

Towards a revision of Paraboea (Gesneriaceae): I.

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fig 7.

TOWARDS A REVISION OF *PARABOEAE* (GESNERIACEAE): I

XU ZHAORAN* & B. L. BURTT

Preparatory to a full revision of *Paraboea* (C. B. Cl.) Ridley (Gesneriaceae) 16 new species are described: these come from China (1), Laos (1), Thailand (8), Malay Peninsula (1), Borneo (4 - 2 from Sabah, 2 from Kalimantan) and Sulawesi (1). There is also a new variety of *P. multiflora* (Thailand). All these plants have spirally twisted fruits except *P. amplifolia* (Thailand) in which they are short and not twisted.

In a recent paper, one of us (Burtt, 1984) proposed revised generic concepts for *Boea* Lam., *Paraboea* (C. B. Cl.) Ridley and *Trisepalum* C.B.Cl. The essence of the change was to transfer emphasis from the character of the fruit (*Boea* had been defined by a twisted fruit, *Paraboea* by one not twisted) to that of the indumentum (*Boea* being restricted to plants with long straight hairs, while *Paraboea* has, at least on the undersurface of the leaf, an indumentum of interwoven, woolly hairs or, in the few species where this is completely lacking, hairs with short branches, dendroid, stellate or similar). Thus revised, *Boea* always has twisted fruits, but in *Paraboea* they may be twisted or not. *Trisepalum* was described with untwisted fruits, *Dichiloboea* Stapf with twisted fruits; they were combined by Burtt. The enlarged *Trisepalum* agrees with *Paraboea* in indumentum but differs from it in calyx: 5-partite in *Paraboea*, 3-partite in *Trisepalum*, the 3 dorsal segments being united into a single member that shows its triple nature by having three apical teeth.

Boea (incl. *Dorcoceras* Bunge) and *Trisepalum* (incl. *Dichiloboea*) are fairly small genera of less than 20 species each and have been revised by Burtt (1984); but *Paraboea* (incl. *Chlamydoboea* Stapf and *Buxiphyllum* Wang & Gao) is both large and diverse (c.80 spp.) and has not yet been studied in detail. Before Burtt's rearrangement of the genera can be more critically examined and, if correct, be put on a firmer foundation than that of indumentum alone, the first essential step is a more detailed study of the species now included in *Paraboea*. We need to know how they are best classified amongst themselves and, eventually, to decide whether they are all congeneric. Much more work is needed to evaluate the importance of carpology and indumentum in the classification of this genus before satisfactory conclusions can be drawn.

As a first step towards a full revision of *Paraboea*, this paper provides descriptions of some of the new species that have been recognized.

***Paraboea amplifolia* Xu & Burtt, species nova** et indumento vero arachnoideo, et foliis magnis membranaceis, et fructibus parvis (5 × 2mm) non tortis in combinatione distincta.

Perennial rosulate herb. *Leaves* petiolate; petiole 2-10cm long covered with true arachnoid indumentum; blade elliptic or ovate, 15-28 × 5-13cm, 2-2.5 × as long as

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wide, apex obtuse, base cuneate or narrowed, margin entire, membranous, truly arachnoid on both sides, under the arachnoid indumentum with minute white pubescence on the upper surface; veins obscure above, delicately raised beneath, lateral veins about 10 pairs, veinlets delicate. *Inflorescence* axillary cymose, 9–12 × 2–5 cm, few-flowered, entirely covered by loose arachnoid indumentum webbing its branches together; peduncle 7–11 cm long, c. 1.5 mm diam.; pedicels c. 8 mm long. *Calyx* c. 5 mm long, 5-parted to the base, segments 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 similar in size to the lobes of the upper lip. *Stamens* glabrous; anthers transversely ellipsoid, c. 1.5 × 3.5 mm, coherent with each other, opening at the middle inside, dorsifixed, apex turning (c. 90°) towards the gynoecium; filaments c. 1.5 mm long. *Capsule* ovoid, 5 mm long, 2 mm diam., not twisted, 4-valved when open. *Seeds* with flattened faces, ellipsoid, 0.35 × 0.2 mm. Type: Thailand, Nakawn Sritamarat, Kao Chem (Chim), Tunglung (Tungsong), on rock, 20 vii 1929 (fl, fr), *Rabil* 123 (holo. K; iso. ABD, BM, E).

This species is unique in *Paraboea* in its truly web-like arachnoid indumentum covering the whole plant, furthermore the large leaves, membranous when dry, combined with very small untwisted capsule, are also very characteristic. The type specimen was mentioned as possibly belonging to the genus *Orchadocarpa* Ridley by Dr E. C. Barnett (*Fl. Siam. Enum.* 3(3): 209, 1962), but it has no close affinity with that genus.

***Paraboea berouwensis* Xu & Burtt, species nova** *P. meiophyllae* B.L. Burtt affinis, sed foliis serrulatis, petiolis basi inflatis, calycibus lanatis differt.

Perennial caulescent, stem quite stout c. 1 cm diam., internodes less than 1 cm long. *Leaves* in whorls of 3, petiolate; petioles swollen at the base but not joined to each other across the node, and the lamina base long-attenuate extending nearly to the base of the petiole thus the petiole not easily distinguishable from the lamina; leaf narrow-elliptic, 11–15 × 22.5 cm (including the indistinct petiole), apex short-acuminate, base long-attenuate, margin more or less shallowly serrate, white-lanate on both sides (without pubescence on the upper surface under the lanate indumentum); veins obscure above, raised beneath; lateral veins about 13 pairs, veinlets invisible. *Inflorescence* terminal paniculate, white-lanate up to the calyx; flowering stem c. 20 cm long, much thinner than the stem, c. 2 mm diam., floral leaves up to 3.5 × 0.8 cm, reducing size upward, 3 cymes from each node; cymes short, less than 4 cm long, many-flowered and so quite tight; pedicel c. 2–5 mm long, with bracts sepal-like. *Flowers* c. 10 mm across when open. *Calyx* 5-parted to the base, outside white lanate, inside glabrous, segments ovate or narrowly so, 1–2 mm long. *Corolla* outside more or less minutely pubescent, especially when young, c. 7 × 10 mm when open, tube c. 2.5 mm long, limb 2-lipped, upper lip about 5 mm long, 2-lobed, lobes ovate, c. 4 × 5 mm, lower lip c. 7 × 9 mm obovate, 3-lobed, the middle one surpassing the side ones by c. 2 mm, more or less oblong c. 3 × 2 mm. *Stamens* 2, distinct, anthers transversely ellipsoid, c. 2 × 3.5 mm, turning the apex towards the gynoecium, open in the middle inside, coherent to each other at the apex and the bottom, dorsifixed; filaments c. 2.5 mm long, inserted

at the base of the corolla, flat, more or less verrucose. *Gynoecium* glabrous, c.6mm long; ovary 1.5–2 × 0.6–0.8mm; style c.2.5 × 0.3mm; stigma capitate not larger than the style. *Capsule* c.1–2cm long, 1.5mm wide, twisted, glabrous. *Seeds* ellipsoid, c.0.4 × 0.2mm.

Type: Kalimantan, East Borneo, Mt Ilaş Bunga, 600m, limestone, 10 ix 1957 (fl. fr.), *Kostermans* 13785 (holo. L).

In the morphology of flower and inflorescence this species is similar to *P. leporina* (H. J. Lam) B. L. Burt, from Sulawesi, but the leaves lack pubescence below the lanate covering on the upper surface and the petiole is swollen at the base. *P. meiophylla* B.L.Burt may be a closer ally, but has a lax inflorescence, glabrous calyx and corolla, and the petiole is not swollen.

***Paraboea chiangdaoensis* Xu & Burt, species nova** affinis *P. cochinchinensi* (C. B. Cl.) B. L. Burt, sed laminis oblongis in sicco membranaceis basi truncatis supra pubescentibus, petiolis conspicue alatis distincta.

Perennial caulescent herb, stem c.8mm in diam., internodes (seen) 1–3cm long. *Leaves* opposite, petiolate; petioles c.15cm long, winged and joined at the base across the node; blade membranous or nearly so, more or less oblong, 20–25 × 8–15cm, apex obtuse, base more or less truncate and then attenuate into the petiole wings, entire, minutely pubescent above, sparsely lanate beneath, with thicker indumentum when young; veins obscure above, raised beneath; lateral veins sparse, 10–12 pairs, veinlets indistinctly reticulate. *Inflorescence* not seen, judged to be subterminal cymose by seeing one of the bifurcations in the infructescence with 4 cymelets from the apex of the peduncle, with 2 leaflet-like bracts c.4.5 × 3cm, the cymelets in the infructescence 20cm long, 15cm across, many-flowered. *Flower* not seen. *Infructescence* nearly glabrous, pedicel 1–3cm long, slender, more or less minutely glandular, with sepal-like bract; calyx persistent c.2mm long, 5-parted to the base, segments narrowly ovate. *Fruit* twisted, slender, c.2.5cm long, 1.5mm diam., glabrous.

Type: Thailand: Doi Chiangdao (Ban Chiangdao, 19°30'N 99°00'E), 23 x 1926 (fr.), *Put* 430 (holo. K; iso. ABD, BM) [presumably from limestone].

The new species is well distinguished by its large leaf size, truncate leaf base, conspicuously winged petiole, and pubescence on the upper surface of the lamina.

***Paraboea kalimantanensis* Xu & Burt, species nova** *P. caerulescenti* (Ridley) B. L. Burt affinis, sed habitu monocarpico, panícula longa et angusta, calycibus lanatis, fructibus tenuioribus differt.

Monocarpic caulescent semishrub; stem woody 25cm long, 6mm diam., internodes very short, 5mm or so, tawny-lanate. *Leaves* in whorls of 4, sessile, narrowly obovate, 5–11 × 1–2cm, apex obtuse, base cuneate, margin entire, densely pubescent above, greyish-white-lanate beneath except the tawny veins; veins smooth above, raised beneath, lateral veins about 14 pairs, veinlets inconspicuous. *Inflorescence* terminal panicle, tawny-lanate except the flower; flowering stem 45cm long, the first inter-

node c.15cm long, floral leaves much smaller than cauline ones, up to 15×5 mm, reduced in size upward; 4 cymes from each node, very short, less than 5cm long, few-flowered, peduncle bract and pedicel bract similar to each other, sepal-like, pedicel 3–5 mm long. *Calyx* c.3mm long, 5-parted, segments narrow-ovate, tawny-lanate outside, glabrous inside; corolla mauve (*fide* label) c.3.5mm long, c.4mm across, tube 1.5mm long, limb 2-lipped, upper lip 2-lobed, lobes depressed-ovate, 1.7×2.5 mm, lower lip 3-lobed, 2 side lobes depressed-ovate, 1.7×2.5 mm, middle one obovate, 1.7×1.5 mm. *Stamens* 2; anthers transversely ellipsoid, 2×4 mm, coherent with each other at the apex and the bottom, turning the apex towards the gynoecium, opening at the middle inside, dorsifixed; filaments 1.7mm long, flat, more or less verrucose and winged. *Gynoecium* c.2.5mm long, densely capitate-pubescent; style short; stigma capitate not larger than the style. *Capsule* long and delicate, $25\text{--}30 \times 1$ mm, densely capitate-pubescent when young, less so when mature, twisted; seeds with flattened faces, ovoid, 0.6×0.2 mm.

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

This new species is similar to *P. caerulescens* (Ridley) B.L.Burtt in its terminal panicle and densely capitate-pubescent ovary and fruit, but quite different in its monocarpic habit, long but narrow panicle, lanate calyx and very slender capsule.

***Paraboea madaiensis* Xu & Burtt, species nova** affinis *P. candidissimae* B.L.Burtt et *P. sabahensi* Xu & Burtt, sed foliis minoribus basi truncatis conspicue petiolatis differt.

Perennial caulescent semishrub, 40–80cm tall, stem woody nearly 1cm diam., internodes c.0.5cm long, tawny lanate when young (1–2 years) glabrescent when old (3 years or more). *Leaves* in whorls of 3, distinctly petiolate; petiole c.1–2cm long, terete, with similar indumentum as the stem, blades ovate, $c.3\text{--}4 \times 1.5\text{--}2$ cm, $c.2 \times$ as long as wide, apex acute, base truncate, margin entire, dense-pubescent covered by a layer of white-arachnoid hairs above, white lanate beneath; veins invisible above, obscure beneath, lateral veins c.6 pairs, veinlets invisible. *Inflorescence* terminal, paniculate, c.15cm long, rather narrow about 3cm wide, lanate except the flower: the first internode of the flowering stem c.3–5cm long, floral leaves intermediate to the cauline ones, normally without petiole, 2 or 3 cymes from each node; cymes short, with or without short peduncle, peduncle bracts and pedicel bracts similar to calyx segment; pedicel 0.5–1cm long. *Flowers* (corolla light violet, anthers yellow, *fide* label), glabrous except the calyx, sometimes the lanate hairs extending somewhat on to the corolla. *Calyx* c.3mm long, 5-parted, segments narrow-ovate, lanate outside. *Corolla* c.8mm long, 9mm across, tube 2.5mm long, limb 2-lipped, upper lip 2-lobed, lobes wide ovate 3×3.5 mm, lower lip c.5mm long 3-lobed, middle lobe slightly smaller than the two side lobes, obovate, 3×3.5 mm, 2 side lobes equal, ovate, 4×5 mm. *Stamens* 2; anthers transversely ellipsoid, $c.2 \times 3.5$ mm, coherent at the apex and the bottom, opening at the middle inside, turning the apex towards the gynoecium, dorsifixed; filaments c.2.5mm long 0.7mm wide. *Ovary* ovoid, 1.5×1 mm; style c.3mm long;

stigma capitate not larger than the style. *Fruit* a linear capsule, c.13mm long, 1.2mm diam., glabrous, twisted. *Seeds* with flattened faces, ellipsoid, 0.5×0.15 mm. Type: Borneo, Sabah, Lahad Datu District, around Madai caves, limestone area, 90–150m, 15 ix 1976 (fl.), *Tamura & Hotta* 722 (holo. E, iso. KYO).

BORNEO: Sabah: Madai F. R., Mostyn, limestone hill top, 430m, 6 vi 1966 (fl, fr), *Ding Hou* 166 (K, L); Madai, 305m, 16 vi 1963, *Meijer* SAN 37962 (K).

This species is close to *P. candidissima* B. L. Burttt as well as to *P. sabahensis* Xu & Burttt, but the much smaller leaves distinguish it from *P. candidissima* and the truncate leaf-base and distinct petiole from *P. sabahensis*.

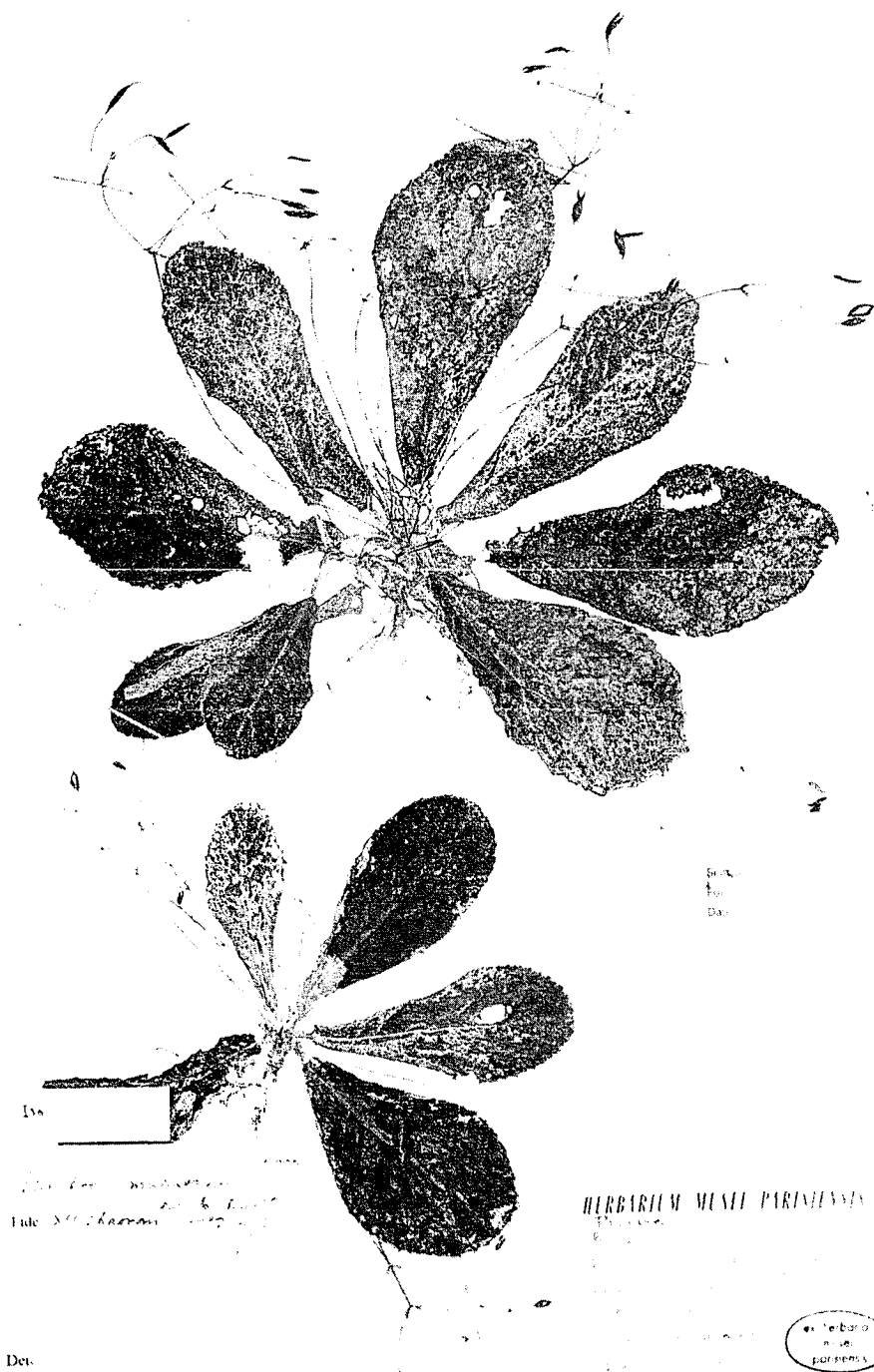
***Paraboea mahaxayana* Xu & Burttt, sp. nov.** *P. neurophyllae* (Collett & Hemsley) B. L. Burttt affinis, sed pedunculis et pedicellis manifeste tenuibus (c.0.5mm diam.), capsulis brevioribus (c.5–8mm longis) differt. **Fig. 1.**

Herb perennial, rosulate. *Leaves* congested in a rosette, shortly petiolate; petiole up to 1.5cm long, with same indumentum as that on the blades beneath; blades coriaceous, obovate, $6-10 \times 2.5-5$ cm, $1.5-2.5 \times$ as long as wide, apex rounded, base attenuate-rounded, margin crenulate to crenate, arachnoid when young glabrescent when old above, brownish yellow sublanate beneath, veins smooth above, prominent beneath, lateral veins c.10 pairs, veinlets conspicuous and reticulate. *Inflorescences* axillary, cymose, very slender, several (c.2–4) congested in an axil, normally longer than the leaves, when in fruit up to 15cm long, very lax, several-flowered, with same indumentum as that on underside of leaf; peduncle up to 10cm long, c.0.3mm diam., peduncle bracts narrowly ovate, 3×0.5 mm; pedicels long and slender, up to 4cm long. *Flower* not seen. *Calyx* persistent, 5-parted to the base; segments narrowly ovate or triangular c.2mm long, 0.5mm wide. *Capsules* short, 5–8mm long, 1–1.5mm wide, glabrous, twisted; persistent style minutely pubescent. *Seeds* ovoid, 0.4×0.15 mm. Type: Laos, Prov. de Cammou (Khammouane), village de Mahaxay [$17^{\circ}25'N$, $105^{\circ}12'E$], 150m, fissures d'un gros rocher calcaire dans un forêt de haute futaie très humide, i 1931 (fr.), *Pételot* s.n. (holo. P, iso. E).

The new species is close to *P. neurophylla* (Collett & Hemsley) B.L.Burttt, but is easily distinguished by several inflorescences arising from one leaf-axil, by its extremely slender peduncles and pedicels, short capsules and pubescent style.

***Paraboea mataënsis* Xu & Burttt, species nova** *P. havilandii* (Ridley) B.L.Burttt affinis, sed calycibus glabris vel paullo pubescentibus (nec lanatis), corollis ciliatis differt.

Large perennial herb, caulescent, erect, monocarpic, up to 1m tall (including the inflorescence); stem terete up to 1.2cm diam.; internodes quite short normally less than 1cm long, up to 2cm 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-narrow-oblong, $5-18 \times 1-3.5$ cm, c.5–10 \times as long as wide, apex short-acute, base long-attenuate, margin entire, with dense pubescence

FIG. 1. *Paraboea mahaxayana*. Isotype.

covered by 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, veinlets invisible. *Inflorescence* terminal paniculate, c.40–50cm long, whitish or brownish lanate except the flower and the upper half of the pedicel; flowering stem quadrangular or multi-ridged, internodes up to 10cm long, floral leaves intermediate to the cauline ones and reduced in size upward, 4 cymes from each node; cymes up to 20cm long, much branched, with numerous flowers, peduncle up to 14cm long with obovate-oblong bracts 8×1.5 mm; pedicels less than 5mm long, the upper half not sublanate but more or less pubescent (or rather, minutely capitate-glandular). *Calyx* 5-parted to the base, segments ovate c. 2×0.6 mm, more or less minutely pubescent on both sides. *Corolla* c. 8×12 mm when open; tube c.2mm long, limb ciliate conspicuously 2-lipped, upper lip c. 6×8 mm fissured in the middle c.3mm deep, lower lip c. 8×10 mm obovate, 3-lobed, middle lobe surpassing the side ones by c.3mm, more less obovate c. 5×3.5 mm. *Stamens* 2; anthers transversely ellipsoid, c. 2×4 mm, open in the middle inside, coherent with each other at the apex and the bottom, turning the apex towards the gynoecium, dorsifixed, filaments inserted at the base of the corolla, c.4mm long, 1.2mm 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 the style. *Capsule* linear, 10–25mm long, 12mm diam., glabrous, twisted. *Seeds* ovoid (brown), 0.6×0.2 mm with two dark brown tips.

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 20m tall along the lake, bedrock conglomerate cemented together by sandstone, covered by a thin layer of humus, rather common solitary herb on steep slope, 400m, 16 vi 1979 (fl, fr), flower pale violet, stamens yellow, *Van Balgooy et al.* 5822 (holo. L).

SULAWESI. Sungai Balambano. 20km SW on road Soroako-Wasupondo-Malili (c.23°6'S, 121°14'E) alt. 600m, 26 vi 1979 (fr.), much disturbed primary forest c.30m tall around waterfall, on slope consisting of bare rock; gregarious herb, exposed on steep rocks, less in the shade; flower pale pink, anthers yellow, *Van Balgooy et al.* 6010 (L). Matano-Meer (Nord ufer), alt. 300m, Konglomeratfelsen, trockener Abhang; die Pflanze stirbt wahrscheinlich nach dem Blühen, xi 1929 [fr.], *Kjellberg* 3938 (S).

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

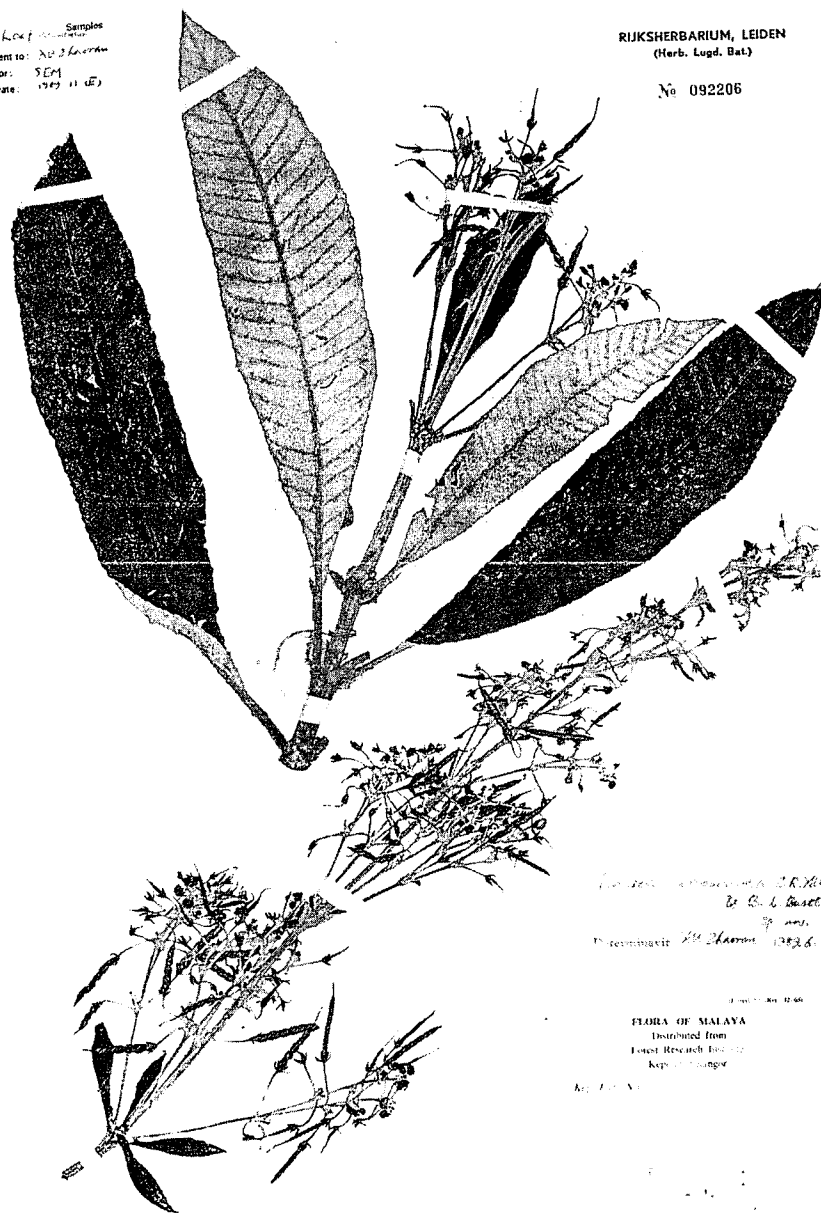
Paraboea multiflora (R. Br.) B.L.Burtt var. ***caulescens*** Xu & Burtt, var. nov. a var. *multiflora* cauli 20cm longo, inflorescentibus foliis brevioribus, calycis lobis valde longioribus differt.

Caulescent semishrub, stem woody more than 20cm long, leaves c. 7.5×3 cm with c.2–3cm long petiole, inflorescence axillary cymose shorter than the leaves, c.6cm long, several-flowered, calyx similar in length to corolla, c.4.5mm long, segments 3.5×0.8 mm, corolla white c.4mm long, 4–5mm across, campanulate, not distinctly 2-lipped, apparently equally 5-lobed, lobes c. 2×2 mm rounded, anthers subrotundate,

Samples
Leaf
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Paraboea nervosissima J.R. & M.
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FIG. 2. *Paraboea nervosissima*. Isotype.

c.1.7 × 1.7mm, slightly coherent at the apex, turning toward the gynoeceium. Other characters are similar to those of var. *multiflora*.

Type: Thailand, near Neekey (near Wangka), steep slopes of limestone, alt. 150m, rather rare, 13 vi 1946 (fr, fl), *G. den Hoed* (Kwae Noi Basin exp. No. 946) (holo. L).

***Paraboea nervosissima* Xu & Burt, species nova** *P. caerulescenti* (Ridley) B.L.Burt affinis, sed foliis petiolatis nervis lateralibus subtus prominentibus numerosissimis sub angulo fere recto abeuntibus differt. **Fig. 2.**

Perennial caulescent semishrub, stem woody more than 1m tall, 1cm diam. or more, internodes 1–2cm long, white or tawny lanate when young and glabrescent when old. *Leaves* in whorls of 3 or 4, petiolate; petiole c.1–3cm long, with the same indumentum as the stem; blade narrow-elliptic, 15–30 × 3–5cm, 4–7 × as long as wide, apex acute, margin more or less crenate, base cuneate, normally glabrous or rarely pubescent above, white or dull brown densely sublanate or lanate beneath; veins smooth above, very prominent beneath, lateral veins numerous 18–45 pairs, forming nearly 90° angle with the midrib; veinlets not visible. *Inflorescence* terminal, paniculate, white or dull brown densely lanate except the flower; flowering stem 30–45cm long, the first internodes not much elongate c.1–5cm long, appearing quite tight in the infructescence, floral leaves intermediate to cauline leaves, gradually reducing in size upward, 3 or 4 cymes from each node; cymes c.10cm long or less, many-flowered, bracts of peduncle narrow-ovate, 7 × 2.5mm or so, bracts of pedicel sepal-like; pedicels 0.5–1.5cm long. *Flowers* (mauve or purple, anthers yellow, *fide* label), with minute capitate pubescence on the calyx, outside of the corolla when young, and the gynoeceium, but glabrous on the stamens. *Calyx* 3–4mm long, segments ovate or narrowly so. *Corolla* c.1cm long, 1cm wide, tube 2.5mm long, limb 2-lipped, upper lip 3.5mm long, 2-lobed, lobes wide-ovate 3.5 × 5mm, lower lip c.8mm long, 3-lobed, 2 side lobes 2 × 3.5mm wide ovate, middle one 2.5 × 2.5mm rotundate. *Stamens* 2; anthers transversely ellipsoid, 2 × 5mm, coherent with each other at the apex and the bottom, open in the middle inside, dorsifixed, turning the apex towards the gynoeceium; filaments c.1.5mm long, verrucose and crenate on the edges. *Gynoeceium* 10mm long, 1.2mm wide, ovary smoothly passing into the style, stigma capitate a little larger than the style. *Fruits* narrowly cylindric, 1.5–2.5 × 0.15–0.2cm, with minute capitate pubescence, extremely twisted. *Seeds* ellipsoid, 0.7 × 0.25mm.

Type: Malaya, Kelantan, Gua Musang, Ulu Kelantan, summit of limestone hill, common, 22 vi 1967 (fl, fr), *F. Ng* (FRI 5568) (holo. K, iso. L).

MALAYA: Kelantan: Gua Musang, Ulu Kelantan, alt. 250m, 1 ix 1967 (fr), *Stone* 7307 (L); S. Nenggiri, Gua Jaya at K. Jenera, limestone hill, 27 vii 1967 (fl), *Whitmore* FRI 4251 (K, L); Gua Serai Gua Musang, limestone hill, 6 viii 1962 (fr), UNESCO 1962 Expt. 429 (L). Pahang: Taman Negara, Gua Peningat, rocky, rather dry summit, c.800m, 14 vii 1970 (ster.), *Loh Hoy Shing* FRI 17221 (L); Gua Tipus, Pahang, 17 ix 1927 (fr, fl), *Henderson* SFN No. 19459 p.p. (K); Lipis distr., Gua Rusa c. 10 km S of Pahang/Kelantan border, 10 v 1987, *Weber* 870510-1/6 (WU).

Paraboea nervosissima is close to *P. caerulescens* (Ridley) B.L.Burt in sharing the same indumentum (minutely capitate pubescence) on the calyx, ovary and fruit, and

the same flower morphology, but its leaves are petiolate, the lateral veins are numerous, very prominent on the undersurface, spreading nearly at right angles to the midrib.

***Paraboea paramartinii* Xu & Burt, species nova affinis *P. martinii* (Lévl.) B.L. Burt, sed foliis majoribus, infructescentiis et calycibus glabris differt.**

Perennial rosulate herb with short stem. *Leaves* congested, all basal, petiolate; petioles 4–13cm long with narrow wings and joined across the node, blades thin elliptic, 13–26 × 6–12cm, apex obtuse, base rounded, margin indistinctly crenate, glabrous above, nearly glabrous beneath except for the lanate veins; veins smooth above, raised beneath, lateral veins 10–15 pairs, veinlets reticulate. *Inflorescence* terminal paniculate with elongate flowering stem, from the cauline node to the first node developing cymes c.22cm long with one or two pairs of much reduced floral leaves bract-like measuring 30 × 8mm, rarely the cymes (or secondary panicles) also coming out from the axils of the basal leaves. *Flowers* not seen. *Infructescence* 30–40cm long, nearly glabrous, peduncle bracts elliptic c.3mm long, pedicel bracts sepal-like, pedicel 1–2cm long; calyx glabrous, c.2.5–3mm long, 5-parted to the base, segments narrow-oblong. *Capsule* linear, c.3cm long, glabrous, twisted. *Seeds* ellipsoid, 0.5 × 0.2mm. Type: China, Yunnan, Pu'er, cliff, 4500ft (1400m), 1901? (fr), A. Henry 13394 (holo. E, iso. K).

CHINA: Yunnan. Szemao (Simao), W. Mt forest, c.5000ft (1500m), 1900? (fr), A. Henry 12574B (part A) (K).

This species is close to *P. martinii* (Lévl.) B.L. Burt, and like it has at least one pair of reduced leaves on the flowering stem; but differs by its large leaves and infructescence (as well as the calyx) being nearly glabrous.

Part B of Henry 12574B (K), may be another undescribed species differing in: lamina distinctly pubescent above, clearly serrate, inflorescence not a terminal panicle but a true cyme. The material is scarcely adequate for description.

***Paraboea pubicorolla* Xu & Burt, species nova affinis *P. cochinchinensi* (C. B. Cl.) B. L. Burt, sed inflorescentiis glabris, corollis glanduloso-pubescentibus, capsulis tenuioribus differt.**

Perennial caulescent herb, with short stem or rhizome 3–10cm long, terete, c.4mm diam. *Leaves* opposite and congested, subrosulate, petiolate; petioles 1–5.5cm long, with narrow wings and joined across the nodes; blades ovate or elliptic, 4–13 × 2.5–8.5cm, apex acute or obtuse, margin entire, base shortly angustate, arachnoid or glabrescent above, greyish lanate beneath; veins smooth above, raised beneath, lateral veins c.10 pairs, veinlets obscure. *Inflorescences* subterminal cymose, brown in colour when dry, glabrous except the pubescent corolla, often two opposite, or sometimes 1 or 3, axillary near the apical bud, much longer than the leaves, 25–35cm tall, 5–7cm across, many-flowered; peduncle c.22cm long with bracts ovate or narrowly so 5 × 2–5mm; pedicel bracts similar in size to calyx segment or slightly wider; pedicel c.5mm long. *Calyx* 2–3mm long, 5-parted, segments slightly obovate or oblong c.2 × 0.5mm.

Corolla (purple, or corolla tube lilac, lobes blue, *fide* labels) c.10mm long, 10mm across, outside pubescent, inside glabrous, tube c.7mm long, limb 2-lipped, upper lip 2-lobed, lobes rounded c.4.5 × 4.5mm, lower lip 3-lobed, 2 side lobes rounded c.3 × 3.5mm, middle one obovate, 4 × 3.5mm. *Stamens* 2; anthers transversely ellipsoid, c.1 × 3mm, coherent with each other, turning the apex toward the gynoecium, opening at the end upward rather than in the middle inside, dorsifixed, somewhat pubescent; filaments c.4mm long, in the middle curved and twisted like a 'S' forming a knee, upper part c.1mm wide, lower part slender c.0.3mm wide, minutely pubescent; staminodes two. *Gynoecium* c.8mm long; ovary c.0.8mm wide, smoothly passing into style, stigma more or less oblique. *Capsule* linear, needle-like, 2.5–3cm long, c.0.6–1mm diam., glabrous, twisted. *Seeds* with flattened faces, ellipsoid or ovoid, c.3 × 1mm.

Type: Thailand, Sisaket Province, Dongrak Range (14°30'N 104°00'E) at Ching Bat Lak, Kantaralak District, 500m, on moist sandstone rocks by shaded stream zone, 17 vii 1976 (fl, fr), *Maxwell* 76–530 (holo. L, iso, BK).

THAILAND: Sisaket Province. Khao Phra Viharn (15°07'N 104°20'E), c.400m. sandstone, 24 viii 1972 (fl, fr). *T. Smitinand* 11676 (BK F).

One specimen collected from Vietnam, Col de Mangiang, Prov. Guinhon (Guy Nhon, 13°47'N 109°11'E), in forest, 800m, on rock, 19 viii 1930 (fl, fr), *Poilane* 18024 (P), is similar to this species in the glabrous inflorescence and the morphology of bracts and the flowers, but differs as follows: inflorescence equal in length to the leaves, pedicel slightly glandular pubescent, stigma more or less 2-lobed. By contrast the typical plants have: inflorescence much longer than leaves, pedicel glabrous, stigma more or less oblique.

Further study is needed to clarify the position of the Vietnamese specimen and so it is not included in the description of the species.

***Paraboea rabilii* Xu & Burtt, species nova** *P. suffruticosae* (Ridley) B.L. Burtt affinis, sed foliis integris, calycibus brevioribus, fructibus longioribus distinguenda.

Perennial shrublet, stem woody c.3.5mm diam., bark peeling off when old. *Leaves* alternate, congested at the apex of the stem, petiolate; petiole 0.5–3.5cm long, lanate; blade narrow-elliptic, 1.5–6 × 0.5–1.5cm, 3–5 × as long as wide, apex acute or obtuse, margin entire curved upward, base cuneate or angustate, minutely pubescent above, brown-lanate beneath; veins smooth above, raised beneath, lateral veins 8–10 pairs, forming c.45° angle with the midrib, veinlets obscure. *Inflorescence* axillary cymose, c.1.5–5cm long, 1–1.5cm across, many-flowered, sublanate except the flowers; peduncle up to 2.5cm long, peduncle bracts narrow-ovate 3–8 × 1.5–2mm, pedicel bracts sepal-like or a little larger, pedicel 2–5mm long. *Flower* white, glabrous except the calyx. *Calyx* 2–5mm long, 5-parted, segments narrow-ovate, c.4 × as long as wide, white-sublanate outside, glabrous inside. *Corolla* c.5mm long, 6mm across, tube 2mm long, limb 2-lipped, upper lip 2-lobed, lobes wide-ovate c.2.5 × 3.5mm, lower lip 3-lobed, 2 side-lobes wide-ovate 2 × 3mm, middle one obovate 2 × 2.5mm; stamens 2, anthers transversely ellipsoid, 1.5 × 2mm, coherent with each other, open in the

middle inside, dorsifixed, filament c.1mm long. *Gynoecium* c.5mm long, ovary c.1mm across, style c.0.25mm across, stigma slightly larger than the style, capitate. *Capsules* narrow-oblong, 1.5cm long, 1.3mm wide, glabrous, twisted. *Seeds* elliptic or nearly so, 0.5×0.2 mm.

Type: Thailand, Kaochom Lem, Ampo Kaokao, on rock, 1 viii 1929 (fl, fr), *Rabil* 301 (holo. E; iso. ABD, BKF, BM, K).

Paraboea rabilii is similar to *P. suffruticosa* (Ridley) B. L. Burtt in its shrubby habit and alternate leaves, but quite different in having a fruit 3–7 times longer than the calyx in comparison to the relatively short fruit and long calyx of *P. suffruticosa* (fruit to calyx ratio only 1.5:2). The entire and inrolled leaf margins of this species also contrast with the sparsely serrulate flat margins of *P. suffruticosa*.

This species seems to grow on limestone although this is not mentioned on the label.

***Paraboea sabahensis* Xu & Burtt, species nova** affinis *P. candidissimae* B. L. Burtt, sed foliis minoribus et angustioribus plus minusve obovatis, floribus valde minoribus differt.

Perennial caulescent shrublet; stem woody, c.1cm diam., internodes 1–3cm long, white lanate when young, glabrescent when old. *Leaves* in whorls of 3, leaf-base long-attenuate into short petiole 0.5–1.5cm long, with same indumentum as the leaves; blades narrowly elliptic and more or less obovate $6.5\text{--}13 \times 1.5\text{--}3$ cm, 3–5 times as long as wide, apex obtuse, base long-attenuate smoothly passing to a short petiole, margin entire, upper surface densely pubescent covered by an arachnoid layer which is shed when old, white lanate beneath; veins obscure above, more or less visible beneath, lateral veins c.8 pairs. *Inflorescence* terminal, paniculate, white-lanate except the flowers; flowering stems 10–30cm long, first internodes c.3–9cm long, floral leaves intermediate to cauline leaves, 3 cymes from each node; basal cymes c. 10 cm long, many-flowered, peduncle bract 5×3 mm or so, pedicel bracts sepal-like, pedicel c.0.5–1cm long. *Flowers* glabrous except the calyx. *Calyx* 2–3mm long, 5-parted, segments narrow-ovate, c.4 times as long as wide, white-lanate outside. *Corolla* c.6.5mm long, 8mm across, tube c.2mm long, limb 2-lipped, upper lip 2-lobed, lobes wide ovate, $c.3 \times 3.5$ mm, lower lip 3-lobed, 2 side-lobes wide ovate 4×5 mm, middle one obovate 3×3.5 mm. *Stamens* 2, anthers transversely ellipsoid, 2×3.5 mm, coherent with each other at the apex and the bottom, open in the middle inside, turning the apex toward the gynoecium, dorsifixed; filaments slightly curved, c.2.5mm long, 0.7mm wide. *Gynoecium* c.4.5mm long; ovary c.1mm diam., smoothly passing into the style; stigma capitate, not enlarged. *Capsule* narrowly ovoid, 1–1.7cm long, 1.5–2.5mm across, glabrous, twisted. *Seeds* ovoid, 0.5×0.2 mm.

Type: Sabah, Lamag district, near Bilit, Sopiloring hill, Kinabatangan, in limestone primary forest, 350ft (c.100m), 18 iv 1963 (fl, fr), *Ampuria* SAN 35269 (holo. E; iso. K, L, SAN, SAR).

This species is similar to *P. candidissima* B. L. Burtt in its thick white lanate indumentum, but differs in its smaller and narrower, more or less obovate leaves, and much smaller flower size.

Paraboea tarutaoensis Xu & Burtt, species nova a *P. laxa* (Ridley) B.L. Burtt cauli ad 35cm longo, internodiis 1.5–4.5cm longis, foliis oppositis lanatis et ramoso-pilosis, inflorescentibus foliis brevioribus differt. Fig. 3.

Type: S Thailand, Tarutao Island, Malacca Ck., on limestone rocks, in 30m tall thick forest, 12 x 1979 (fr), Congdon 10 (holo. E, iso. PSU) (herb to 30cm long, stem brown, hairy, S(5), P(5), white, 2-lipped, stamens 2, united apically, common on limestone).

STHAILAND: Tarutao Island, c.4km S of the N Cape of the island, rocky cliff 10–50m, shrub vegetation, 11 i 1986 (fr), Kurzweil HK783 (WU).

Paraboea tarutaoensis is quite different from *P. laxa* (Ridley) B.L. Burtt in: trailing stem (not rhizome) up to 35cm long but slender, only 2mm in diameter; leaves opposite on the stem with internodes 15–45mm long, with the combined indumentum of sublanate, long-pubescent and branched hairs beneath; inflorescence shorter than the leaf and only few-flowered, filaments more or less enlarged.

The new species is somewhat intermediate between *P. laxa* and *P. vulpina* (Ridley) B.L. Burtt, by having both lanate and branched hairs. The type locality, Tarutao Island, is nearby Langkawi, the type locality of *P. laxa*, but *P. laxa* has never been recorded on Tarutao. The habit of the new species is much closer to *P. laxa* than to *P. vulpina*, and the filaments are more or less enlarged, which provides further evidence of its relationship to *P. laxa*.

Paraboea trachyphylla Xu & Burtt, species nova affinis *P. acutifoliae* (Ridley) B. L. Burtt, sed habitu tenuiore, foliis supra pubescentibus serrulatis, ovario glabro differt.

Perennial caulescent herb, stem c.3mm diam., internodes 1–7cm long, tawny lanate when young, glabrescent when old. *Leaves* opposite, without distinctive petiole, slightly oblique, elliptic or nearly so, 3–17 × 1.5–5cm, apex acute or obtuse, margin sparsely serrulate or nearly entire, base attenuate and forming 2 narrow wings on the indistinct petiole, minutely pubescent above, tawny-lanate beneath; veins smooth above, raised beneath, lateral veins 7–10 pairs, veinlets obscure. *Inflorescences* axillary near the apical bud, cymose, usually two opposite, unequal or nearly equal, 11–25 × 5–15cm, many-flowered, totally glabrous or tawny-sublanate except the flower; peduncle 6–15cm long, peduncle bracts very small sepal-like or a little larger, pedicel bracts even smaller, pedicel 2–6mm long. *Flowers* pale pinkish or white (*fide* labels). *Calyx* glabrous or lanate, 2–3.2mm long, 5-parted, segments ovate, c.1.5–3 × as long as wide. *Corolla* c.4mm long, 5mm across, tube c.1.5mm long, limb 2-lipped, upper lip 2-lobed, lobes wide ovate, 2.5 × 2.7mm, lower lip 3-lobed, 2 side lobes similar in size and shape to the lobes of the upper lip, the middle one slightly obovate, size similar to the side ones. *Stamens* 2, anthers transversely ellipsoid, 1.6 × 3.2mm, coherent with each other at the apex, open in the middle inside, basifixed, filaments c.1mm long. *Gynoecium* c.3.5mm long, ovary c.1.2mm across, glabrous, smoothly

FIG. 3. *Paraboea tarutaoënsis*. Holotype.

passing to the short style, stigma capitate not larger than style. *Fruit* a linear capsule, 1.3–1.6cm long, 1.2–1.5mm diam., glabrous, twisted. *Seeds* narrowly ellipsoid, c. 0.5 × 0.15 mm.

Type: Thailand, Surat, Khao Lang Tao, 50km W of Surat, road to Takuapa, 200–300m, common on limestone, 26 ix 1963 (fl, fr), *Smitinand & Sleumer et al.* 1289 (holo. E; iso. BKF, C, P).

THAILAND: Takuapah-Surat Thani road, 20–60km from Takuapah, 8°53'N 98°21'E, 100–250m, 14 vii 1972 (fl), *Larsen et al.* 30949 (E, AAU). Phangnga, Tham Suwankuha, 8°15'N 98°40'E, in rock crevices, 50m, 20 vii 1972 (fl), *Larsen et al.* 31181 (AAU).

Paraboea trachyphylla is similar to *P. acutifolia* (Ridley) B.L. Burt in its inflorescence pattern, but differs by its more slender habit, by its leaves having a pubescence of very short sharp hairs above and serrulate margins, and especially by its glabrous ovary.

The type specimen is different from the other two specimens cited above, in having a totally glabrous inflorescence and white flowers, whereas the others have a tawny lanate inflorescence and pinkish flowers.

***Paraboea uniflora* Xu & Burt, species nova** *P. lanatae* (Ridley) B.L. Burt affinis, sed nervis prominentioribus, inflorescentiis unifloris differt. Fig. 4.

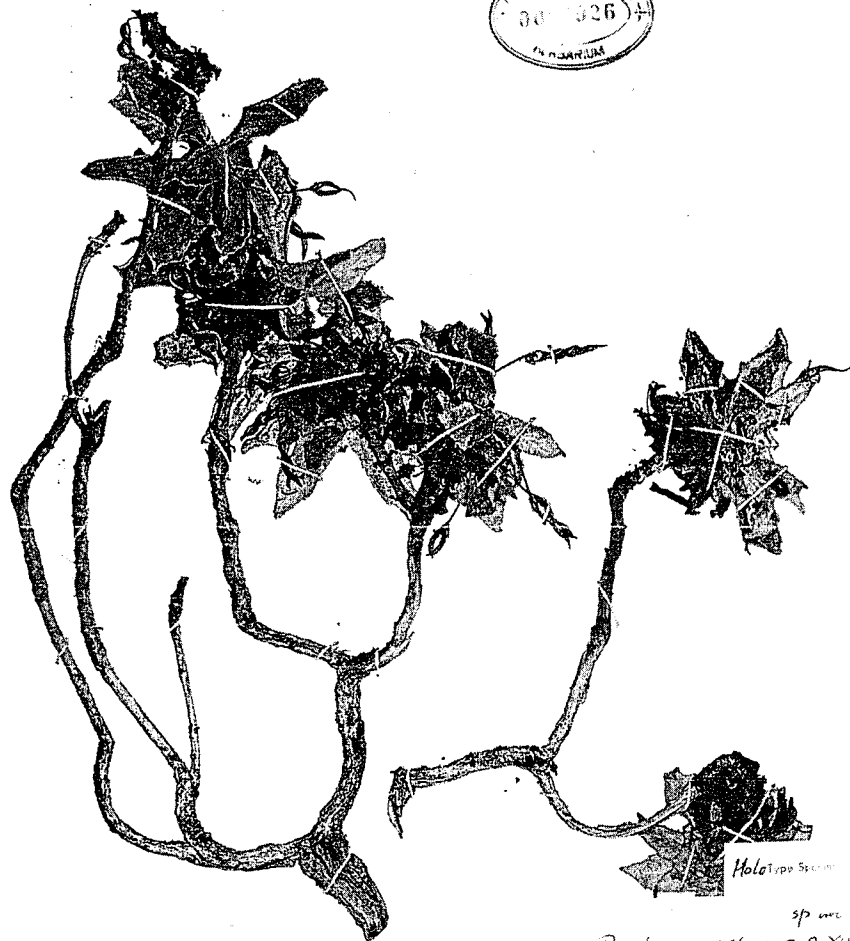
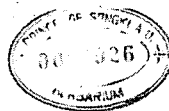
Semishrub with branched woody stem, stem tawny-sublanate when young (1–2 years), glabrous when old (3 years or more), more than 1cm diam., internodes quite short. *Leaves* congested at the apex of the stem, sessile, elliptic 1.5–2.5 × 0.8–1.5cm, apex acute or obtuse, base angustate or attenuate, margin entire, white-lanate beneath, looser and thinner covering of strigulose pubescence above; veins smooth above, raised beneath, lateral veins about 5 pairs, forming an acute angle of less than 45° with the mid-rib; veinlets invisible. *Inflorescence* axillary single-flowered, pedicels 1.5–2.5cm long, white-sublanate. *Flower* (corolla pale lilac to blue, calyx very pale green, anthers yellow; *fide* Maxwell). *Calyx* c.4.5mm long, 5-parted, segments narrowly oblong 6–10 × as long as wide, outside white-sublanate, inside glabrous. *Ovary* ovoid, 3.5 × 1mm, glabrous, style 4.5mm long, stigma capitate, a little larger than style. *Capsule* narrow-ovoid, 1–2.5cm long, glabrous, twisted. *Seeds* not seen.

Type: Thailand, Songkla, Sadao District, Kao Roop Chang, Padnag Besar, on open, rugged summit of a limestone peak, 11 vii 1986 (fr, fl fragment), *J. F. Maxwell* 86451 (holo. PSU).

This species is unique in the genus on account of its single-flowered inflorescence. In habit it seems close to *P. lanata* (Ridley) B. L. Burt, but the nerves of the leaves are more prominent in *P. uniflora*.

***Paraboea variopila* Xu & Burt, species nova** *P. trachyphyllae* Xu & Burt affinis, sed inflorescentibus, floribus et fructibus glanduloso-pubescentibus distinguenda.

Perennial caulescent herb, stem c.30–50cm tall, 7mm diam., internodes 1.2–7cm long, when young more or less compressed and greyish brown lanate and then becoming terete and glabrescent. *Leaves* opposite, sessile, obovate, (5–)11–17cm long,



sp. nov.
Paraboea uniflora Z. R. Xu
& B. C. Buril

Determined Xu Zhuran 1993 7-E

FLORA OF THAILAND

Prince of Songkla University, Haad Yai, Songkla Province, Thailand

FAMILY: *Simarubaceae*
BOTANICAL NAME: *Paraboea uniflora*

Common Name: *ใบไม้เถา*

Province: *Haad Yai*
Location: *Haad Yai, Songkla Province*

District: *Haad Yai*

Elevation: *200* m

Date: *11 July 1986*

Habitat: *Forest edge, on limestone soil, 20-30 m tall; flowers white, petals 5, sepals 5, fruit green; leaves ovate, serrated, petiole 1-2 cm, petiole 1-2 cm, petiole 1-2 cm.*

Notes: *Flowers white, petals 5, sepals 5, fruit green; leaves ovate, serrated, petiole 1-2 cm, petiole 1-2 cm, petiole 1-2 cm.*

Collected By: *Z. R. Xu & B. C. Buril*

Number: *451*

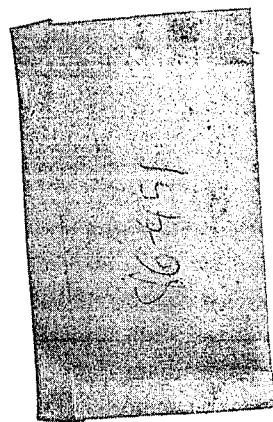


FIG. 4. *Paraboea uniflora*. Holotype.

(2-)3-5.5cm wide, apex obtuse, blade narrowed downwards then slightly expanded just above the base, margin sparsely serrulate or entire, dense pubescent with very short sharp hairs above, greyish-orange lanate beneath; veins smooth above, raised beneath, lateral veins 5-11 pairs, veinlets obscure. *Inflorescence* axillary near the apical bud, cymose, 10-17 × 3-15cm, many-flowered, with dense dark brown glandular hairs; peduncle (2-)4.5-9cm long, compressed, c.2mm wide, peduncle bracts sepal-like, pedicel bracts very tiny, c. $\frac{1}{3}$ size of sepal or invisible; pedicel short, c.1-2mm long. *Calyx* (2-)4.5mm long, 5-parted, segments linear, c.10 × as long as wide, inside glabrous, outside with the same indumentum as that on the inflorescence. *Corolla* (pinkish white, *fide* label) c.6mm long, 8mm across, outside with same indumentum as the inflorescence, inside glabrous, tube 2mm long, limb 2-lipped, upper lip 2-lobed, lobes ovate 3.5 × 2.2mm, lower lip 3-lobed, 2 side lobes similar in size and shape to the lobes of the upper lip, the middle one slightly obovate or elliptic, similar in size to the side lobes. *Stamens* 2; anthers transversely ellipsoid, 2 × 3mm, glabrous, coherent with each other at the apex, open in the middle inside, turning the apex towards the gynoecium, basifixed; filaments c.1.5mm long. *Gynoecium* c.6mm long; ovary c.1.2mm wide, pubescent, smoothly passing into the style; stigma enlarged capitate. *Capsules* narrow oblong or linear, 1.5-2.7cm long, c.1.7mm in diam., with dark brown glandular hairs, slightly twisted. *Seeds* narrowly ellipsoid, c.0.5 × 0.1mm. Type: Thailand, Peninsular, Surat Thanee (Tani) Prov.: common on stone in evergreen forest, 12 viii 1975 (fl, fr), D. Praphat 8 (holo. E, iso. BKF).

THAILAND: Pa Nom district, Khao Sok National Park, limestone hill, 100-200m, 12 xii 1979, T. Shimizu et al. T27070 (BKF).

This new species is similar to *P. trachyphylla* Xu & Burt in its habit and inflorescence, but quite different in its densely glandular-hairy inflorescences, flowers and fruits.

In this genus, three species share the common character of a capsule that is only slightly twisted: *P. dictyoneura* (Hance) B. L. Burt, *P. trachyphylla*, and this new species. *P. dictyoneura* is a rosulate plant with alternate leaves, while the other two have opposite leaves and are easy to distinguish from each other by the indumentum on the inflorescence.

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