curtis* s.n. (SING); Telok Apau [06°20'N 99°48'E], 17 xi 1921 (fr), *M. Haniff & Nur* 7083 (K, SING); Selat Panchor [06°25'N 99°43'E], 21 xi 1934 (fr), *M.R. Henderson* SFN 21366 (K, SING); Batu Ayam, Selat

Panchor, 21 xi 1934 (fr), *M.R. Henderson* SFN 29187 (K, SING); East End of Langkawi, facing P. Timun, face of Limestone cliff [06°18'N 99°52'E], 19 viii 1972 (fr), *B.C. Stone* 11018 (E); Pulau Langkawi, forested limestone rocks near country club, 27 iv 1987 (fr), *S. Stone & A. Weber* 87-0427 (WU).

THAILAND. **Kamphaeng Phet**: [16°30'N 99°35'E], 22 vi 1930 (fl, fr), *Y. Kiah* 24376 (BM, K, SING).

On the type material and the collections of this species from Langkawi the leaves have branched hairs and the leaf base is attenuate with no distinct petiole. The plant from Thailand, *Kiah* 24376 (K), is somewhat different to typical *Paraboea laxa* with its truncate to rounded leaf base, distinct petiole and an entire leaf margin, characters reminiscent of *P. brunnescens*. But the plant has branched hairs and a non-twisted capsule, linking it to *Paraboea laxa* rather than to *P. brunnescens* which has no branched hairs and a twisted capsule. Thus, *Kiah* 24376 may be an abnormal record of either *Paraboea brunnescens* or *P. laxa*, or it may be an undescribed species. Until more and better material is available we do not feel it is appropriate to create a new name for *Kiah* 24376. See also discussion under *Paraboea vulpina*.

44. *Paraboea leopoldii* K.M. Wong, J.T. Pereira, Sugau & S.P. Lim, Sandakania 13: 28 (1999). – Type: Malaysia, Sabah, Semporna, Bodgaya island, sea fringe on north side, *K.M. Wong, Postar Miun & Ahmad Sappan* WKM 2864 (holo SAN; iso E, K, KEP).

Perennial herb, appearing rosulate by leaves crowded at apex of decumbent stem; stem woody, prostrate, c.23 cm long, c.4 mm in diameter. *Leaves* opposite, congested in a rosette, petiolate; petiole 3.5–4.5(–6) mm, with an arachnoid indumentum, later glabrescent; blades ovate, 5.9–6.8 × 4.1–5.7 cm, 1.1–1.5 times as long as wide, apex rounded, base cordate, margin entire, upper surface arachnoid, lower surface with a matted indumentum and an arachnoid covering; veins smooth above, raised beneath, lateral veins c.6–7 pairs, tertiary venation mostly invisible. *Inflorescence* axillary, cymose, much longer than the leaves, (16–)24–30 cm long, many-flowered, with arachnoid indumentum or glabrescent, except on the flower; peduncle 15–23 cm long, primary bracts elliptic, 6–9 mm long; pedicels 6–13 mm long. *Calyx* 2.8–3 × 0.7–0.8 mm, 5-lobed to the base, lobes lanceolate, glabrous or with few sessile glands, especially inside. *Corolla* c.8 mm long, 7–8 mm across; tube 4.2 mm long, limb slightly 2-lipped; upper lip 2-lobed, lobes rounded, c.4.3 × 5 mm, lower lip slightly longer, 3-lobed, lobes rounded, c.6.3 × 5.3 mm. *Anthers* ± triangular, c.2 × 3.1 mm, opening in the centre of the anther locules, coherent with each other, dorsifixed; filaments c.4 mm long, inserted at base of the corolla tube, curved to make anther apex point towards gynoecium. *Gynoecium* c.8 mm long; ovary 1.5 mm wide; style distinct, 0.8 mm wide; stigma slightly larger than style. *Fruit* a linear non-twisted capsule, 1–1.2 cm long, glabrous. *Seeds* not seen.

Distribution. Malaysia: Sabah.

Habitat and ecology. On rocky headlands.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species is known from very few collections the island where it was collected, Bodgaya, has long been protected.

Additional specimen examined. MALAYSIA. **Sabah:** Semporna District, Bod Gaya Island [05°23'N 118°45'E], 3 m, 10 ix 1980 (fl), *A. Gibot* SAN93025 (K).

There are considerable problems in the delimitation of species in the group which comprises *Paraboea leopoldii*, *P. minahassae*, *P. luzoniensis* and *P. schefferi*. More collections are needed from Sulawesi, the Philippines and Borneo to clarify the issues but in this group *Paraboea leopoldii* is one of the more distinctive species with its strongly cordate leaf bases and no stalked glands on the inflorescence.

Two specimens from Sabah, *Stone* 6767 (KLU) and *Meijer* SAN23322 (SAN), may also belong to this species but better material is necessary to be sure of its identity. The leaves are more markedly separated by internodes and the blades less cordate than the Semporna material.

45. *Paraboea leporina* (H.J.Lam) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 431 (1984). – *Boea leporina* H.J.Lam, Blumea 5: 580, fig. 7 (1965). – Type: Central Celebes [Sulawesi], Enrokang, West of Kalosi, on limestone rocks, along road Kalosi–Makale, 800 m, xii 1937–xi 1939 (fl, fr), *C. Monod de Froideville* 401 (holo L).

Perennial caulescent herb or subshrub, monocarpic?; stem woody, c.25 cm tall, 4–10 mm in diameter, internodes 3–25 mm long. *Leaves* in whorls of 3, often congested, in one monocarpic plant internodes elongating to 1–2.5 cm long, sessile, obovate or narrowly so, 2.5–10 × 0.8–2 cm, 2–5 times as long as wide, obtuse at the apex, attenuate at the base, margin entire, dense white-arachnoid above, with a white or yellowish matted indumentum on the lower leaf surface; midrib smooth above, prominent beneath, lateral veins c.6 pairs, obscure or prominent, tertiary venation obscure. *Inflorescence* paniculate, terminal, with a matted indumentum throughout except on the flower; flowering stem 6–12 cm long, the basalmost internode not especially elongated; floral leaves ± intermediate to the vegetative leaves; 3 or 4 cymes from each node; cymes short, c.2–3 cm long, with a few to many flowers [Exception: *G.K. Kjellberg* 3939 has a cyme extending to c.20 cm long]; peduncle or pedicel bracts small, sepal-like, pedicel c.2–3 mm long. *Calyx* c.2 mm long, with a whitish matted indumentum outside, glabrous inside, 5-lobed to the base, lobes c.1.3 mm long, narrow-ovate. *Corolla* glabrous, obscure purpureous; tube c.2 mm long, limb 2-lipped; upper lip 2-lobed, lower lip 3-lobed, the lobes, excepting the middle lobe of the lower lip, of similar shape and size, rounded, c.2 × 2 mm, middle lobe of the lower lip 2 times as long as the others. *Stamens* glabrous; filaments 2 mm long; staminodes 3; anthers transversely ellipsoid, 3–3.5 × 1.5 mm, adnate to each other, opening in the centre of the anther locules, apex pointing towards the

gynoecium. *Gynoecium* c.6.5 mm long; ovary oblong, 2 mm long; style 4 mm long; stigma not especially enlarged. *Fruit* a spirally twisted capsule, c.1.3–2.5 cm long, c.1.3 mm across, glabrous. *Seeds* ellipsoid, c.6 × 2 mm.

Distribution. Indonesia: Sulawesi.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This species is only known from two localities. We are unclear how far apart the two localities are: if they are quite disconnected a status of Severely Fragmented may have been enough to push this into the higher category of CR. However, we are not sure if the extent of occurrence or area of occupancy is low enough to justify this. Further research is clearly necessary.

Additional specimen examined. SULAWESI. Rante Pal Bodenbeschaffenheit, Kalkfelsen, 12 xii 1929 (fl), G.K. Kjellberg 2919 (L, S).

The miniature appearance and its isolation in Sulawesi makes this species quite characteristic.

46. *Paraboea leuserensis* B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 431 (1984). – Type: Indonesia, Atjeh [Aceh], Gunung Leuser Nature Reserve, Gunung Ketambe and vicinity, 8–15 km SW from the mouth of Lau Ketambe, c.40 km NW of Kutatjane, 800 m, on shaded limestone rock in montane rain forest, 16 vii 1969, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes* 13639 (holo L).
Fig. 26.

Perennial rosulate herb, sometimes with a rhizome up to 10 cm long. *Leaves* oppositely congested in a rosette, petiolate; petiole c.4–11 cm long, with a brown matted indumentum; blades ± elliptic, in rare cases appearing slightly ovate or obovate, 10–28 × 5–9 cm, 1.5–4 times as long as wide, apex acute or obtuse, base cuneate to truncate, margin entire or indistinctly crenulate or serrulate, upper surface arachnoid when young and glabrescent when mature, lower surface with a matted indumentum; veins smooth above, raised beneath, lateral veins c.8–12 pairs, tertiary venation invisible. *Inflorescence* axillary, cymose, shorter than or equal to the leaves, c.15–30 cm long, few- to many-flowered, with a brown matted indumentum throughout except on the flower; peduncle 14–24 cm long, primary bracts narrowly ovate, 5–15 mm long; pedicels longer or similar in length to the primary branches of the cyme, 5–35 mm long. *Calyx* 3–6 mm long, 5-lobed to the base, lobes lanceolate, with a brown matted indumentum on both sides. *Corolla* c.15 mm across, 10 mm long; tube c.2 mm long, limb slightly 2-lipped; upper lip c.6 × 6.5 mm, 2-lobed, lobes ± rounded, lower lip slightly longer, c.10 × 8 mm, 3-lobed, lobes ± rounded. *Anthers* transversely ellipsoid, c.1.2 × 2.5 mm, opening in the centre of the anther locules, coherent with each other; filaments c.2 mm long, inserted at the base of the corolla, curved and making anthers point to gynoecium;



FIG. 26. *Paraboea leuserensis* B.L.Burtt.

staminodes 0.5×0.1 mm. *Gynoeceum* narrowly ovoid, c.6 mm long; style indistinct; stigma not much larger than style. *Fruit* a linear non-twisted capsule, 2–3 cm long, glabrous, dehiscing along the upper suture. *Seeds* brown, ellipsoid, c. 0.4×0.1 mm.

Distribution. Indonesia: Sumatra (Aceh Province).

Habitat and ecology. Reported from limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species is known from relatively few collections these are mostly from Gunung Leuser Nature Reserve, a protected area, and there are no major threats.

Additional specimens examined. INDONESIA. Sumatra: **Aceh:** Gunung Leuser Nature Reserve, Ketambe, valley of Lau Alas, near tributary of Lau, 200–400 m, 29 v 1972 (fr), *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes* 12469 (K, L, US); Gunung Leuser Nature Reserve, c.7 km SW from the mouth of Lau Ketambe, Climbing Gunung Mamas [03°00'N 97°50'E], 1200–1400 m, 6 v 1975 (fl), *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes* 16619 (K, L, US); Gunung Leuser Nature Reserve, c.6 km SW from the mouth of Lau Ketambe, 12–1500 m, 23 iii 1975 (fr, fl), *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes* 15747 (K, KEP, L, MO, US); Gunung Leuser Nature Reserve, Alas River valley near mouth of Renun, 50–125 m, 21 vii 1979 (fl), *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes* 18968 (L); Gunung Leuser Nature Reserve, Camp 1 Climbing Gunung Mamas c.5 km SW from the mouth of Lau Ketambe, 1000 m, 5 v 1975 (fl), *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes* 16590 (K, L).

Odd collection: INDONESIA. Sumatra: **Aceh:** Archipel. Ind. Gajolanden. From Kongke to Goempang [03°00'N 97°50'E], 1000 m, 5 iii 1937 (fl, fr), *C.G.G.J. van Steenis* 9503 (K, L).

The species is similar to *Paraboea capitata* (var. *oblongifolia*) but its long pedicels, resulting in a lax appearance to the (non-capitate) inflorescence, means that it is easily distinguished from this species.

47. *Paraboea luzoniensis* Merr., Philipp. J. Sci. 1: Suppl. 225 (1906); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 432 (1984). – Type: Luzon, Cavite Province, Maragongdong, 100–400 m, vii 1905 (fl, fr), *Merrill* 4178 (lecto L, designated by Burt (1984: 432); iso E, K, NY, P). **Fig. 27.**

Paraboea ridleyi Elmer, Leaf. Philipp. Bot. 3: 949 (1910); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 435 (1984). – Type: Philippines, Mindanao, district of Davao, Mt. Apo, *Elmer* 11145 (lecto E, designated by Burt (1984: 435); iso BM, K, L, NY, W).

Perennial rosulate herb, sometimes seen with a subterranean stem (or rhizome) up to 10 cm long. *Leaves* congested in a rosette or opposite on an extending stem or rhizome, petiolate; petiole 2–10 cm long, slightly enlarged at the base and joining across the node, with a brownish matted indumentum; blades \pm ovate, 4–10 \times 2.5–6 cm, c.1–1.5 times as long as wide, apex obtuse to rounded, base truncate, subcordate or cordate, margin entire, upper surface arachnoid when young and later glabrescent, lower surface with a generally brownish (or in rare cases whitish) matted indumentum; veins smooth above, raised beneath, lateral veins c.8 pairs, tertiary venation inconspicuous. *Inflorescence* an axillary cyme, 14–20 cm long, with several to many flowers, possessing some matted indumentum and with minute stalked glands throughout except on the flower; peduncles 5–14 cm long; with two primary bracts, narrowly ovate, 3 mm long, minutely pubescent on the upper



FIG. 27. *Paraboea luzoniensis* Merr.

surface; pedicels c.10–15 mm long, glabrescent, or rarely with a minute glandular pubescence, with sepal-like bracts. *Calyx lobes* narrowly ovate, 3×0.8 mm, glabrous outside, with a very minute pubescence (or sessile glands) inside. *Corolla* violet or violet-blue, 8 mm long, 12 mm across, \pm minutely pubescent outside, glabrous inside; tube c.4 mm long, limb distinctly 2-lipped; upper lip 2-lobed, rounded, c.4 \times 3.5 mm, lower lip 3-lobed, rounded, c.4.5 \times 5.5 mm. *Anthers* \pm triangular, c.2.2 \times 3 mm, opening in the centre of the anther locules, coherent with each other, dorsifixed; filaments c.3.5 mm long, inserted 2 mm from the corolla base, curved to make anther apex point towards gynoecium. *Gynoecium* 7 mm long; ovary 1 mm

wide; style distinct, 0.3 mm wide; stigma slightly larger than style. *Fruit* a linear non-twisted capsule, 1.5–4 cm long, glabrous. *Seeds* ovoid, 0.4 × 0.2 mm.

Distribution. Philippines.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. PHILIPPINES. **Mindanao:** Bukidnon: [08°05'N 125°03'E], viii 1912 (fl), *E. Fenix* 15780 (BM); Bukidnon subprovince, Vicinity of Tangkulan, [08°20'N 124°50'E], vii 1916 (fl), *E. Fenix* 2107 (P), vii 1916 (fl, fr), *E. Fenix* 24945 (K, NY, US). Zamboanga: [06°55'N 122°05'E], xi–xii 1911 (fr), *E.D. Merrill* 8150 (K, US); Santa Maria, ix–x 1912 (fr), *J. Reillo* BS16451 (BM, K, US), ix–x 1912, *J. Reillo* BS16513 (BM, L). **Panay:** SW range of Mt. Baloy Anunang, c.5 km S of Lublub [11°05'N 123°02'E], 4 viii 1987 (fr, fl), *G.S. Vavadavajan et al.* 1520 (K); Igbaras, Ilo-ilo [10°40'N 122°40'E], iii 1886 (fr), *S. Vidal y Soler* 3392 (K). **Samar:** Mt. Yohoton [Sohoton] Summit, Gwinbawi-an, Terrestrial [11°30'N 124°55'E], 600 m, iv 1970 (fl), *Gutierrez et al.* 1081 (L). **Sulu Archipelago:** Kabungan, Jolo [06°00'N 121°00'E], 250 m, 17 ii 1957 (fl, fr), *Y. Kondo & G. Edaño* PNH36896 (K, L, PNH, US). **Tawi-Tawi:** Tawi-Tawi island, Silisad, Bongao Peak [05°01'N 119°45'E], 227 m, 23 v 1992 (fl), *F.J.M. Gaerlan & E.C. Sagcal* PPI10037 (E).

There are no outstanding differences between the types of the two names being merged (*Paraboea luzoniensis* and *P. ridleyi*) except that in the type of *P. luzoniensis* the leaf texture seems thinner and the inflorescence looks shorter. These differences do not warrant specific delimitation. Several other collections included in this name expand the distribution area of this species into both the Philippines and Borneo. Even so, the species has relatively consistent morphology in the habit, the leaf morphology and the inflorescence. This species is close to *Paraboea schefferi*, *P. minahassae* and *P. leopoldii* (see discussions under those species).

48. *Paraboea madaiensis* Z.R.Xu & B.L.Burtt, *Edinburgh J. Bot.* 48: 4 (1991).

– Type: Borneo, Sabah, Lahad Datu District, around Madai cave [05°15'N 118°18'E], 90–150 m, 15 ix 1976 (fl), *Tamura & Hotta* 722 (holo E; iso KYO).

Fig. 28.

Perennial caulescent subshrub, 40–80 cm tall; stem woody, nearly 1 cm in diameter, internodes c.0.5 cm long, tawny lanate when young (1–2 years old), glabrescent when older (3 years or more). *Leaves* in whorls of 3, distinctly petiolate; petiole c.1–2 cm long, terete, with similar indumentum to the stem; blades ovate, c.3–4 × 1.5–2 cm, c.2 times as long as wide, apex acute, base truncate, margin entire, upper surface with a dense pubescence under a layer of white arachnoid indumentum, lower surface with a white matted indumentum; veins obscure above and beneath, lateral veins c.6 pairs, tertiary venation obscure. *Inflorescence* terminal, paniculate, c.15 cm long, rather narrow, c.3 cm wide, with a matted indumentum throughout except on the flower; the basalmost internode of the flowering stem c.3–5 cm long, floral leaves

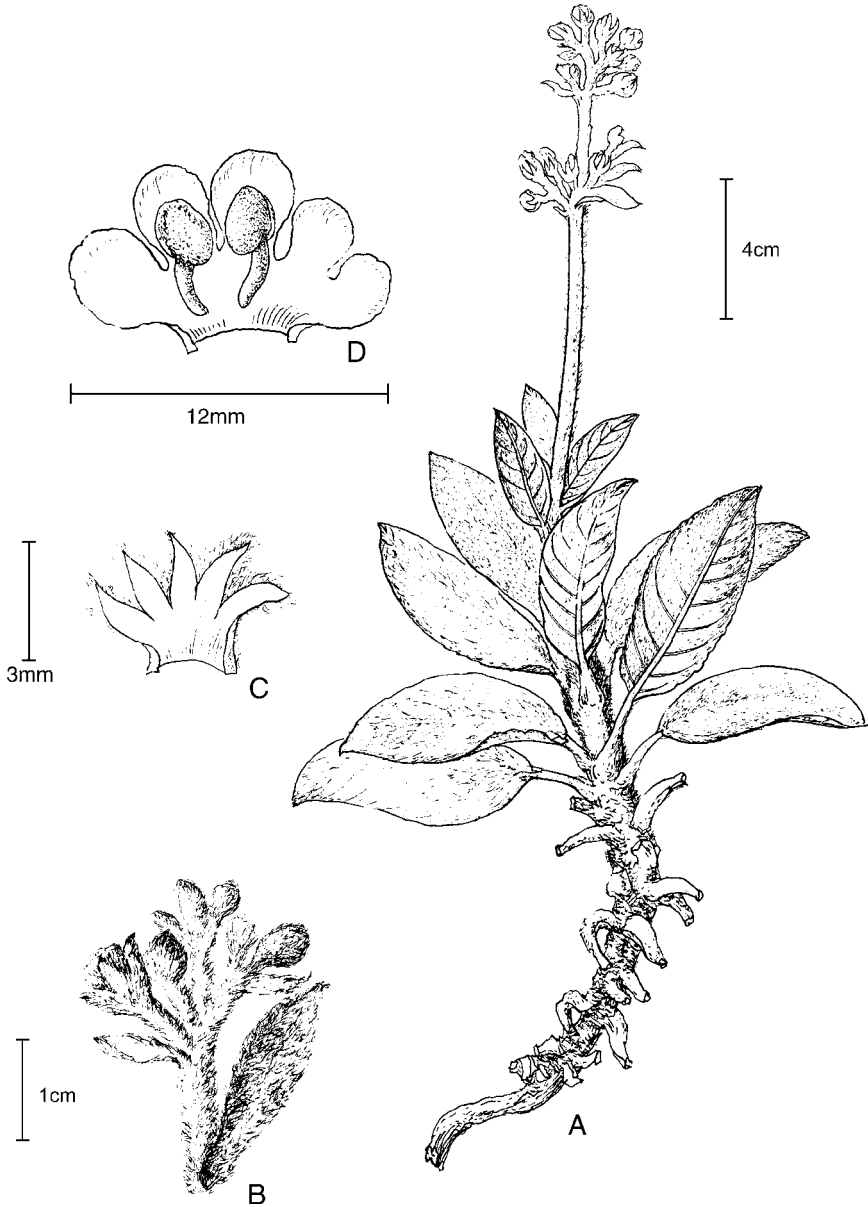


FIG. 28. *Paraboea madaiensis* Z.R.Xu & B.L.Burtt. A, habit; B, inflorescence; C, calyx opened out; D, corolla opened out.

intermediate to the cauline ones, normally without petiole, 2 or 3 cymes at each node; cymes short, with or without a short peduncle, peduncle bracts and pedicel bracts similar to calyx lobes; pedicels 5–10 mm long. *Flowers* glabrous except on the

calyx, sometimes the lanate hairs extending to the corolla outside. *Calyx* c.3 mm long, 5-lobed to the base, lobes narrow-ovate, lanate outside. *Corolla* pale violet, c.8 mm long, 9 mm across; tube 2.5 mm long, limb 2-lipped; upper lip 2-lobed, lobes wide-ovate, 3×3.5 mm, lower lip c.5 mm long, 3-lobed, middle lobe slightly smaller than the two lateral lobes, obovate, 3×3.5 mm, two lateral lobes equal, ovate, 4×5 mm. *Anthers* yellow, transversely ellipsoid, $c.2 \times 3.5$ mm, coherent at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments c.2.5 mm long, 0.7 mm wide; ovary ovoid, 1.5×1 mm; style c.3 mm long; stigma capitate, not larger than style. *Fruit* a spirally twisted capsule, linear, c.1.3 cm long, 1.2 mm in diameter, glabrous. *Seeds* compressed, ellipsoid, 0.5×0.15 mm.

Distribution. Malaysia: Sabah.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). The conservation assessment given reflects the fact that although this species is known from few collections they are all from a limestone area that is in the Madai Baturong Forest Reserve and there are no major threats.

Additional specimens examined. MALAYSIA. **Sabah:** Lahad Datu District, Madai Forest Reserve, Mostyn [$05^{\circ}20'N$ $118^{\circ}11'E$], limestone hill top, 430 m, 6 vi 1966 (fl, fr), *Ding Hou* 166 (A, K, L); Madai, Lahad Datu, Madai limestone hill, E coast Darrel Bay, 305 m, 16 vi 1963 (lv), *W. Meijer* SAN37962 (K); Batu Tengar Cave, Segarong P.F.R., 200 m, *R. Kiew* RK 4318 (KEP, SAN).

This species is close to *Paraboea candidissima* as well as to *P. sabahensis* but the leaves are much smaller than in *P. candidissima* and the truncate leaf base and distinct petiole distinguish it from *P. sabahensis*. Kiew (1998) noted that this species is used medicinally by local people.

49. *Paraboea mahaxayana* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 5 (1991).
– Type: Laos, Prov. de Cammoun [Khammouane], village de Mahaxay [$17^{\circ}25'N$ $105^{\circ}12'E$], 150 m, fissures d'un gros rocher calcaire dans un forêt de haute futaie très humide, 22 i 1931 (fr), *Pételot* s.n. (holo P; iso E). **Fig. 29.**

Perennial rosulate herb. *Leaves* congested in a rosette, shortly petiolate; petiole up to 1.5 cm long, with the same indumentum as that on the underside of the blades; blades coriaceous, obovate, $6\text{--}10 \times 2.5\text{--}5$ cm, 1.5–2.5 times as long as wide, apex rounded, base attenuate to rounded, margin crenulate to crenate, upper surface arachnoid when young, glabrescent when older, lower surface with a brownish yellow matted indumentum; veins smooth above, prominent beneath, lateral veins c.10 pairs, tertiary venation conspicuous and reticulate. *Inflorescences* axillary, cymose, with a very slender peduncle, several (c.2–4) clustered on an indistinct (extremely short) stalk from an axil, normally longer than the leaves, when in fruit

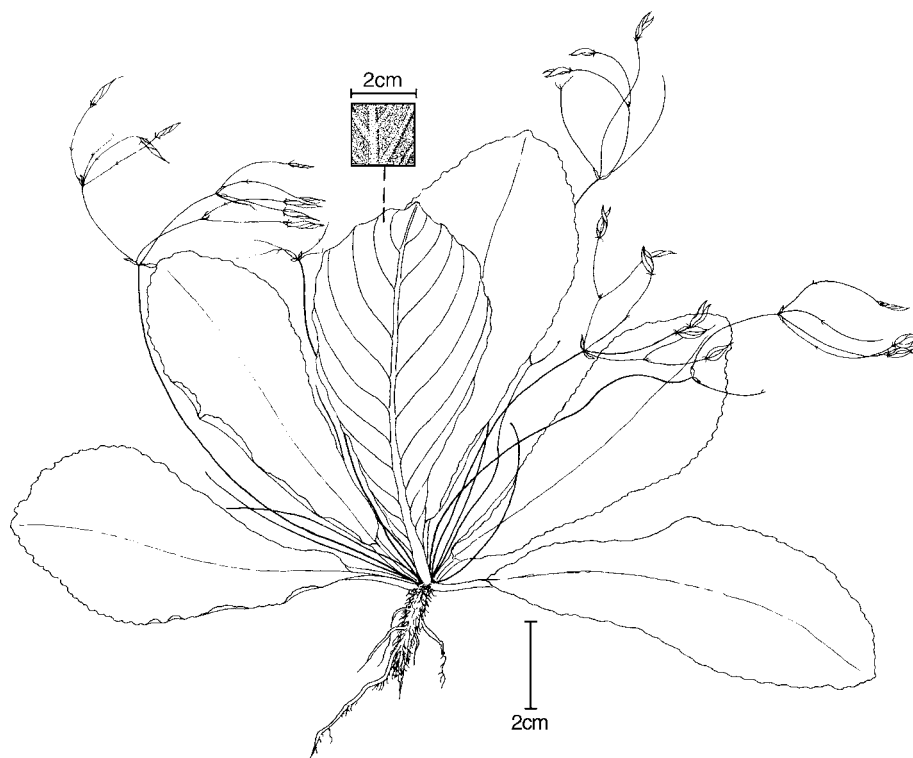


FIG. 29. *Paraboea mahaxayana* Z.R.Xu & B.L.Burt.

up to 15 cm long, very lax, several-flowered, with the same indumentum as that on the lower leaf surface; peduncle up to 10 cm long, c.0.3 mm in diameter, peduncle bracts narrowly ovate, 3×0.5 mm; pedicels long and slender, up to 40 mm long. *Calyx* persistent, 5-lobed to the base; lobes narrowly ovate or triangular, c.2 mm long, 0.5 mm wide. *Corolla* not seen. *Fruits* short, 0.5–0.8 cm long, 1–1.5 mm wide, glabrous, twisted; style persistent on the capsule with a minute pubescence. *Seeds* ovoid, 0.4×0.15 mm.

Distribution. Laos. Known only from the type.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

The species is remarkable in that each fertile axil develops 2–4 cymes from an extremely short stalk and the cyme has an extremely slender peduncle with very few flowers. In addition it has a distinctive very short capsule. In its rosulate habit and

the \pm obovate leaves this species is similar to *Paraboea neurophylla*, *P. crassifolia* and *P. dictyoneura*. In *Paraboea neurophylla* two cymes sometimes develop in a single axil.

50. *Paraboea martinii* (H.Lév.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 38: 470 (1980); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 432 (1984). – *Boea martinii* H.Lév., Fl. Kouy-Tchéou, 180 in clavi, 181 (1914). – Type: China, Kweichow [Guizhou Province], environs de Gan-pin [near Pinba], [c.26°26'N 106°16'E], 13 vi 1898 (fl), *Martin in herb. Bodinier* 2378 (holo E; iso P). **Fig. 30.**

Paraboea barbartipes K.Y.Pan, Acta Phytotax. Sin. 26: 441 (1988); K.Y.Pan in Wang et al., Fl. Reipubl. Popularis Sin. 69: 468 (1990). – Type: China, Guangxi, Napo, on limestone, *D. Fang et al.* 22417 (holo PE).

Paraboea clavisejala D.Fang & D.H.Qin, Acta Phytotax. Sin. 33: 602 (1995). – Type: China, Guangxi, Napo, on limestone, *D. Fang et al.* 79619 (holo GXMI).

Perennial rosulate herb, with a short stem c.10 cm long, 5–8 mm in diameter. *Leaves* opposite, petiolate; petiole c.3–10 cm long; blades elliptic, 8–14 \times 3–5 cm, 2.5–4 times as long as wide, apex acute, base cuneate, margin entire or slightly crenulate, upper surface with some arachnoid indumentum or glabrescent, lower surface with a pale brown matted indumentum; veins obscure above, prominent beneath, lateral veins c.11 pairs, tertiary venation reticulate. *Inflorescence* a terminal panicle, with a matted indumentum on the flowering stem and the floral leaves but less pubescence on the peduncles and the pedicels; flowering stem c.30 cm long, elongating to c.15–20 cm long between the axil of the uppermost normal vegetative leaves and the lowest axil bearing a cyme, with 1–2 pairs of much reduced floral leaves in-between, c.3 \times 1.2 cm; 2 cymes at each node, the lowest axillary cymes 10–15 cm long, many-flowered; peduncle 5–7 cm long, peduncle bracts narrow-ovate, < 1 cm long; pedicel c.7 mm long, with bracts sepal-like. *Flowers* large, glabrous or in rare cases with some pubescence on the calyx and the corolla outside. *Calyx* 2–3 mm long, 5-lobed to the base, lobes narrow-oblong or ovate, c.2.8 \times 0.8 mm. *Corolla* blue, c.1.5 cm long, 1.2 cm across when fully open, tube c.7 mm long, slightly swelling in the middle, limb with 2 lips; upper lip with 2 lobes, semi-circular, c.3 \times 4 mm, lower lip c.8 mm long, with 3 lobes, middle lobe semi-circular, c.4.5 \times 5 mm, two lateral lobes wide-ovate, c.2.5 \times 4 mm. *Stamens* 2, anthers transversely ellipsoid, c.1.5 \times 4 mm, with apex pointing towards the gynoecium, coherent with each other at the apex, apertured at the upward end, dorsifixed; filaments c.10 mm long, curved into a knee in the middle with a beard of branched multicellular hairs. *Gynoecium* c.9 mm long, 1 mm at the widest, stigma capitate. *Fruit* a spirally twisted capsule, c.3.5 cm long, 1.2 mm wide, glabrous. *Seeds* ellipsoid, 0.7 \times 0.2 mm.

Distribution. China: Guangxi, Guizhou and Yunnan.

Habitat and ecology. On limestone.

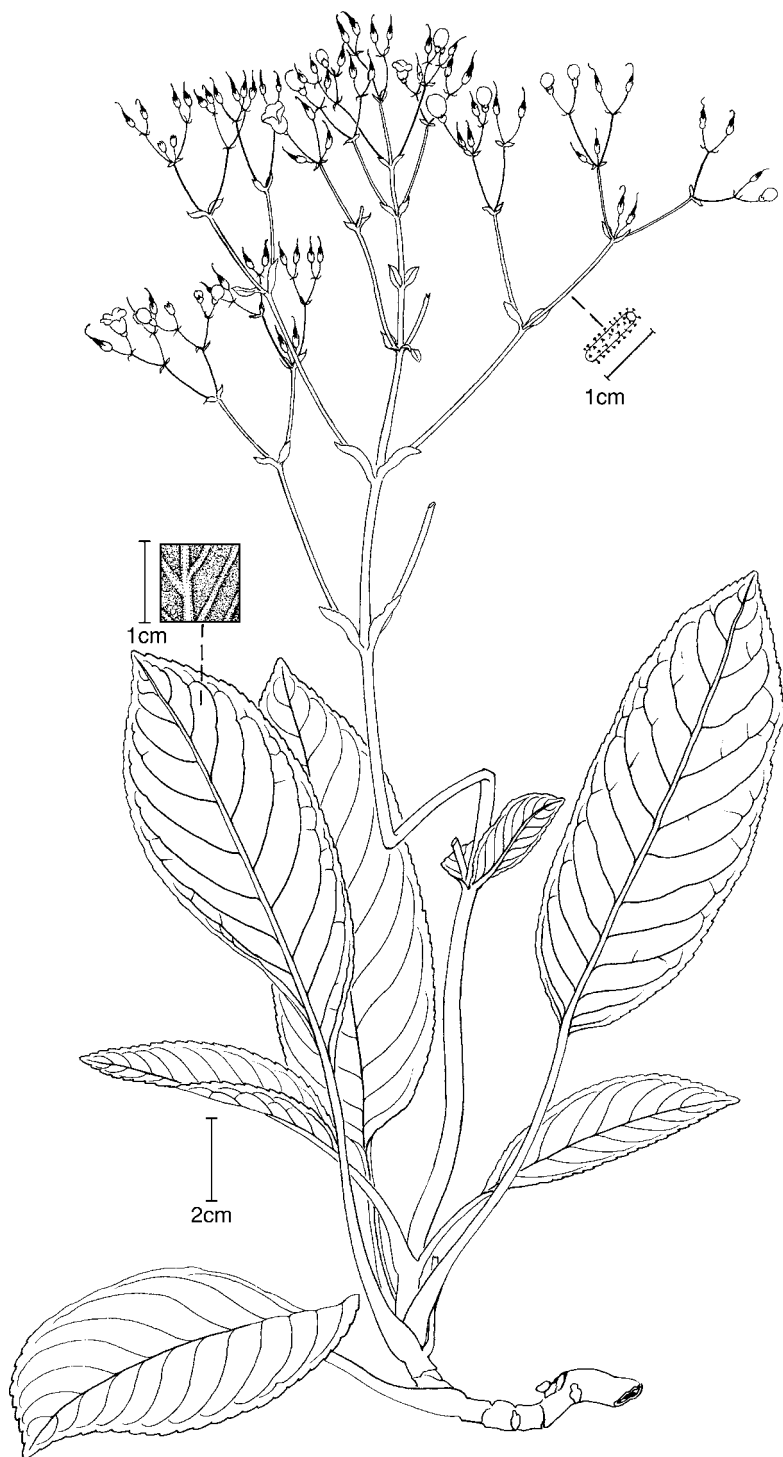


FIG. 30. *Paraboea martinii* (H.Lév.) B.L.Burtt.

Proposed IUCN conservation assessment. Least Concern (LC). Although the species is only known from few collections these are distributed over a very wide area and it is likely that it will be found in many more limestone ranges with further exploration, and there are no major threats.

Additional specimen examined. CHINA. **Yunnan:** Loping [24°52'N 104°14'E], 1200 m, 20–25 ix 1985 (fr), Z.R. Xu LM4994 (E, SYS).

When Pan (1988) published her species *Paraboea barbartipes* she stated that it was unique in the genus in the possession of a beard of hairs on the filaments. However, all the specimens of *Paraboea martinii*, *P. glutinosa* and *P. thorelii* examined in our study possess this character. *Paraboea barbartipes* has been reduced to a synonym of *P. martinii* (H.Lév.) B.L.Burt (1984).

The French missionaries' spellings for some Chinese places like *Gan-chouen-tchiou*, *Gan-chouen-fou* and *Gan-pin* (in Guizhou Province) seem to have derived from the local dialect pronunciation. From the first author's experience in minority areas of Guizhou the locals pronounce the Mandarin *An* (meaning 'peace' or 'safe') as *Ngan*, similar to a linguistic element in the Vietnamese language. French has no *Ng* at the beginning of a word and they appeared to have spelled *Ngan* as *Gan*. *Tchiou* is no doubt *zhou* in the Chinese Pinyin system (*Zhou* is a district or a county), *fou* is *fu* (a city or a prefecture then). Thus, *Gan-chouen-fou* [= An1Shun4Fu3] should be today's Anshun City (c.26°15'N 106°56'E), *Gan-chouen-tchiou* [= An1Quan2Zhou1, a safe county] should be today's Changshun County (c.26°02'N 106°29'E), and *Gan-pin* [= An1Pin2, a safe place] should be today's Pingba town (c.26°26'N 106°16'E). These interpretations are supported by studying the map made by Lévillé in his Fl. Kouy-Tchéou (Flora of Guizhou).

In the protologue for *Paraboea clavisepala* a wonderful line drawing (p. 603) of this newly published taxon points directly to the earlier published *Paraboea barbartipes*. The type of *Paraboea clavisepala* is a paratype of *P. barbartipes* collected from exactly the same locality by the same collector (D. Fang *et al.*). Obviously the collector sent some of the collections to PE and IBSC, which were identified as *Paraboea barbartipes* K.Y.Pan (*sp. nov.* in 1988) and later re-annotated as *P. martinii* (H.Lév.) B.L.Burt by K.Y. Pan. D. Fang *et al.* selected a paratype collection of *Paraboea barbartipes* for their new taxon *P. clavisepala* D.Fang & D.H.Qin.

50a. *Paraboea* aff. *martinii*, *sp. nov.*?

CHINA. **Yunnan:** Maguan Co., Gulinqing, on limestone rock, [22°58'N 104°28'E], 1500–1700 m, 1–20 iv 1986 (fr), Z.R. Xu GL86-7477 (E, SYS).

VIETNAM. **Lao Cai:** massif vers 1600 m, env. de Chapa [22°21'N 103°50'E], viii 1930, *A. Pételot* s.n. (P). **Khanh Hoa:** Hon Heo, Nha Trang [12°24'N 109°16'E], 28 ix 1922 (fr), *E. Poilane* 4751 (P); 14 km Nha Trang, 300 m, 2 km de la mer (Ninh Thuan, Binh Thuan, Binh Tuy), 22 ix 1922 (fr), *E. Poilane* 4676 (P).

Xu GL86-7477 may be an undescribed species related to *Paraboea martinii*. It differs from *Paraboea martinii* in the leaf blades being wide-ovate to circular, c.7.5–26 × (3–)7–14.5 cm, 1–2.5 times as long as wide, obtuse or rounded at the apex and truncate to shallowly cordate at the base. Although there is no flowering material it can be seen from its dried infructescence that it has a terminal panicle, a flowering stem c.35 cm long and fruits of a spirally twisted capsule, c.1.5 cm long. The Vietnamese material is similar but quite far removed from the specimen from China. A new name or new names will be established for the above group of collections when sufficient material is available.

51. *Paraboea mataensis* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 5 (1991). – Type: Sulawesi, N shore of Lake Mata on East of Nuha (c.2°27'S 121°22'E), in patches of coastal forest up to 20 m tall along the lake, bedrock conglomerate cemented together by sandstone, covered by a thin layer of humus, rather common solitary herb on steep slope, 400 m, 16 vi 1979 (fl, fr), *M.M.J. van Balgooy et al.* 5822 (holo L).

Large perennial herb, caulescent, erect, monocarpic, up to 1 m tall (including the inflorescence); stem terete, up to 1.2 cm in diameter; internodes quite short, normally < 1 cm long, up to 2 cm long (excluding those on the flowering stem), with a thick layer of lanate indumentum. *Leaves* in whorls of 4, indistinctly petiolate, the leaf bases long-attenuate to the base of the petioles and more or less joining each other across the node, more or less obovate to narrow-oblong, 5–18 × 1–3.5 cm, 5–10 times as long as wide, apex short-acute, base long-attenuate, margin entire, with a dense pubescence covered by an arachnoid indumentum on the upper surface, with a thick layer of brownish lanate hairs on the undersurface; veins smooth above, raised beneath, lateral veins c.10–12 pairs, tertiary venation invisible. *Inflorescence* terminal, paniculate, c.40–50 cm long, whitish or brownish lanate except on the flower and the upper half of the pedicel; flowering stem quadrangular or multi-ridged, internodes up to 10 cm long, floral leaves intermediate to the cauline ones and reducing in size upward, 4 cymes from each node; cymes up to 20 cm long, much branched, with numerous flowers, peduncle up to 14 cm long with obovate-oblong bracts 8 × 1.5 mm; pedicels < 5 mm long, the upper half not sublanate but more or less pubescent (or rather, minutely capitate-glandular). *Calyx* 5-lobed to the base, lobes ovate, c.2 × 0.6 mm, more or less minutely pubescent on both sides. *Corolla* c.8 × 12 mm when open; tube c.2 mm long, limb ciliate, conspicuously 2-lipped; upper lip c.6 × 8 mm, with a sinus c.3 mm deep, lower lip c.8 × 10 mm, obovate, 3-lobed, middle lobe surpassing the side ones by c.3 mm, more or less obovate, c.5 × 3.5 mm. *Stamens* 2; anthers transversely ellipsoid, c.2 × 4 mm, open in the centre of the anther locules, coherent with each other at the apex and the base, apex turned towards the gynoecium, dorsifixed; filaments inserted at the base of the corolla, c.4 mm long, 1.2 mm wide, flat, verrucose and crenate on the edge; staminodes 2, 0.5–2 mm long. *Ovary* c.2 × 0.8 mm; style distinct from the ovary, c.6.5 × 0.3 mm; stigma capitate, slightly larger than style. *Fruit* linear, 1–2.5 cm long, 12 mm in diameter, glabrous, spirally twisted. *Seeds* ovoid (brown), 0.6 × 0.2 mm, with two dark brown tips.

Distribution. Indonesia: Sulawesi.

Habitat and ecology. On soils over conglomerate rock.

Proposed IUCN conservation assessment. Least Concern (LC). Although the species is only known from few collections these are widespread and there is no evidence that the species is confined to limestone, and there are no major threats.

Additional specimens examined. SULAWESI. Sungai Balambano, 20 km SW on road Soroako-Wasupondo-Malili (c.2°36'S 121°14'E), 600 m, 26 vi 1979 (fr), much disturbed primary forest c.30 m tall around waterfall, *M.M.J. van Balgooy et al.* 6010 (L); Matano-Meer (Nord ufer), 300 m, Konglomeratfelsen, xi 1929 (fr), *G.K. Kjellberg* 3938 (S); SW peninsula, NE of Makassar within 54–60 km on the road [05°01'S 119°35'E], 5 vii 1976 (fr, fl), *W. Meijer* 10850 (MO).

The species is close to *Paraboea havilandii* (Ridl.) B.L.Burtt, but the glabrous or minutely pubescent calyx (not lanate) and ciliate corolla (not glabrous) easily distinguish it.

52. *Paraboea meiophylla* B.L.Burtt, Bot. J. Linn. Soc. 85: 29 (1982); Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 433 (1984). – Type: Sarawak, 4th Division, Gunung Mulu National Park, [04°05'N 114°50'E], 24 vi 1962 (fl, fr), *B.L. Burtt & P.J.B. Woods* 2265 (holo E; iso SAR). **Fig. 31.**

Perennial caulescent herb; stem terete, slender, arising from a woody caudix, up to 15 cm long excluding the inflorescence, internodes 0.5–2 cm long, with a whitish arachnoid or matted indumentum or glabrescent. *Leaves* in whorls of 3 or in rare cases opposite, shortly petiolate; petiole 0.5 mm long, sharing the same indumentum as the blades; blades narrow-elliptic to elliptic, 2–12 × 0.6–5.2 cm, apex acute, base attenuate, margin entire, upper surface glabrous or with some whitish arachnoid covering, lower surface with a white matted indumentum; veins smooth above, raised beneath, lateral veins c.7 pairs, tertiary venation invisible. *Inflorescence* terminal, paniculate, with a whitish matted indumentum throughout except on the pedicels and flowers; flowering stem up to 30 cm long, basal internodes elongated, 2–10 cm long; floral leaves dramatically reduced in size compared with the caulescent leaves, up to 3 × 1 cm; 3 cymes from each node; cymes from the lowest axil 3–12 cm long, several-flowered; peduncle 1–6 cm long, peduncle bracts narrow-oblong, sepal-like or up to 2 times as long as sepals; pedicel c.7 mm long, glabrous. *Calyx* 1.5–2 mm long, 5-lobed to the base, lobes ovate. *Corolla* purple or pale mauve-blue, c.9 mm long, 10 mm across when fully open; tube 1.5 mm long, limb 2-lipped; upper lip 2-lobed, lobes wide-ovate, c.5 × 5 mm, lower lip c.7 mm long, 3-lobed, middle lobe longer than the lateral lobes, ± oblong, c.3 × 3.5 mm, lateral lobes wide-ovate, c.4.5 × 5 mm. *Anthers* yellow, transversely ellipsoid, c.1.5 × 3.5 mm, coherent with each other at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments inserted at the corolla base with

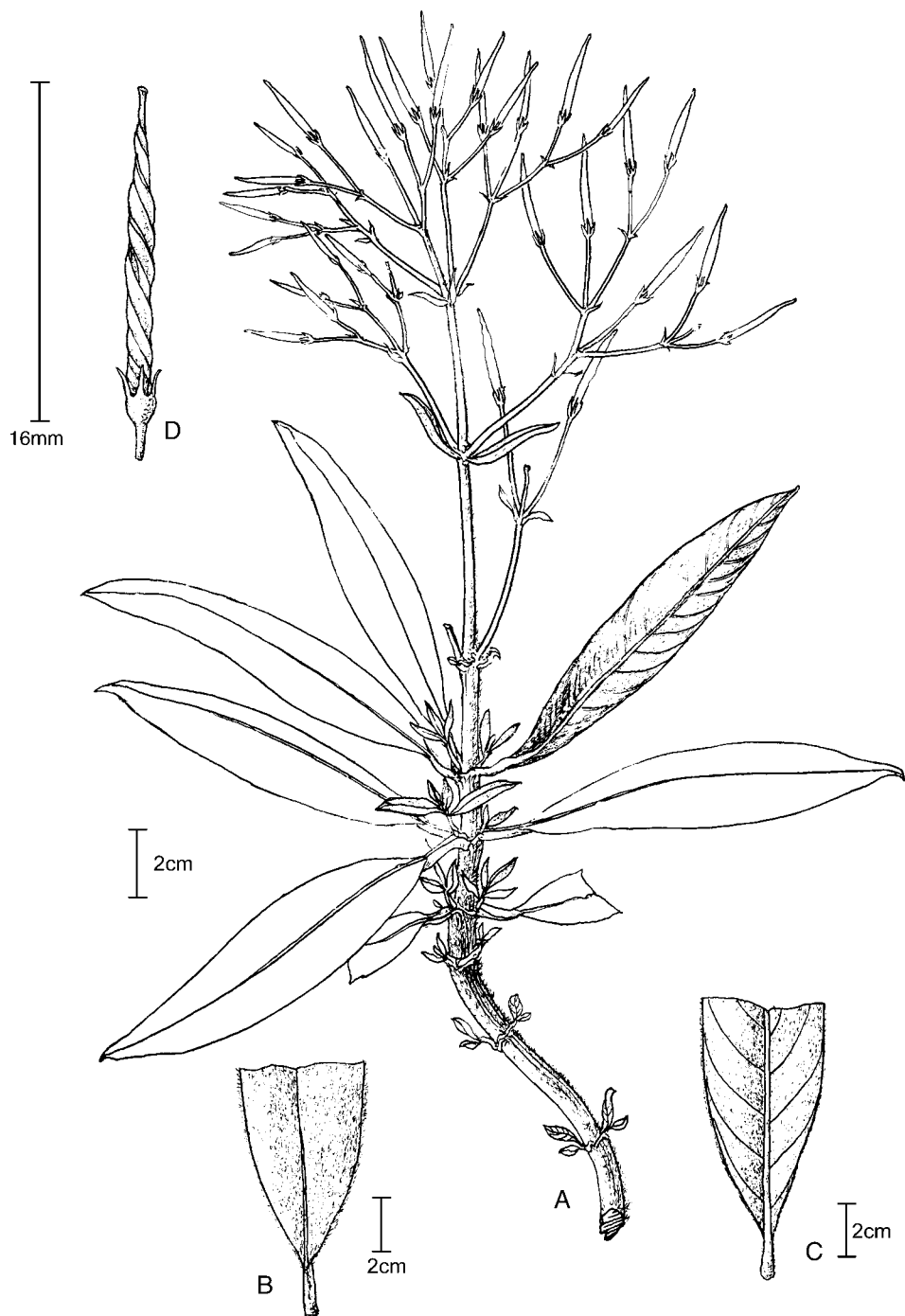


FIG. 31. *Paraboea meiophylla* B.L.Burtt. A, habit; B, upper leaf surface; C, lower leaf surface; D, fruit.

a free part c.3 mm long, crenate in the middle. *Ovary* ovoid, c.2 × 1 mm, distinct from the style; style narrower, c.5 mm long; stigma capitate, similar to style. *Fruit* a spirally twisted capsule, c.1.5 cm long, 1.5 mm in diameter, glabrous. *Seeds* ellipsoid, 7 × 2 mm.

Distribution. Malaysia: Sarawak.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). The conservation assessment given reflects the fact that although this species is known from few collections they are all from Gunung Mulu National Park which is a World Heritage Site and well protected.

Additional specimens examined. MALAYSIA. **Sarawak:** 4th Division, Gunung Mulu National Park, S flank of Benarat Cliffs, facing Melinau on Limestone [04°02'N 114°50'E], 24 vi 1962 (fl, fr), *B.L. Burt* & *P.J.B. Woods* 2281 (E, SAR), 2282 (E, SAR), 2278 (E); Gunung Mulu National Park [04°05'N 114°54'E], 30 i 1978 (fr, fl), *C. Hansen* 227 (B, E, SAR); Gunung Mulu National Park, Benarat, SW face [04°02'N 114°50'E], 700 m, 23 viii 1978 (fl, fr), *A.C. Jermy* 14475 (E).

This species is close to *Paraboea effusa* B.L.Burt, but differs in having a whitish (vs. yellowish-white or light brown) indumentum on the leaves and inflorescence and generally smaller leaves.

53. *Paraboea minahassae* (Teijsm. & Binn.) B.L.Burt, Kew Bull. 1948: 56 (1948); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 433 (1984). – *Boea minahassae* Teijsm. & Binn., Tijdschr. Ned. Ind. 25: 415 (1863). – *Didymocarpus minahassae* (Teijsm. & Binn.) H.O.Forbes, J. Linn. Soc., Bot. 19: 298 (1882). – Type: Celebes [Sulawesi], Prov. Minahassa, Likoepang [Likupang], Hab. Insulam, 1859–1860 (fl, fr), *W.H. de Vriese* & *J.E. Teijsmann* 29 (lecto L, designated here). **Fig. 32.**

Perennial caulescent herb with a short stem < 20 cm long. *Leaves* oppositely congested at top of the stem or with internodes up to 2 cm long, long-petiolate; petiole 2–9 cm long, slightly enlarged at base and joining each other across the node, with a whitish or dark brown matted indumentum; blades more or less oblong-ovate, 3–7.5 × 1.5–3 cm, c.1.5–2 times as long as wide, apex obtuse, base rounded to shallowly cordate, margin entire, upper surface arachnoid or glabrescent, lower surface with a whitish to dark brown matted indumentum; veins smooth above, raised beneath, lateral veins c.6 pairs, tertiary venation invisible. *Inflorescence* an axillary cyme, much longer than the leaves, c.10–15 × 2–5 cm with a few to many flowers; peduncle 7–14 cm long, with a matted indumentum throughout when young, the two primary bracts narrowly ovate, c.3 mm long; pedicels c.5–10 mm long, glabrous or with a minute glandular pubescence. *Calyx lobes* narrowly ovate, 2 × 0.8 mm, glabrous outside, minutely pubescent inside. *Corolla* c.5 mm long, 6 mm across, glabrous; tube c.2–2.5 mm long, limb ± 2-lipped, lower lip slightly longer



FIG. 32. *Paraboea minahassae* (Teijsm. & Binn.) B.L.Burtt. A, habit; B, section of peduncle.

than upper lip, 5 lobes of similar size and shape, rounded, c.2.5 × 3–3.5 mm. *Anthers* ± triangular, c.2.5 × 3 mm, opening in the centre of the anther locules, dorsifixed; filaments 2.5 mm long, inserted at c.1.5 mm from the corolla base, curved to make anther apex point towards gynoecium. *Gynoecium* 6.5 mm long; ovary 0.8 mm wide; style distinct, 0.3 mm wide; stigma larger than style. *Fruit* a linear non-twisted capsule, c.2.5 cm long, glabrous, ± curved like a sickle when mature. *Seeds* ellipsoid, 0.4 × 0.2 mm.

Distribution. Indonesia: Sulawesi.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Data Deficient (DD). This species has only been collected twice and these both long ago. We have no information on the habitat from which it was collected nor whether it was indeed from limestone.

Additional specimen examined. INDONESIA. [Sulawesi:] prope Menado, *Hort. Bogor.* 5262 (BM).

Burtt (1984) listed syntypes for this name including ‘prope Menado, *Hort. Bogor.* 5262 (BM)’. Here we lectotypify the name with *de Vriese & Teijsmann* 29 as this collection is a complete plant from Minahassa. Forbes (1882) suggested the corolla of this species was 17 mm in diameter but we have seen no material approaching this size.

54. *Paraboea minor* (Barnett) B.L.Burtt, *Notes Roy. Bot. Gard. Edinburgh* 41: 433 (1984). – *Boea minor* Barnett, *Nat. Hist. Bull. Siam Soc.* 20: 19 (1961); Barnett, *Kew Bull.* 15: 255 (1961). – Type: Thailand, Songkhla, on Kaokao [07°12'N 100°30'E], 29 ix 1929 (fl, fr), *A.F.G. Kerr* 17575 (lecto K, designated by Barnett, *Kew Bull.* 15: 255 (1961)) [cult. Bangkok]. **Fig. 33.**

Perennial small herb 10–30 cm tall (not including the inflorescence); stem 1.5–3 mm in diameter, with internodes 5–25 mm long, with a whitish matted indumentum. *Leaves* opposite, petiolate; petiole c.1–4 cm long, with 2 narrow wings that join across the node, with a whitish matted indumentum; blades more or less elliptic, 2.5–10 × 1.5–3.5 cm, 2–4 times as long as wide, apex obtuse, base angustate, margin entire, upper surface with some arachnoid covering and then glabrescent, lower surface with a whitish or slight yellowish matted indumentum; veins smooth above, slightly raised beneath, lateral veins sparse, c.5 pairs, tertiary venation invisible. *Inflorescences* subterminal, cymose from the axils beneath the terminal bud, c.10–20 cm long, few-flowered and quite lax, more or less with a minute pubescence; peduncle 7–15 cm long, with 2 linear bracts c.3 mm long; pedicels 10–20 mm long. *Calyx* green, 1.5–2 mm long, 5-lobed to the base, lobes ovate or narrowly so, appearing glabrous. *Corolla* blue, lower part inside whitish, campanulate, c.1.3 cm across; tube c.3 mm long, limb slightly 2-lipped; upper lip c.5 × 10 mm, 2-lobed, lobes widely ovate, c.5 × 6 mm, lower lip c.7 × 12 mm, 3-lobed, middle lobe slightly longer than the lateral lobes, all three c.5 × 7 mm. *Anthers* yellow, heart-shaped with

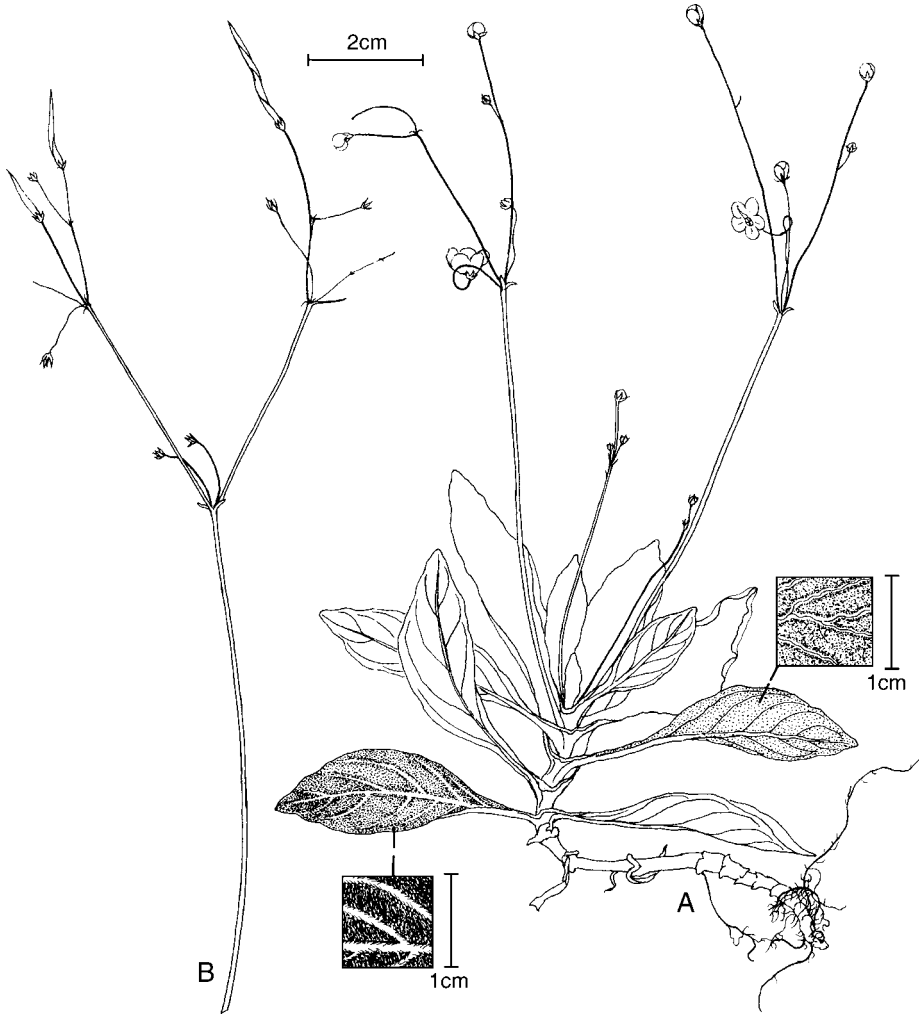


FIG. 33. *Paraboea minor* (Barnett) B.L.Burt. A, habit; B, infructescence.

the apex pointing towards the gynoecium, coherent with each other at the apical part, c.2 × 3 mm, opening in the centre of the anther locules, basifixed; filaments inserted at the corolla base with a free part c.3 mm long. *Gynoecium* lilac, c.8 mm long, 1.2 mm wide at the ovary base and 0.4 mm below the stigma; ovary narrowing into the style without a clear boundary between them; stigma much larger than style. *Fruit* a linear capsule, c.2–2.5 cm long, 2.5 mm in diameter, glabrous, spirally twisted. *Seeds* ovoid or ellipsoid, 0.6–0.9 × 0.25 mm.

Distribution. Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats. This species was, however, included in Poona (2005) as threatened in Thailand.

Additional specimens examined. THAILAND. **Kanchanaburi:** Kin Sayok, about 120 km NW of Kanburi [Kanchanaburi town] [14°15'N 99°10'E], 100–150 m, 3 viii 1946 (fl), *A.J.G.H. Kostermans* 1450 (A). **Satun:** Adang Island [06°34'N 99°06'E], 24 vi 1980 (fl, fr), *Congdon* 711a (A). **Songkhla:** Suan Toon waterfall at Khao Gaeo, c.10 km S of Songkhla, on the highway Songkhla–Chana, 07°04'N 100°32'E, 75 m, 1 xi 1993, *K. Larsen et al.* 44180 (AAU); Boriphat Waterfall, 07°00'N 100°12'E, 100–200 m, 19 x 1991, *K. Larsen et al.* 42391 (AAU); Boriphat Waterfall, 100 m, 29 x 1993, *K. Larsen et al.* 44124 (AAU); Boriphat Waterfall, SW of Hat Yai [07°04'N 100°08'E], (fr, fl), *W.M.M. Eddie* 1 (E); Boriphat Waterfalls, SW of Hat Yai, Rattaphum District, 28 viii 1983? (fr, fl), *W.M.M. Eddie* 2 (E); Boriphat Waterfall, SW of Hat Yai, Rattaphum District, 28 viii 1983? (fr, fl), *W.M.M. Eddie* 3 (E); Boriphat Waterfall, Rattaphum District, 120–150 m, 18 xii 1979 (fr), *T. Shimizu et al.* T-27613 (BKF); Boriphat Waterfall, Rattaphum District [07°04'N 100°08'E], 120–150 m, 18 xii 1979 (fr), *T. Shimizu et al.* T-27657 (BKF); Ton Nga Chang National Park [07°05'N 100°10'E], 9 viii 1980 (fl), *IN* 7 (PSU); Muang District, Suan Toon Falls, 50 m, 5 x 1984 (fr), *J.F. Maxwell* 84-289 (PSU); Ton Nga Chang Reserve, Rattaphum District, 240 m, 2 x 1984 (fr), *J.F. Maxwell* 84-279 (A, PSU); Hat Yai District, Ton Nga Chang Falls, 9 x 1982 (fl), *Piajaporn* 9 (PSU); Ton Nga Chang waterfall, 100–250 m, 1 xi 1990, *Larsen et al.* 41034 (AAU); Ton Nga Chang Waterfall [Nat'l Park], 80–350 m, 19 xii 1979 (fr), *T. Shimizu* T-27712 (BKF); cult. in Bangkok, from Kaokao [07°12'N 100°30'E], 22 x 1928 (fl), *A.F.G. Kerr* 16111 (ABD, K).

See discussion under *Paraboea parviflora*.

55. *Paraboea minuta* (Kraenzl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 24: 47 (1962); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 433 (1984). – *Didymocarpus minutus* Kraenzl., Mitt. Inst. Bot. Hamburg 7: 88 (1927). – Type: [Indonesia, Kalimantan], West Borneo, Bukit Tilung, 700 m, 8 ii 1924 (fr, fl), *H. Winkler* 1488 (holo HBG).

Small perennial herb, lacking any arachnoid covering. *Leaves* (oppositely?) congested in a rosette, petiolate; petiole c.5 mm long, with a brown matted indumentum; blades elliptic, 1.5–2.5 × 0.7–1 cm, c.2–2.5 times as long as wide, apex obtuse, base cuneate or widely so, in some rare cases appearing rounded, margin entire, upper surface with a dense pubescence, lower surface with a brown matted indumentum; veins smooth above, raised beneath, lateral veins c.4 pairs, tertiary venation invisible. *Infructescence* axillary, umbelliform, longer than the leaf, c.5–8 cm long, few-flowered; peduncle slender, c.4–5.5 cm long, glabrescent, bracts sepal-like, narrowly ovate, c.0.5 mm long; pedicels c.6 mm long. *Calyx lobes* ovate, 1 × 0.4 mm, with a minute pubescence outside, glabrous inside. *Corolla* c.4.5 mm long, 8 mm across, ± hairy outside, glabrous inside; tube c.2 mm long, limb 2-lipped; upper lip c.2 × 4 mm, with lobes rounded, 2 × 2 mm, lower lip much larger, c.5 × 8 mm, with 3 lobes c.2.5 × 2.5 mm. *Anthers* widely ovoid, c.0.5 × 1 mm, opening in the centre of the anther locules, coherent only at the apex, basifixed; filaments 1.5 mm long,

inserted at the corolla base, curved to turn anther apex horizontal. *Gynoeceium* c.4 mm long; ovary c.1 × 0.5 mm; style long and distinct, 0.15 mm wide; stigma slightly larger. *Fruit* a linear non-twisted capsule, 0.5–1 cm long, glabrous, opening along the upper suture. *Seeds* not seen.

Distribution. Indonesia: Kalimantan. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

The species is characterised by its miniature appearance and the infructescence that has only 1–2 mature capsules.

56. *Paraboea multiflora* (R.Br.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 433 (1984). – *Boea? multiflora* R.Br., Cyrtandreae 120 (1839), preprint from Benn., Pl. Jav. Rav. 120 (1840). – *Didymocarpus multiflorus* Wall., Num. List. No. 793 (1829), *nomen nudum*. – Type: Bangladesh, Pundua, Sylhet Mt., [collected in early nineteenth century], *F. De Silva in Wallich* 793 (lecto BM, designated here; iso K, K-W). **Fig. 34.**

Boea flocculosa C.B.Clarke, Commelyn. Cyrtandr. Bengal. t.83 (1874). – Type: India, Khasia Hills, *Hooker & Thomson* s.n. (lecto K, designated by Burtt (1984: 434)).

Boea multiflora R.Br. var. *burmannica* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5: 144 (1883). – Type: Burma, Moulmein, *Parish* 436 (lecto K, designated by Burtt (1984: 434)).

Boea microcarpa Drake, Bull. Soc. Philom. Paris, sér. 8, 2: 130 (1890). – *Paraboea microcarpa* (Drake) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 433 (1984). – Type: Vietnam, Quang Ninh: Tangkeuin, près de Quang-Yen, [20°56'N 106°48'E], 1885–1889 (fr), *Balansa* 4302 (holo P).

Boea thirionii H.Lév., Repert. Spec. Nov. Regni Veg. 11: 301 (1912). – *Paraboea thirionii* (H.Lév.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 439 (1984). – Type: China, Kweichow, Gny-ken, chemin de la source, *Esquirol* 2699 (holo E). The type locality should be interpreted as: 'On the way from the starting place (Anlong?) to Ceheng'. Anlong (= *Hing y Fou*, i.e. Xinglyi4fu3) was then the locality of the church of the French missionaries. 'Gny-ken' is nowadays Ceheng, a town (25°00'N 105°48'E) c.40 km E of Anlong (25°06'N 105°28'E).

Boea multiflora R.Br. var. *villosa* Pellegr. in Lecomte, Fl. Indo-Chine 4: 549 (1930). – Type: Laos, Savannakhet, haut vours de la Tch'èpone a 500–600 m, dans les roches, *E. Poilane* 12188 (lecto P, designated here).

Boea reticulata Barnett, Nat. Hist. Bull. Siam Soc. 20: 20 (1961); Barnett, Kew Bull. 15: 256 (1961). – Type: Thailand, Chiangmai [Chiang Mai], Me Wang, *Kerr* 6356 (lecto K, designated by Barnett, Kew Bull. 15: 256 (1961); iso ABD).

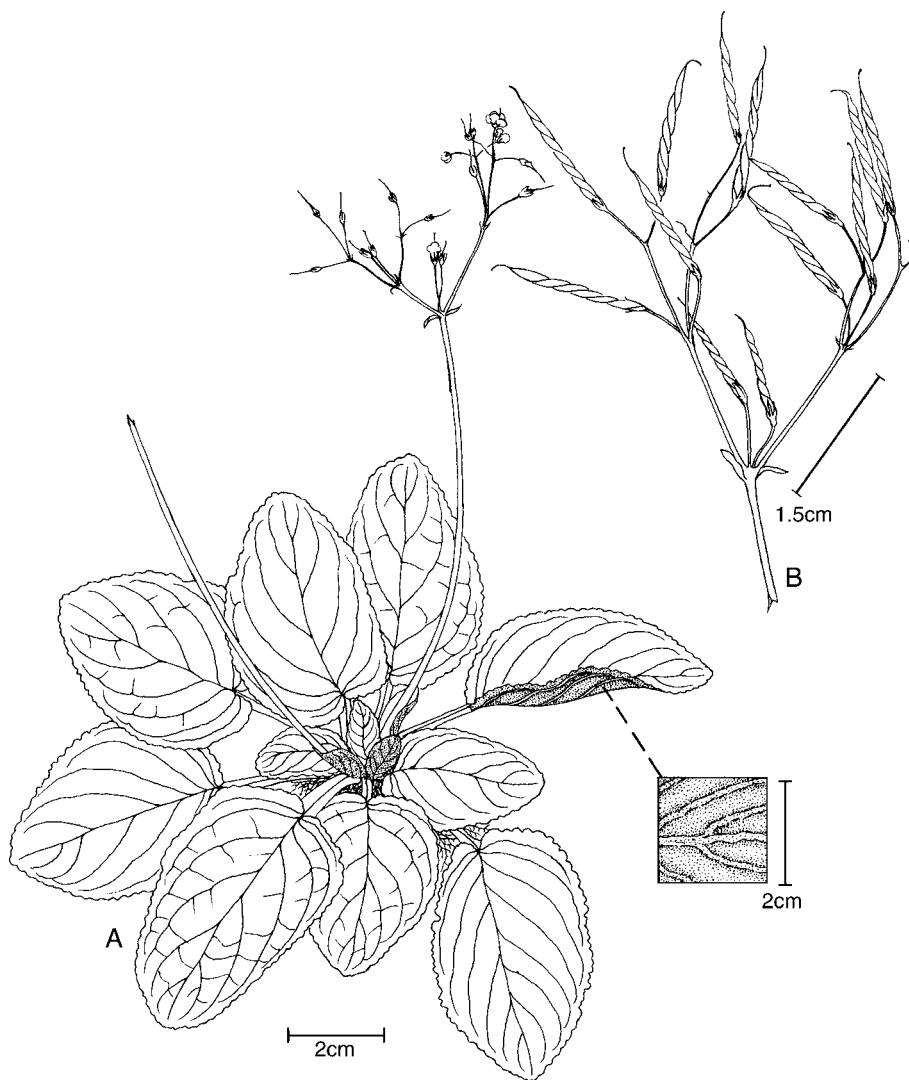


FIG. 34. *Paraboea multiflora* (R.Br.) B.L.Burtt. A, habit; B, infructescence.

56a. *Paraboea multiflora* var. *multiflora*

Perennial rosulate herb, with or without a woody stem or a rhizome; rhizome sometimes up to 20 cm long, 7 mm in diameter. *Leaves* congested in a rosette or sometimes cauline on an extending rhizome, petiolate; petiole 1–12 cm long, with the same indumentum as that on the blades; blades elliptic, more or less unequal, or rarely ovate, 4–22 × 2.5–9 cm, apex obtuse, base normally cuneate and in rare cases slightly cordate, margin more or less crenate, upper surface glabrescent or rarely with some indistinct pubescence, lower surface with a greenish or ferruginous

matted indumentum; veins smooth or scabrate above, raised beneath; lateral veins c.10–15 pairs, tertiary venation reticulate, with a thin or thick matted indumentum. *Inflorescence* axillary, cymose, 4–25 cm long, longer than or similar in length to the leaves, spreading, c.2–6 cm wide, many-flowered, with a matted indumentum except on the flower; peduncle 3.5–22 cm long, peduncle bracts inconspicuous; pedicels 2–7 mm long. *Calyx* 1–2.5 mm long, 5-lobed to the base, lobes ovate or narrowly so, c.1.3 × 0.7 mm, glabrous inside, minutely greyish farinose or pubescent outside. *Corolla* white, c.4.5 mm long, 8 mm across, with some minute pubescence; tube c.1 mm long, limb indistinctly 2-lipped, 2 lobes of the upper lip and 3 lobes of the lower lip similar in size, wide-ovate, c.2.5 × 3 mm. *Anthers* ellipsoid, c.2 × 2 mm, distinctly yellowish or greenish farinose, not coherent with each other, basifixed, opening towards the top of the anther; filaments inserted at the corolla base with a free part c.1 mm long. *Ovary* ovoid, c.2.5 × 1 mm, whitish to greenish farinose, also present on the mature capsule; style distinct from the ovary, c.3 mm long, glabrous; stigma capitate, not enlarged. *Fruit* a narrow-ovoid capsule, c.0.6–1.2 cm long, 1–2 mm in diameter, greyish to greenish farinose, spirally twisted. *Seeds* ovoid or ellipsoid, 3 × 1.5 mm.

Distribution. India, Bangladesh, Bhutan, Burma, Laos, Vietnam, Thailand and China.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This variety has been collected at many sites over a wide area and there are no major threats.

Additional specimens examined. BANGLADESH. East Bengal, (fr), Griffith 3843 (P, W) [East Bengal, *Cult. in Roy. Bot. Gard. Kew* (A)].

BURMA. Moulmein [16°30'N 97°39'E], 1862? (fr, fl), *J. Lobb* 436 (K).

CHINA. vii 1911 (fl), *J. Esquirol* 2699 (E). **Guangxi:** (fr), *L.Q. Chen* 92733 (IBSC, photo US).

Guizhou: Lodian Xian (District Lofou) [25°25'N 106°48'E], 1909 (fr), *J. Cavalerie* 3620 (E, K, P).

INDIA. **Assam:** N. Lakhimpur [27°57'N 80°47'E], Kakoi Reservo, 13 v 1965 (fr), *D.M. Verma* 41776 (E). **Meghalaya:** Cherrapunjee, Khasi Hills [25°34'N 91°53'E], c.1300 m, 4 vii 1952 (fl), *T.R. Chand* 5977 (L, MICH); Cherrapunjee, Khasi Hills, c.1300 m, 7 viii 1952 (fl), *T.R. Chand* 6394 (MICH); Sabhar Khasiyas [Khasi Hills], 1500 m, 3 x 1867 (fr), *C.B. Clarke* 5536 (L); E. Hiri Bordge Khasia [Khasi Hills], 13 v 1886 (fr), *C.B. Clarke* 43839 (BM); Hab. Mount. Khasia [Khasi Hills], 4000 ft (c.1200 m), *J.D. & T. Coll* s.n. (C, L, P); Buxaduars [Khasi Hills], 700 m, 23 vi 1914 (fr, fl), *R.E. Cooper* 1026 (E); Mop, (fr), *J.D. Hooker* 2 (GH, NY, US, W); Cherrapunjee, Khasi Hills, 1333 m, 27 vi 1952 (fl), *W.N. Koelz* 30371 (L, MICH).

LAOS. **Champassak:** Mekong, Bassac [14°54'N 105°51'E], 1866–1868 (fr), *M.L. Thorel* 2353 (P). **Savannakhet:** cours de la Tchepone [16°42'N 106°13'E], 500–600 m, 24 vii 1925 (fl), *E. Poilane* 12188 (P).

THAILAND. s.l., 10 xi 1965 (fl), *P. Sangkhachand* 25 (BKF). **Chiangmai:** Me Wang (type locality of *Boea reticulata* Barnett), 400 m, 19 vii 1922 (lv), *A.F.G. Kerr* 6356 (ABD, K); 12 km W of Hot, Hot District [18°12'N 98°34'E], 23 ix 1958 (fl), *K. Larsen et al.* 5210 (ABD, C); Maeklang Falls, 50 km NW of Chiang Mai, Jawng Tong District, Doi Inthanon National Park [18°30'N 98°40'E], 430 m, 3 xi 1967 (fr), *B.L. Burtt* 5612 (E); Nam Tok

Mae Klang, Jawar Tong District, Doi Inthanon National Park, 25 xi 1965 (fl), S. *Phusomsaeng* 5 (BKF, L); Payap, West of Muang Hot [W of Hot, Hot District], in rocky forest [18°12'N 98°34'E], 23 ix 1958 (fl), T. *Sorensen et al.* 5201 (BKF); Hot District, Awp Luang Nature Park, Doi Awp Luang, Mae Jam River, c.15 km W of Hot, 550 m, 23 x 1987, *Maxwell* 87-1281 (L). **Lampang:** Lampang [18°22'N 99°34'E], 420 m, 23 viii 1922 (fr), *Winit* 740 (BKF, K). **Nakhon Nayok:** s.l., 29 vii 1959 (fl), T. *Sorensen et al.* 7803 (C); Nang Rawng Waterfall, 100 m, 29 vii 1959 (fr, fl), T. *Smitinand & Floto* 6106 (ABD, BKF, E, K).

The species and its relatives constitute a natural group of plants which have been recognised as several different species (and varieties) from various different regions: *Boea multiflora* R.Br. var. *multiflora* (= *Paraboea multiflora*) from Bangladesh, Bhutan and India (Assam); *Boea multiflora* var. *burmannica* C.B. Clarke (= *Paraboea multiflora*) from Burma; *Boea multiflora* var. *villosa* Pellegr. (= *Paraboea multiflora*) from Laos (south) and adjacent Vietnam; *Boea reticulata* Barnett (= *Paraboea multiflora*) from Thailand; *Boea evrardii* Pellegr. (= *Paraboea evrardii*) from southern Vietnam; *Boea thirionii* H.Lév. (= *Paraboea multiflora*) from China; and *Boea microcarpa* Pellegr. (= *Paraboea multiflora*) from northern Vietnam. The distribution area of this group of plants is second only to that of *Paraboea swinhoei*. Despite such a large geographic area, a diverse range of habitats, and variable morphologies in habit and leaves, they are remarkably consistent in other characters such as the whitish or yellowish or greenish farinose indumentum on the anthers and the ovary which is retained on the mature capsule. The anther morphology of this species and its relatives is unique in the genus, with erect anthers, free from each other and opening towards the top of the anther, in sharp contrast to the majority of species in this genus that possess anthers coherent with each other and with their apex turned almost 90° towards the gynoecium. They all have a rosulate habit and axillary cymose inflorescences.

The types of those names that are reduced to synonymy of *Paraboea multiflora* var. *multiflora* all have a similar leaf texture and inflorescence morphology (see discussion under *Paraboea evrardii*). There is some doubt over *Paraboea microcarpa* as the type material is poor but we have chosen to synonymise it here. The type has only 'after-season' capsules with remnant valves of a capsule retained from an earlier flowering season but without any remaining seeds. Pellegrin (1930) described the species as 'calyx glabrescent, ... fruit glabrous'. It is possible that he was confused by the old capsules, which, in general, lose their indumentum or attachments with time.

56b. *Paraboea multiflora* var. *caulescens* Z.R.Xu & B.L.Burt, Edinburgh J. Bot. 48: 7 (1991). – Type: Thailand, Kanchanaburi, near Neekey, near Wangka [14°15'N 99°10'E], steep slopes of limestone, 150 m, rather rare, 13 vi 1946 (fr, fl), G. *Den Hoed* Exp. No. 946 (holo L).

Caulescent subshrub; stem woody, > 20 cm long. *Leaves* c.7.5 × 3 cm, petiole c.2–3 cm long. *Inflorescence* axillary, cymose, shorter than the leaves, c.6 cm long,

several-flowered. *Calyx* similar in length to corolla, c.4.5 mm long, lobes 3.5×0.8 mm. *Corolla* white, c.4 mm long, 4–5 mm across, campanulate, indistinctly 2-lipped, or appearing almost actinomorphic, lobes c. 2×2 mm, rounded. *Anthers* suborbicular, c. 1.7×1.7 mm, slightly coherent at the apex. Other characters similar to *Paraboea multiflora* var. *multiflora*.

Distribution. Thailand. Known only from the type.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction. This variety was also included in Pooma (2005) as threatened in Thailand.

This variety is easily distinguished from the type variety by the elongated woody stem and by the relatively long calyx.

- 57. *Paraboea nervosissima*** Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 9 (1991).
– Type: Peninsular Malaysia, Kelantan, Gua Musang, Ulu Kelantan [04°53'N 101°58'E], summit of limestone hill, common, 22 vi 1967 (fl, fr), *F.S.P. Ng* FRI 5568 (holo K; iso KEP, L). **Fig. 35.**

Perennial caulescent subshrub; stem woody, > 1 m tall, 1 cm in diameter or more, internodes 1–2 cm long, with a white or tawny matted indumentum when young and later glabrescent. *Leaves* in whorls of 3 or 4, petiolate; petiole c.1–3 cm long, with the same indumentum as the stem; blades narrow-elliptic, $15\text{--}30 \times 3\text{--}5$ cm, 4–7 times as long as wide, apex acute, base cuneate, margin more or less crenate, upper surface glabrous or pubescent, lower surface with a white or dull brown appressed matted indumentum; veins smooth above, very prominent beneath, lateral veins numerous, 18–45 pairs, forming an almost 90° angle with the midrib, tertiary venation invisible. *Inflorescence* a terminal panicle, with a white or dull brown appressed matted indumentum throughout except on the flower; flowering stem 30–45 cm long, the most basal internodes not much elongated, c.1–5 cm long, appearing quite tight in the infructescence, floral leaves intermediate to vegetative leaves, gradually reducing in size upward; 3 or 4 cymes from each node, cymes c.10 cm long or less, many-flowered; peduncle bracts narrow-ovate, c. 7×2.5 mm, pedicel bracts sepal-like; pedicels 5–15 mm long. *Flowers* with minute capitate pubescence on the calyx, the young corolla outside and the gynoeceum, but glabrous on the stamens. *Calyx* 3–4 mm long, lobes ovate or narrowly so. *Corolla* mauve or purple, c.1 cm long, 1 cm wide; tube 2.5 mm long, limb 2-lipped; upper lip 3.5 mm long, 2-lobed, lobes wide-ovate, 3.5×5 mm, lower lip c.8 mm long, 3-lobed, two lateral lobes 2×3.5 mm, wide-ovate, middle one 2.5×2.5 mm, rounded. *Anthers* yellow, transversely ellipsoid, 2×5 mm, coherent with each other at the apex and the base, opening in the centre of the anther locules, dorsifixed, apex turned towards the gynoeceum; filaments c.1.5 mm long, crenate on the two sides. *Gynoeceum* 10 mm long, 1.2 mm



FIG. 35. *Paraboea nervosissima* Z.R.Xu & B.L.Burt. A, habit; B, indumentum on lower leaf surface.

wide, stigma capitate, a little larger than style. *Fruit* a spirally (extremely) twisted capsule, 1.5–2.5 cm long, 1.5–2 mm in diameter, with minute capitate pubescence. *Seeds* ellipsoid, 0.7×0.25 mm.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area, some of them in protected areas, and there are no major threats.

Additional specimens examined. MALAYSIA. **Pahang:** Gua Tipus, 17 x 1927 (fl, fr), M.R. Henderson 19459a (K); Taman Negara, Gua Peningat, Pahang, 790 m, 14 vii 1970 (lv), L.H. Shing FRI 17221 (KEP, L). **Kelantan:** s.l. [05°30'N 102°00'E], 250 m, 1 xi 1967 (fr), B.C. Stone 7449b (KLU); Gua Musang limestone hill summit [04°53'N 101°58'E], 250 m, 1 ix 1967 (fr), B.C. Stone 7307 (K, KEP, KLU, L); Gua Serai, Gua Musang limestone hill, 6 viii 1962 (fr), UNESCO Limestone Exp. 429 (L); W. Kelantan, S. Nenggiri, Gua Jaya at K. Jenera [05°06'N 101°46'E], 27 vii 1967 (fl), T.C. Whitmore FRI 4251 (K, KEP, L).

This species is particularly distinct in its venation with numerous very prominent and horizontally spreading lateral veins on the lower leaf surface. It may be related to *Paraboea caerulescens* (Ridl.) B.L.Burtt with which it shares the same indumentum (minute capitate pubescence) on the calyx, ovary and fruit.

58. *Paraboea neurophylla* (Collett & Hemsl.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 434 (1984). – *Didymocarpus neurophyllus* Collett & Hemsl., J. Linn. Soc., Bot. 28: 102 (1880). – Type: Upper Burma, Shan Hills, Pinlong, 6000 ft (c.2000 m), [20°05'N 96°50'E], vi 1888 (fl), Collett 804 (holo K; iso E).

Fig. 36.

Perennial rosulate herb. *Leaves* more or less petiolate, petioles 0.5–3 cm long; blades obovate, (2.5–)6–12 × 1.5–7 cm, 2–4 times as long as wide, apex acute or rounded, base more or less angustate-rounded, margin crenate, upper surface glabrous, lower surface with a brown matted indumentum; veins smooth above, raised beneath, lateral veins c.6 pairs, tertiary venation distinctly reticulate. *Inflorescences* axillary, cymose, equal to or longer than the leaves, 7–12 cm long, 3–6 cm wide, many-flowered, with a matted indumentum; peduncle bracts and pedicel bracts narrow-oblong, sepal-like (*G.F. Li* 61192 has larger peduncle bracts); pedicels c.10 mm long. *Calyx* 1.5–3.5 mm long, 5-lobed, lobes ovate to narrowly oblong, 2–3.5 times as long as wide, with a matted indumentum or sparsely so outside, glabrous inside. *Corolla* violet; tube c.5 mm long, limb 2-lipped; upper lip 2-lobed, lobes wide-ovate, c.2 × 4 mm, lower lip c.5 mm long, 3-lobed, middle lobe semi-circular, c.3 × 3.5 mm, lateral lobes similar in shape, c.2 × 3 mm. *Anthers* transversely ellipsoid, coherent with each other, opening at each end, apex pointing towards the gynoeceum, dorsifixed; filaments c.3 mm long, inserted at the base of the corolla, curved, but not swelling to form a knee in the middle, glabrous. *Gynoeceum* c.9 mm long, 1.2 mm wide at the ovary base; stigma not enlarged. *Fruit* a linear capsule, c.1.5–2.5 cm long, glabrous, spirally twisted.

Distribution. Burma and China.

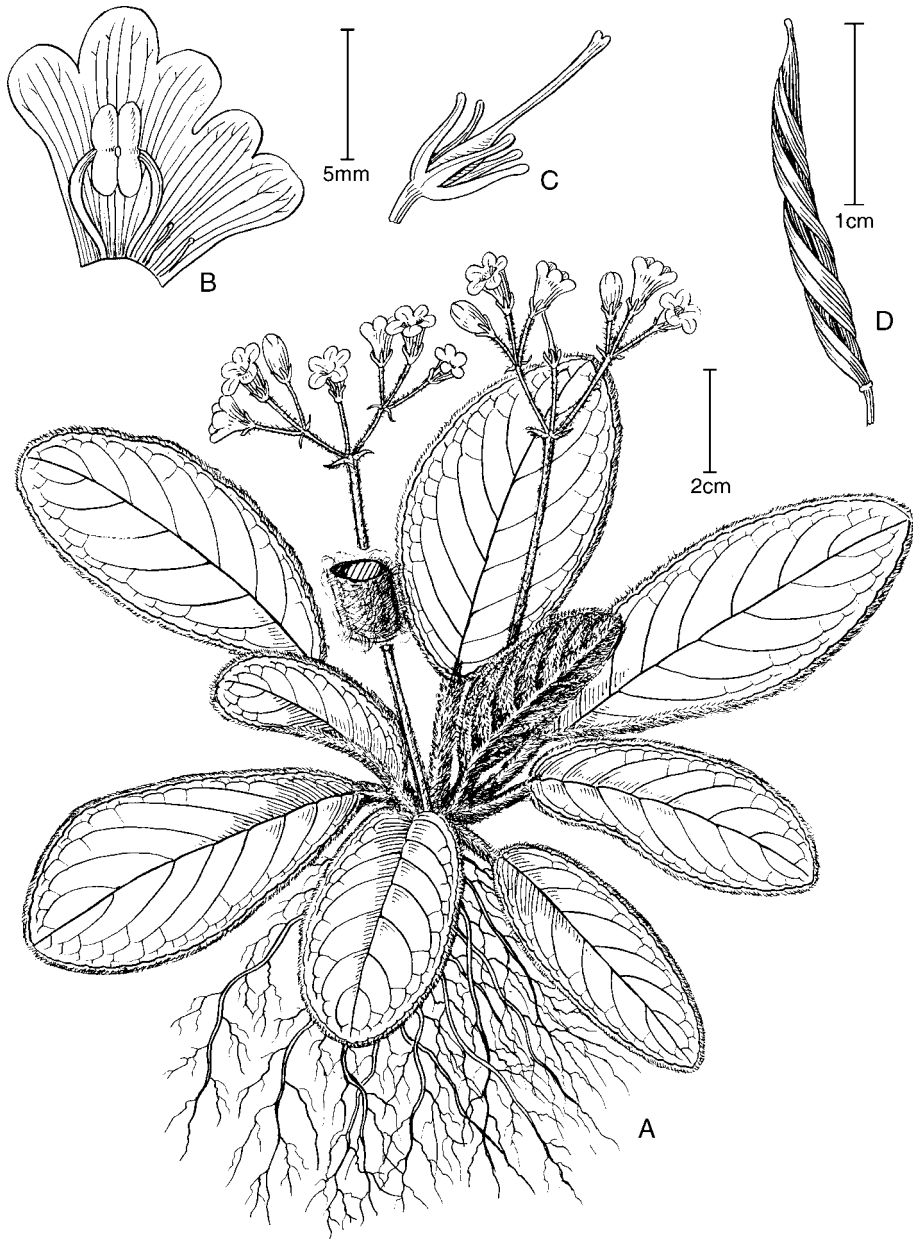


FIG. 36. *Paraboea neurophylla* (Collett & Hemsl.) B.L.Burtt. A, habit; B, corolla opened out; C, pistil and calyx; D, fruit.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. CHINA. Eokou region de Kiao Kia, vi 1909 (fr), *F. Ducloux* 6068 (P); Suen-oui [Xuenlwei1, NE Yunnan], 2600 m, (fl), *R.P. Maire* s.n. (P). **Sichuan:** 17 v 1957 (fl), *G.F. Li* 61192 (IBSC). **Yunnan:** 9 ix 1903 (fr), *F. Ducloux* 2279 (P); Kunming, San Chingke [Xi1shan1] [25°04'N 102°55'E], 12 vii 1945 (fl, fr), *T.N. Liou* 13831 (PE); Kunming Xishan (West-Hill) [25°04'N 102°55'E], (fr, fl), *T.N. Liou* 13970 (IBSC); Kunming, San Chingke [Xi1shan1], 16 vii 1946 (fr), *T.N. Liou* 20691 (PE); 2100 m, viii 17? (fl), *O. Schoch* 286 (K, US).

Burt (1984) suggested that this species can be distinguished from *Paraboea crassifolia* by having petiolate leaves and blunter calyx lobes. In addition to these characters *Paraboea neurophylla* also has filaments which are smoothly curved, whilst in *Paraboea crassifolia* the filaments have a swollen knee.

G.F. Li (*Li3 Gu02Feng1*) 61192 (IBSC) is somewhat different from the specimens collected in Yunnan (China) and Burma in its longer inflorescence and more distinct peduncle bracts. However, the flower structure is the same and there is no swollen knee on the filaments.

59. *Paraboea nutans* D.Fang & D.H.Qin, *Acta Phytotax. Sin.* 33(6): 604 (1995).

– Type: China, Guangxi, Napo, *D. Fang & D.H. Qin* 79634 (holo GXMI).

Perennial rosulate herb. *Leaves* petiolate; petiole 0.5–3 cm long, rarely almost absent, matted indumentum; blades obovate, (2.7–)4–16.5 × (1.5–)2.8–8.8 cm, apex rounded to obtuse, base attenuate or broadly cuneate, margin crenate or subentire, with some arachnoid covering above when young, greyish matted indumentum beneath; 7–11 pairs of lateral veins. *Inflorescence* axillary, cymose, shorter than the leaves, 1–2-branched, c.5–12-flowered, tomentose; peduncle 2.5–9 cm long, bracts oblong, 5–8 mm long. *Flowers* nodding. *Calyx* 5-lobed to the base, lobes oblong or oblong-lanceolate, 5–6 mm long, more or less tomentose outside. *Corolla* purplish-blue, 10–11 mm long, 15–16 mm in diameter, glabrous; tube c.7 mm long, limb 2-lipped; upper lip 2-lobed, lobes 3 mm long, lower lip 3-lobed, 4 mm long, 7 mm wide, rounded. *Anthers* reniform, 3 mm long; filaments 2 mm long; staminodes 3, 1–1.5 mm long. *Gynoecium* glabrous; ovary c.5 mm long; style 6–7 mm long; stigma capitate. *Fruit* a non-twisted capsule, 1–2.5 cm long, c.2 mm in diameter.

Distribution. China: Guangxi.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction. The second specimen noted below is from the same locality.

An additional specimen has been listed by the authors of the name but this has not been studied.

60. *Paraboea paniculata* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 434 (1984). – *Boea paniculata* Ridl., J. Linn. Soc., Bot. 32: 519 (1896). – Type: Peninsular Malaysia, Selangor, Kuala Lumpur, Caves, i 1891, *Kelsall* 1970 (lecto SING, inflorescence on right hand side, designated here [the shoot on the left of the sheet belongs to *P. verticillata*]).

Perennial caulescent herb; stem woody, c.10–15 cm long, 1–1.5 cm in diameter. *Leaves* congested on the upper part of the stem, like a rosette, in whorls of 4–6, sessile, narrow-obovate, c.10–25 × 2–4.5 cm, c.3–6 times as long as wide, apex acute or acuminate, base attenuate, margin entire, upper surface arachnoid, lower surface with a white or greyish-orange matted indumentum; veins smooth above, raised beneath, lateral veins 12–20 pairs, tertiary venation obscure. *Inflorescence* terminal, paniculate, not very long but very widely spreading, with some pubescence throughout; flowering stem 30–70 cm long, the most basal internodes c.2–15 cm long, floral leaves smaller than the vegetative leaves, up to 8 × 1.5–2 cm, 5–6 cymes from each node; cymes relatively long, up to 10–30 cm, many-flowered; peduncle 10–15 cm long; peduncle bracts a little larger than or similar in size to the pedicel bracts, pedicel bracts sepal-like; pedicels 5–20 mm long. *Calyx* 4.7 mm long, 5-lobed to the base, lobes ovate or narrowly ovate, c.3 × 1.5 mm, with glandular hairs outside, glabrous inside. *Corolla* blue-lilac, sky blue to mauve blue or magenta, 1.2 cm long, 1 cm across; tube 3 mm long, limb 2-lipped; upper lip 3 mm long, 2-lobed, lobes rounded, 3 × 4 mm, lower lip 8 mm long, 3-lobed, lateral lobes rounded, c.4 × 6 mm, middle lobe 5 × 4 mm, glabrous inside, with some glandular hairs outside. *Anthers* transversely ellipsoid, c.2.5 × 5 mm, coherent with each other, opening in the centre of the anther locules, dorsifixed, apex pointing towards the gynoeceum, glabrous; filaments inserted at the corolla base, free part c.3.5 mm long. *Gynoeceum* c.7 mm long, with glandular pubescence; ovary c.1.2 mm wide; style 4.5 × 0.6 mm; stigma capitate, larger than style. *Fruit* a spirally twisted capsule, narrow oblong or linear, 1.5–2.5 cm long, 1.5–3 mm in diameter, with dense brown pubescence. *Seeds* ovoid, 6–7 × 2 mm.

Distribution. Peninsular Malaysia and Sumatra.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. INDONESIA. Sumatra: **Aceh:** Gunung Leuser Nature Reserve, Road Blang Kedjeren to Kotacane [03°00'N 97°50'E], 800 m, 16 iv 1975 (fl), *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffes* 16450 (L); Atjeh, Gajolanden from Kongke via Goempang, sandy slope along road, steep slope, 1000 m, 5 iii 1937 (fr, fl), *C.G.G.J. van Steenis* 9487 (A, K, L).

MALAYSIA. Peninsular Malaysia: **Perak:** (fl), *C. Curtis* 3105 (K); Cheecheo Ngum Temple, Gunong Rapat 3.5 miles S of Ipoh, limestone cliffs [04°34'N 101°07'E], 25 x 1958 (fr), *J. Sinclair* 9872 (A, E, L, US). **Selangor:** Kanching Rock (= Bukit Takun), Kanching F.R. [03°18'N 101°41'E], 5 xi 1940 (fl), *S. Reid* KEP51676 (KEP); Kanching Rock, Rawang [03°18'N 101°35'E], 400 m, 30 x 1940 (fl), *C.C.L. Durant* 56251 (KEP); Ulu Selangor, Kanching F.R., 533 m, 4 v 1947 (fr), *KEP* 63169 (KEP); Batu Caves, [03°13'N 101°41'E], 11 xi 1962 (fr), *K. Jong & Woods* 4514 (E); Batu Caves, 233 m, 22 iv 1959 (fl, fr), *KEP* 79245 (KEP); Batu Caves, Selangor, 4 xi 1953 (fr), *J. Sinclair* 7833 (E, US).

This species is close to *Paraboea caerulescens* with which it shares the large terminal panicle with glandular pubescence on the cymes. However, *Paraboea paniculata* has a much wider panicle and the indumentum on the flower and the fruit is multicellular and glandular, while in *P. caerulescens* the panicle is narrower and the indumentum is of minute capitate glands, similar to a farinose pubescence.

61. *Paraboea paramartinii* Z.R.Xu & B.L.Burtt, *Edinburgh J. Bot.* 48: 10 (1991).
– Type: China, Yunnan, Pu'er, cliff, 4500 ft (c.1350 m), 1901? (fr), *A. Henry* 13394 (holo E; iso K, MO, US). **Fig. 37.**

Perennial rosulate herb with a short stem. *Leaves* petiolate; petiole 4–13 cm long with narrow wings which join at the base; blades thin papery, elliptic, c.13–26 × 6–12 cm, apex obtuse, base rounded, margin indistinctly crenate, upper surface glabrous, lower surface with a matted indumentum on the veins only; veins smooth above, raised beneath, lateral veins 10–15 pairs, tertiary venation reticulate. *Inflorescence* a terminal panicle; flowering stem elongated, c.22 cm long from the uppermost vegetative axil to the lowest fertile axil that bears a cyme, with one or two pairs of much reduced floral leaves measuring 30 × 8 mm in this elongated part. *Flowers* not seen. *Infructescence* 30–40 cm long, nearly glabrous; peduncle bracts elliptic, c.3 mm long, pedicel bracts sepal-like; pedicel 1–2 cm long. *Calyx* glabrous, c.2.5–3 mm long, 5-lobed to the base, lobes narrow-oblong. *Fruit* a spirally twisted capsule, c.3 cm long, glabrous. *Seeds* ellipsoid, 0.5 × 0.2 mm.

Distribution. China (Yunnan) and Thailand (?).

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Data Deficient (DD). There is a taxonomic problem to be solved before a conservation assessment can be made (see note below).

Additional specimens examined. CHINA. **Yunnan:** Szemao (Simao) [22°50'N 101°02'E], W. Mt. forest, c.5000 ft (1500 m), 1900? (fr), *A. Henry* 12574B (part A) (K, NY).

THAILAND. **Chiangrai:** Doi Tam Tu Pu, Saddle between peaks c.4 km west of Chiangrai town [= Muang Chiang Rai] [19°56'N 99°51'E], 520 m, 5 x 1924 (fr), *H.B.G. Garrett* 204 (K).

This species is similar to *Paraboea martinii* (H.Lév.) B.L.Burtt in having the same kind of inflorescence, but can be distinguished by the larger and thinner leaves and the glabrous inflorescence.

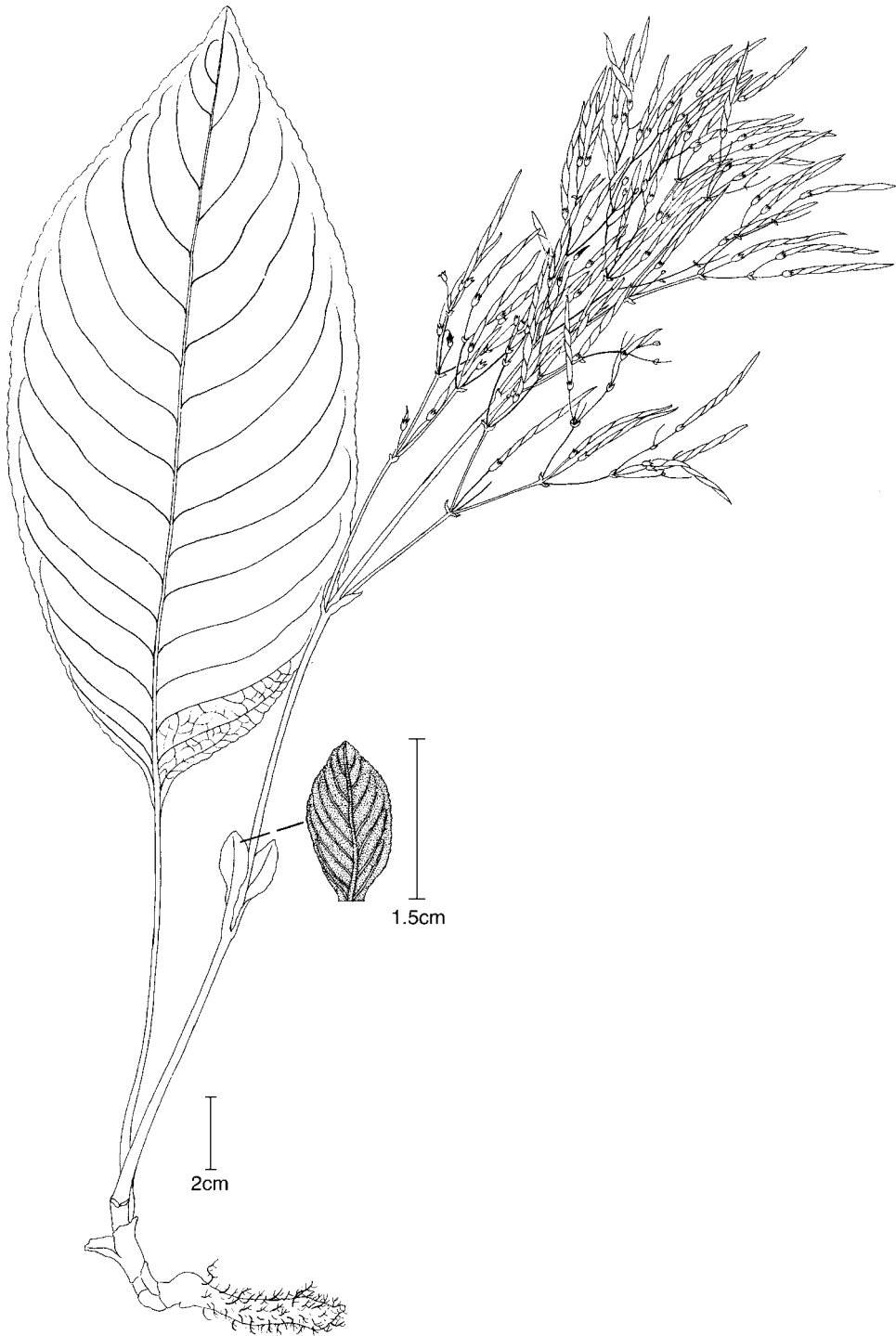


FIG. 37. *Paraboea paramartinii* Z.R.Xu & B.L.Burt.

Part B of *A. Henry* 12574B (K) and *H.B.G. Garrett* 204 (K) [collected from Thailand, Doi Tam Tu Pu] may represent an undescribed species. They have a pubescence on the upper leaf surface and a subterminal cymose inflorescence rather than a terminal panicle. The material is insufficient for justifying a new name and they are here included under this species.

62. *Paraboea parprimuloides* Z.R.Xu, sp. nov.

Paraboea primuloides affinis, sed foliis oblongis, c.5–18 × 3–9 cm, et inflorescentibus glabris differt. – Type: Malaysia, Sarawak, Third Division, SE end Hose Mts, cliffs below Bukit Nibong, c.02°06'N 113°42'E, 8 viii 1967, *Burt & Martin* 4857 (holo E; iso E, SAR).

This species is close to *Paraboea primuloides* but the differences are: Leaves oblong, much larger, 5–18 × 3–9 cm, with a brownish matted indumentum on the lower surface. Inflorescence 8–24 cm long; peduncle completely glabrous. Flower cream. Fruit obliquely spreading, not twisted, c.3 cm long, seeds ovoid, 0.7 × 0.22 mm. The other characters are not significantly different from those of *Paraboea primuloides*.

Distribution. Malaysia: Sarawak. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

Burt (1984) included the type collection for this new species in *Paraboea parboeoides*. However, even though the material is not ideal, it does deserve specific status due to the differences noted above.

63. *Paraboea parviflora* (Ridl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 435 (1984). – *Boea parviflora* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 76 (1905). – Type: Malay Peninsula, Perak, Kinta [04°35'N 101°06'E], 166–333 m, i 1885 (fl), *King's Collector* 7108 (lecto K, designated here; iso SING). **Fig. 38.**

Perennial caulescent herb; stem c.15 cm long, internodes 5–25 mm long, 2–5 mm in diameter, with a yellowish brown to ferruginous matted indumentum. *Leaves* opposite, petiolate, those of a pair unequal in size; petiole 1–2.5 cm long, with the same indumentum as that on the stem; blades elliptic, 5–13 × 1.5–5 cm, c.3 times as long as wide, apex acute, base wide-cuneate to rounded, margin entire, upper surface with some arachnoid indumentum when young and glabrescent when older, lower surface with a yellowish brown to ferruginous matted indumentum; veins smooth above, raised beneath, lateral veins c.8–12 pairs, tertiary venation invisible. *Inflorescences* subterminal, cymose, spreading and lax, few- to many-flowered, 15–25 cm long, with the same kind of indumentum as that on the stem but more or less glabrescent when mature; subordinate branches developing below the primary branches in the cyme; peduncles very slender, 12–14 cm long, < 1 mm in diameter,



FIG. 38. *Paraboea parviflora* (Ridl.) B.L.Burtt.

with 2 linear bracts c.3 mm long; primary branches, subordinate branches, and secondary branches all rather delicate; pedicels even thinner than the peduncle, c.3–5 mm long. *Calyx* 1 mm long, 5-lobed to the base, lobes ovate or narrowly so, glabrous. *Corolla* white, c.3 mm long, 3 mm across; tube c.1.5 mm long, limb 2-lipped; upper lip not visibly 2-lobed, widely ovate, c.1 × 1.5 mm, lower lip with 3 lobes of similar size and shape, glabrous. *Anthers* transversely ellipsoid (reniform), c.1 × 2 mm, coherent at the apex, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments inserted at the corolla base with a free part c.2 mm long. *Ovary* ovoid, c.1.5 × 1 mm; style distinct from the ovary, c.3 mm long, much thinner than the ovary; stigma oblique, glabrous. *Fruit* a linear capsule, 0.8 cm long, 0.6 mm in diameter, glabrous, spirally twisted. *Seeds* ellipsoid, c.0.4 × 0.15 mm.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species is known from relatively few collections they are almost all from protected areas and there are no major threats.

Additional specimens examined. MALAYSIA. **Perak:** Gunong Tempurong [04°25'N 101°06'E], 266–566 m, 13 viii 1959 (fr), *B. Allen & Kadim* 502MK (E, SING); Ayer Hangat, Ipoh [04°35'N 101°06'E], 100 m, 21 iv 1962 (fr), *B.L. Burtt & P.J.B. Woods* 1686 (E); Perak Hot Springs [= Ayer Hangat], xii 1895 (fl), *C. Curtis* 3134 (SING).

The inflorescence structure and the flower morphology of this species suggest an affinity with *Paraboea minor* (Barnett) B.L.Burtt. However, the latter species does not normally have subordinate branches in the cymes and the peduncle is much thicker. *Paraboea parviflora* is characterised by the delicate peduncle and branches of the cyme as well as the miniature flowers and capsules. The anisophyllous leaves are also distinctive for this species. *B.L. Burtt & P.J.B. Woods* 1686 (E) is unusual for the species in its very narrow leaves.

64. *Paraboea patens* (Ridl.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 435 (1984). – *Boea patens* Ridl., J. Linn. Soc., Bot. 32: 520 (1896). – Type: Thailand, Punga [Phangnga] [08°32'N 98°28'E], collected in ii 1893, flowered in viii 1893 (in cultivation), *Curtis* s.n. (holo SING). **Fig. 39.**

Perennial rosulate herb with very short but stout stem. *Leaves* opposite, congested in a rosette, with very short petiole, leaf bases forming auricle around the node; blades oblong-elliptic, c.8–15 × 3–7 cm, c.2 times as long as wide, apex obtuse to rounded, base wide-cuneate, margin shallowly serrate, upper surface with a dense pubescence, lower surface with matted indumentum; veins obscure above, raised beneath, lateral veins c.7–10 pairs, tertiary venation reticulate. *Inflorescence* a subterminal cyme, appearing terminal, 30–70 cm long, spreading to 40 cm wide, with c.4 orders of

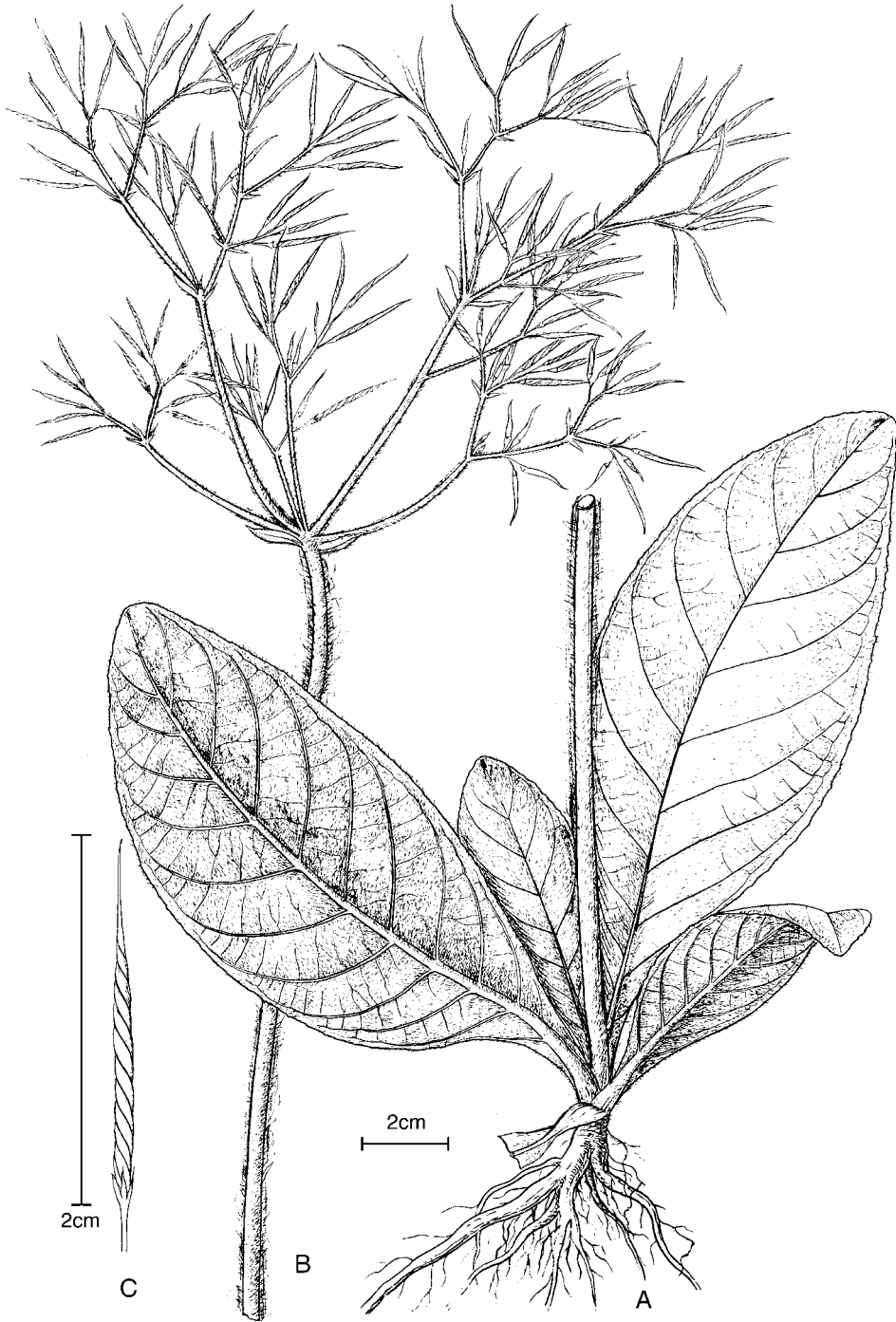


FIG. 39. *Paraboea patens* (Ridl.) B.L. Burtt. A, habit; B, infructescence; C, fruit.

branching, many-flowered, quite lax, subordinate branches developing below or between the two primary branches on top of the peduncle, with a matted indumentum throughout up to the pedicel; peduncles 20–55 cm long, stout, with bracts oblong-ovate, c. 10×5 mm; pedicels slender, 2–5 mm long, normally glabrescent or with minute sessile glands, with bracts sepal-like. *Calyx* 5-lobed to the base, lobes narrowly ovate, c. 1×0.3 mm, with minute hairs outside. *Corolla* c. 6 mm across with indistinct tube, limb 2-lipped; upper lip c. 2.5×3.5 mm, 2-lobed, lower lip c. 2.5×5 mm, 3-lobed, 5 lobes all quite similar, rounded or wide-ovate, c. 2×2.5 mm. *Anthers* narrowly ellipsoid, c. 1.3×2 mm, apex pointing towards the gynoecium, coherent with each other, opening at each end, dorsifixed; filaments inserted at c. 1 mm from the corolla base with a free part c. 1.5 mm long, slightly enlarged in the middle. *Ovary* ovoid, c. 1.8×0.6 mm; style c. 3 mm long, 0.3 mm wide; stigma capitate. *Fruit* a very slender delicate capsule, 1–2.5 cm long, c. 0.6 mm in diameter, glabrous, spirally twisted. *Seeds* compressed, ovoid, 0.5×0.2 mm, brown.

Distribution. Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Data Deficient (DD). Many of the limestone areas in Phangnga are protected but not all. Without better locality information it cannot be ascertained whether this species is in the protected area or not.

Additional specimens examined. THAILAND. **Phangnga:** Kasoom [$08^{\circ}24'N$ $98^{\circ}27'E$], on limestone rock, *C. Curtis* 3218 (collected in 1896) (K, SING); Panga [Phangnga] [$08^{\circ}32'N$ $98^{\circ}28'E$], 12 xii 1918 (fr), *M. Haniff & Nur* 4026 (SING).

This species is characterised by its subterminal cyme which develops subordinate branches below and between the two primary branches on top of the peduncle. *Paraboea divaricata* shares the same inflorescence structure (subterminal cyme with subordinate branches) but has leaves in whorls.

65. *Paraboea peltifolia* D.Fang & L.Zeng, *Acta Phytotax. Sin.* 33(6): 606 (1995).

– Type: China, Guangxi, Mashan, *D. Fang & L. Zeng* 31379 (holo GXMI).

Perennial caulescent herb; stems 2–7 cm tall, 5–10 mm wide. *Leaves* alternate (?); petiole 1–9 cm long, with a matted indumentum; blades obovate, oblanceolate, spatulate or subpandurate, $6\text{--}33.5 \times 3\text{--}14.3$ cm, apex rounded or obtuse, base peltate-auriculate, rarely cordate, subtruncate or cuneate, margin irregularly crenate-serrate, with some arachnoid covering when young above, with a greyish matted indumentum beneath; lateral veins 11–18 pairs. *Inflorescence* axillary, cymose, appearing umbellate, 1–2-branched, c. 2–15-flowered; peduncle 4–6 cm long, lanate, bracts lanceolate-triangular, 2–3(–4) mm long. *Calyx* c. 3.5 mm long, 2-lipped, lanate outside; upper lip 2-dentate, segments c. 0.7 mm long, lower lip 3-dentate, segments

c.2 mm long. *Corolla* white, 14 mm long, 15 mm in diameter, glabrous; tube 7 mm long, limb 2-lipped; upper lip 2-lobed, 5 mm long, lower lip 3-lobed, 7 mm long, lobes 7 mm wide, apex rounded, middle lobe slightly retuse. *Anthers* reniform, 3 mm long; filaments 3 mm long; staminodes 2, 2 mm long. *Gynoecium* sparsely lanate; ovary c.5 mm long; style 7 mm long; stigma shortly capitate. *Fruit* not twisted, 1–3.6 cm long, 2–3 mm in diameter.

Distribution. China: Guangxi.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

A distinctive species in the non-twisted fruit group from China by its large, peltate leaves.

66. *Paraboea primuloides* Z.R.Xu, nom. nov. – *Didymocarpus primuloides* Kraenzl., Mitt. Inst. Bot. Hamburg 7: 90 (1927), non (Miq.) Maxim. (1876). – Type: [Indonesia, Kalimantan], West Borneo, auf dem Bukit Mulu, c.1100 m, 2 xii 1924 (fl, fr), *H. Winkler* 522 (holo HBG; iso E). **Fig. 40.**

Perennial rosette-like herb without a distinct stem. *Leaves* oppositely congested in a rosette, with a very short petiole c.0.5 cm long; blades more or less elliptic, c.3–5 × 1.5–2 cm, c.1.5–2 times as long as wide, apex obtuse, base cuneate or widely so, margin entire, upper surface with a thin but dense layer of whitish matted indumentum, which is thicker and tighter on the lower surface; veins smooth above, raised beneath, lateral veins c.5–6 pairs, tertiary venation invisible. *Inflorescence* of axillary cymes, longer than the leaves, c.8–14 cm long, few-flowered; peduncle c.6–12 cm long, whitish with a matted indumentum; two primary bracts narrowly ovate, c.4 mm long, with minute sessile glands inside and glabrous outside; pedicels c.10 cm long, glabrous, bracts on pedicels with minute sessile glands inside and glabrous outside. *Calyx lobes* narrowly ovate, 3 × 0.8 mm, ± with minute sessile glands inside. *Corolla* violet (?), ± with the same kind of glands inside and outside, c.15 mm across when open, with a short tube, 2-lipped; upper lip suborbicular, c.6 mm long and wide, lower lip similar in shape but appearing slightly smaller. *Stamens* short and thick, anthers ± widely ovate, 1.5 × 2.2 mm, opening in the centre of the anther locules; filaments 2.5 mm long. *Gynoecium* 6 mm long; ovary 1 mm wide. *Fruit* a linear non-twisted capsule up to 2.5 cm long, glabrous. *Seeds* not seen.

Distribution. Indonesia: West Kalimantan. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

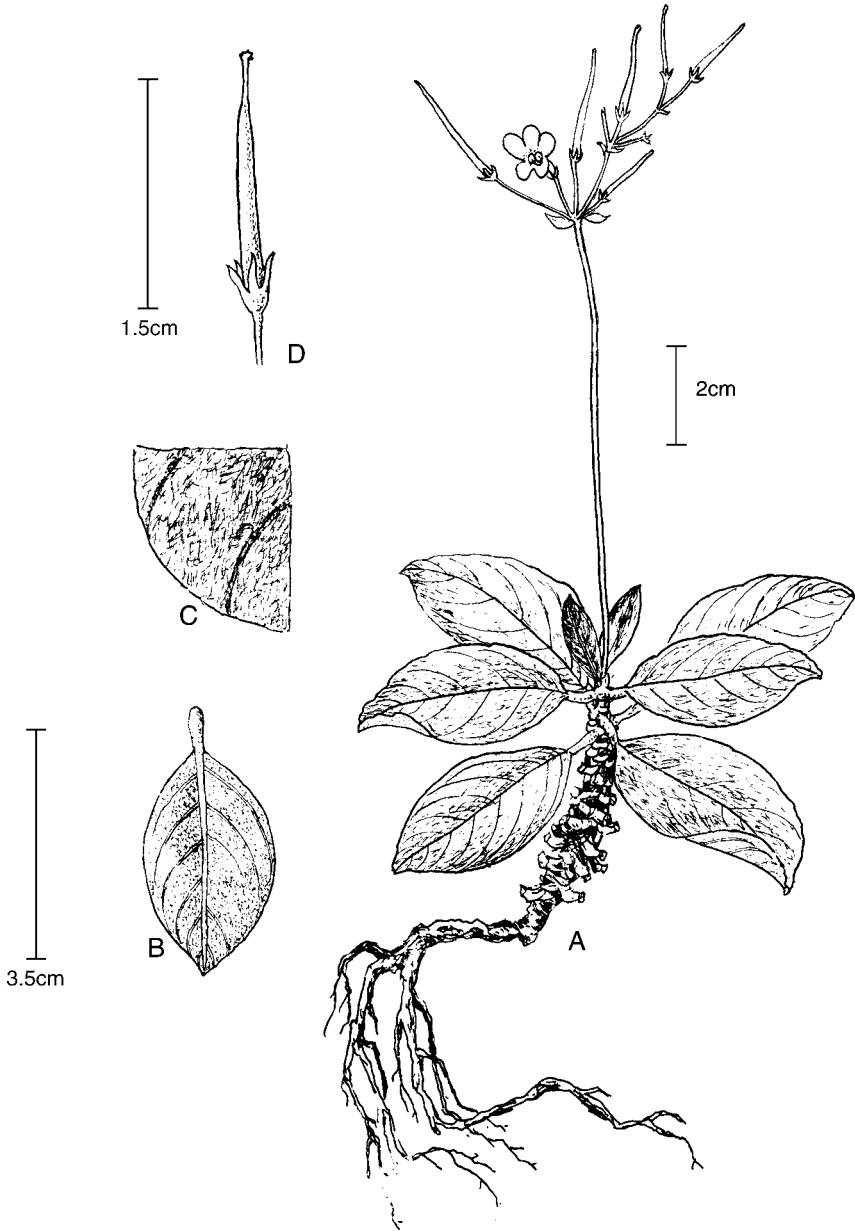


FIG. 40. *Paraboea primuloides* Z.R.Xu. A, habit; B, leaf; C, indumentum on leaf; D, pistil.

Burt (1984) mis-cited *Winkler* 1150 as the type of *Didymocarpus primuloides*. This specimen typifies *Didymocarpus johannis-winkleri* Kraenzl. (1927). Burt (1984) noted that *Didymocarpus primuloides* Kraenzl. is a later homonym of *Didymocarpus primuloides* (Miq.) Maxim. and he reduced the name to a synonym of *Paraboea*

paraboeoides. However, in this study we have reduced *Paraboea paraboeoides* to a synonym of *P. schefferi* while we recognise *Didymocarpus primulooides* Kraenzl. as deserving specific status in *Paraboea*.

67. *Paraboea prolixa* (C.B.Clarke) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 435 (1984). – *Boea prolixa* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5: 143 (1883). – Type: Burma inferior, Thoungyun, *Kurz* s.n. (holo K).

Perennial caulescent herb, with a very short stem 7 cm long (partly rhizome?); internodes c.5 mm long, with a brown matted indumentum. *Leaves* opposite; petiole 2–4 cm long; blades narrowly ovate, 9 × 2.5–3.5 cm, apex acute, base angustate, margin more or less serrulate, upper surface glabrous, lower surface with a brown matted indumentum; veins smooth above, invisible on the lower leaf surface. *Inflorescence* subterminal, cymose; infructescence c.30 cm long, 6 cm wide; peduncle 20 cm long, with a brown matted indumentum; bracts 2, narrowly oblong, 7 mm long; pedicels c.5 mm long with some pubescence. Mature *flower* not seen, flower buds very tiny. *Calyx* persistent in the capsule, c.2 mm long, 5-lobed to the base, lobes narrowly ovate, more or less hairy. *Fruit* a delicate capsule, c.1–1.5 cm long, glabrous, spirally twisted. Mature *seeds* not seen.

Distribution. Burma. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Data Deficient (DD). There is a taxonomic problem to be solved before a conservation assessment can be made (see note below).

The type is very poor. From the inflorescence structure and the delicate capsules it looks rather like *Paraboea pubicorolla* and *P. patens*. It is also possible that the species may be related to *Paraboea cochinchinensis* and *P. harroviana*. *G. Den Hoed* 580 (BKF, L, P), collected from near Wangka, has a similar indumentum in colour, but the leaves and the bracts are much larger. This specimen has been treated as *Paraboea harroviana*. Further collecting in the type locality of *Paraboea prolixa* may shed more light on its affinities.

68. *Paraboea pubicorolla* Z.R.Xu & B.L.Burt, Edinburgh J. Bot. 48: 10 (1991). – Type: Thailand, Sisaket Province, Dongrak Range (14°30'N 104°00'E) at Ching Bat Lak, Kantarak District, 500 m, on moist sandstone rocks by shaded stream zone, 17 viii 1976 (fl, fr), *J.F. Maxwell* 76-530 (holo L; iso AAU, BK).

Perennial caulescent herb, with a short stem or a rhizome 3–10 cm long, terete, c.4 mm in diameter. *Leaves* oppositely congested, seemingly rosulate, petiolate; petiole 1–5.5 cm long, with narrow wings and joining across the nodes; blades ovate or elliptic, 4–13 × 2.5–8.5 cm, apex acute or obtuse, base shortly angustate, margin entire, upper surface arachnoid or glabrescent, lower surface with a greyish matted indumentum; veins smooth above, raised beneath, lateral veins c.10 pairs, tertiary

venation obscure. *Inflorescence* subterminal, cymose, brown in colour when dry, glabrous except the pubescent corolla, often 2 opposite, sometimes 1 or 3, axillary below the apical bud, much longer than the leaves, 25–35 cm long, 5–7 cm across, many-flowered; peduncle c.22 cm long, with 2 or 3 bracts which are ovate or narrowly so, $5 \times 2\text{--}5$ mm; pedicel bracts similar in size to calyx lobes or slightly wider, pedicels c.5 mm long. *Calyx* 2–3 mm long, 5-lobed, lobes slightly obovate or oblong, $c.2 \times 0.5$ mm. *Corolla* purple or tube lilac and lobes blue, c.10 mm long, 10 mm across, outside pubescent, inside glabrous; tube c.7 mm long, limb 2-lipped; upper lip 2-lobed, lobes rounded, $c.4.5 \times 4.5$ mm, lower lip 3-lobed, two lateral lobes rounded, $c.3 \times 3.5$ mm, middle one obovate, 4×3.5 mm. *Anthers* transversely ellipsoid, $c.1 \times 3$ mm, coherent with each other, apex pointing towards the gynoecium, opening at the upper end, dorsifixed, somewhat pubescent; filaments c.4 mm long, in the middle curved and twisted like an 'S', forming a knee, upper part c.1 mm wide, lower part slender, c.0.3 mm wide, minutely pubescent; 2 staminodes seen. *Gynoecium* c.8 mm long; ovary c.0.8 mm wide, smoothly passing into a style; stigma more or less oblique. *Fruit* a linear capsule, needle-like, 2.5–3 cm long, c.0.6–1 mm in diameter, glabrous, spirally twisted. *Seeds* compressed, ellipsoid or ovoid, $c.3 \times 1$ mm.

Distribution. Thailand (and Vietnam?).

Habitat and ecology. On sandstone substrate.

Proposed IUCN conservation assessment. Least Concern (LC). This species is both quite widespread and not confined to limestone and there are no major threats. This species was, however, included in Pooma (2005) as threatened in Thailand.

Additional specimens examined. THAILAND. **Sisaket:** Khao Phra Viharn [$15^{\circ}07'N$ $104^{\circ}20'E$], c.400 m, sandstone, 24 viii 1972 (fl, fr), *T. Smitinand* 11676 (BKF). **Trat:** Laem Nawp District, Chang Island (= Ko Chang) [$12^{\circ}00'N$ $102^{\circ}15'E$], 100 m, 2 viii 1973 (fl), *J.F. Maxwell* 73-310 (BKF).

VIETNAM. **Binh Dinh:** Qui Nhon, Col de Mangiang [$13^{\circ}46'N$ $109^{\circ}14'E$], 800 m, 19 viii 1930 (fr, fl), *E. Poilane* 18024 (P). [*Poilane* 18024 may belong to this species, but the inflorescence is equal in length to the leaves and the pedicel has some glandular pubescence, different from the typical plants, which have inflorescence much longer than the leaves and pedicels glabrous. The specific description does not include this collection.]

This species has a similar inflorescence to *Paraboea prolixa*, *P. cochinchinensis* and *P. harroviana*. It can be distinguished from its possible relatives by its glabrous inflorescence and the pubescent corolla.

69. *Paraboea rabilii* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 11 (1991). – Type: Thailand, Kaochom Lem, Ampoe Kaokao [$07^{\circ}35'N$ $99^{\circ}42'E$], on rock, 1 viii 1929 (fl, fr), *Rabil* 301 (holo E; iso ABD, BKF, BM, K).

Boea lanata auct. non Ridl.: Barnett, *Fl. Siam. Enum.* 3(3): 231 (1962).

Paraboea lancifolia auct. non (Ridl.) B.L.Burt: Burt, *Notes Roy. Bot. Gard. Edinburgh* 41: 431 (1984), pro parte (quoad *Rabil* 301).

Perennial subshrub; stem woody, c.3.5 mm in diameter, bark peeling off with age. *Leaves* alternately congested at the apex of the stem, petiolate; petiole 0.5–3.5 cm long, with a matted indumentum; blades narrow-elliptic, 1.5–6 × 0.5–1.5 cm, 3–5 times as long as wide, apex acute or obtuse, base cuneate or angustate, margin entire and curving upward, upper surface with a minute pubescence, lower surface with a brown matted indumentum; veins smooth above, raised beneath, lateral veins 8–10 pairs, forming c.45° angle with the midrib, tertiary venation obscure. *Inflorescence* axillary, cymose, c.1.5–5 cm long, 1–1.5 cm across, many-flowered, with a matted indumentum throughout except on the flowers; peduncle up to 2.5 cm long, peduncle bracts narrow-ovate, 3–8 × 1.5–2 mm; pedicel 2–5 mm long, pedicel bract sepal-like or a bit larger. *Calyx* 2–5 mm long, 5-lobed, lobes narrow-ovate, c.4 times as long as wide, with a white matted indumentum outside, glabrous inside. *Corolla* white, glabrous, c.5 mm long, 6 mm across; tube 2 mm long, limb 2-lipped; upper lip 2-lobed, lobes wide-ovate, c.2.5 × 3.5 mm, lower lip 3-lobed, two lateral lobes wide-ovate, 2 × 3 mm, middle one obovate, 2 × 2.5 mm. *Anthers* transversely ellipsoid, 1.5 × 2 mm, coherent with each other, opening in the centre of the anther locules, dorsifixed; filament c.1 mm long. *Gynoeceium* c.5 mm long; ovary c.1 mm across; style c.0.25 mm across; stigma slightly larger than style, capitate. *Fruit* a narrow-oblong capsule, c.1.5 cm long, 1.3 mm in diameter, glabrous, spirally twisted. *Seeds* elliptic or nearly so, 0.5 × 0.2 mm.

Distribution. Thailand. Known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction. This species was also included in Pooma (2005) as threatened in Thailand.

This species is similar to *Paraboea suffruticosa* but can be easily recognised by the large ratio of capsule vs. calyx (3–7 times) in a sharp contrast to *P. suffruticosa* (only 1.5–2 times).

70. *Paraboea regularis* (Ridl.) Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 67 (1905); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 435 (1984). – *Didymocarpus regularis* Ridl., J. Linn. Soc., Bot. 32: 515 (1896). – Type: Peninsular Malaysia, Langkawi [06°20'N 99°48'E], 1893, *C. Curtis* (s.n.) cult. Hort. Bot. Sing. (lecto SING, designated by Burt (1984: 435); iso E).

Perennial herb with a short stem, lacking any arachnoid covering. *Leaves* congested in a rosette; blades very unequal, oblong-lanceolate, 2–10 × 1–6 cm, c.2–3 times as long as wide, apex obtuse or rounded, base attenuate to widely cuneate, margin crenate (or crenulate), minutely pubescent above, with a matted indumentum or sparsely so beneath; veins slightly depressed above, raised beneath, lateral veins c.6–10 pairs, tertiary venation reticulate. *Inflorescence* axillary, cymose, similar in length

to the leaf, c.4–8 cm long, with a matted indumentum throughout except for the flower; peduncle 3–6 cm long, with small sepal-like bracts; pedicels 2–5 mm long. *Calyx* c.2 mm long. *Corolla* up to 0.5 cm wide, lobes oblong, apex obtuse. *Stamens* 2, filaments similar to the stigma, white; anthers round-ovoid, slightly compressed. *Gynoecium* white; ovary cylindrical. *Fruit* c.1 cm long, non-twisted.

Distribution. Peninsular Malaysia (Langkawi) and Peninsular Thailand, with some doubtful collections from Cambodia and Vietnam.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Data Deficient (DD). See discussion below.

The type material was taken from a cultivated plant in the Singapore Botanic Garden. Ridley (1896) reported that the original material for this plant came from Langkawi (Island) and that the fresh flower had a snow white colour. The type is not a complete plant but consists of detached leaves and inflorescences, of which a drawing made by Rosemary Smith was preserved in E. From the available material this species may be related to *Paraboea bakeri* as both species have a similar habit and similar leaf and inflorescence morphologies. They differ in their capsule vs. calyx ratios (see discussion under *Paraboea bakeri*).

Pierre 4540 (P), which was previously named as *Boea multiflora* R.Br. var. *burmannica* C.B. Clarke (= *Paraboea multiflora*), has some similarity to this species in its general appearance and the non-twisted capsule. However, the yellowish sessile glands (or farinose indumentum) on the fruit suggests a close relationship to *Paraboea multiflora* R.Br. except that the latter species has twisted capsules. Also, *Paraboea regularis* is recorded from the area around Langkawi, an island off Peninsular Malaysia, but *Pierre* 4540 is recorded from southern Vietnam where *P. multiflora* occurs. Thus, more work is needed to clarify whether this collection is an abnormal specimen of *Paraboea regularis* or of *P. multiflora*, or if it belongs to neither species but is of an undescribed one.

Pierre 4540 is part of the original material of *Boea multiflora* var. *burmannica* C.B. Clarke. As Burt (1984) has selected *Parish* 436 (K) as the lectotype for that name, removing *Pierre* 4540 from *Boea multiflora* var. *burmannica* does not result in a nomenclatural problem. Although we now reluctantly place the collection in *Paraboea regularis*, a description of the collection is included here:

Pierre 4540 (P): Rosulate herb. *Leaves* congested in a rosette; petiole 1–4 cm long, covered by a brunnescent matted indumentum; blades elliptic to obovate, 2–10 × 1–6 cm, c.2–3 times as long as wide, apex obtuse or rotundate, base attenuate to widely cuneate, margin crenate (or crenulate), minutely pubescent above, with a (sparse or dense) brunnescent matted indumentum beneath; veins slightly depressed above, raised beneath, lateral veins c.6–10 pairs, tertiary venation reticulate. *Inflorescence* axillary, cymose, similar in length to the leaf, c.4–8 cm long, many-flowered, with a matted indumentum except on the flower; peduncle 3–6 cm long, with small

sepal-like bracts; pedicels 2–5 mm long. *Flowers* small, c.4 mm long, 5 mm across when open. *Calyx lobes* c.1.5 mm long, narrowly ovate, ferruginously tomentose at least outside. *Corolla* glabrous, tube c.3 mm long, limb slightly 2-lipped; all 5 lobes similar, oblong-ovate, c.2 × 1.2 mm. *Stamens* 2; anthers oblong-ovate, 1 × 1 mm, opening near the apex, coherent at the apex, with very minute red sessile glands [or farinose].

Additional specimens examined. THAILAND. ‘Lower Siam’, Palau Panji [possibly Ko Panji in Phangnga], 2 xii 1918 (fr), *M. Haniff & Nur* 4013 (K, SING).

Doubtful collections: CAMBODIA. 1866–1868 (fl, fr), *M.L. Thorel* 2268 (P).

VIETNAM. **Dong Nai:** Mt. Dinh, near Baria (Phuoc Tuy, Long Khanh, Bien Hoa) [10°32′N 107°08′E], ix 1867 (fr), *H.L. Pierre* 4540 (GH, K, NY, P, US).

71. *Paraboea rufescens* (Franch.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 38: 471 (1980); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 436 (1984), pro parte; Wang et al., Fl. Reipubl. Popularis Sin. 69: 465 (1990), pro parte. – *Boea rufescens* Franch., Bull. Mens. Soc. Linn. Paris 1 (no. 57): 449 (1885). – *Dorcoceras rufescens* (Franch.) Schltr., Bot. Jahrb. 58: 259 (1923). – Type: China, Kweichow [Guizhou], 1885 (fr, fl), *M. Simon* 1858 (lecto P, designated by Burt (1984: 436)). **Fig. 41.**

Didymocarpus seguinii H.Lév. & Vaniot, Compt. Rend. Assoc. Franc. Avancem. Sci. 34: 427 (1906). – *Boea rufescens* var. *seguinii* (H.Lév. & Vaniot) H.Lév., Fl. Kouy-Tchéou 181 (1914). – Type: China, Guizhou, Hoang Ko Chou [Huang2gu03shu4] [25°59′N 105°35′E], 9 vi 1898 (fl), *J. Seguin in Bodinier* 2377 (lecto E, designated here; iso P).

Phylloboea henryi Duthie ex Beddome, J. Roy. Hort. Soc. 33: 96 (1908). – Type: China, Yunnan, Mengtze, *Henry* 9318 (lecto K, designated here; iso E, K, US).

Paraboea tribracteata D.Fang & W.Y.Rao, Acta Phytotax. Sin. 33: 607 (1995). – Type: China, Guizhou, Libo, on limestone, *W. Y. Rao* 79047 (holo GXMI).

71a. *Paraboea rufescens* var. *rufescens*

Perennial rosulate herb with or without a short rhizome up to 12 cm long. *Leaves* oppositely congested in a rosette, petiolate; petiole 1–10 cm long with the same indumentum as that on the leaves; blades ovate, elliptic, 3–10 × 1.5–5 cm, 1.5–3 times as long as wide, apex obtuse, base cuneate to truncate, margin serrate or indistinctly so, upper surface densely pubescent, lower surface with a yellowish to dark brown or ferruginous matted indumentum; veins obscure above, raised beneath, lateral veins c.6 pairs, tertiary venation reticulate or indistinctly so. *Inflorescence* axillary, cymose, normally longer than the leaves, primary and secondary branches of the cyme hardly developed and so appearing umbellate (or in bud capitate), many-flowered, with a matted indumentum on peduncles, bracts, pedicels and calyx when young, more or less shedding off when older; peduncle 4–12 cm long with two large ovate bracts enclosing the flower buds when young, up



FIG. 41. *Paraboea rufescens* (Franch.) B.L.Burtt. A, habit; B, corolla opened out; C, pistil; D, fruits.

to 12 × 6 mm; pedicels c.5–10 mm long, bracts indistinct. *Calyx* c.3 mm long, 5-lobed to the base, lobes narrowly oblong, c.2.5 × 0.6 mm, apex truncate or slightly sinuate, spreading outward. *Corolla* violet or blue, glabrous, c.10 mm long, 8 mm across; tube c.6 mm long, limb not remarkably 2-lipped; upper lip 2-lobed, lobes widely ovate, c.3 × 5 mm, lower lip 3-lobed, lateral lobes rounded, c.3 × 4 mm, middle lobe similar in shape, c.4 × 4.5 mm. *Anthers* transversely ellipsoid, c.2 × 4 mm, coherent with each other, apertured at the upper end, apex turned towards the gynoecium, basifixed; filaments inserted at the extreme base of the corolla with a free part c.3.5 mm long, pubescent; staminodes 2, one of which c.1 mm long, the other almost invisible. *Gynoecium* c.10 mm long, 1.2 mm wide at the base of the ovary; stigma oblique, seemingly scabrous. *Fruit* a linear capsule, 3–4.5 cm long, 1.5 mm in diameter, glabrous, spirally twisted. *Seeds* ellipsoid, c.0.5 × 0.22 mm.

Distribution. South and southwest China (possibly also in northern Vietnam).

Habitat and ecology. On limestone. The species is remarkable in its habitat preference as it is often found on exposed and unshaded barren limestone rocks without any visible soil layer and any other associated plants.

Proposed IUCN conservation assessment. Least Concern (LC). This variety has been collected at many sites over a wide area and there are no major threats.

Additional specimens examined. CHINA. (fl, fr), *J. Esquirol* 896 (E). **Guangdong:** 6 vi 1907 (fl), *K.K. Chung* 1827 (IBSC); *K.K. Tsoong* 3725 (A). **Guangxi:** Tian E Xian [Tian1e2 Co.], Shangli [25°00'N 107°10'E], 400 m, 9 ix 1989 (fl), *Beijing Exp.* 89-6886 (US); Chang Tung, E Tan Shan, on open cliff, herb uniserial to 8', deep green above, tawny brown beneath, 933 m, 27 vii 1928 (fl, fr), *R.C. Ching* 6567 (A, NY, W); (fr), *S.K. Lau* 28450 (E); *C. Wang* 41291 (A); Dahongbao, [Long21in2] [24°50'N 105°15'E], 800–1300 m, 5–15 x 1985 (fr, fl), *Z.R. Xu* DH4492 (US). **Guizhou:** Xingyi [25°06'N 104°53'E], 1900–1920 (fr), *J. Cavalerie* 7567 (E); (fl, fr), *J. Cavalerie* s.n. (P); XingRen [25°26'N 105°08'E], 700 m, (fl), *Z.X. Chang & Chang* 8006 (PE); Laoteyorten [L02dian4 Co.] [25°25'N 106°48'E], vii 1904 (fl, fr), *J. Esquirol* 88 (E); Tong-mou [= Tong-fou, Tong1zhoul] [25°51'N 106°58'E], 3 xi 1904 (fr), *J. Esquirol* 317 (E); Tchong-fou [Chang2shun4] [26°02'N 106°E], 28 vi 1905 (fr), *J. Esquirol* s.n. (E); Zhengfeng [25°25'N 105°40'E], vi 1913 (fl), *J. Esquirol* 4334 (P); 800 m, vi 1912 (fl), *J. Esquirol* 3825 (P); vii 1911 (fr, fl), *J. Esquirol* 3086 (P); Chu-Hsiung, Tuan-Shan [Du2shan1, Guizhou] [25°50'N 107°32'E], 1100 m, 17 ix 1939 (fr), *M.K. Li* 29 (PE); 27 vii year? (fr, fl), *J. Seguin in Bodinier* 509 (E). **Yunnan:** Lunan Xian, vicinity of Shilin [24°53'N 103°24'E], 1800 m, 1 viii 1984, *B. Bartholomew et al. (SINO-US)* 1566 (A); (fl, fr), *F. Ducloux* 336 (NY); 23 vii 1905 (fr, fl), *F. Ducloux* 3712 (P); 1533 m, (fl, fr), *A. Henry* 9318 (E, MO); Yuan-Ching, (fr, fl), *A. Henry* 13385 (NY, US); Dan-mu, 12 x 1979 (fr), *J. Muraba & Yamazaki* 9262 (P); Bei Yangtze Faenre Laka tiang Felsenschlucht, 19 iii 1914 (fr), *C. Schneider* 483 (K); zw. Yüenkiang & Damingan, 460–1160 m, 1934, *H. von Wissmann* 812 (W); Yangtse-kiang, between Yunnanfu & Huili, 900–2000 m, 18 iii 1914, *Handel-Mazzetti* 714 (W).

VIETNAM. **Ha Noi:** [21°02'N 105°50'E], 3 vii 1917 (fl, fr), *J. Esquirol* 6153 (P) – doubtful collection; see note below.

Paraboea rufescens possesses a distinctive thick layer of yellowish to dark brown or ferruginous matted indumentum on the lower leaf surface. It is possibly related to *Paraboea umbellata* from which it can be distinguished by the smaller leaves and the

true axillary cymes from basal leaves (vs. subterminal cymes from an extended flowering stem). The capsules are generally around 4 cm long, but one specimen from China (Yunnan), *C. Schneider* 483 (K), has much shorter capsules (c.1.5 cm long).

The *Esquirol* collection from Vietnam is more than likely mislabelled because Esquirol is not known to have made collections in Vietnam. Pellegrin (1930) identified two specimens from Vietnam as *Boea rufescens* Franch. (= *Paraboea rufescens*). One of those two collections, *Bon* 2688A (P), in fruit, from 'Tonkin Occidental', has been identified as *Paraboea umbellata* in this study. The other collection, which was collected from Annam (south Vietnam) by *Poilane*, has not been found by us but is unlikely to be *Paraboea rufescens* given its locality. The distribution of *Paraboea umbellata* is along the South China Sea coast, and *P. rufescens* from central China westward to Yunnan, Burma and Thailand. If *Paraboea umbellata* is eventually found in Vietnam it is likely to be on the border with Yunnan in Lai Chau or Lao Cai.

Fang and Rao described a typical plant of *Paraboea rufescens* when they published *P. tribracteata*. They distinguished their new species by its '3 bracts'; however, 2–4 bracts, generally large and obvious in size, are common in *Paraboea rufescens*.

71b. *Paraboea rufescens* var. *tomentosa* (Barnett) Z.R.Xu, *stat. nov.* – *Paraboea tomentosa* Barnett, *Dansk Bot. Ark.* 20: 202 (1962). – Type: Thailand, Northern region, Chiangmai [Chiang Mai], Doi Chieng Dao, *Larsen* 4078 (holo C; iso ABD).

This variety differs from *Paraboea rufescens* var. *rufescens* in the dark brown colour of the indumentum on the lower leaf surface and the extended primary branches of the cyme. In *Paraboea rufescens* var. *rufescens* the primary and the secondary branches of the cyme are short or hardly develop making the cyme appear umbellate, even in the infructescence. In *Paraboea rufescens* var. *tomentosa* the primary branches of the cyme in the infructescence always extend to c.3–4 cm long and the secondary branches to c.1 cm long. This gives the cyme a truly dichasial appearance. The two varieties do not overlap geographically; *Paraboea rufescens* var. *rufescens* is found only in China (and northern Vietnam?) and *P. rufescens* var. *tomentosa* is in Thailand and Burma. There are some other differences between the two varieties. The flowers of the Chinese collections (i.e. *Paraboea rufescens* var. *rufescens*) are usually blue or violet in colour, and the Thai collections (i.e. *P. rufescens* var. *tomentosa*) are recorded as pinkish and reddish in colour. Colour, however, may not be reliable in delimiting a species. They also differ in bract morphology. The Chinese plants have two large bracts (c.12 × 6 mm) on top of the peduncle and these envelop the flower buds of the young inflorescence. The bracts in the Thai plants measure only 6 × 2 mm and do not envelop the young flowers in the juvenile inflorescence. Burt (1984) and Wang *et al.* (1990) both reduced *Paraboea tomentosa* Barnett to a synonym of *Paraboea rufescens* (Franch.) B.L.Burt. As the differences in the inflorescences and the peduncle bracts between the two groups of plants mentioned can be used to recognise two quite clear entities, but these entities are not sufficiently

distinct to warrant specific limitation, we recognise Barnett's species here as a variety of *Paraboea rufescens*.

Distribution. Burma and Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This variety has been collected at many sites over a wide area and there are no major threats.

Additional specimens examined. BURMA. Kalaw [20°37'N 96°35'E], viii 1932 (fr), *F.G. Dickason* 1093 (GH).

THAILAND. **Chiangmai:** Fang [19°20'N 98°50'E], 2 vii 1978 (fl, fr), *C. Phengkklai et al.* 4222 (BKF); between Chiang Dao and Fang, 500 m, 7 vi 1973 (fr, fl), *R. Geesink et al.* 5762 (E, L); Doi Chiang Dao [19°25'N 99°00'E], 1050 m, 15 vii 1958 (fl, fr), *K. Larsen* 4078 (ABD, C); *ibid.*, 600–1300 m, 25 ix 1971 (fr), *G. Murata et al.* 14995 (L); *ibid.*, 18 x 1926 (fr), *Put* 389 (K); *ibid.*, 1100 m, 15 vii 1958 (fl, fr), *T. Smitinand* 4689 (BKF); *ibid.*, 1100–1800 m, 16 viii 1963 (fr, fl), *T. Smitinand et al.* 1036 (BKF, E, L); *ibid.*, 1100 m, 16 ii 1958 (fr), *T. Sorensen et al.* 1233 (C); *ibid.*, 1050 m, 15 vii 1958 (fl, fr), *Sorensen et al.* 4077 (ABD, BKF, C); *ibid.*, 1050 m, v 1963 (fl, fr), *Sorensen et al.* 4078 (photos NY, UC).

72. *Paraboea sabahensis* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 12 (1991).

– Type: Malaysia, Sabah, Lamag District, near Bilit, Sopiloring hill, Kinabatangan, in limestone primary forest, 350 ft (c.100 m), 18 iv 1963 (fl, fr), *J. Ampuria* SAN35269 (holo E; iso K, L, SAN, SAR). **Fig. 42.**

Perennial caulescent subshrub; stem woody, c.1 cm in diameter, internodes 1–3 cm long, with a white matted indumentum when young and later glabrescent. *Leaves* in whorls of 3, leaf base long-attenuate into a short petiole 0.5–1.5 cm long; blades narrow-elliptic and more or less obovate, 6.5–13 × 1.5–3 cm, 3–5 times as long as wide, apex obtuse, base long-attenuate into a short petiole, margin entire, upper surface with a dense pubescence of an arachnoid layer which sheds off with age, lower surface with a white matted indumentum; veins obscure above, more or less visible beneath, lateral veins c.8 pairs. *Inflorescence* terminal, paniculate, with a white matted indumentum throughout except on the flowers; flowering stems 10–30 cm long, the most basal internodes c.3–9 cm long, floral leaves intermediate in size to vegetative leaves, 3 cymes from each node; basal cymes c.10 cm long, many-flowered, peduncle bract c.5 × 3 mm, pedicel bracts sepal-like; pedicel c.0.5–1 cm long. *Calyx* 2–3 mm long, 5-lobed, lobes narrow-ovate, c.4 times as long as wide, with a white matted indumentum outside. *Corolla* purple, glabrous, c.6.5 mm long, 8 mm across; tube c.2 mm long, limb 2-lipped; upper lip 2-lobed, lobes wide-ovate, c.3 × 3.5 mm, lower lip 3-lobed, two lateral lobes wide-ovate, 4 × 5 mm, middle one obovate, 3 × 3.5 mm. *Anthers* transversely ellipsoid, 2 × 3.5 mm, coherent with each other at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments slightly curved, c.2.5 mm long, 0.7 mm wide. *Gynoecium* c.4.5 mm long; ovary c.1 mm in diameter; stigma capitate, not enlarged.

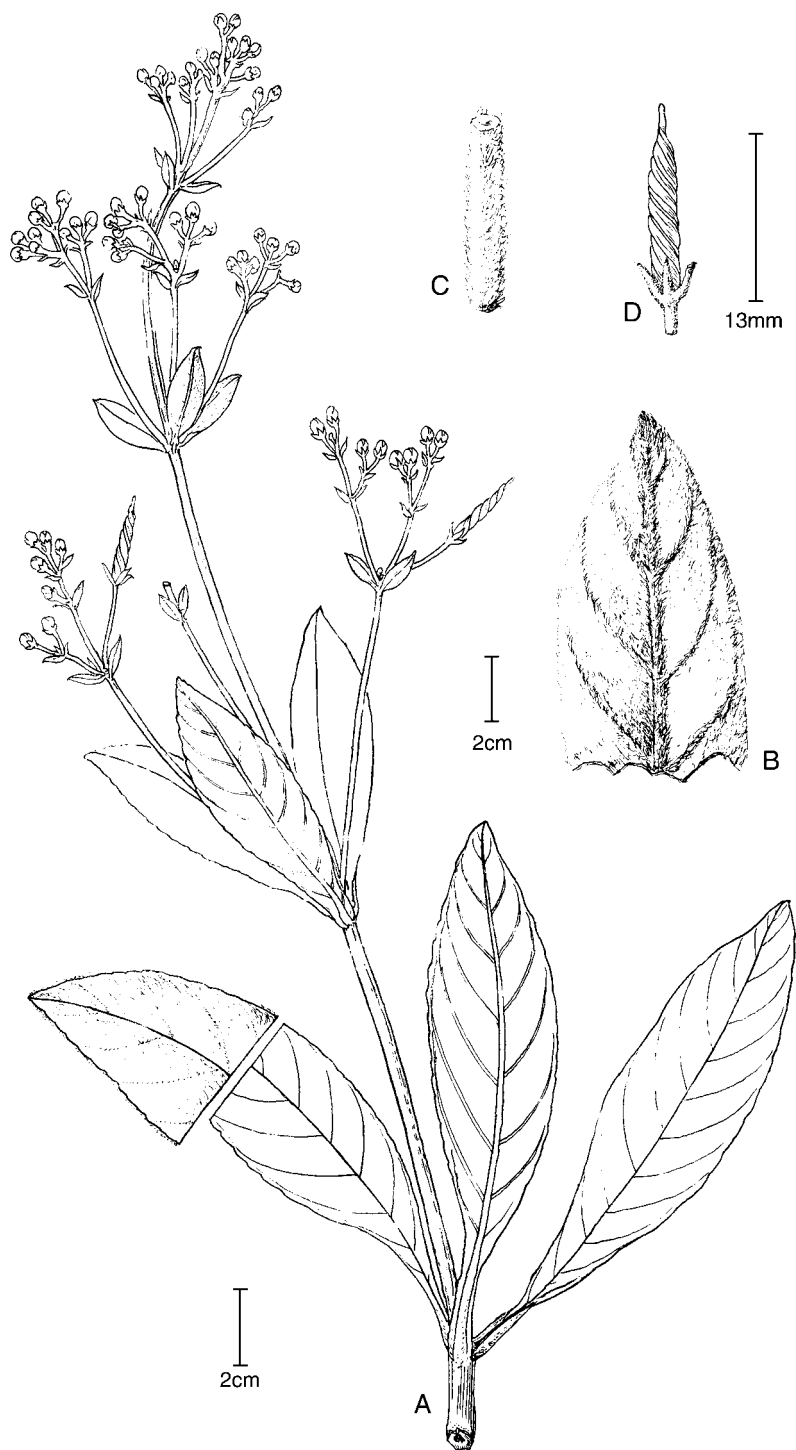


FIG. 42. *Paraboea sabahensis* Z.R.Xu & B.L.Burt. A, habit; B, leaf; C, section of peduncle; D, fruit.

Fruit a narrow ovoid capsule, 1–1.7 cm long, 1.5–2.5 mm in diameter, glabrous, spirally twisted. *Seeds* ovoid, 0.5×0.2 mm.

Distribution. Malaysia: Sabah.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This species is only known from two localities. Although the extent of occurrence is possibly < 100 km², which would justify a Critically Endangered category, the two localities reduces the threat somewhat and Endangered is a more suitable category.

Additional specimen examined. MALAYSIA. **Sabah:** Sapulut District, Batu Punggul, 405 m, 28 i 1993 (fl), *Fidilis & J. Sumbing* SAN135773 (E).

This species is similar to *Paraboea candidissima* in its thick matted indumentum, but differs in its smaller and narrower obovate leaves. *J. Ampuria* noted that the flower is yellow. This likely refers to the conspicuous yellow anthers but not to the corolla as there is no other record of a yellow corolla in this genus.

73. *Paraboea scabriflora* B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 437 (1984).

– Type: Sumatra, Atjeh [Aceh], Gunung Leuser Nature Reserve, Gunung Ketambe and vicinity, 8–15 km SW from the mouth of Lau Ketambe, c.40 km NW of Kutajane, 1800–1900 m, Camp 5, on steep limestone rock in montane rainforest, 16 viii 1972, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes* 14332 (holo L; photo E).

Perennial herb with a short stem c.10 cm long when in flower, rhizome c.10 cm long; internodes c.1 cm long and extending up to 5 cm long when in flower; indumentum the same as that on the lower leaf surface. *Leaves* opposite, congested on the lower part of the stem but less so on the upper part, petiolate; petiole 4–8 cm long, slightly swelling at the base and joining across the node, indumentum the same as that on the lower leaf surface; blades elliptic or ovate, $7\text{--}14 \times 3.5\text{--}6.5$ cm, 1.5–2.5 times as long as wide, apex acute to obtuse, base unequal and more or less shortly angustate, margin crenate-serrate, upper surface pubescent, lower surface with long unbranched multicellular hairs mixed with a layer of a fine interwoven matted indumentum; veins smooth above, raised beneath, lateral veins 6–8 pairs, tertiary venation reticulate. *Inflorescence* subterminal, cymose; often two cymose flowering branches opposite in the uppermost axils below the apical bud, up to 5.5 cm long, with leaflet-like bracts at the apex of the cymose peduncle; leaflet-like bracts c.1 cm long with a c.0.5 cm long petiole; the whole cymose flowering branch up to 10 cm long, 5 cm wide, many-flowered; two primary branches dichasially developing from the cymose peduncle, up to 7 cm long, with the same indumentum as that on the lower leaf surface, with 2 linear bracts $c.6 \times 1$ mm growing not at the apex of this primary branch but c.5 mm lower; pedicels 5–10 mm long, pubescent. *Calyx* c.2.5 mm long, 5-lobed to the base,

lobes narrowly ovate, c.1 mm wide, pubescent outside, glabrous inside. *Corolla* campanulate, c.9 mm long, 7 mm across; tube c.7 mm long, limb indistinctly 2-lipped; 5 lobes of similar size and shape, wide-ovate, c.1.5 × 2.5 mm. *Anthers* transversely ellipsoid, c.1.5 × 3.5 mm, seemingly coherent with the gynoecium but not adnate to each other, open at the upper end, apex turned towards the gynoecium, dorsifixed; filaments inserted at c.0.5 mm from the corolla base with a free part c.2 mm long; staminodes 3, two of 1.5 mm long and one of 0.5 mm long. *Gynoecium* c.7 mm long; ovary ovoid, c.3 × 1 mm; style distinct from the ovary, c.4 mm long; stigma slightly larger than style. Young *fruit* a linear capsule, c.2 cm long, glabrous, visibly twisted. *Seeds* not seen.

Distribution. Indonesia: Sumatra. Known only from the type.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

This species is likely closely related to *Paraboea glanduliflora*. They are similar in their subterminal cymose inflorescence. However, they are very different in their indumentum for *Paraboea glanduliflora* has a glandular pubescence on the inflorescence and *P. scabriflora* has a mixture of a long unbranched pubescence and a matted indumentum. Our study does not support the suggested relationship between this species and *Paraboea detergibilis* (Burt, 1984). The two species differ in indumentum, inflorescence structure and capsule morphology.

74. *Paraboea schefferi* (H.O.Forbes) B.L.Burt, Kew Bull. 1948: 56 (1948); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 438 (1984). – *Didymocarpus schefferi* H.O.Forbes, J. Linn. Soc., Bot. 19: 298 (1882). – Type: Borneo, Pulau Pandan, *Teysmann* 8430 (lecto BM, designated by Burt (1984: 438); photo K). **Fig. 43.**

Didymocarpus paraboeoides Kraenzl., Mitt. Inst. Bot. Hamburg 7: 90 (1927). – *Paraboea paraboeoides* (Kraenzl.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 434 (1984). – Type: [Indonesia, Kalimantan], West Borneo, Bukit Pehipit, 9 xii 1924, *Winkler* 672 (holo HBG).

Boea borneensis Scheff. ex H.O.Forbes, J. Linn. Soc. 19: 298 (1882), *nom. illeg.* (in synonymy).

74a. *Paraboea schefferi* var. *schefferi*

Perennial herb with a woody stem; stem normally 15–40 cm long, up to 1 cm in diameter, with a thick layer of matted indumentum, which is so appressed and so smooth on the surface that it would be easily mistaken as a glabrous bark on the stem, the bark of the stem under this layer of indumentum is very loose, internodes 5–30 mm long. *Leaves* opposite, cauline, petiolate; petiole c.2–10 cm long, enlarged at the base and joining each other across the node, with a whitish matted

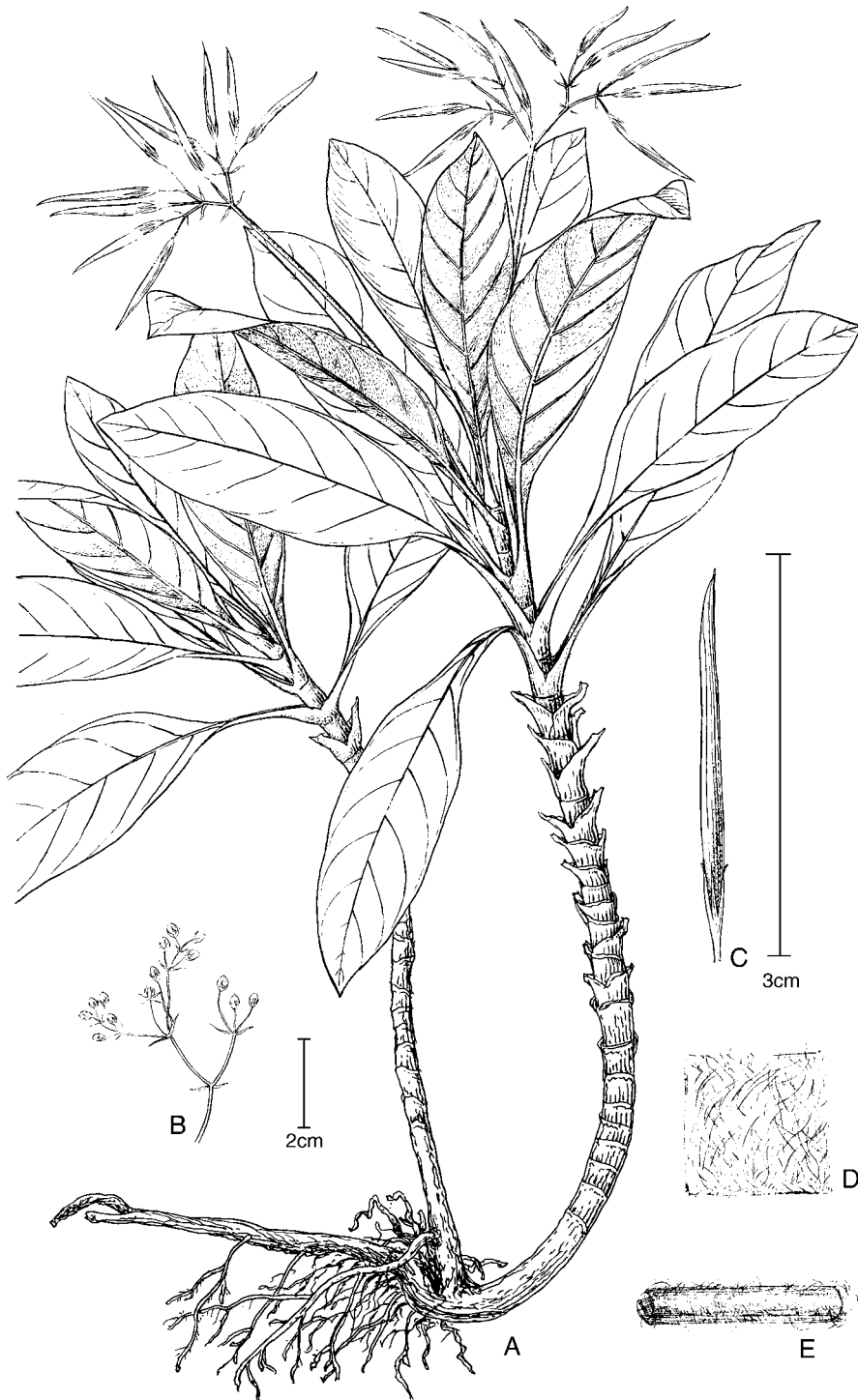


FIG. 43. *Paraboea schefferi* (H.O.Forbes) B.L.Burtt. A, habit; B, part of inflorescence; C, fruit; D, indumentum on leaf; E, section of peduncle.

indumentum; blades oblong-elliptic or elliptic, c.10–15 × 3.5–6.5 cm, c.1–2 times as long as wide, apex obtuse or acute, base cuneate or widely so, margin entire, upper surface arachnoid when young and glabrescent when mature, lower surface with a whitish matted indumentum; veins smooth above, raised beneath, lateral veins c.7–10 pairs, tertiary venation obscure. *Inflorescence* an axillary cyme, much longer than the leaf, c.20–40 × 10–15 cm, with c.4 bifurcations, bearing several to many flowers; peduncle ± with some matted indumentum, 20–30 cm long, two primary bracts narrowly ovate, c.3–5 mm long, with minute sessile glands on the upper surface; pedicels 5 mm long, glabrous, with sepal-like secondary bracts similar in morphology to the primary bracts. *Calyx lobes* narrowly ovate, c.2.5 × 0.8 mm, glabrous outside, minutely pubescent inside. *Corolla* blue, blue-pink, purple-violet or violet, c.5 mm across, minutely pubescent outside and inside; tube 1.5–2 mm long, limb 2-lipped; upper lip 2-lobed, lobes rounded, c.3 × 3 mm, lower lip 3-lobed, lobes c.4 × 4 mm. *Anthers* ± triangular, 2.2 × 3.2 mm, opening in the centre of the anther locules, coherent, ± dorsifixed; filaments 1.5 mm long. *Gynoecium* 3.5 mm long, ovary 1 mm wide; style 0.4 mm wide; stigma slightly larger than style. *Fruit* a linear non-twisted capsule up to 4 cm long, very slender, ± curved. *Seeds* compressed, ovoid.

Distribution. Borneo.

Habitat and ecology. Reported from limestone.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This variety is only known from a few localities. We are unsure of the extent of occurrence but do not believe it to be above 5000 km².

Additional specimens examined. INDONESIA. **West Kalimantan:** Pulow [Pulau] Sepandan, D. Luar, 10 viii 1949 (fl, fr), Main exp. E. Polak, *F.H. Endert* 1991 (K, L); exp. Liang-gagang, 1893 (lv), *H. Hallier* 94 (L).

No specific differences can be found between *Paraboea schefferi* and the type of *Didymocarpus paraboeoides* except that the internodes are somewhat longer in the latter. Thus, we reduce *Didymocarpus paraboeoides* to synonymy. *Paraboea schefferi* belongs in a group of species with *P. luzoniensis*, *P. minahassae* and *P. leopoldii*. Within this group it is most distinctive by a combination of cuneate leaf blade base, a large inflorescence and distinct internodes.

74b. *Paraboea schefferi* var. *ambigua* (C.B.Clarke) Z.R.Xu, **comb. nov.** – *Didymocarpus schefferi* H.O.Forbes var. *ambigua* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5: 106 (1883). – Type: prope Karimata, *Teysmann* 4214 (BM, not found). Neotype: Borneo, Karimata Arch., Poelau Pelapis Tiangbalai, 21 iii 1931 (fr), *Mondi* 129 (neo L, designated here; isoneo K, SING).

This variety differs from *Paraboea schefferi* var. *schefferi* in its cordate or rounded leaf base. Also, the two varieties are isolated geographically: Karimata Archipelago is a group of small islands off the south coast of Borneo.

Distribution. Borneo: Karimata Archipelago.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This variety is only known from two localities. The collection localities are from the same group of islands but within those it is not clear how far apart the collections were made. We are confident, however, that the extent of occurrence is not more than 5000 km², justifying the EN category.

The type has not been found, but *Mondi* 129 (K, L, SING), collected from the type locality, matches the description by Clarke (1883) well and is selected here as a neotype.

75. *Paraboea sinensis* (Oliv.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 38: 471 (1980); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 438 (1984); Wang et al., Fl. Reipubl. Popularis Sin. 69: 464 (1990). – *Phylloboea sinensis* Oliv., Hook. Ic. Pl. 18: t.1721 (1887). – *Chlamydoboea sinensis* (Oliv.) Stapf, Bull. Misc. Inform. Kew 1913: 355 (1913). – Type: China, Hupeh (Hubei), Ichang, *Henry* 1572 (holo K).

Fig. 44.

Chlamydoboea sinensis (Oliv.) Stapf forma *macrophylla* Stapf, Bull. Misc. Inform. Kew 1913: 355 (1913). – Type: China, Yunnan, Szemao [Simao] [22°50'N 101°02'E] (fl), 4500 ft (c.1350 m), *Henry* 12305 (lecto K, designated here).

Chlamydoboea sinensis (Oliv.) Stapf forma *macra* Stapf, Bull. Misc. Inform. Kew 1913: 355 (1913). – Type: China, Yunnan, South of Red River, (fr), *A. Henry* 9630 (lecto K, designated here; iso US).

Boea macrophylla Drake, Bull. Soc. Philom. Paris, sér. 8, 2: 130 (1890); Pellegrin in Lecomte, Fl. Indo-Chine 4: 544 (1930). – Type: Tonkin, forêts de Mont Bavi, *Balansa* 4304 (lecto P, designated by Burt (1984: 438)).

Boea chaffanjonii H.Lév., Repert. Spec. Nov. Regni Veg. 9: 330 (1911). – Type: China, Kweichow, env. de Houy-yang, *Chaffanjon in herb. Bodinier* 2312 (holo E).

Perennial caulescent herb; stem woody, up to 1 m long, 5 mm in diameter, with internodes c.1 cm long, with a brown matted indumentum when young, glabrescent when older. *Leaves* opposite, petiolate; petiole 2–10 cm long, indistinctly joining across the node, with the same indumentum as that on the lower leaf surface; blades elliptic, or narrowly so, 7–26 × 2–10 cm, 2–3 times as long as wide, apex obtuse or acute, base cuneate, margin entire or serrulate, upper surface with some arachnoid covering and later glabrescent, lower surface with a brown or greyish matted indumentum; veins obscure above, raised beneath, lateral veins 10–15 pairs. *Inflorescences* subterminal, cymose; cymes often two opposite to each other from the uppermost axils, the two floral leaves much smaller than the mature vegetative

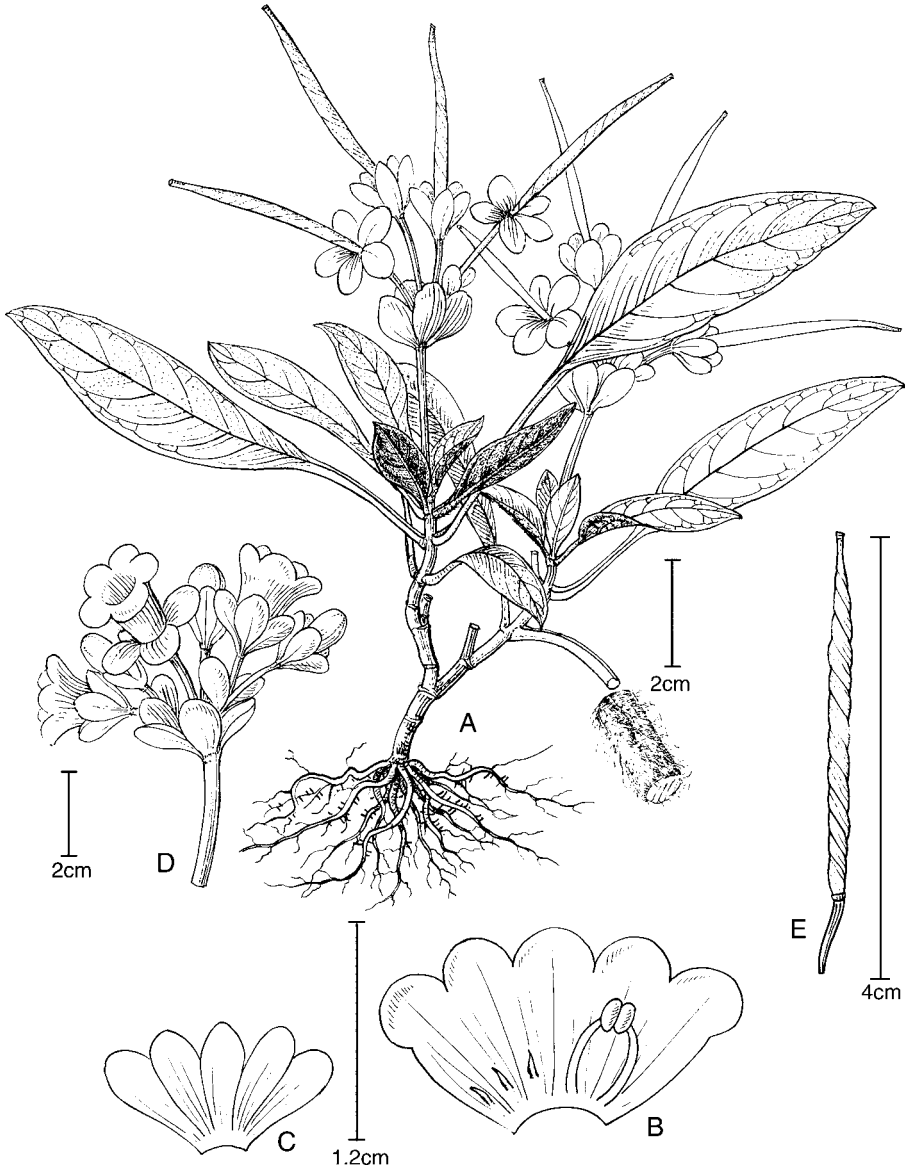


FIG. 44. *Paraboea sinensis* (Oliv.) B.L.Burtt. A, habit; B, corolla opened out; C, calyx opened out; D, inflorescence; E, fruit.

leaves, sometimes joining each other to form a seemingly large leaflet-like bract, making the young inflorescence appear terminal; juvenile cymes having many congested flowers embraced by numerous large membranous bracts, appearing like a capitulum, and then gradually extending into a tight cyme c.5–10 cm long, 3–6 cm

wide; peduncle 2–4 cm long, with a matted indumentum, bracts large, wide-ovate or rounded, 1–1.5 cm long, membranous, glabrous (reddish or white but with blue and pinkish in the upper part); pedicels 5–10 mm long with bracts of similar shape to the peduncle bracts but smaller. *Calyx* white or reddish, large, lobes narrowly trapeziform but more or less rounded at the apex, or \pm narrowly obovate, c.10–15 mm long, 5–7 mm wide. *Corolla* violet, violet-blue, blue, lilac, purple-red, purple or white with blue and purple, c.15 mm long, 13 mm across when fully open; tube c.10 mm long, swelling at the base and where the stamens are inserted, limb not distinctly 2-lipped; lower lip slightly larger than the upper lip, with 5 lobes of similar size and shape, widely ovate, c.4 \times 5 mm. *Anthers* reniform, c.2.5 \times 4 mm, coherent with each other at the apex, opening towards the top of the anther, apex truncate or turning towards the gynoecium, dorsifixed; filaments inserted at the corolla base with a free part c.8 mm long, upper half swelling greatly to almost 5 times larger than the lower half, curved and forming a knee, with some hairs; staminodes 3, linear, c.3 mm long. *Gynoecium* c.12 mm long, 1.2 mm wide at the ovary base; ovary extending into a short style, curved towards the anthers; stigma not larger than style. *Fruit* a linear capsule, 3–5 cm long, 2 mm in diameter, spirally twisted, glabrous. *Seeds* narrowly ellipsoid, c.0.5 \times 0.15 mm.

Distribution. Burma, China, Thailand and Vietnam.

Habitat and ecology. On limestone substrates inside forest or scrub.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats.

Additional specimens examined. BURMA. Maymyo [22°05'N 96°33'E], Ani Sakan Falls, 15 x 1911 (fr), *J.H. Lace* 5502 (E); Maymyo, Gokteik Gorge, 500 m, 2 viii 1908 (fl), *J.H. Lace* 4158 (E); Maymyo, Urtrin, 1000 m, vi 1916 (fr), *J.H. Lace* 130 (E); S Shan States, 1000 m, vii 1909 (fl), *R.W. MacGregor* 554 (E).

CHINA. **Guangxi:** 125 m, 24 iv 1981 (fl), *D. Fang et al.* 24985 (PE). **Guizhou:** Gan-Chouen [An1shun4] [26°13'N 105°55'E], 19 ii 1921 (fl), *J. Cavalerie* 2914 (P); Pinfa [Dai4hua4] [25°45'N 106°25'E], (fl), *J. Cavalerie* 3149 (E, P), 15 vi 1905 (fl), *J. Cavalerie et al.* 2367 (P); Mont du Collège [vicinity of Guiyang nearby a university?] [26°32'N 106°41'E], 5 vii 1900, *Chaffanjon & Bodinier* s.n. (A); Pinfa [Dai4hua4] [25°45'N 106°25'E], 1902 (fl, fr), *B. Chaffanjon* 560 (E); 5 v 1898 (fl), *B. Chaffanjon* 2312 (E, P); 26 v 1898, *B. Chaffanjon* s.n. (P); Guiyang [26°32'N 106°41'E], *H.C. Chow* s.n.; vii 1905 (fl), *J. Esquirol* 398 (E); vi 1909 (fl), *J. Esquirol* 1568 (E); Ku-kai-shan, Tating [Da4tang2, close to Du1yun2] [26°20'N 108°05'E], 2951 m, ix 1930 (fl, fr), *Y. Tsiang* 8854 (NY); Mogan, Lipo [25°28'N 107°52'E], 900–1100 m, 10–25 xii 1985 (fr), *Z.R. Xu* L1132 (SYS, US). **Hubei:** Shennongjia, EW running side Canyon or the E side of the Songlo River E of Jingyin [31°30'N 110°30'E], 1050 m, 22 ix 1980, *B. Bartholomew et al.* (SINO-US) 1715 (A, E); Patung Hsien [31°02'N 110°23'E], 15 vi 1934 (fl, fr), *H.C. Chou* 506 (E, NY); Yichang [30°41'N 111°18'E], x 1887 (fl), *A. Henry* 3958 (E, GH, P, US, W), v 1888 (fl, fr), *A. Henry* 4158 (P, US), 1885–1888 (fl), *A. Henry* 6017 (E, P, US), iii 1889 (fl), *A. Henry* s.n. (P), 1885–1888 (fl, fr), *A. Henry* 6071 (US); Fangxian [32°05'N 110°41'E], 5 vi 1982 (fr, fl), *Z.D. Jiang & G.F. Tao* 364 (E, NY); Xuanen [30°01'N 109°28'E], 800–900 m, (fr), *H.J. Li* 3851 (PE); Nanto [Nan2jin1guan1, close to Yi2chang1] [30°45'N 111°12'E], 5 vi 1899–1911 (fl), *E.H. Wilson* 859 (E, NY, P, US, W). **Sichuan:** District de

Tchen-Keou-Tin [Jiang1kou3zhen4] [31°10'N 118°52'E], (fl, fr), *R.P. Farges* 1172 (A, P, US, W), 1400 m, 1 vii 1892 (fl), *R.P. Farges* 1192 (P), 1895–1897 (fl), *R.P. Farges* s.n. (E, IBSC, P, US); S Wushan [31°06'N 109°51'E], v 1910 (fl), *E.H. Wilson* s.n. (E). **Yunnan:** Western flank Zali, c.3300 m, ix 1917 (fr), *G. Forrest* 15565 (E); Mikong–Salwin divide [26°30'N], 3000 m, vii 1919 (fl, fr), *G. Forrest* 18259 (E); Shweli–Salwin Divide (= Mekong–Salwin divide?) [25°40'N], 2333 m, viii 1919 (fr), *G. Forrest* 18437 (E); Shweli–Saluuecci divide [25°45'N 98°58'E], 2666 m, x 1924 (fr), *G. Forrest* 25309 (E); (fl, fr), *A. Henry* 9836 (NY); (fl, fr), *A. Henry* 11223A (NY, US); Szemao [Simao] [22°50'N 101°02'E], (fr, fl), *A. Henry* 12162B (NY); Szemao [Simao], (fl, fr), 1200–1500 m, *A. Henry* 12162A (NY, US); Collines arides, de Pa-Eul-gai, 790 m, vi year? (fl), *R.P. Maire* s.n. (P); Rochers des mont. a Sau-Kwr, 2690 m, (fl), *R.P. Maire* s.n. (P); SE Yunnan, Loping [24°52'N 104°14'E], 1400 m, 20–25 ix 1985 (fr), *Z.R. Xu* NS4813 (E, SYS); SE Yunnan, Maguan [22°58'N 104°28'E], 1500 m, vii 1985 (fl), *Z.R. Xu* & *Chen* GL3809 (E, SYS); Chengkang Snow Ranges Sangeorshan [30°N 120°E], 2300 m, 30 vii 1938 (fl), *T.T. Yu* 17103 (E).

VIETNAM. Ha Bac: Bac Giang [21°16'N 106°11'E], v 1925 (fl), *E. Colani* 2937 (NY, P, US); Bac Giang (Bac Ninh) [21°16'N 106°11'E], v 1925 (fl), *A. Pételot* 2937 (C). **Ha Giang:** Meo Vac District, Sung Chang, vicinity of Lu Lu Phin village, 23°11'N 105°18'E, 1350–1450 m, 29 iv 1999 (fl), *P.K. Loc et al.* CBL1826 (AAU); Yen Minh District, La Va Chai, vicinity of Ngan Chai Village, 6 km W of Yen Minh town, 23°07'N 105°08'E, 1500–1600 m, 1 v 1999 (fl), *P.K. Loc et al.* CBL1894 (AAU); Dong Van District, Ho Quang Phin, Vicinity of Ta Xa Village, 14–16 km SSW of Dong Van town, 23°16'N 105°22'E, 1550–1600 m, 28 iv 1999 (fl), *P.K. Loc et al.* CBL1784 (AAU). **Ha Noi:** [21°02'N 105°50'E], 1929? (fl, fr), *A. Pételot* 1624 (NY). **Ha Tay:** Mt. Bavi [21°03'N 105°22'E], 800 m, 16 vi 1886 (fr), *Balansa* 4304 (E, P). **Hoa Binh:** Mai Chau District, Pa Co Village, 20°44'N 104°57'E, *Nguyen Tien Hiep* NTH2108 (E). **Lao Cai:** Chapa [Sa Pa] [22°21'N 103°50'E], 1500 m, vii 1924 (fl), *A. Pételot* 1492 (P); Chapa [22°21'N 103°50'E], vii 1924 (fr, fl), *A. Pételot* 1605 (HNU, P); Chapa [22°21'N 103°50'E], iv 1925 (fr, fl), *A. Pételot* 1505 (HNU, P); Mt. Ta Pinh near Chapa [22°21'N 103°50'E], 8 ii 1926 (fr, fl), *E. Poilane* 12770 (P). **Thanh Hoa:** Thanh Hoa [20°00'N 105°30'E], 100 m, 27 i 1931 (fr), *E. Poilane* 18948 (P).

This is a species comparable to *Paraboea swinhoei* and *P. multiflora* in its large populations and widespread distribution. The species is very diverse in leaf morphology and habit but is consistent in characters such as the inflorescence structure, the numerous large membranous bracts, and the large membranous obtrapeziform or obovate calyx lobes. The large calyx lobes are unique in the genus which is possibly why it has been treated in separate genera in the past (Oliver, 1887; Stapf, 1913). The other flower characters are similar to the groups around *Paraboea martinii* and *P. glabrisepala*. These have a large corolla with a long tube and less distinctly lipped limbs. They also have a swollen and kneed filament with some pubescence, and the anthers have an aperture at the upper end. The subterminal cymose inflorescence is also characteristic for this species although it could be mistaken as terminal and cymose. However, when the infructescence is mature, the aborted terminal bud in-between the two subterminal cymes is revealed. Because the terminal bud is aborted the subsequent growth is resumed from an axil below the previous flowering region.

76. *Paraboea speciosa* (Rech.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 438 (1984). – *Boea speciosa* Rech., Oesterr. Bot. Z. 49: 145 (1899). – Type: Cult. 9 viii 1897 in Hort. Bot. Vindob., Acq. Journ. n. 1800 (holo WU).

Leaf blade 7.5×5.5 cm, broadly elliptic, apex damaged, probably unequal-sided at base (leaf damaged), petiolate (petiole 3.5 cm), upper surface glabrescent, lower surface with a brown matted indumentum. *Inflorescence* densely congested. *Calyx* divided to the base into 5 lobes, broadly oblong-truncate at the apex, lobes 6×4 mm. *Corolla* white, marked with anthocyanin near the tips of some lobes (probably the tips exposed in bud) and perhaps in the throat, glandular-puberulous inside around the mouth and in the throat, otherwise glabrous, c.2.2 cm long, 1.5 cm in diameter (in pressed material). *Anthers* c.5 mm in diameter, cohering face to face, hard, yellow, fully exposed at corolla mouth. *Staminodes* 3, filiform.

Distribution. Unknown.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Data Deficient (DD). See discussion below.

The species was described from cultivated material from the Vienna University herbarium and so far no other records have been added to this species. There are also no records to show where the original seeds for the cultivation came from. It is also unfortunate that no successor of that cultivation has been reported in current botanical gardens. The type specimen, a leaf and several flowers remains the only material for this specific name. However, the broadly oblong-truncate calyx lobes are quite characteristic as very few species in this genus possess these kinds of lobes. It may be a relative of *Paraboea burttii*, which has the same shape of lobes, but that species has a different texture to and indumentum on the leaves.

77. *Paraboea speluncarum* (B.L.Burt) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 438 (1984). – *Boea speluncarum* B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 31: 36 (1971). – Type: Sarawak, Gunong Subis, on soft tufa limestone at mouth of Niah Cave, 5 vi 1962 (fl, fr), *B.L. Burt & P.J.B. Woods* 2019 (holo E; iso E, SAR).

Fig. 45.

Perennial herb with a woody stem; stem pendulous and branched, 60 cm long, 1 cm in diameter, internodes c.1 cm long, with a brownish orange matted indumentum. *Leaves* in whorls of 3, sessile, leaf base attenuate to the stem and then swelling, joining with each other and so forming conspicuous ring surrounding the stem, elliptic or narrowly so, sometimes appearing more or less obovate, $10\text{--}20 \times 3\text{--}5.5$ cm, 3–5 times as long as wide, apex acute, margin entire, upper surface arachnoid, lower surface with a white matted indumentum; veins obscure above, raised beneath, lateral veins 10–20 pairs, tertiary venation obscure. *Inflorescence* a terminal panicle with a short underdeveloped flowering stem but rather well-developed cymes from the axils of the flowering stem near the terminal bud; the terminal bud visibly active when the plant is in flower and fruit [but we do not know if it is aborted after the current flowering season]; cymes normally equal to the leaves or shorter, rarely



FIG. 45. *Paraboea spehuncarum* (B.L.Burtt) B.L.Burtt. A, habit; B, underside of leaf; C, fruit.

longer, 8–13 cm long, c.3 cm wide, several-flowered (normally < 10), with a white matted indumentum except on corolla, stamen and gynoecium; peduncle c.5–7 cm long, peduncle bracts ovate, 5×2.5 mm; pedicel c.5 mm long, pedicel bracts sepallike or indistinct. *Calyx* c.3 mm long, 5-lobed, lobes narrowly ovate, $c.3 \times 0.5$ – 0.6 mm, with a matted indumentum outside. *Corolla* blue-violet, glabrous, c.7 mm long, 15 mm across; tube 2 mm long, limb 2-lipped; upper lip with 2 lobes, rounded,

c.6 × 6 mm, lower lip c.10 mm long with 3 lobes, middle lobe obovate, c.6 × 4.5 mm, lateral lobes wide-ovate, c.4 × 4 mm. *Stamens* 2, staminodes not seen; anthers yellow, transversely ellipsoid, c.1.5 × 4 mm, apex pointing towards the gynoeceium, coherent with each other at both the apex and the base, opening in the centre of the anther locules, dorsifixed; filaments inserted at c.2 mm from the corolla base with a free part c.3 mm long, ± twisted. *Gynoeceium* c.8 mm long; ovary ovoid, c.1 × 1 mm; style c.7 mm long, 0.3 mm wide; stigma slightly larger, capitate. *Fruit* a spirally twisted capsule, c.1–2 cm long, 1.5–2 mm in diameter, glabrous. *Seeds* narrowly ellipsoid, 0.6 × 0.2 mm.

Distribution. Malaysia: Sarawak.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species has not been collected often it is not infrequent in a protected area and there are no major threats.

Additional specimens examined. MALAYSIA. **Sarawak:** Niah Caves, 4th Division [03°00'N 114°00'E], 166 m, 9 vi 1962 (fr), *Alphonso & Samsuri* A.241 (A, E, L, SAR); Gua Pangomah, Gunong Subis, Niah Caves, Miri District, 25 iv 1972 (fl, fr), *J.A.R. Anderson* S31675 (A, E, K, L, SAR); Niah Caves on tufa stalactites overhanging mouth of cave, 3 vi 1962 (fl, fr), *B.L. Burtt & P.J.B. Woods* 1992 (E); (fr), *Cult. in E* C4918 (E).

When Burtt (1971) published this species he compared it with *Boea lanata* Ridl. (= *Paraboea lanata*) and mentioned that both species shared axillary inflorescences. We believe that *Paraboea speluncarum* has closer relatives in Borneo, such as *P. candidissima* and its relatives, tropical species with a terminal panicle and a whorled leaf formation. Similarity in the inflorescences of *Paraboea speluncarum* and *P. lanata* is of superficial value. We cannot judge from the type whether this species has an axillary cymose or a terminal paniculate inflorescence but it is clear from the type that the inflorescence is not typically cymose for several cymes develop from the uppermost axils of a short flowering stem with the appearance of a terminal panicle. Whether the terminal bud remains active or is aborted after one flowering season cannot be answered from the specimen itself.

78. *Paraboea suffruticosa* (Ridl.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 439 (1984). – *Boea suffruticosa* Ridl., J. Linn. Soc., Bot. 32: 518 (1896). – Type: Peninsular Malaysia, Langkawi, on small islands, ix 1890 (fl, fr), *C. Curtis* 2565 (lecto SING, designated by Burtt (1984: 439)). **Fig. 46.**

A bushy plant, with a branched stem, to 60 cm tall; flowering branches monocarpic (i.e. the flowering branches die back after fruiting); stem 5 mm in diameter, internodes 5 mm long or shorter, with a brownish matted indumentum when young, changing colour to dark brown when older. *Leaves* alternately congested close to the terminal bud of a branch, petiolate; petiole 0.5–1.5 cm long, with the same indumentum as that on the lower leaf surface; blades elliptic or narrowly so,

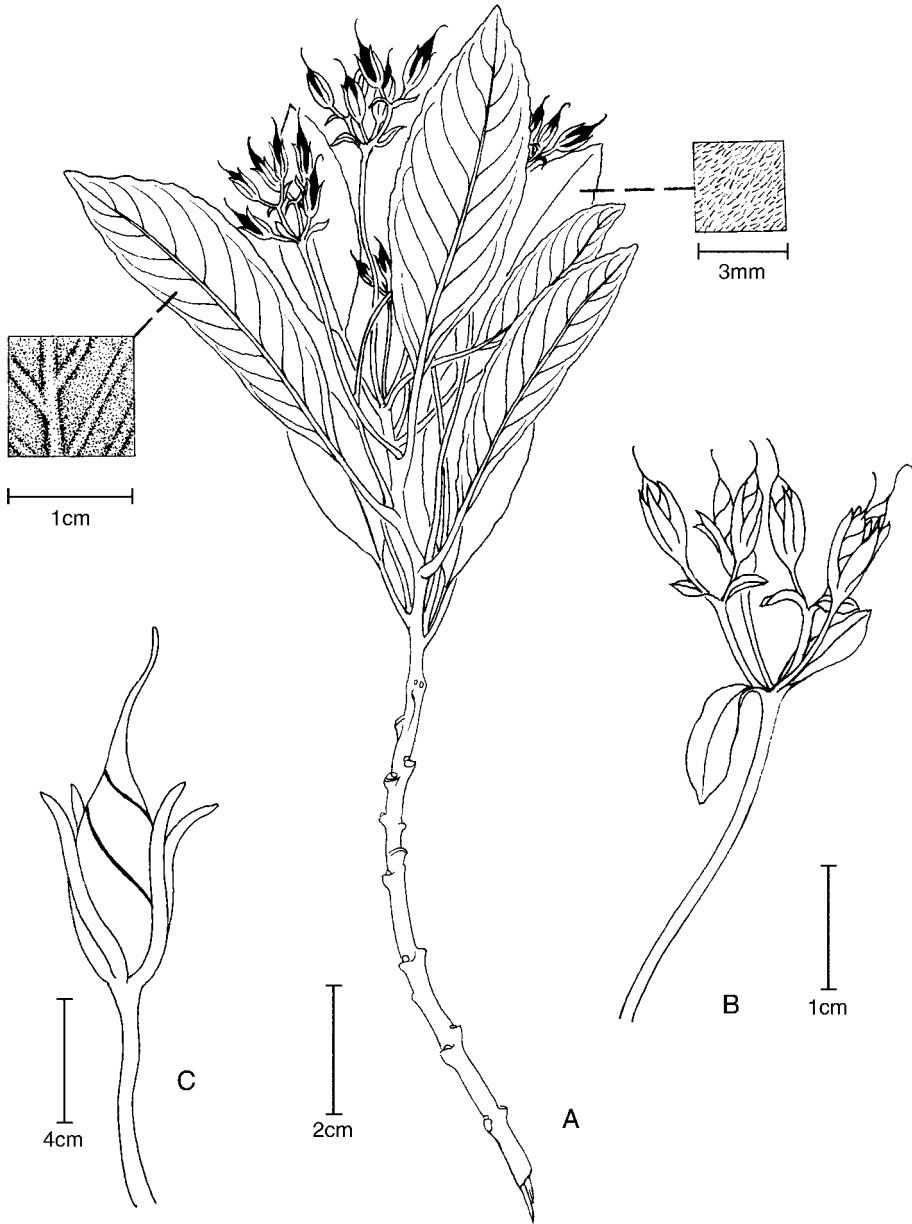


FIG. 46. *Paraboea suffruticosa* (Ridl.) B.L. Burt. A, habit; B, infructescence; C, fruit.

3–7 × 1–2 cm, 2–5 times as long as wide, apex obtuse, base angustate, margin entire, upper surface minutely pubescent, lower surface with a greyish or brownish-orange matted indumentum; veins smooth above, raised beneath, lateral veins 6–10 pairs, tertiary venation invisible. *Inflorescences* subterminal cymose from a truly axillary flowering branch; cymelets growing in the axils near the apical bud of the

flowering branch, resulting in a flowering branch appearing like a panicle, cymelets nearly equal in length to the leaves, c.6 cm long, several-flowered (normally < 10), with a brownish-orange matted indumentum except on the flower; peduncle 2–3 cm long; peduncle bract leaflet-like or narrowly ovate, up to 1 cm long, 4 mm wide; pedicel c.5 mm long, pedicel bracts sepal-like. *Calyx* relatively long, c.5–8 mm long, 5-lobed to the base, lobes very narrowly linear, c.0.3 mm wide, indumentum brownish-orange and matted. *Corolla* white, glabrous, c.6 mm long, 7 mm across; tube c.2 mm long, limb 2-lipped; upper lip with 2 lobes, lobes widely ovate, c.2.5 × 4 mm, lower lip with 3 lobes, middle lobe ovate, c.3 × 2.5 mm, lateral lobes rounded, c.2.5 × 3.5 mm. *Anthers* transversely ellipsoid, c.1.5 × 2.8 mm, opening in the centre of the anther locules, coherent with each other at the apex and the base, apex turned towards the gynoeceium, dorsifixed; filaments inserted at c.1 mm from the corolla base with a free part c.1.5 mm long. *Gynoeceium* c.5 mm long; ovary ovoid, c.1 × 0.8 mm, pubescent; style distinct, much narrower than the ovary; stigma not much larger than style. *Fruit* a narrowly ovoid capsule, c.1 cm long or slightly shorter, 2 mm in diameter, glabrous, spirally twisted. *Seeds* compressed-ellipsoid, 0.6 × 0.2 mm.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites on Langkawi and neighbouring islands and there are no major threats.

Additional specimens examined. MALAYSIA. **Kedah:** Langkawi: P. Dayang Bunting, S end, rocks above SW corner of lake [06°13'N 99°49'E], 29 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1763 (E); Langkawi Main island, N end, limestone hill, N Bank S Kisap [06°21'N 99°52'E], 30 iv 1962 (fr), *B.L. Burt & P.J.B. Woods* 1774 (E); Batu Puteh, 20 xi 1941 (fl, fr), *E.J.H. Corner* s.n. (SING); Pulau Kedrah, 17 xi 1941 (fr), *E.J.H. Corner* 37811 (K, SING); small island N of Kuah, xi 1901 (fl, fr), *C. Curtis* 3682 (K, SING); Pulau Langkawi, East coast [06°21'N 99°55'E], 19 viii 1972 (fl), *E. Soepadmo & Mahmud* 1250 (L); P. Timun [06°18'N 99°55'E], 19 viii 1972 (fr, fl), *B.C. Stone* 11007 (E).

This species is similar to *Paraboea lancifolia* but is easy to distinguish by its long and linear calyx lobes that are almost as long as the capsule. The inflorescences of *Paraboea suffruticosa* are described above as axillary although taking the branch as a whole it does appear somewhat like a terminal panicle. *Paraboea lancifolia* is described as having a paniculate inflorescence from an axillary flowering branch but the distinction is one only of appearance and is not a hard and fast difference. Both species were collected from the Langkawi Islands but isolated from each other on different small islands.

79. *Paraboea swinhoi* (Hance) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 439 (1984). – *Boea swinhoi* Hance, Ann. Sci. Nat. ser. 5, 5: 231 (1966). – Type:

Formosa [Taiwan], Takow-Taiwan, Apes Hill, Bush [Ga01xiong2 City, Shou4shan1] [22°06'N 120°03'E], 1863 (fr), *R. Swinhoe* 62 (lecto BM, designated here; iso K). **Fig. 47.**

Boea swinhoei var. *diffusior* C.B. Clarke in A. DC. & C. DC., Monogr. Phan. 5: 142 (1883). – Type: Borneo, *Korthals* (?*Blume*) s.n. (Herb. Lugd. Batav. No. 182) (lecto L [acc. no. 903307-283], designated here; iso L [acc. no. 903307-284], K [sub Clarke No. 182]).

Boea kerrii Craib, Bull. Misc. Inform. Kew 1916: 267 (1916). – *Paraboea kerrii* (Craib) B. L. Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 430 (1984). – Type: Thailand, Doi Sutep, 600 m, *Kerr* 1973 (lecto ABD, designated by Burtt (1984: 430); iso E, K).

Perennial herb with a woody stem c. 50 cm tall, 3–4 mm in diameter, internodes 1–5 cm long, with a yellowish matted indumentum when young and later glabrescent. *Leaves* opposite, petiolate; petiole 1–3 cm long with the same indumentum as that on the blades; blades ovate, narrowly ovate, or in some rare cases somewhat obovate, 4–14 × 2.5–7 cm, apex acute, base rounded to truncate, sometimes very slightly cordate, margin more or less serrate, upper surface with some arachnoid covering when young and glabrescent when mature, lower surface with a yellowish matted indumentum; veins smooth above, raised beneath, lateral veins 5–11 pairs, tertiary venation obscure. *Inflorescence* a large terminal panicle comprised of axillary cymes, with a yellowish matted indumentum throughout except for the flower; flowering stem 15–25 cm long, internodes similar in length to those of the vegetative stem; floral leaves similar in size to the vegetative leaves; the cymes opposite to each other on the nodes of the flowering stem, many-flowered, up to 13 cm long, with peduncle bracts ovate, c. 3 × 2 mm, and pedicel bracts sepal-like; pedicel 5–8 mm long. *Calyx* campanulate, 1.5–2.5 mm long, 5-lobed to the base, lobes narrowly oblong, 2.3 × 1 mm with a matted indumentum outside, glabrous inside. *Corolla* white, glabrous, c. 5 mm across when open, ± campanulate, 6 mm long; tube c. 4 mm long, limb ± 2-lipped; upper lip 2-lobed, lobes widely ovate, 2.5 × 3.5 mm, lower lip 3-lobed, middle lobe 2 × 3.5 mm, lateral lobes 2.5 × 2.5 mm. *Stamens* 2, staminodes 3; anthers transversely ellipsoid, 1.5 × 3.5 mm, coherent with each other, ± dorsifixed; filaments short, c. 3 × 0.8 mm, curved to turn the apex of the anthers towards the gynoecium, minutely pubescent; sometimes staminodes developing into half the size of the fertile anthers (which shows the origin of this group from 5 fertile stamens). *Gynoecium* c. 7 × 1.2 mm; stigma capitate, sometimes visibly 2-lobed, not much larger than style. *Fruit* linear, very slender, c. 2 cm long, 1 mm in diameter, glabrous, with a degree of twisting. *Seeds* compressed, ellipsoid, c. 0.7 × 0.2 mm.

Distribution. Southern China, Taiwan, Vietnam, Burma, Thailand, Borneo, Java (and Sulawesi?).

Habitat and ecology. On limestone.

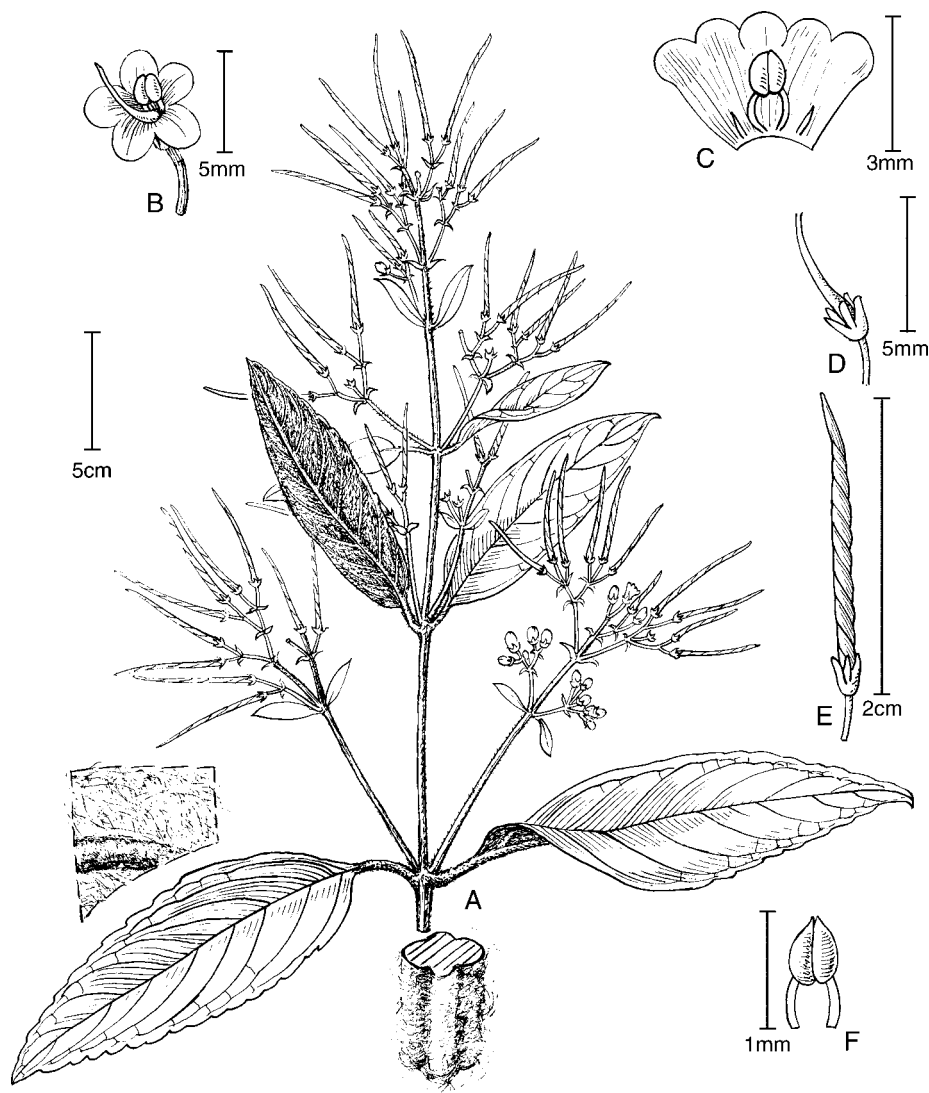


FIG. 47. *Paraboea swinhoei* (Hance) B.L.Burtt. A, habit; B, flower; C, corolla opened out; D, pistil; E, fruit; F, stamens.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats. This species was, however, included in Pooma (2005) as threatened in Thailand.

Additional specimens examined. BURMA. Rangoon [16°47'N 96°10'E], v 1935 (fr), *F.G. Kickason* 6000 (GH); Ani-Sakau, Fallo, Magmijo [= Maymyo, 22°05'N 96°33'E], 15 x 1911 (fr), *J.H. Luce* 5501 (E).

CHINA. **Guangxi**: s.l., 14 iv 1966 (fl), *J.J. Wang* 4391 (PE); Longlin [24°50'N 105°15'E], 300–550 m, 12 vii 1957 (fr, fl), *X.Q. Chen* 13224 (IBSC); 15 Li S. of Nee Bai, Border of Kweichow, on exposed cliff, low shrub 2 ft, [24°50'N 106°08'E], 2300 ft (c.700 m), 29 vi 1928 (fr, fl), *R.C. Ching* 6291 (NY, W); Tien-o [25°00'N 107°10'E], 700 m, 10 viii 1958 (fr), *C.T. Li* 601176 (E); Daxin [22°52'N 107°10'E], 10 iv 1981 (fl), *H.N. Qin* 81 (PE); Nam Tan, 2500 ft (c.750m), 13 vii 1937, *C. Wang* 41150 (A).

TAIWAN. s.l., ii 1924 (fr), *A. Fauquier* 554 (P); Busai, 1000 m, v–viii 1934 (fl), *J.L. Gressitt* 300 (L, MICH, NY, S); Canyon side [Not exact locality], 700 m, v–viii 1934 (fl), *J.L. Gressitt* 363 (NY); Mt. Kappan, vii 1914 (fl), *B. Hayata* 241 (UC); *ibid.*, (fr, fl), *A. Henry* 897 (MO, NY, US); *ibid.*, (fr, fl), *B. Hayata* 8937 (MO); *ibid.*, iv 1895 (fr), *B. Hayata* 897A (BM); Tamali, Taitung [Tai4ma21i3, Tai2dong1xian4] [22°06'N 121°00'E], 10 ix 1949 (fl), *H. Keng* K1382 (L); Chung-hsing, Tahu, Miao-li Hsien [Da4hu2xiang1, Mia021i4xian4] [24°05'N 120°09'E], 13 vii 1965 (fr, fl), *Liao & Kuo* 1636 (L); Apes' Hill, Takow, [22°06'N 120°03'E], 19 vi 1892 (fl), *Playfaio* 6363 (P); Hab. mt. Taihei [Yi21an2xian4, Tai4ping2shan1] [24°05'N 121°05'E], 18 ii 1939 (fl), *S. Sasaki* 380537 (MO, S); Takimi [Hua1lian2xian4, Long2jan4] [24°00'N 121°04'E], 19 viii 1929 (fr), *S. Suzuki* 1475 (MO, S); Cholan, Miaoli Co. roadside [Da4hu2xiang1, 24°05'N 120°09'E], 29 vi 1984, *W.S. Tang* 566 (A); Wulai, Taipei Co. [25°05'N 121°32'E], 2 ix 1976 (fr, fl), *M. Teruya* 130F (CM).

INDONESIA. **Borneo**: *Blume* 182 (L); 10 ii 1882 (fl), *Korthals* 182 (K). **Java**: s.l., 18?? (fl, fr), *Blume* 241 (L). The *Blume* 182 and the *Korthals* 182 specimens may be the same collection and, therefore, all type material.

PHILIPPINES. **Luzon**: Pampanga, Mt. Arayat [15°00'N 120°45'E], ix 1905 (fr, fl), *E.D. Merrill* 4209 (K, L, NY, P, US); Benguet subprovince [16°25'N 120°35'E], v 1914 (fr), *E.D. Merrill* 1754 (L, MO, NY, P); Mt. Trail 8–10 km Benguet subprovince [16°25'N 120°35'E], x 1929 (fl), *T. Quisumbing* 78085 (NY); Benguet subprovince, Twin Peaks, Northern Luzon, 8 ix 1904 (fr, fl), *R.S. Williams* 938 (NY); Central Luzon [Benguet? 16°25'N 120°35'E], 26 v 1990 (fr), *Loher* 1552 (US); Mt. Nagapatan, Ilocos Norte Province [18°04'N 120°46'E], viii 1918, *M. Ramos* BS33147 (A, NY); Rizal, San Andales [14°38'N 121°21'E], 570 m, xii 1926 (fr, fl), *G. Edaño* 48827 (NY, UC, US); Rizal [14°30'N 121°20'E], (fr, fl), *M.S. Clemens* 15851 (UC); Montalban (Rizal), 4 v 1906 (fr), *Loher* 6671 (K); Rizal, viii 1913 (fr, fl), *Loher* 14825 (UC); 'Monteoh la bueva' on Montalban, N. bam bus region, 300–400 m, 16 x 1890 (fl, fr), *Loher* 1552 (K); Rizal, xii 1915 (fr), *M. Ramos* 24076 (US); Rizal, Mt. Susong-Dalaga, viii 1917 (fl), *M. Ramos & Edano* 29286 (K, L, P, US); Rizal, Mt. Susong-Dalaga, viii 1917 (fl), *M. Ramos & Edano* 107 (P). **Mindoro**: Mt. Yagaw, Eastern slope [12°24'N 121°18'E], 500 m, xii 1952 (fr, fl), *M.D. Sulit & Conklin* 4774 (PNH16956) (A, K, L, PNH).

TAIWAN. **Hualien Hsien**: Hsiulin Hsiang, Taroko National Park, mountain trail between Taroko and Tali, 100–200 m, 20 vii 1992 (fl, fr), *W.P. Leu et al.* 1433 (E).

THAILAND. **Chiangmai**: Doi Sutep [18°55'N 99°00'E], 1000 m, 31 x 1967 (fr), *B.L. Burt* 5578 (ABD, E); 1976 (fl), *Cult. in E* C4029 (E); Doi Sutep, x 1914 (fr), *Y. Jung* s.n. (BKF); Doi Sutep, 4 vii 1958 (fl), *T. Sorensen et al.* 3888 (BKF, C, K); Doi Sutep, 1100 m, 30 vii 1958 (fl), *T. Sorensen et al.* 4543 (C, K). **Khonkaen**: Pha Nok Khao [16°30'N 103°00'E], 800 m, 9 ix 1963 (fr, fl), *T. Smitinand & H. Sleumer* 1130 (BKF, E, K, L). **Lampang**: Doi Luang National Park, Wahng Cayo Falls, 600 m, 8 viii 1997, *Maxwell* 97-830 (A).

VIETNAM. **Cao Bang**: Ha Lang District, Thang Loi, vicinity of Lung Sam Village, 22°45'N 106°42'E, 650–700 m, 24 iv 1999, *P.K. Loc et al.* CBL1684 (AA). **Vinh Phu**: Roches Notre-Dame, near Tu Vu [21°01'N 105°19'E], 1887, *Balansa* 4303 (P).

Hance spelled the specific epithet as 'swinhoii'. Being a Latin scholar he translated Swinhoe into Latin as Swinhoius and so 'swinhoii' for 'of Swinhoius'. However,

under Art. 60.7 of the ICBN (McNeill *et al.*, 2006), this must be corrected to 'swinhoei'.

There may be arguments for recognising *Boea swinhoei* var. *diffusior* and *Boea kerrii* as varieties under *Paraboea swinhoei*. Craib (1916) compared his *Boea kerrii* with Hance's *Boea swinhoei* and listed some quantitative differences: leaves larger, pedicels longer, and so on. However, there are no qualitative differences and the quantitative characters have a large overlap. Thus, we reduce Craib's species to synonymy although further collections may suggest that it deserves varietal recognition. No significant differences can be identified between *Boea swinhoei* var. *diffusior* and typical *Paraboea swinhoei*, except that the leaf blades are slightly larger and slightly more obovate, c.12 × 5 cm, with a longer acumen, and that the inflorescence is slightly more spreading. However, again the characters overlap with the type variety and it is here reduced to synonymy. There is an uncertain record from Sulawesi, *Rant* 53 (BO) from Bantimocroeng (southwest Sulawesi), in which the upper leaf surface is pubescent rather than being glabrescent.

Paraboea swinhoei has the widest distribution of any species in the genus but further collections are necessary in parts of its range, particularly in Borneo and Java, to fully understand its variation.

80. *Paraboea tarutaensis* Z.R.Xu & B.L.Burtt, *Edinburgh J. Bot.* 48: 13 (1991).

– Type: Thailand, Satun Province, Tarutao Island, Malacca ck. [06°50'N 99°30'E], on limestone rocks, in 30 m tall thick forest, 12 x 1979 (fr), *Congdon* 10 (holo E; iso A, AAU, PSU). **Fig. 48.**

Perennial herb with a climbing stem up to 35 cm long and c.2 mm in diameter; internodes c.15–45 mm long. *Leaves* opposite, cauline; petiole 0.8–1.5 cm long; blade possessing a mixture of a matted indumentum and a long pubescence of branched hairs on the lower leaf surface, margin dentate. *Inflorescence* a cyme of very few flowers, shorter than the leaf. *Flowers* only known immature; corolla white, 2-lipped; the 2 stamens united at their apex, filaments more or less swollen. *Fruit* not twisted, slender, 2–4 cm long, c.2 mm in diameter.

Distribution. Thailand: Tarutao Island.

Habitat and ecology. Common on limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species has not been collected often it is reported as being common from a site that is protected. This species was, however, included in Pooma (2005) as threatened in Thailand.

Additional specimen examined. THAILAND. **Satun:** Tarutao Island, c.4 km south of the N. Cape of the island, on rocky cliff, 10–50 m in shrub vegetation, 11 i 1986 (fr), *Kurzweil* HK783 (WU).

In its multi-branched hairs, this species is similar to *Paraboea vulpina*, but with the long pubescence mixed in with a matted indumentum, this species may be related to

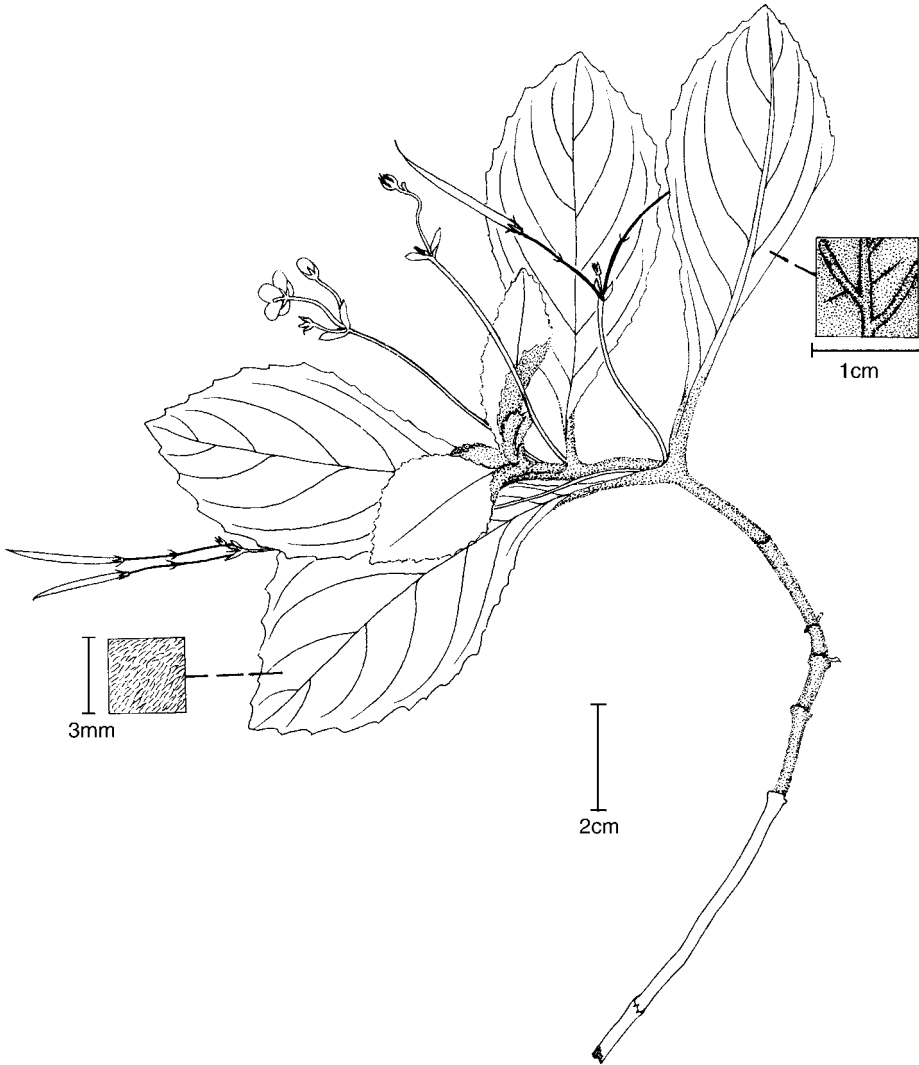


FIG. 48. *Paraboea tarutaoensis* Z.R.Xu & B.L.Burtt.

P. laxa. Although *Paraboea laxa* is recorded from the nearby Langkawi Islands it has never been found on Tarutao.

81. *Paraboea thorelii* (Pellegr.) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 439 (1984). – *Boea thorelii* Pellegr., Bull. Soc. Bot. France 73: 424 (1926). – Type: Laos, Champassak, Mt. Bassac [14°55'N 105°47'E], 1866–1868 (fr), *M.L. Thorel* 2352 (lecto P, designated by Burtt (1984: 439); photo E).

Perennial herb with a very short stem, the whole plant c.30 cm tall including the inflorescence. *Leaves* oppositely congested near ground level, petiolate; petiole with

two wings from the leaf base along the whole length of the petiole and joining each other across the stem; blades \pm elliptic, $11\text{--}19 \times 4\text{--}6.5$ cm, c.2.5–3 times as long as wide, apex acute, base long-attenuate, margin shallowly (or indistinctly) crenate, upper surface pubescent, lower surface with a thin matted indumentum; veins smooth above, raised beneath, lateral veins c.10 pairs, tertiary venation visibly reticulate. *Inflorescence* terminal paniculate, c.25 cm long, 12 cm wide in fruit, with glandular hairs throughout except on the calyx and corolla; flowering stem with extended internodes, the lowest one c.9 cm long, floral leaves much smaller than vegetative leaves, the two lowermost fertile leaves $c.1.5 \times 0.7$ cm; pedicels c.10–15 cm long. *Calyx* glabrous or with few hairs outside, 1 mm long, 5-lobed to the base, lobes narrowly ovate. *Corolla* campanulate, 7 mm long, 7 mm wide; tube c.3 mm long, limb with 2 similar lips; 5 lobes similar, wide-ovate, $c.4 \times 4$ mm. *Stamens* 2, staminodes not apparent; anthers transversely ellipsoid, $c.2.5 \times 3.2$ mm, coherent at the apex, pointing towards the gynoeceium, opening at the apex, dorsifixed; filaments c.2.5 mm long, inserted at c.0.5 mm from the corolla base. *Gynoeceium* c.5 mm long; ovary ovoid, $c.3 \times 1$ mm; style distinct, c.0.4 mm wide. *Fruit* a spirally twisted capsule, 2–3 cm long, glabrous. *Seeds* ellipsoid, 0.4×0.1 mm.

Distribution. Laos. So far known only from the type.

Habitat and ecology. Unknown.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

This species is similar to *Paraboea glutinosa* in habit and in the inflorescence but is easily distinguished by having a pubescence on the upper leaf surface and some glandular hairs on the inflorescence.

82. *Paraboea trachyphylla* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 13 (1991).

– Type: Thailand, Surat Thani, Khao Lang Tao, 50 km W of Surat, road to Takuapah [$09^{\circ}00'N$ $98^{\circ}08'E$], 200–300 m, common on limestone, 26 ix 1963 (fl, fr), *Smitinand, Sleumer et al.* 1289 (holo E; iso A, B, BKF, C, E, K, L, P). **Fig. 49.**

Perennial caulescent herb; stem c.3 mm in diameter; internodes 1–7 cm long, with a tawny matted indumentum when young and glabrescent when older. *Leaves* opposite, without a distinct petiole, slightly oblique, elliptic or nearly so, $3\text{--}17 \times 1.5\text{--}5$ cm, apex acute or obtuse, margin sparsely serrulate or nearly entire, base attenuate and forming 2 narrow wings on the indistinct petiole, upper surface minutely pubescent, lower surface with a tawny matted indumentum; veins smooth above, raised beneath, lateral veins 7–10 pairs, tertiary venation obscure. *Inflorescences* axillary below the terminal bud (or subterminal), cymose, usually two in opposite axils, $11\text{--}25 \times 5\text{--}15$ cm, many-flowered, totally glabrous or with a tawny matted indumentum except on the flower; some branches of the cyme tending to develop monochasially, forming racemose branches with no bifurcations; peduncle 6–15 cm

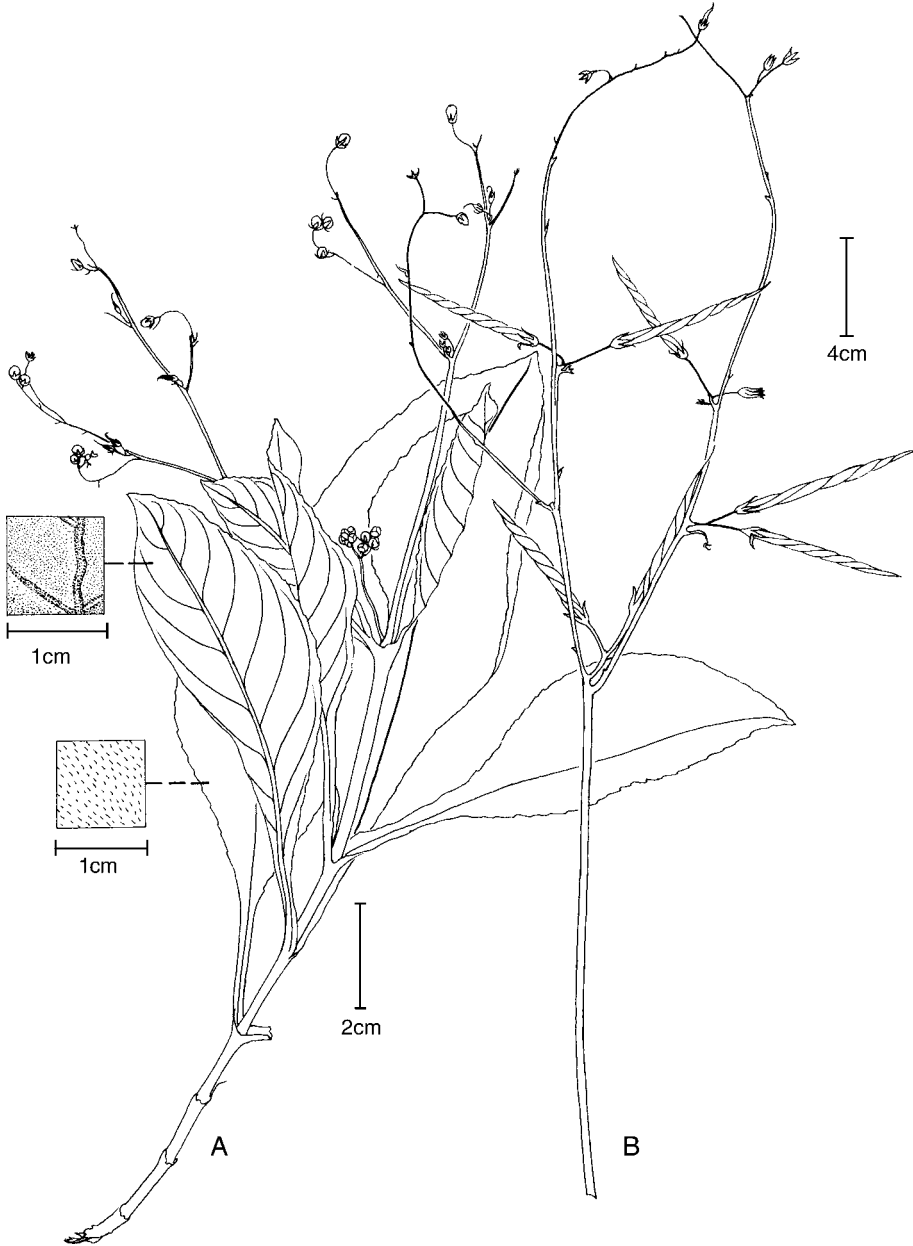


FIG. 49. *Paraboea trachyphylla* Z.R.Xu & B.L.Burt. A, habit; B, infructescence.

long, peduncle bracts very small and sepal-like or a little larger; pedicel bracts even smaller, pedicel 2–6 mm long. *Calyx* 2–3.2 mm long, 5-lobed, lobes ovate, c.1.5–3 times as long as wide, glabrous or with a matted indumentum on the outside. *Corolla* pale pinkish or white, c.4 mm long, 5 mm across; tube c.1.5 mm long, limb 2-lipped;

upper lip 2-lobed, lobes wide-ovate, 2.5×2.7 mm, lower lip 3-lobed, two lateral lobes similar in size and shape to the upper lip lobes, middle one slightly obovate. *Anthers* transversely ellipsoid, 1.6×3.2 mm, coherent with each other at the apex, opening in the centre of the anther locules, basifixed; filaments c.1 mm long. *Gynoecium* c.3.5 mm long; ovary c.1.2 mm wide; stigma capitate, not larger than style. *Fruit* a linear capsule, 1.3–1.6 cm long, 1.2–1.5 mm in diameter, glabrous, spirally twisted. *Seeds* narrowly ellipsoid, $c.0.5 \times 0.15$ mm.

Distribution. Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Endangered (EN B1ab(ii,iii,v)). This species is only known from two localities from neighbouring provinces. The extent of occurrence is < 5000 km² and the known localities few, justifying the EN status. This species was also included in Pooma (2005) as threatened in Thailand.

Additional specimens examined. THAILAND. **Surat Thani:** Takuapah–Surat Thani road, 20–60 km from Takuapah, $08^{\circ}53'N$ $98^{\circ}21'E$, 100–250 m, 14 vii 1972 (fl), *K. Larsen et al.* 30949 (AAU, B, E, K, L). **Phangnga:** Tham Suwankuha, $08^{\circ}15'N$ $98^{\circ}40'E$, in rock crevices, 50 m, 20 vii 1972 (fl), *K. Larsen et al.* 31181 (AAU).

See discussion under *Paraboea variopila*. The type specimen differs from the other two collections cited above in having a totally glabrous inflorescence and white flowers, whereas the other two collections have a tawny matted indumentum and pinkish flowers.

83. *Paraboea treubii* (H.O.Forbes) B.L.Burt, Bot. J. Linn. Soc. 85: 25 (1982); Burt, Notes Roy. Bot. Gard. Edinburgh 41: 440 (1984). – *Boea treubii* H.O.Forbes, J. Linn. Soc., Bot. 19: 297 (1882). – Type: Sumatra, Palembang, top of Mt. Karangnata [Karang Natoe] (limestone), near Napal Nitjin, 1000 ft (c.300 m), 1880 (fl, fr), *H.O. Forbes* 3103 (holo BM; iso GH, L, P, SING). **Fig. 50.**

Paraboea culminicola K.G.Pearce, Gard. Bull. Singapore 57: 147 (2005). – Type: Malaysia, Sarawak, Fourth Division, Miri District, Southern slopes of Gunong Subis, near Sekaloh river, *Sonny Tan & E. Wright* S27279 (holo SAR).

Perennial caulescent subshrub; stem up to 2 m tall, internodes 1.5–6 cm long, with a tawny matted indumentum. *Leaves* in whorls of 3–6, sessile or with a short petiole c.2.5 cm long, narrow-elliptic or somewhat obovate, mature leaves $c.20\text{--}35 \times 5\text{--}7.5$ cm, c.3.5–5 times as long as wide, apex acuminate, base long-attenuate, margin entire, upper surface glabrous or with some arachnoid covering, sometimes with a matted pubescence above, lower surface with an appressed thick tawny or whitish matted indumentum; veins smooth above, raised beneath, lateral veins numerous, 20–40 pairs, 5–10 mm apart, tertiary venation obscure or reticulate. *Inflorescence* terminal, paniculate, large and spreading, 30–60 cm long, 30 cm wide, with a tawny or whitish matted indumentum throughout except on the corolla; flowering stems

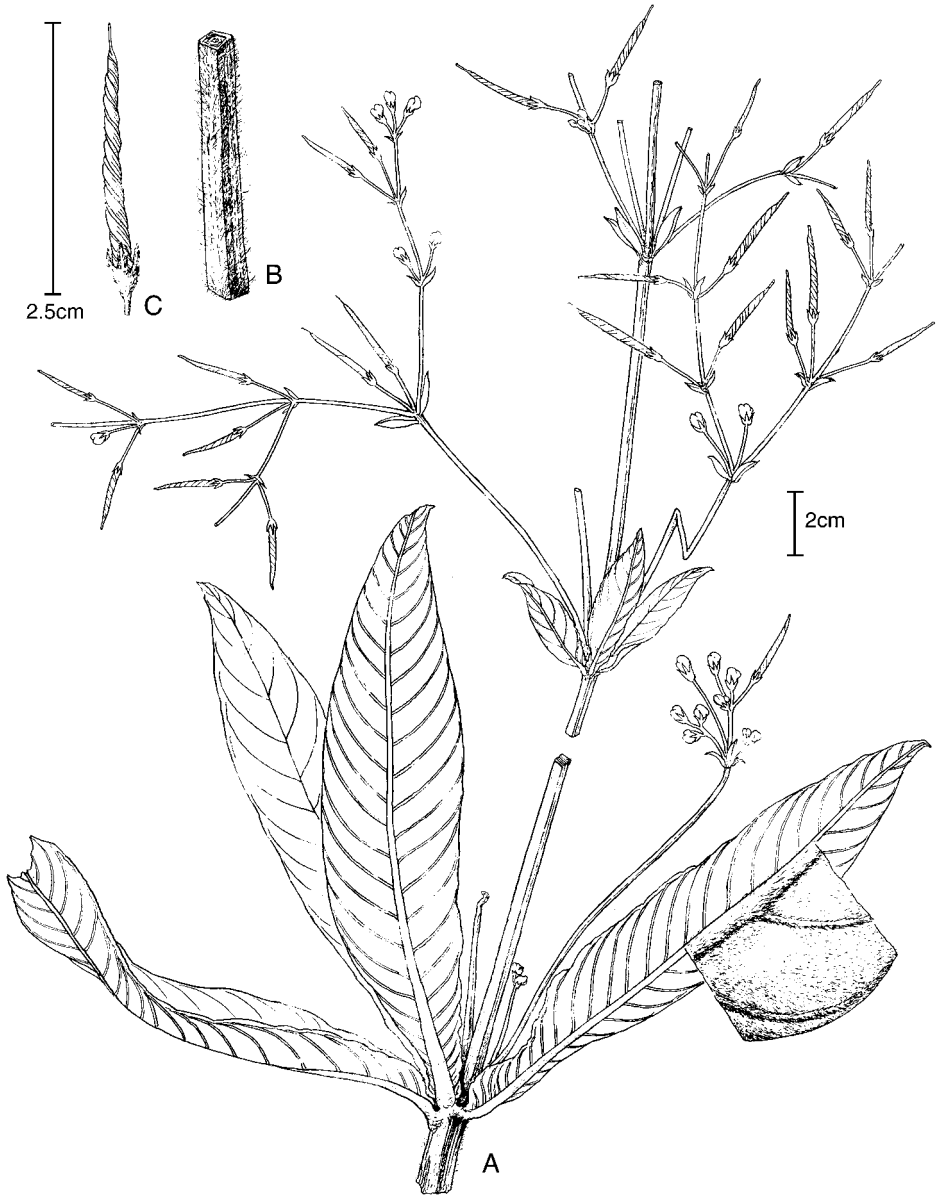


FIG. 50. *Paraboea treubii* (H.O. Forbes) B.L. Burtt. A, habit; B, section of stem; C, fruit.

with internodes normally c.10–20 cm long, floral leaves much smaller than cauline ones, up to 4×1.5 cm, 3–5 cymes from each node; cymes long and spreading, c.10–30 cm long, many-flowered, with a peduncle up to 20 cm long, bracts narrow-ovate, $5\text{--}10 \times 2\text{--}4$ mm; pedicel 5–15 mm long, with a sepal-like bract. Calyx 2–3 mm long, 5-lobed, lobes narrow-ovate, with a greyish matted indumentum outside, glabrous

inside. *Corolla* pale purple, glabrous, c.1 cm long, c.1.4 cm across; tube c.2.5 mm long, limb 2-lipped; upper lip c.6 mm long, 2-lobed, lobes wide-ovate, c.6 × 7 mm, lower lip 10 mm long, 3-lobed, lateral lobes wide-ovate, c.5 × 5 mm, median one ± obovate, c.5 × 4 mm. *Anthers* transversely ellipsoid, c.2.5 × 5 mm, coherent at the apex, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments inserted at the corolla base with a free part c.3 mm long, margin crenate. *Gynoecium* c.1.2 cm long, ovary ovate, c.2 × 1.2 mm; style long and slender, c.0.3 mm wide; stigma capitate, larger than style. *Fruit* a linear capsule, 1.3–3 cm long, 1.2–1.5 mm in diameter, glabrous, spirally twisted. *Seeds* narrow ellipsoid, compressed, c.0.7–0.8 × 0.1–0.2 mm.

Distribution. Peninsular Malaysia, Sumatra and Borneo.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. INDONESIA. **W Sumatra:** Near Mount Sigirik within Bukit Sebelah nature reserve, 700 m, 15 v 1983 (fl), *Y. Laumonier* 4312 (L); Pajakumbuh (Payakumbuh), W coast, Region near Halaban, 800 m, 29 i 1958 (fr), *W. Meijer* 7554; near Pajakumbuh, Timur Pjk., G. Kapur Gadut, limestone hill [0°10'S 100°30'E], 14 iv 1956 (fr), *Ichlas Dj* 112 (L).

MALAYSIA. Batu Bayan, 30 vii 1962 (fl), *UNESCO Limestone Exp.* 154 (L). **Kelantan:** Gua Musang, Gua Batu Boh [04°52'N 101°58'E], 300 m, 12 viii 1971 (fl, fr), *S.C. Chin* 1461 (E); *ibid.*, 22 xi 1971 (fl), *Cult. in E* 146 (E); Gua Musang [04°53'N 101°58'E], 14 viii 1970 (fl, fr), *B.C. Stone* 9517 (L). **Pahang:** Gua Tipus, 17 x 1927, *M.R. Henderson* 19459b (K). **Sarawak:** s.l., vi 1894 (fl), *G.D. Haviland* 3569 (K); Gunong Subis, Niah Caves [03°00'N 114°00'E], 133 m, 6 vi 1962 (fr, fl), *J.A.R. Anderson* S16045 (E, SAR); Niah Caves, limestone, 6 vi 1962 (fr, fl), *B.L. Burt & P.J.B. Woods* 2032 (E); Niah, 4th Division [03°00'N 114°00'E], xi 1932 (fr, fl), *P.M. Synge* S589 (A, K, L).

Forbes (1882) cited no specimens in the protologue but mentioned 'I found this singularly beautiful and graceful plant in full flower in November 1881, first near the village of Napal Litjin, 580 feet above the sea; but in profusion on the large disrupted calcareous blocks near the summit of the peak of Karangnata, in company with magnificent spike-bearing Coelogynes and pink-fruited Melastomaceae'. We found the *Forbes* collection in BM, K and L, bearing the label 'Sumatra, 3130, H.O.Forbes: 1880'. We believe that these are the original material of *Forbes*' species.

It is not easy to define this species and there is a degree of variation amongst the specimens cited. Most of the collections from Peninsular Malaysia have leaves in whorls of 3, while those from Borneo (Sarawak), recently described as *Paraboea culminicola* but here treated in synonymy, have leaves in whorls of 4. They also differ slightly in leaf shape and indumentum. The type was collected from Sumatra. Two isotypes (K, L) have leaves in whorls of 3 whilst the holotype (BM), with two individuals, has one with leaves in whorls of 3 and the other with leaves in whorls of

4. Thus, there is no hard and fast geographical basis to this variation and the other slight variations do not merit specific delimitation.

This species is close to *Paraboea verticillata* and *P. havilandii*. *Paraboea verticillata* can be recognised by its delicate whitish indumentum on the lower leaf surface, and the last species may be defined by its very narrowly \pm obovate-oblong leaves.

84. *Paraboea umbellata* (Drake) B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 440 (1984). – *Boea umbellata* Drake, Bull. Soc. Philom. Paris, ser. 8, 2: 129 (1890). – *Paraboea rufescens* var. *umbellata* (Drake) K.Y.Pan in Wang et al., Fl. Reipubl. Popularis Sin. 69: 467 (1990). – Type: Vietnam, Tonkin (Ha Noi), Cho-bo [21°02'N 105°50'E], 18 x 1888 (fr), *Balansa* 4313 (lecto P, designated by Burtt (1984: 440); photo E).

Perennial rosulate herb with a stem extending up to 20 cm long when in flower, internodes then c.5–8 cm long. *Leaves* opposite, petiolate; petiole 5–10 cm long, indumentum the same as that on the lower leaf surface; blades ovate or elliptic, 8–20 \times 5–10 cm for mature vegetative leaves but much smaller for the leaves that subtend flowering cymes, 2–3 times as long as wide, apex obtuse, base cuneate, margin serrate or serrulate, upper surface densely pubescent, lower surface with a yellowish to brownish matted indumentum; veins obscure above, raised beneath, lateral veins c.6–10 pairs, tertiary venation reticulate. *Inflorescence* subterminal, cymose on an extended stem; cymes often 2 or 4 from the uppermost axils below the apical bud, generally shorter than the mature vegetative leaves (including the petiole), primary and secondary branches of the cyme hardly developed and so appearing umbellate (or capitate in bud), many-flowered, with a matted indumentum on peduncles, bracts, pedicels and calyx when young, this more or less shedding off when older; peduncle usually of similar length to the petiole of the mature vegetative leaves, with two large \pm rounded bracts embracing the flower buds when young; pedicels up to 10 mm long, bracts indistinct. *Calyx* c.3.5 mm long, 5-lobed to the base, lobes narrowly oblong, c.3 \times 0.7 mm, apex truncate or slightly sinuate, spreading outward. *Corolla* c.10 mm long, 10 mm across; tube c.8 mm long, limb barely 2-lipped; 5 lobes of similar shape and size, rounded, c.3 \times 4 mm. *Anthers* transversely ellipsoid, c.1.2 \times 3.5 mm, coherent with each other at the upper end, apertured at the upper end, apex turned towards the gynoeceium, basifixed; filaments inserted at the extreme base of the corolla with a free part c.3 mm long, with tiny lanate hairs; staminodes 2, c.1 mm long to almost absent. *Gynoeceium* c.10 mm long, 1.5 mm wide at the base of the ovary; style curved towards the anthers; stigma oblique, seemingly scabrous. *Fruit* a linear capsule, relatively long, up to 5 cm long, glabrous, spirally twisted. *Seeds* ellipsoid, c.0.7 \times 0.3 mm.

Distribution. Northern Vietnam and southern China (southwest Guangxi).

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at many sites over a wide area and there are no major threats.

Additional specimens examined. CHINA. **Guangxi:** 5 vii 1957 (fr, fl), *S.C. Chen* 13048 (IBSC); 9 viii 1953 (fl, fr), *Guangxi-Team* 3303 (PE); Lungchow [Long2zhou1] [22°25'N 106°50'E], 1901 (fl), *A. Henry* 691 (K, NY); [cultivated at Bailey Garden from *Henry* 691, the *Morse* 691 below may be the same collection], 1901 (fl), *H.B. Morse* 691 (US); Daxin [Da4xin1] [22°52'N 107°10'E], vi–vi 1981 (fr), *H.N. Qin* 425 (PE).

VIETNAM. **Caobang:** Hang Pac Bo, near Ho Chi Minh Memorial, 22°58'37"N 106°03'26"E, 390 m, 1 xi 2002 (ster), grown on at RBGE as accession no. 20022504, vouchered as *D.J. Middleton* 4217 (E). **Hoa Binh:** Mt. Lang Mat [20°42'N 105°10'E], 17 vi 1884 (fr, fl), *R.P. Bon* 2688 (P); Hoa Binh, route des Concessions [20°40'N 105°20'E], v 1935 (fl), *A. Pételot* 7242 (E). **Ha Noi:** [21°02'N 105°50'E], 800 m, vii 1922 (fr, fl), *A. Pételot* 711 (NY, US). **Ninh Binh:** Cho Ganh [20°10'N 105°57'E], vii 1922 (fl, fr), *A. Pételot* 711N (P); Cho Ganh, calcaires [20°10'N 105°57'E], vii 1922 (fl), *A. Pételot* s.n. (P). **Thanh Hoa:** Thanh Hoa [20°00'N 105°30'E], 23 vii 1920 (fl), *E. Poilane* 1659 (P).

Pan (in Wang *et al.*, 1990) reduced this specific name to a variety of *Paraboea rufescens* (var. *umbellata*) and argued that *P. umbellata* has intermediate forms with *P. rufescens* var. *rufescens* in southwest Guangxi (China). From there southward the plants gradually have larger leaves and longer stems. Our study has maintained *Paraboea umbellata* and *P. rufescens* as distinct species with clear differences in their inflorescence structure. *Paraboea umbellata* has an extended flowering stem from which the inflorescence is subterminal. This means the plant is monocarpic because the terminal bud in such a flowering branch will cease growing after a flowering season. In *Paraboea rufescens* the plants have axillary cymes from basal leaves and the terminal bud will continue to grow after the flowering season. Unlike the relationship between *Paraboea rufescens* var. *rufescens* and var. *tomentosa*, the differences between *P. rufescens* and *P. umbellata* are not merely an elongated stem vs. a short stem, but rather a completely different inflorescence structure. We have not found any intermediate forms that produce both patterns on the same plant in either *Paraboea rufescens* or *P. umbellata*. This is also the case throughout the genus. Thus, we resurrect *Paraboea umbellata*.

Chun (*Chen2 Huan4 Yong2*) identified *S.P. Ko* 55128 as a new species. However, it seems that he never published it. The collection is referable to *Paraboea umbellata*.

85. *Paraboea uniflora* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 15 (1991). – Type: Thailand, Songkhla, Sadao District [06°55'N 100°24'E], Kao Roop Chang, Padang Besar, on open, rugged summit of a limestone peak, 11 vii 1986 (fr, fl fragment), *J.F. Maxwell* 86-451 (holo PSU; iso A, L).

Subshrub with branched woody stem; stem with a tawny matted indumentum when young (1–2 years), glabrous when older (3 years or more), > 1 cm in diameter; internodes quite short. *Leaves* congested at the apex of the stem, sessile, elliptic, 1.5–2.5 × 0.8–1.5 cm, apex acute or obtuse, base angustate or attenuate to the base, margin entire, lower surface with a white matted indumentum, upper surface with a looser and thinner covering of strigulose pubescence; veins smooth above, raised beneath, lateral veins c.5 pairs, forming an acute angle, < 45° with the midrib, tertiary venation invisible. *Inflorescence* axillary, single-flowered; pedicel 1.5–2.5 cm

long, with a white matted indumentum. *Calyx* pale green, c.4.5 mm long, 5-lobed, lobes narrowly oblong, 6–10 times as long as wide, with a white matted indumentum outside, glabrous inside. *Corolla* unknown, pale lilac to blue (fide Maxwell). *Anthers* yellow (fide Maxwell). *Ovary* ovoid, 3.5 × 1 mm, glabrous; style 4.5 mm long; stigma capitate, a little larger than style. *Fruit* a narrow-ovoid capsule, 1–2.5 cm long, glabrous, spirally twisted. *Seeds* not seen.

Distribution. Thailand: Songkhla. Known only from the type.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction. This species was also included in Pooma (2005) as threatened in Thailand.

This species is unique in the genus with its single-flowered inflorescence. This may be an extreme reduction of a normal cyme. The habit seems close to *Paraboea lanata* but the veins on the leaves are more prominent.

86. *Paraboea variopila* Z.R.Xu & B.L.Burt, *Edinburgh J. Bot.* 48: 15 (1991). – Type: Thailand, Surat Thanee [Surat Thani] Province, common on stone in evergreen forest, 12 viii 1975 (fl, fr), *D. Praphat* 8 (holo E; iso BKF, C, L).

Perennial caulescent herb; stem c.30–50 cm tall, 7 mm in diameter; internodes 1.2–7 cm long, with a greyish brown matted indumentum and later glabrescent. *Leaves* opposite, sessile, obovate, (5–)11–17 × (2–)3–5.5 cm, apex obtuse, blade narrowed and then slightly expanded just above base, margin sparsely serrulate or entire, upper surface densely pubescent, lower surface with a greyish-orange matted indumentum; veins smooth above, raised beneath, lateral veins 5–11 pairs, tertiary venation obscure. *Inflorescence* axillary near the apical bud (or subterminal), cymose, 10–17 × 3–15 cm, many-flowered, with dense dark brown glandular hairs throughout; the two primary branches of the cyme not dichasially branching again, but monochasially extending to a long racemose branch without a bifurcation; peduncle (2–)4.5–9 cm long, c.2 mm wide, peduncle bracts sepal-like; pedicel short, c.1–2 mm long, pedicel bracts very tiny, c.1/5 size of a sepal or invisible. *Calyx* (2–)4.5 mm long, 5-lobed, lobes linear, c.10 times as long as wide, glabrous inside, with dark brown glandular hairs outside. *Corolla* pinkish-white, c.6 mm long, 8 mm across, with dark brown glandular hairs outside, glabrous inside; tube 2 mm long, limb 2-lipped; upper lip 2-lobed, lobes ovate, 3.5 × 2.2 mm, lower lip 3-lobed, two lateral lobes similar in size and shape to the upper lobes, middle one slightly obovate or elliptic, similar in size to lateral lobes. *Anthers* transversely ellipsoid, 2 × 3 mm, glabrous, coherent with each other at the apex, opening in the centre of the anther locules, apex turned towards the gynoecium, basifixed; filaments c.1.5 mm long. *Gynoecium* c.6 mm long; ovary c.1.2 mm wide, with glandular hairs; stigma enlarged, capitate. *Fruit* narrow oblong or linear, 1.5–2.7 cm long, c.1.7 mm in diameter,

with dark brown glandular hairs, slightly twisted. *Seeds* narrow-ellipsoid, c.0.5 × 0.1 mm.

Distribution. Thailand.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species is only known from two collections at least one of these is from the well-protected and extensive limestone area of Khao Sok National Park. This species was, however, included in Pooma (2005) as threatened in Thailand.

Additional specimen examined. THAILAND. **Surat Thani:** Pa Nom district, Khao Sok National Park [09°10'N 98°42'E], limestone hill, 100–200 m, 12 xii 1979 (ster), *T. Shimizu et al.* T-27070 (BKF, L).

This species is similar to *Paraboea trachyphylla* and *P. acutifolia* with which it shares the same inflorescence structure. However, the indumentum on the ovary and the capsule separates the three species: *Paraboea variopila* having dark brown glandular hairs, *P. acutifolia* possessing a matted indumentum, and *P. trachyphylla* without an indumentum.

87. *Paraboea velutina* (W.T.Wang & C.Z.Gao) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 41: 440 (1984). – *Buxiphyllum velutinum* W.T.Wang & C.Z.Gao, Bull. Bot. Res., Harbin 1: 37 (1981). – Type: China, Kwangsi (Guangxi), Fengshan [24°30'N 107°02'E], 13 i 1978 (fl), *C.Z. Gao & A.J. Zhung* 30491 (holo GXMI n.v.; iso PE). **Fig. 51.**

Small plant with a short woody stem. *Leaves* numerous, alternately congested at top of the stem; petiole terete, very short, c.5 mm long, with a greyish matted indumentum; blades obovate, 1.5–2.5 × 0.7–1 cm, 1.5–3 times as long as wide, apex rounded, base attenuate or widely cuneate, margin entire, upper surface with some arachnoid indumentum when young and glabrescent when mature, lower surface with a greyish matted indumentum; veins visible on both surfaces, slightly depressed above, raised beneath, lateral veins c.5 pairs, joining each other near the margin and forming a distinct intramarginal vein, tertiary venation visible above, conspicuously reticulate beneath. *Inflorescence* axillary, cymose, with a few flowers or only one flower in rare cases, similar in length to the leaves, c.2.5 cm long, ± hairy; peduncle slender, c.2–2.5 cm long, primary bracts sepal-like; pedicel 4–5 mm long, with a distinct ferruginous pubescence. *Calyx* c.1 mm long, 5-lobed to the base, lobes narrowly ovate or oblong-ovate, 1 × 0.3 mm, obtuse at apex, ± farinose inside. *Corolla* white, 5 mm long, c.7 mm across, ± minutely pubescent; tube 3.5 mm long, limb 2-lipped; upper lip with 2 lobes, rounded, c.1.5 × 1 mm, lower lip 7 mm wide with 3 lobes, rounded or widely ovate, c.1.5 × 2.3 mm. *Anthers* transversely ellipsoid, c.0.5 × 1.5 mm, dehiscing in the centre, coherent with each other, ± dorsifixed; filaments ± curved, c.1 mm long; visible staminodes 2, c.0.5 mm

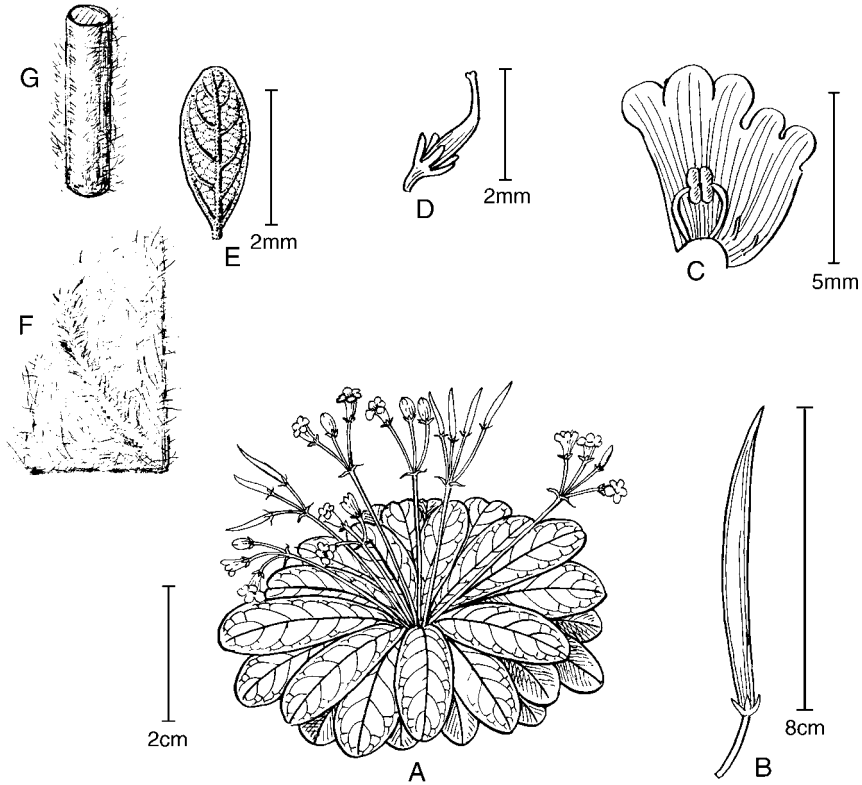


FIG. 51. *Paraboea velutina* (W.T.Wang & C.Z.Gao) B.L.Burtt. A, habit; B, fruit; C, corolla opened out; D, pistil; E, leaf; F, indumentum on leaf; G, section of peduncle.

long. *Gynoeceium* c.3.5 mm long, \pm with sessile glands; ovary c.1.5 \times 0.6 mm; style distinct from ovary, c.2 \times 0.1 mm; stigma slightly larger than style. *Fruit* a non-twisted capsule, 0.8 cm long, 4-valved. *Seeds* not seen.

Distribution. China: Guangxi. Known only from the type.

Habitat and ecology. Reported from the cliff beside a limestone cave.

Proposed IUCN conservation assessment. Critically Endangered (CR B1ab(ii,iii,v)) – see conservation assessment section in introduction.

This species is similar to *Paraboea filipes* in the appearance of the leaves and inflorescence. The difference lies in their habits and in the venation (see the key). This species has a woody stem and the venation on the lower leaf surface is conspicuously reticulate, while *Paraboea filipes* is truly rosulate and possesses no conspicuous venation.

88. *Paraboea verticillata* (Ridl.) B.L.Burtt, Bot. J. Linn. Soc. 85: 25 (1982); Burtt, Notes Roy. Bot. Gard. Edinburgh 41: 440 (1984). – *Boea verticillata* Ridl., J. Linn.

Soc., Bot. 32: 519 (1896). – Type: Malay Peninsula, Selangor Gua Batu, limestone rocks at Kuala Lumpur, vii 1897 (fr, fl), *Kelsall* s.n. (lecto K, designated here; iso BM). **Fig. 52.**

Perennial caulescent herb, up to 60 cm tall; stem woody, c.5 mm in diameter, basal internodes 0.5–2.5 cm long, upper internodes up to 11 cm long, with a white matted indumentum when young, glabrescent when old. *Leaves* in whorls of 3, rarely of 4, short-petiolate; petiole up to 2.5 cm long, upper leaves appearing sessile; blades elliptic or narrowly so, 4.5–13 × 1.5–3.5 cm, 2.5–4 times as long as wide, apex acute, base angustate, margin entire, upper surface with some white arachnoid covering, lower surface with a white matted indumentum; veins smooth above, raised beneath, lateral veins dense, 7–23 pairs, c.5 mm apart, tertiary venation invisible. *Inflorescence* terminal, paniculate, with a white matted indumentum throughout except on the flower; flowering stem c.20–45 cm long, the lowest internodes c.(2–)6–12 cm long, floral leaves gradually reducing in size from caulescent leaves upward; 3 (rarely 4) cymes from each node; cymes short, normally < 10 cm long, peduncle bracts narrow-ovate, c.5 mm long, pedicel bracts sepal-like; pedicels < 10 mm long. *Calyx* c.3 mm long, 5-lobed, lobes narrow-ovate, outside with a whitish matted indumentum, inside glabrous. *Corolla* blue, purple or violet; tube c.2 mm long, limb 2-lipped; upper lip 5 mm long, 2-lobed, lobes wide-ovate, 3.5 × 4 mm, lower lip 8 mm long, 3-lobed, lateral lobes wide-ovate, 3 × 4 mm, middle one obovate or rounded, c.3 × 3.5 mm. *Anthers* transversely ellipsoid, c.2 × 4 mm, coherent with each other at the apex and the base, opening in the centre of the anther locules, apex turned towards the gynoecium, dorsifixed; filaments inserted at the corolla base with a free part c.3 mm long, seemingly ciliate in the middle, crenulate on the margin. *Ovary* ovoid, c.1.5 × 1.2 mm, distinguishable from the style; style 5 mm long, narrower than the ovary; stigma capitate, little larger than style. *Fruit* a linear capsule, c.1–2 cm long, 2 mm in diameter, glabrous, spirally twisted. *Seeds* ellipsoid, 0.5 × 0.15 mm.

Distribution. Peninsular Malaysia.

Habitat and ecology. On limestone.

Proposed IUCN conservation assessment. Least Concern (LC). This species has been collected at several sites over a wide area and there are no major threats.

Additional specimens examined. MALAYSIA. Gua Batu, ix 1898 (fl, fr), *H.N. Ridley* 8551 (BM, K). **Selangor:** Near Kuala Lumpur, Bukit Takun, Templer Park [03°16'N 101°40'E], 400 m, 29 vi 1975 (fr), *M.M.J. van Balgooy* 2701 (E, L); Gua Batu [= Batu Cave], 200 m, 27 vii 1971 (fl), *S.C. Chin* 1252 (K, KLU, L); Bukit Takun, Kanching F.R. [03°20'N 101°35'E], 500 m, 30 x 1940 (fl, fr), *C.C.L. Durant* 56255 (KEP); Batu Caves, limestone hill [03°13'N 101°41'E], 266 m, 14 x 1966 (fl, fr), *FRI* 1628 (A, K, L); Bukit Takun, Kanching, Selangor, on limestone [03°18'N 101°38'E], 166 m, 3 xi 1937 (fl), *M. Nur* 34366 (A, K, MICH, MO, L, P, UC, US); Ulu Selangor, Bukit Takun, Kanching F.R., Kanching, 500–600 m, 5 xi 1940 (fl), *S. Reid* KEP51677 (KEP); Kanching, 16 iii 1935 (fl), *S. Reid* KEP37429 (KEP); Bukit Takun, 8 v 1939



FIG. 52. *Paraboea verticillata* (Ridl.) B.L.Burtt.

(fr), *C.F. Symington* KEP39596 (K); Batu Caves, 233 m, 22 xi 1959 (fl), *J.W. Smith* KEP79244 (KEP); Bukit Takun, Kanching, 17 ix 1940 (fl, fr), *Sow & Tachun* KEP35093 (KEP). **Kedah:** Gunung Baling [05°42'N 100°55'E], 200 m, 19 vii 1956 (fl), *KEP* 72557 (KEP); Gunong Baling, 333 m, 8 v 1941 (fl), *J.C. Nauen* 38021 (A, K, KEP).

This species is similar to *Paraboea treubii*. *Paraboea verticillata* can be distinguished by the smaller leaves on which a whitish arachnoid covering persists (vs. no persisting arachnoid covering) on the upper surface and a silvery (vs. tawny or whitish) matted indumentum occurs on the lower surface.

89. *Paraboea vulpina* Ridl., *J. Straits Branch Roy. Asiat. Soc.* 44: 69 (1905); Burt, *Notes Roy. Bot. Gard. Edinburgh* 41: 441 (1984). – Type: Peninsular Malaysia, Hot Springs, Ipoh, Kinta [03°31'N 101°12'E], xii 1896 (fl), *Curtis* 3132 (lecto K, designated by Burt (1984: 441); iso SING). **Fig. 53.**

Perennial herb, with or without a very short stem. *Leaves* (oppositely?) congested in a rosette with a visible petiole; petiole c.2–8 cm long, with ferruginous multi-branched hairs; blades ovate, 6–10 × 5–7 cm, 1–1.5 times as long as wide, apex obtuse or rounded, base truncate or shallowly cordate, margin regularly crenate, with a sparse long pubescence above and ferruginous multi-branched hairs beneath; veins slightly depressed above, raised beneath, lateral veins 6–8 pairs, tertiary venation reticulate. *Inflorescence* axillary, cymose, longer than leaves, c.15–35 cm long, many-flowered, very lax, more or less with multi-branched hairs except on flowers which are glabrescent; peduncle 14–20 cm long, with 2 linear bracts up to 1 cm long; primary branches up to 9 cm long; pedicels 5–15 mm long, slender, with sepal-like bracts. *Calyx* campanulate, 5-lobed to the base; lobes narrowly ovate, 1.5 × 0.5 mm, obtuse at apex, glabrous outside, with minute sessile glands inside. *Corolla* purple in cultivation; 8 mm across, 5 mm long, glabrous outside, with minute sessile glands inside; tube short, 2–2.5 mm long, limb 2-lipped; upper lip 2-lobed, lobes widely ovate, 3.5 × 3 mm, lower lip 3-lobed, middle lobe smaller, c.3 × 3 mm, lateral lobes 7 × 8 mm. *Stamens* 2; anthers transversely ellipsoid, 1.5–1.7 × 2.5 mm, opening in the centre of the anther locules, coherent with each other, dorsifixed by the filaments, apex ± pointing to gynoecium; filaments short, inserted c.2 mm from the corolla base. *Gynoecium* narrowly ovoid, c.6.5 mm long; ovary 0.7 mm wide, smoothly intergrading into style, but style distinct, 0.2 mm wide; stigma slightly enlarged. *Fruit* a cylindrical capsule, not spirally twisted, c.2.2 cm long, c.2 mm in diameter, glabrous. *Seeds* not seen.

Distribution. Peninsular Malaysia and Peninsular Thailand.

Habitat and ecology. Recorded from limestone.

Proposed IUCN conservation assessment. Least Concern (LC). Although this species is only known from few collections it is found over a large area and several of the known sites are in protected areas, and there are no major threats.

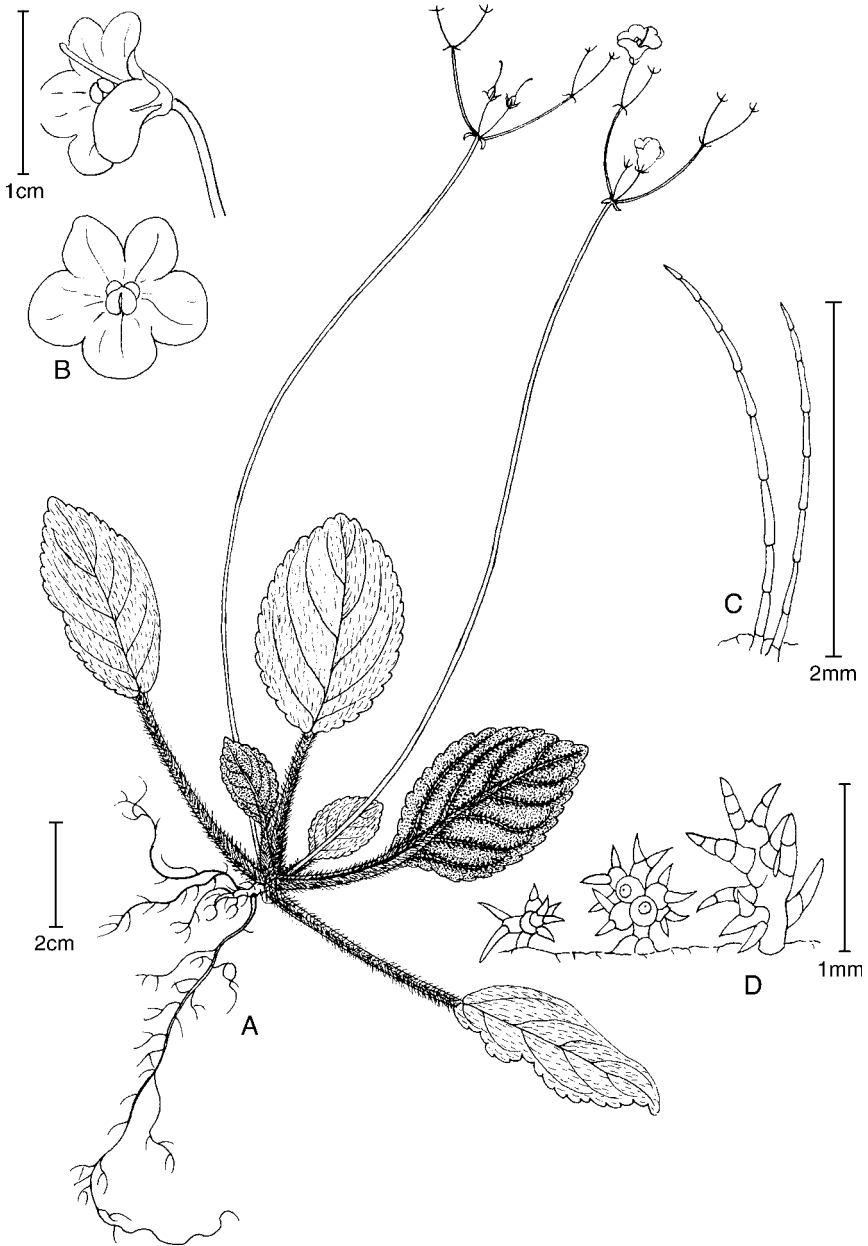


FIG. 53. *Paraboea vulpina* Ridl. A, habit; B, flower; C, hairs on upper leaf surface; D, hairs on lower leaf surface.

Additional specimens examined. MALAYSIA. **Perak:** Ipoh Ayer Hangat, c.400 ft (120 m), on limestone [04°35'N 101°06'E], 166 m, 21 iv 1962 (fl), *B.L. Burt & P.J.B. Woods* 1688 (E); [collection from c.04°00'N 102°00'E], 1962 (fl), *Cult. in E* 3980 (E).

THAILAND. **Trang:** Nam Tai, 20 km N of Trang, limestone rock [07°42'N 99°47'E], 11 x 1970 (fr), *Charoenphol, Larsen & Warncke* 3642 (AAU). **Krabi:** Tam Soea, 10 km N of Krabi, limestone hill [08°10'N 98°57'E], 50–250 m, 24 x 1991 (fr), *K. Larsen et al.* 42551 (AAU).

This species may be related to *Paraboea laxa* with which it shares similar large and spreading cymes. However, *Paraboea vulpina* has branched hairs while *P. laxa* does not. This species may also be related to *Paraboea tarutaensis* with which it shares the same multi-branched hairs. The latter species can be recognised by its few-flowered inflorescence. Another species, *Paraboea brunnescens*, which has both branched hairs and a matted indumentum, is also comparable to the above species, but the latter species has a twisted capsule. The similarity between species differing only in whether the fruit is twisted or not was used by Burt (1984) as evidence to challenge the phylogenetic value of the carpology between *Paraboea* and *Boea*. Two collections, however, may blur the difference between *Paraboea vulpina* and *P. laxa* (and maybe also *P. tarutaensis* and *P. brunnescens*). *Kurzweil* HK783 (WU), collected from Peninsular Thailand (Satun Province), has both a long pubescence and multi-branched hairs, and *Kiah* 24376 (BM, K, SING), collected from northern Thailand (Kamphaeng Phet), has petiolate leaves but no multi-branched hairs. In this treatment, *Kurzweil* HK783 (WU) is recognised as *Paraboea tarutaensis*, *Kiah* 24376 as *P. laxa*, and *Charoenphol, Larsen & Warncke* 3642 (AAU) is treated as *P. vulpina*. *Paraboea vulpina* can be distinguished from *P. laxa* and *P. tarutaensis* by the lack of a matted indumentum on the lower leaf surface.

Burt (1984) noted that *Charoenphol, Larsen & Warncke* 3642 (AAU) may represent an allied but undescribed species to *Paraboea vulpina*, differing by: leaves with a dense short pubescence above (rather than sparse long hairs), and multi-branched hairs with a long stalk and a whorl of longish branches at top (rather than with a short or absent stalk).

EXCLUDED TAXA

Paraboea alternifolia (C.B.Clarke) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 24: 46 (1962). = *Henckelia alternifolia* (C.B.Clarke) A.Weber, Beitr. Biol. Pflanzen 70: 339 (1998 [‘1997’]).

Paraboea bettiana M.R.Hend., Gard. Bull. Straits Settl. 7: 116 (1933). = *Emarhendia bettiana* (M.R.Hend.) Kiew, A.Weber & B.L.Burt, Beitr. Biol. Pflanzen 70: 398 (1998 [‘1997’]).

Paraboea caerulea Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 66 (1905). = *Henckelia densifolia* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 343 (1998 [‘1997’]).

Paraboea campanulata Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 65 (1905). = probably *Henckelia hirta* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 346 (1998 [‘1997’]).

Paraboea cordata (A.DC.) Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 64 (1905). = *Didymocarpus cordatus* A.DC., Prodr. 9: 265 (1845).

- Paraboea densifolia* (Ridl.) M.R.Hend., Gard. Bull. Straits Settl. 5: 79 (1930). = *Henckelia densifolia* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 343 (1998 [‘1997’]).
- Paraboea filicifolia* (Ridl.) Ridl., Fl. Malay Penins. 2: 530 (1923). = *Henckelia salicina* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 355 (1998 [‘1997’]).
- Paraboea floribunda* M.R.Hend., Gard. Bull. Straits Settl. 7: 117 (1933). = *Henckelia floribunda* (M.R.Hend.) A.Weber, Beitr. Biol. Pflanzen 70: 345 (1998 [‘1997’]).
- Paraboea grandifolia* Ridl., Fl. Malay Penins. 2: 531 (1923). = *Henckelia tahananica* (B.L.Burt) A.Weber, Beitr. Biol. Pflanzen 70: 357 (1998 [‘1997’]).
- Paraboea holttumii* M.R.Hend., Gard. Bull. Singapore 4: 54 (1927). = *Henckelia holttumii* (M.R.Hend.) A.Weber, Beitr. Biol. Pflanzen 70: 346 (1998 [‘1997’]).
- Paraboea leucocodon* Ridl., J. Fed. Malay States Mus. 6: 167 (1915). = *Henckelia leucocodon* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 348 (1998 [‘1997’]).
- Paraboea nagalandiana* Deb & Dutta, J. Bombay Nat. Hist. Soc. 85: 168 (1988). = *Staurogyne* sp.
- Paraboea pubiflora* Ridl., J. Fed. Malay States Mus. 4: 51 (1909). = *Henckelia venusta* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 358 (1998 [‘1997’]).
- Paraboea pyroliflora* (Ridl.) Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 67 (1905). = *Henckelia pyroliflora* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 353 (1998 [‘1997’]).
- Paraboea rubiginosa* Ridl., J. Linn. Soc., Bot. 38: 319 (1908). = *Henckelia rubiginosa* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 355 (1998 [‘1997’]).
- Paraboea salicina* (Ridl.) Ridl., Fl. Malay Penins. 2: 530 (1923). = *Henckelia salicina* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 355 (1998 [‘1997’]).
- Paraboea scortechinii* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 65 (1905). = *Henckelia scortechinii* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 356 (1998 [‘1997’]).
- Paraboea tiumanica* Ridl., Fl. Malay Penins. 2: 530 (1923). = *Henckelia tiumanica* (Ridl.) A.Weber, Beitr. Biol. Pflanzen 70: 357 (1998 [‘1997’]).

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- Boea acutifolia* Ridl. (1)
Boea borneensis Scheff. ex H.O.Forbes (74a)
Boea brachycarpa Ridl. (9)
Boea brettiana W.W.Sm. (38)
Boea caeruleascens Ridl. (12)
Boea chaffanjonii H.Lév. (75)
Boea cochinchinensis C.B.Clarke (18)
Boea crassifolia Hemsl. (19)
Boea dictyoneura Hance (21)
Boea divaricata Ridl. (22)
Boea elegans Ridl. (24)
Boea evrardii Pellegr. (25)
Boea ferruginea Ridl. (26)
Boea flocculosa C.B.Clarke (56a)
Boea glabra Ridl. (28)
Boea glabriflora Barnett (29)
Boea glabrisepala (B.L.Burt) Barnett (30)
Boea glutinosa Hand.-Mazz. (32)
Boea hainanensis Chun (35)
Boea hancei C.B.Clarke (21)
Boea harroviana Craib (37a)
Boea havilandii Ridl. (38)
Boea kerrii Craib (79)
Boea lanata Ridl. (41)
Boea lancifolia Ridl. (42)

- Boea leporina* H.J.Lam (45)
Boea macrophylla Drake (75)
Boea martinii H.Lév. (50)
Boea microcarpa Drake (56a)
Boea minahassae Teijsm. & Binn. (53)
Boea minor Barnett (54)
Boea multiflora R.Br. (56a)
Boea multiflora var. *burmannica* C.B.Clarke (56a)
Boea multiflora var. *villosa* Pellegr. (56a)
Boea paniculata Ridl. (60)
Boea parviflora Ridl. (63)
Boea patens Ridl. (64)
Boea proluxa C.B.Clarke (67)
Boea reticulata Barnett (56a)
Boea rufescens Franch. (71a)
Boea rufescens var. *seguinii* (H.Lév. & Vaniot) H.Lév. (71a)
Boea speciosa Rech. (76)
Boea speluncarum B.L.Burtt (77)
Boea suffruticosa Ridl. (78)
Boea swinhoei Hance (79)
Boea swinhoei var. *diffusior* C.B.Clarke (79)
Boea thirionii H.Lév. (56a)
Boea thorelii Pellegr. (81)
Boea treubii H.O.Forbes (83)
Boea umbellata Drake (84)
Boea verticillata Ridl. (88)
Buxiphyllum velutinum W.T.Wang & C.Z.Gao (87)
Chlamydoboea sinensis (Oliv.) Stapf (75)
Chlamydoboea sinensis (Oliv.) Stapf forma *macra* Stapf (75)
Chlamydoboea sinensis (Oliv.) Stapf forma *macrophylla* Stapf (75)
Didymocarpus cordatus A.DC. (exc)
Didymocarpus detergibilis C.B.Clarke (20)
Didymocarpus minahassae (Teijsm. & Binn.) H.O.Forbes (53)
Didymocarpus minutus Kraenzl. (55)
Didymocarpus multiflorus Wall. (56a)
Didymocarpus neurophyllus Collett & Hemsl. (58)
Didymocarpus paraboea C.B.Clarke (17)
Didymocarpus paraboeoides Kraenzl. (74a)
Didymocarpus primuloides Kraenzl. (66)
Didymocarpus regularis Ridl. (70)
Didymocarpus schefferi H.O.Forbes (74a)
Didymocarpus schefferi var. *ambigua* C.B.Clarke (74b)
Didymocarpus seguinii H.Lév. & Vaniot (71a)
Dorcoceras crassifolium (Hemsl.) Schltr. (19)
Dorcoceras rufescens (Franch.) Schltr. (71a)
Emarhendia bettiana (M.R.Hend.) Kiew (exc)
Henckelia alternifolia (C.B.Clarke) A.Weber (exc)
Henckelia densifolia (Ridl.) A.Weber (exc)
Henckelia floribunda (M.R.Hend.) A.Weber (exc)
Henckelia hirta (Ridl.) A.Weber (exc)

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- Henckelia holttumii* (M.R.Hend.) A.Weber (exc)
Henckelia leucocodon (Ridl.) A.Weber (exc)
Henckelia pyroliflora (Ridl.) A.Weber (exc)
Henckelia rubiginosa (Ridl.) A.Weber (exc)
Henckelia salicina (Ridl.) A.Weber (exc)
Henckelia scortechinii (Ridl.) A.Weber (exc)
Henckelia tahanica (B.L.Burtt) A.Weber (exc)
Henckelia tiumanica (Ridl.) A.Weber (exc)
Henckelia venusta (Ridl.) A.Weber (exc)
Oreocharis filipes Hance (27)
Paraboea acutifolia (Ridl.) B.L.Burtt (1)
Paraboea aff. *glutinosa* (32a)
Paraboea aff. *martinii* (50a)
Paraboea alternifolia (C.B.Clarke) B.L.Burtt (exc)
Paraboea amplifolia Z.R.Xu & B.L.Burtt (2)
Paraboea apiensis Z.R.Xu (3)
Paraboea argentea Z.R.Xu (4)
Paraboea bakeri M.R.Hend. (5)
Paraboea banyengiana B.L.Burtt (6)
Paraboea barbartipes K.Y.Pan (50)
Paraboea berouwensis Z.R.Xu & B.L.Burtt (7)
Paraboea bettiana M.R.Hend. (exc)
Paraboea bintangensis B.L.Burtt (8)
Paraboea brachycarpa (Ridl.) B.L.Burtt (9)
Paraboea brunnescens B.L.Burtt (10)
Paraboea burttii Z.R.Xu (11)
Paraboea caerulea Ridl. (exc)
Paraboea caerulescens (Ridl.) B.L.Burtt (12)
Paraboea campanulata Ridl. (exc)
Paraboea candidissima B.L.Burtt (13)
Paraboea capitata Ridl. (14a)
Paraboea capitata var. *oblongifolia* Ridl. (14b)
Paraboea changjiangensis F.W.Xing & Z.X.Li (15)
Paraboea chiangdaoensis Z.R.Xu & B.L.Burtt (16)
Paraboea clarkei B.L.Burtt (17)
Paraboea clavisepala D.Fang & D.H.Qin (50)
Paraboea cochinchinensis (C.B.Clarke) B.L.Burtt (18)
Paraboea cordata (A.DC.) Ridl. (exc)
Paraboea crassifolia (Hemsl.) B.L.Burtt (19)
Paraboea culminicola K.G.Pearce (83)
Paraboea curtisii Ridl. (14a)
Paraboea densifolia (Ridl.) M.R.Hend. (exc)
Paraboea detergibilis (C.B.Clarke) B.L.Burtt (20)
Paraboea dictyoneura (Hance) B.L.Burtt (21)
Paraboea divaricata (Ridl.) B.L.Burtt (22)
Paraboea effusa B.L.Burtt (23)
Paraboea elegans (Ridl.) B.L.Burtt (24)
Paraboea evrardii (Pellegr.) B.L.Burtt (25)
Paraboea ferruginea (Ridl.) Ridl. (26)
Paraboea filicifolia (Ridl.) Ridl. (exc)

- Paraboea filipes* (Hance) B.L.Burt (27)
Paraboea floribunda M.R.Hend. (exc)
Paraboea glabra (Ridl.) B.L.Burt (28)
Paraboea glabriflora (Barnett) B.L.Burt (29)
Paraboea glabrisepala B.L.Burt (30)
Paraboea glanduliflora Barnett (31)
Paraboea glutinosa (Hand.-Mazz.) K.Y.Pan (32)
Paraboea grandifolia Ridl. (exc)
Paraboea granitcola Z.R.Xu (33)
Paraboea guilinensis L.Xu & Y.G.Wei (34)
Paraboea hainanensis (Chun) B.L.Burt (35)
Paraboea halongensis Kiew & T.H.Nguyèn (36)
Paraboea harroviana (Craib) Z.R.Xu (37a)
Paraboea harroviana* var. *ovata Z.R.Xu (37b)
Paraboea havilandii (Ridl.) B.L.Burt (38)
Paraboea holttumii M.R.Hend. (exc)
Paraboea incudicarpa B.L.Burt (39)
Paraboea kalimantanensis Z.R.Xu & B.L.Burt (40)
Paraboea kerrii (Craib) B.L.Burt (79)
Paraboea lanata (Ridl.) B.L.Burt (41)
Paraboea lancifolia (Ridl.) B.L.Burt (42)
Paraboea laxa Ridl. (43)
Paraboea leopoldii K.M.Wong, J.T.Pereira, Sugau & S.P.Lim (44)
Paraboea leporina (H.J.Lam) B.L.Burt (45)
Paraboea leucocodon Ridl. (exc)
Paraboea leuserensis B.L.Burt (46)
Paraboea luzoniensis Merr. (47)
Paraboea madaiensis Z.R.Xu & B.L.Burt (48)
Paraboea mahaxayana Z.R.Xu & B.L.Burt (49)
Paraboea martinii (H.Lév.) B.L.Burt (50)
Paraboea mataensis Z.R.Xu & B.L.Burt (51)
Paraboea meiophylla B.L.Burt (52)
Paraboea microcarpa (Drake) B.L.Burt (56a)
Paraboea minahassae (Teijsm. & Binn.) B.L.Burt (53)
Paraboea minor (Barnett) B.L.Burt (54)
Paraboea minuta (Kraenzl.) B.L.Burt (55)
Paraboea multiflora (R.Br.) B.L.Burt (56a)
Paraboea multiflora var. *caulescens* Z.R.Xu & B.L.Burt (56b)
Paraboea nagalandiana Deb & Dutta (exc)
Paraboea nervosissima Z.R.Xu & B.L.Burt (57)
Paraboea neurophylla (Collett & Hemsl.) B.L.Burt (58)
Paraboea nutans D.Fang & D.H.Qin (59)
Paraboea obovata Ridl. (24)
Paraboea paniculata (Ridl.) B.L.Burt (60)
Paraboea paraboeoides (Kraenzl.) B.L.Burt (74a)
Paraboea paramartinii Z.R.Xu & B.L.Burt (61)
Paraboea paraprimumoides Z.R.Xu (62)
Paraboea parviflora (Ridl.) B.L.Burt (63)
Paraboea patens (Ridl.) B.L.Burt (64)
Paraboea peltifolia D.Fang & L.Zeng (65)

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- Paraboea polita* Ridl. (14a)
Paraboea primuloides Z.R.Xu (66)
Paraboea proluxa (C.B.Clarke) B.L.Burttt (67)
Paraboea pubicorolla Z.R.Xu & B.L.Burttt (68)
Paraboea pubiflora Ridl. (exc)
Paraboea pyroliflora (Ridl.) Ridl. (exc)
Paraboea rabilii Z.R.Xu & B.L.Burttt (69)
Paraboea regularis (Ridl.) Ridl. (70)
Paraboea ridleyi Elmer (47)
Paraboea rubiginosa Ridl. (exc)
Paraboea rufescens (Franch.) B.L.Burttt (71a)
Paraboea rufescens var. **tomentosa** (Barnett) Z.R.Xu (71b)
Paraboea rufescens var. *umbellata* (Drake) K.Y.Pan (84)
Paraboea rupestris B.L.Burttt (28)
Paraboea sabahensis Z.R.Xu & B.L.Burttt (72)
Paraboea salicina (Ridl.) Ridl. (exc)
Paraboea scabriflora B.L.Burttt (73)
Paraboea schefferi (H.O.Forbes) B.L.Burttt (74a)
Paraboea schefferi var. **ambigua** (C.B.Clarke) Z.R.Xu (74b)
Paraboea scortechinii Ridl. (exc)
Paraboea sinensis (Oliv.) B.L.Burttt (75)
Paraboea speciosa (Rech.) B.L.Burttt (76)
Paraboea speluncarum (B.L.Burttt) B.L.Burttt (77)
Paraboea suffruticosa (Ridl.) B.L.Burttt (78)
Paraboea swinhoei (Hance) B.L.Burttt (79)
Paraboea tarutaoensis Z.R.Xu & B.L.Burttt (80)
Paraboea thirionii (H.Lév.) B.L.Burttt (56a)
Paraboea thorelii (Pellegr.) B.L.Burttt (81)
Paraboea tiumanica Ridl. (exc)
Paraboea tomentosa Barnett (71b)
Paraboea trachyphylla Z.R.Xu & B.L.Burttt (82)
Paraboea treubii (H.O.Forbes) B.L.Burttt (83)
Paraboea tribracteata D.Fang & W.Y.Rao (71a)
Paraboea umbellata (Drake) B.L.Burttt (84)
Paraboea uniflora Z.R.Xu & B.L.Burttt (85)
Paraboea variopila Z.R.Xu & B.L.Burttt (86)
Paraboea velutina (W.T.Wang & C.Z.Gao) B.L.Burttt (87)
Paraboea verticillata (Ridl.) B.L.Burttt (88)
Paraboea vulpina Ridl. (89)
Phylloboea henryi Duthie ex Beddome (71a)
Phylloboea sinensis Oliv. (75)