

Four new species of *Breynia* (Phyllanthaceae / Euphorbiaceae sensu lato) and one new combination from Thailand and Malaysia

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ABSTRACT. Four new species in *Breynia* are described. These species belong in fact to the genus *Sauropus*, but this publication anticipates the formal transfer of all *Sauropus* species to *Breynia*. *Breynia lithophila* sp. nov., *B. carnosa* sp. nov., and *B. obscura* sp. nov. are local endemic species hanging down from limestone rocks. *Breynia repens* sp. nov. is found on the ground in rainforest and displays a variegated leaf. Three of the species are new for Thailand, and one is new for the Malay Peninsula. The new Malay species was formerly tentatively identified as '*Sauropus calcareus*': this species is described again here and the new combination *Breynia calcarea* is made.

KEY WORDS: *Breynia*, Euphorbiaceae, Malay Peninsula, Phyllanthaceae, *Sauropus*, Thailand.

INTRODUCTION

The generic delimitation within the tribe Phyllanthae (sensu Hoffmann et al., 2006, based on the phylogenies produced by Kathriarachchi et al., 2005, 2006) is difficult. Genera like *Glochidion* J.R.Forst. & G.Forst., *Sauropus* Blume, and *Breynia* J.R.Forst. & G.Forst. are phylogenetically embedded in *Phyllanthus* L. and the option exists to unite them all under *Phyllanthus*. However, though this large genus might be monophyletic, it is neither easily recognizable nor tenable. We prefer the other option, to divide *Phyllanthus* into monophyletic genera that can be identified. Van Welzen (2003) revised the Thai and Malesian species of *Sauropus* in the circumscription of Airy Shaw (1980), whereby the genera *Sauropus* and *Synostemon* F.Muell. are united. Recent molecular research by Pruesapan et al. (2008 and in prep.) showed that *Synostemon* has to be separated again from the Asian species of *Sauropus* (*Sauropus* s.s.; Fig. 1), because it forms a monophyletic group separate from *Sauropus*. However, the molecular analysis also showed that the genus *Breynia* is embedded in *Sauropus* s.s. and together these two genera form a monophyletic group too (Fig. 1). Therefore, in the near future, we will refer all

Sauropus species to *Breynia* (the older generic name) (Pruesapan et al., in prep.). We already anticipate this publication by referring the species newly described here to *Breynia* (otherwise they are typical *Sauropus* species).

There are two major clades within *Breynia-Sauropus* s.s. (Pruesapan et al., 2008, in prep.; Fig. 1). The four new species described here and the new combination belong to the clade formed by the former sections *Glochidioidei*, *Sauropus*, and *Schizanthi* (Fig. 1), a group generally characterized by large leaves (even though the four new species have small leaves) and no marginal rim on the top of the ovary. The stigmas are still functional, flat on the flat top of the ovary and apically split and curved. The other clade, including *Breynia* often has pistillate flowers with reduced stigmas (with a reversal to well developed stigmas in *B. retusa* (Dennst.) Alston), because of the obligate pollination by *Epicephala* moths (Kawakita & Kato, 2009).

The four new species are all local endemics. Three are found on limestone and hang down from the bare rock while rooting in crevices. These species are often termed cremnophytes. Two other species from a similar habitat have already been

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described: *Sauropus poomae* Welzen & Chayamarit (2001), from Chiang Rai, Thailand, and *S. calcareus* M.R.Hend. from Pahang, Malaysia. Van Welzen (2003) referred two specimens to the latter species, but the recent collections from Thailand show that quite a number of species have specialised on limestone. It is now clear that the Malay non-type specimen (*Molesworth-Allen* s.n., SING), even though quite poor, should be regarded as a separate species.

'*Sauropus calcareus*' and *Breynia carnosa* are woody and have a dark brown outer bark that fissures and partly detaches, while both have small leaves that are slightly peltate. *Breynia carnosa* has hairs (*S. calcareus* is glabrous), much thicker leaves than *S. calcareus*, coriaceous staminate and pistillate calices instead of thin calices, and staminate calyx lobes that apically split instead of being rounded.

The other three new species are more herb-like in that the branches remain green and the bark does not fissure; also, the leaves have a basal attachment. Morphologically, *Breynia lithophila* and *B. repens* could have been conspecific, though variable, but molecular data demonstrates that they are distinct (Pruesapan et al., 2008, and in prep.).

Breynia repens has two types of leaves: along the basal part of the branches the leaves are very small and usually broader than long, while at the tip of the branches there are elliptic leaves, twice as long as wide (all similar, longer than wide and ovate in *B. lithophila*). The leaves of *B. repens* are thinner and variegated, and the stipules longer than those of *B. lithophila*, while short papillae are restricted to the stigmas in *B. repens* and all over the ovary in *B. lithophila*. Both species have more or less round, hardly lobed staminate calices, while *B. obscura* has deeply incised staminate calices, the lobes being only united basally. The leaf blades of *B. obscura* are more or less round and very thin, much thinner than the other two species.

There are not enough data to assess the conservation status of the species as they are known from the type specimens only. They fall within the IUCN Red List category DD = Data Deficient (IUCN, 2001). All species are probably rare local endemics and as such the populations will be small and vulnerable and might even be endangered. However, the Thai species were all collected in protected areas, which might guarantee their safety.

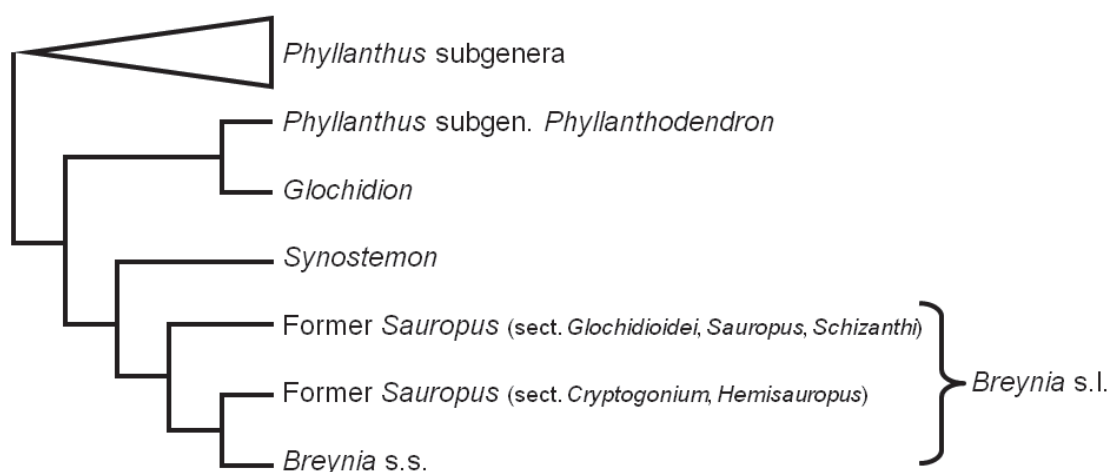


Figure 1. Simplified phylogeny of *Breynia* and related genera (after Pruesapan et al., 2008, in prep.). *Breynia* s.s. together with *Sauropus* and excluding *Synostemon* will be a monophyletic, recognizable group.

KEYS

The key to the Thai species (Welzen & Chayamarit, 2001) can be changed accordingly (www.nationaalherbarium.nl/thai-eph): Lead 1a to 1'

- 1'a. Plants subshrubs on limestone 1''
- 1'b. Plants subshrubs to shrubs growing in other habitats 2
- 1''a. Leaf blades slightly peltate. Outer bark dark brown and flaking. **B. carnosa**
- 1''b. Leaf blades basally attached. Outer bark green and not flaking 1'''
- 1'''a. All leaf blades more or less equal in size, longer than wide, ovate, not variegated. Stipules ca 1.2 mm long. Ovaries completely covered with short papillae. **B. litophila**
- 1'''b. Basal leaf blades small, wider than long, upper ones longer than wide but elliptic, variegated. Stipules 2–3.2 mm long. Ovaries smooth except for the papillae on the stigmas lobes. **B. repens**

The key to the Malesian species (Welzen, 2003) can be adjusted accordingly (www.nationaalherbarium.nl/euphorbs): Lead 2a will not be *S. calcareus* but *B. obscura*.

DESCRIPTIONS

Breynia calcarea (M.R.Hend.) Welzen & Pruesapan, **comb. nov.**— *Sauropus calcareus* M.R.Hend., Gard. Bull. Straits Settlement. 7: 121. 1933; J. Malayan Branch Roy. Asiatic Soc. 17: 72. 1939; Whitmore, Tree Fl. Malaya 2: 130. 1973; Welzen, Blumea 48: 350. 2003, map 8.— Type: Malaysia, Pahang, Gunung Senyum limestone hill, 31 July 1929, SF (Henderson) 22316 (holo **SING!**, barcodes: SING 0032822, SING 0046765; iso **K!** (4 sheets), **KEP**, **NY**).

Subshrub; branches round, glabrous, outer bark of branchlets blackish, fissuring and flaking; flowering branches 0.7–0.9 mm thick. Indumentum absent. Stipules triangular, 1.5–2.3 by 0.8–1.2 mm, stiff, persistent. Leaves simple, alternate; petiole ca 1.5 mm long, round; blade ovate to round, 1.5–2.8 by 1–2.3 cm, length/width ratio 1.2–1.4, very thin, almost translucent, symmetric, base slightly peltate, emarginate to truncate, margin entire, flat, apex emarginate to subacute, upper surface drying greyish green, lower surface drying more olive green; nerves 6–8 per side, looped and closed near the margin; venation very distinct, reticulate, raised on both sides. Inflorescences axillary fascicles to very short racemes (up to 5 mm long); flowers single or a few together, red. Staminate flowers (partly after Henderson, 1933): 1.6–2 mm in diam.; pedicel up to 8 mm long, round, slightly thickening upwards; calyx consisting of 6 almost completely connate lobes, disc-like, lobes ca 0.5 by 1 mm, apex rounded; scales present; staminal column very short, anthers small. Pistillate flowers ca 3.5 mm in diam.; pedicel 2–3 mm long; calyx consisting of 6 basally

connate lobes, lobes ca 1.9 by 1.5 mm; ovary ca 1 mm high, top flat, without marginal rims, stigmas 3, flat on top of ovary, apex split and circling for ca 180°. Fruits depressed globose, ca 4.5 mm in diam., black when dry. Seeds straw-coloured.

Distribution.— Endemic to the Malay Peninsula (Pahang).

Ecology.— On limestone; ca 35 m altitude. Flowering and fruiting: July.

Note.— This description is an amendment to that published in Van Welzen (2003). Diagnostic characters include the absence of hairs and the slightly peltate leaf blades.

Breynia carnosa Welzen & Pruesapan, **sp. nov.**, *Breyniae calcareae* similis habitu suffrutescenti super petras calcareas penduloso, sed ramis pubescentibus, foliis crassioribus carnosius, margine incrassato, infra colore alio, calycibus staminatis pistillatisque succulentioribus, calycis staminati lobis breviter partibus duabus triangularibus fissis differt.— Type: Thailand, Surat Thani, Phanom, Khao Sok National Park, 9°00'58" N, 98°44'24" E, 2006, Middleton, Hemrat, Lindsay, Suddee & Suwanachat 4070 (holo **L!**, barcode: L 0787125; iso **A**, **BKF!**, **L!**, barcode L 0845595). Fig. 2.

Subshrub, hanging, up to 20 cm high; flowering branches up to 2 mm thick, dark grey (brown when dried), slightly angular, bark fissuring and slightly detaching along fissures. Indumentum of short, simple, whitish hairs, only on branches, rest glabrous. Stipules triangular, 0.9–1.2 by 0.6–0.8 mm, completely hairy, caducous. Leaves alternate, simple; petiole 1.5–2 mm long, round, (sub)

glabrous; blade ovate to rounded to elliptic, 1.1–2.2 by 1.1–1.8 cm, length/width ratio 1–1.2, succulent, symmetric, glabrous, base slightly peltate, slightly emarginate, margin entire, thickened underneath and drying brownish instead of greenish, apex slightly emarginate to rounded, upper surface grey-green when fresh, lower surface pale green; nerves 4 or 5 per side, looped and closed near the margin; venation hardly visible, mainly so beneath. Staminate flowers single per axil, ca 4.5 mm in diam., dark red, glabrous; pedicel ca 4.5 mm long, round, slight thickening upwards; calyx 6-lobed,

lobes connate for up to 2/3rd, triangular, 0.8 by 1.7 mm, succulent, upper part split for 0.3 mm into two triangular lips; scales present; androphore ca 0.2 mm high, branches up to 0.5 mm long, anthers ca 0.6 by 0.6 mm. Pistillate flowers single per axil, ca 5 mm in diam., dark red, glabrous; pedicel ca 1 mm long, thickening upwards, round; calyx consisting of 6 basally connate lobes, 3 outer lobes \pm obovate, ca 1.5 by 1.8 mm, apex round, inner 3 lobes ovate-elliptic, ca 2 by 2.3 mm, apex broadly acute; ovary ca 1 by 1.5 mm, 3-locular, 2 ovules per locule, top \pm flat, slightly deepened, without marginal rim,

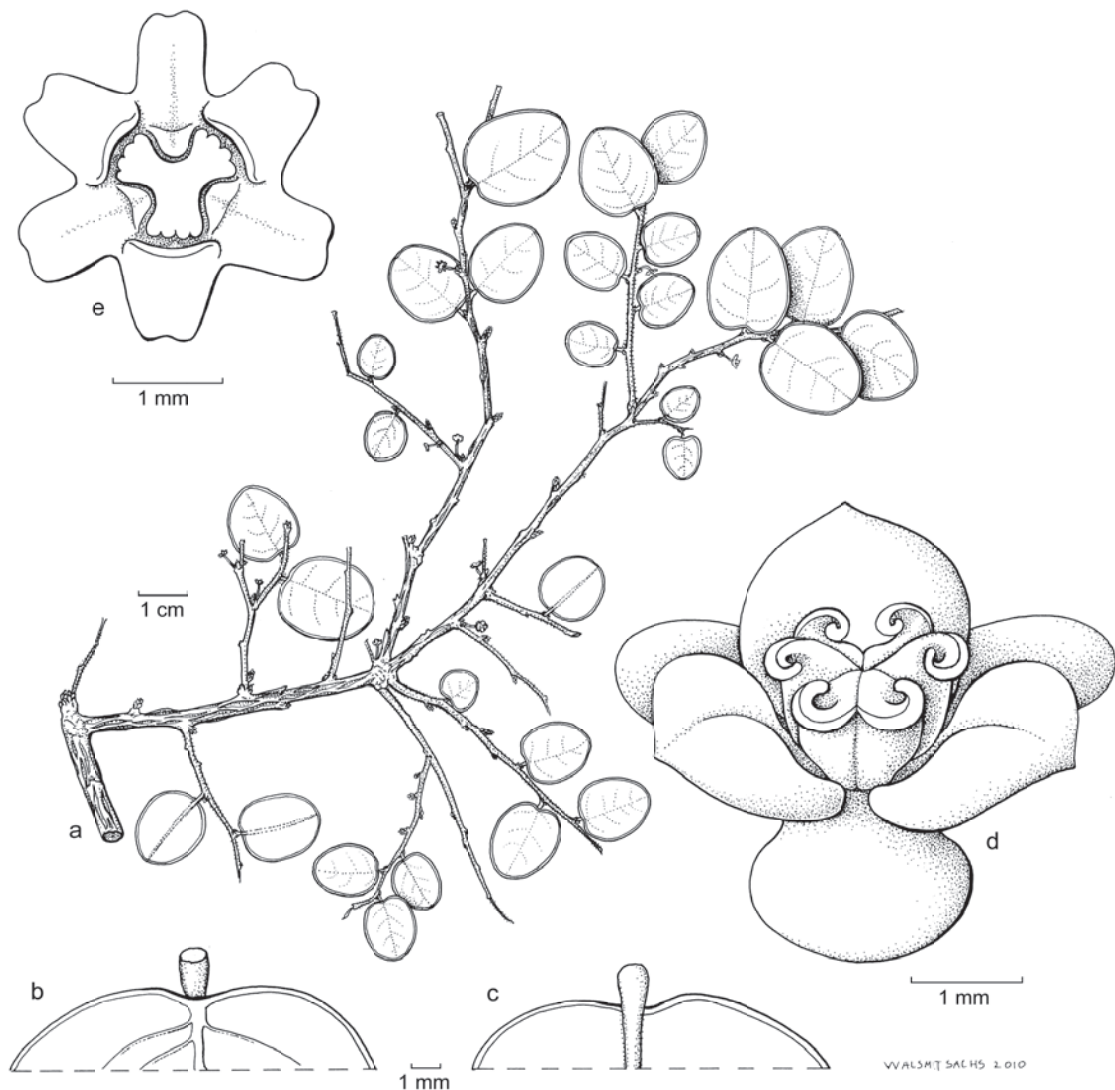


Figure 2. *Breynia carnosa* Welzen & Pruesapan: a. habit; b. base of leaf blade upper surface, slightly peltate; c. base of leaf blade lower surface; d. staminate flower; e. pistillate flower (Middleton, Hemrat, Lindsay, Suddee & Suwanachat 4070, L.). Drawing by Anita Walsmit Sachs, 2010.

stigmas 3, flat on top of ovary, apex split and circling for ca 180°. Fruits unknown.

Thailand.— PENINSULAR: Surat Thani [Khao Sok National Park, *Middleton et al.* 4070 (A, BKF, L)].

Distribution.— Endemic to peninsular Thailand.

Ecology.— Growing on limestone cliffs above water of a reservoir; 200 m altitude. Flowering: February.

Note.— Only known from the type. It resembles *B. calcarea* in being a subshrub with slightly peltate leaves hanging on limestone rocks. It differs in its hairy branches, having much thicker, succulent leaves with a thickened margin that is differently coloured underneath when dry, more succulent staminate and pistillate calyces, and the staminate calyx lobes shortly split into two triangular parts.

Breynia lithophila Welzen & Pruesapan, **sp. nov.**, *Breyniae calcareae* similis habitu suffrutescenti super petras calcareas penduloso, sed ramis floribusque pistillatis pubescentibus, foliis crassioribus carnosus non-peltatis, margine recurvato, calycibus pistillatis carnosioribus, ovario papillato differt.— Typus: Thailand, Chon Buri, Bo Thong, Phluang Thong, Khao Cha-ang, Song Khruang, 13°13' N, 101°36' E, 25 Oct. 2007, *Phonsena, Chusithong, De Wilde & Duyffes* 5594 (holo **L!**, barcode L 0845593; iso **BKF!**, **L!**, barcodes L 0872575, L 0872574). Fig. 3.

Subshrub/herb; branches round, hairy, drying light greenish, bark not fissuring; flowering branches ca 0.7 mm thick. Indumentum of white, patent hairs variable in length, most parts hirsute. Stipules triangular, ca 1.2 by 0.5 mm, hairy on both sides, light green when dry, persistent. Leaves alternate, simple; petiole 1.5–2 mm long, flattened above, hairy; blade ovate, 1.5–3.7 by 0.9–2.8 cm, length/width ratio 1.3–1.7, coriaceous, symmetric, base not peltate, truncate to rounded, margin entire, recurved, apex rounded (to subacute), upper surface somewhat hairy on venation when young, dull, darkish green when dry, lower surface hirsute, light green, dull; venation reticulate, partly to completely distinct underneath, nerves 7 or 8 per side, looped and closed near the margin. Staminate

flowers single or in pairs per node, ca 4 mm in diam., dark red; pedicel ca 5 mm long, thin, slightly broadening upwards, glabrous; calyx almost circular, hardly 6-lobed, thin, glabrous, lobes ca 0.2 by 2.5 mm; scales present; androphore ca 0.2 mm high, branches ca 0.6 mm long, anthers ca 0.6 by 0.6 mm. Pistillate flowers single per node, ca 4.5 mm in diam., greenish to dark red; pedicel ca 1 mm long, thickening upwards, round, hirsute; calyx consisting of 6 basally connate lobes, succulent, hairy outside, glabrous inside, 3 outer lobes obovate, ca 1.4 by 1.8 mm, 3 inner lobes rhomboid, ca 1.8 by 2.3 mm; ovary ca 1.7 by 1.7 mm, papillate all over, 2 ovules per locule, top \pm flat, slightly deepened, without marginal rim, stigmas 3, flat on ovary, apex split and circling for ca 180°, tinged reddish. Fruits not seen, on photo of BKF specimen young fruit globose.

Thailand.— SOUTHEASTERN: Chon Buri [Song Khruang, *Phonsena et al.* 5594 (BKF, L)].

Distribution.— Endemic to southeastern Thailand.

Ecology.— Growing on limestone rocks; 80–120 m altitude. Flowering and fruiting: October.

Notes.— Known from the type collection only. Diagnostic characters include the succulent leaves and flowers with indistinct venation. Species from a similar habitat, e.g. *S. calcareus*, have very thin leaves and calices with a distinct venation.

Breynia obscura Welzen & Pruesapan, **sp. nov.**, *Breyniae calcareae* similis sed foliorum laminis non-peltatis, undamenti praesentia, calycis staminatis profunde incisus differt.— Type: Malaysia, Perak, Ipoh, Gunong Rapat, 31 Jan. 1959 *Molesworth-Allen* s.n. (holo **SING!**). Fig. 4.

Subshrub; branches round, hairy, drying light greenish, bark not fissuring; flowering branches ca 0.7 mm thick. Indumentum of whitish patent hairs, most parts hirsute. Stipules triangular, ca 0.8 by 0.5 mm, hairy, not very persistent. Leaves simple, alternate; petiole ca 0.8 mm long, channelled above, hirsute; blade ovate to round, 1.3–1.6 by 1.3–1.7 cm, length/width ratio 0.9–1.1, very thin, almost translucent, symmetric, base emarginate to truncate, margin entire, flat, apex rounded, upper and lower surface only hairy on the midrib, upper surface darker, lower surface glaucous, venation

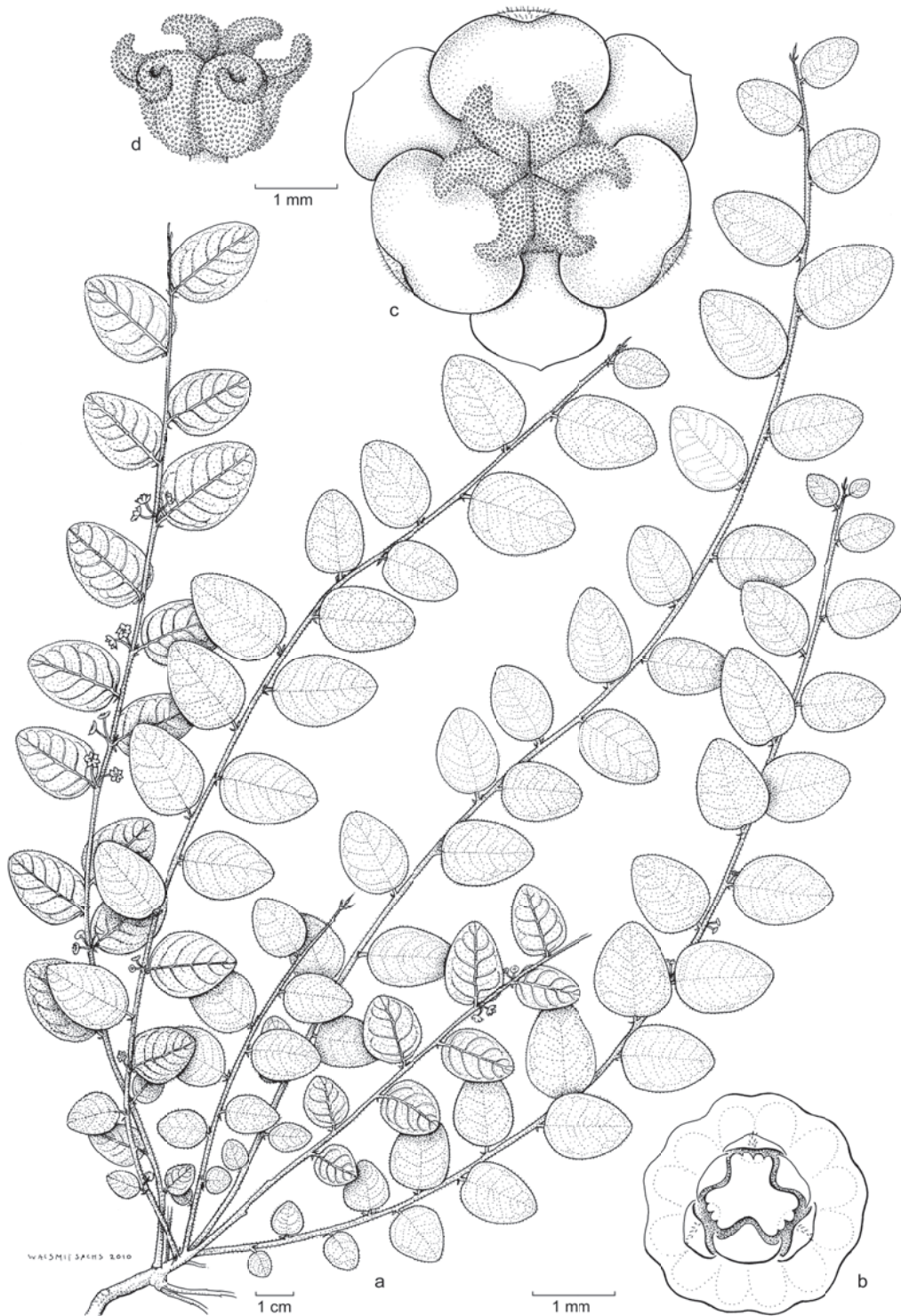


Figure 3. *Breynia lithophila* Welzen & Pruesapan: a. habit; b. staminate flower in top view showing central androecium with anthers underneath, six scales and the calyx; c. pistillate flower in top view; d. gynoecium in side view (Phonsena, Chusithong, De Wilde & Duyfjes 5594, L). Drawing by Anita Walsmit Sachs, 2010.

very distinct, reticulate, raised on both sides, nerves 7 or 8 per side, looped and closed near the margin. Staminate flowers single per node, ca 2 mm in diam., glabrous; pedicel up to 8 mm long, round, slightly thickening upwards; calyx consisting of 6 almost free lobes; scales broader than lobes; staminal column short, anthers small. Pistillate flowers, fruits and seeds unknown.

Distribution.— Endemic to the Malay Peninsula.

Ecology.— Limestone ledge, usually in holes on cliffs. Flowering: January.

Notes.— Known from the type collection only, one poor quality specimen (few loose leaves

and a small staminate flower on a short piece of branchlet) with distinct characters like the almost completely free staminate lobes, presence of hairs and basally attached leaves.

Breynia repens Welzen & Pruesapan, **sp. nov.**, *Breyniae lithophilae* similis sed stipulis maioribus, foliis dimorphis, ramorum parte inferiore foliis minimis, distaliter foliis maioribus ellipticis variegatis differt. Ovaria nitida, stigmatibus lobi non nisi papillati nec ovaria toto papillata ut in *B. lithophila*.— Typus: Middleton, Pooma, Suddee, Suwanachat & Williams 2287 (holo **L!**, barcode: L 0845594; iso **A, BKF!, E**), SW Thailand, Prachuap Khiri Khan,

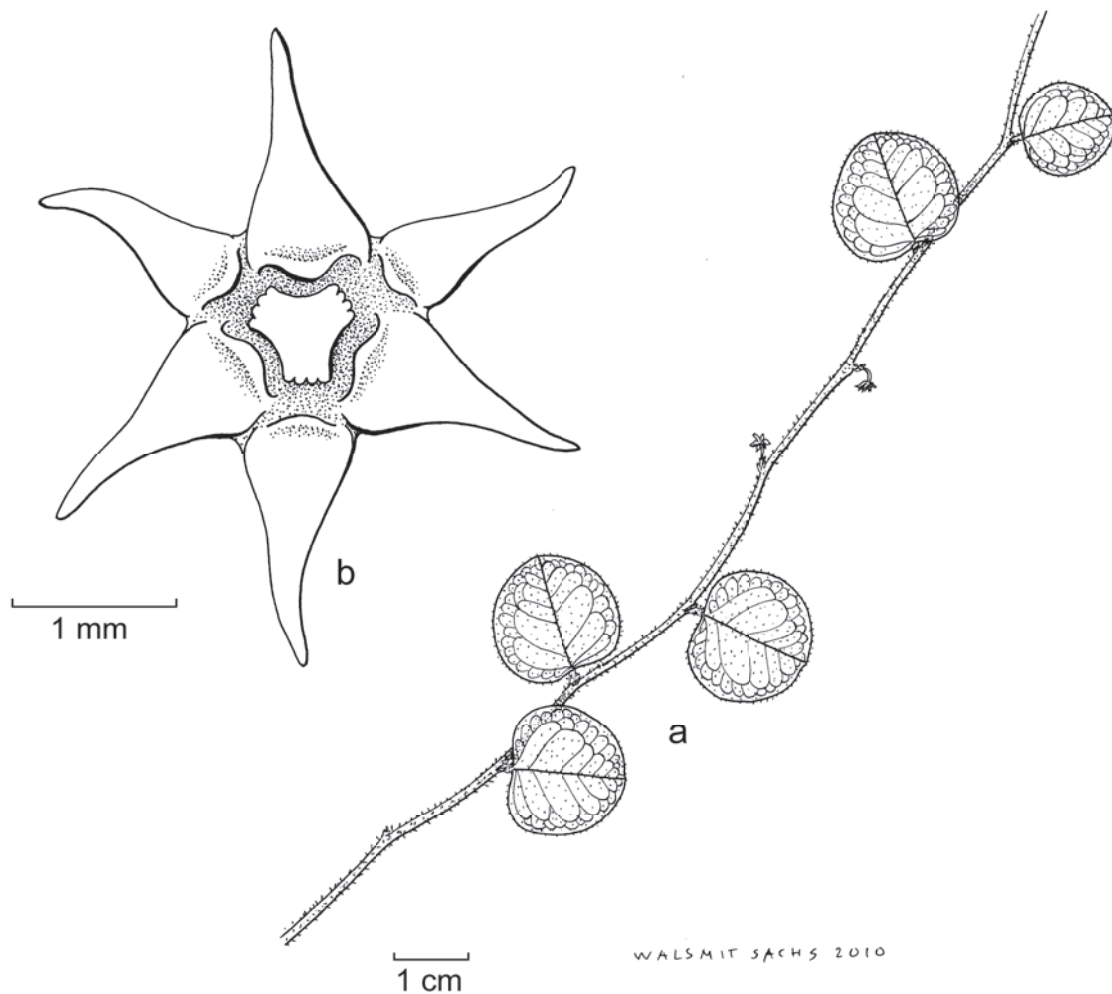


Figure 4. *Breynia obscura* Welzen & Pruesapan: a. habit; b. staminate flower (b. Molesworth-Allen s.n., 31 Jan. 1959, SING). Drawing by Anita Walsmit Sachs, 2010.

Hua Hin, Kaeng Krachan National Park, Pa La U, trail from dam up mountain, 12°31'40" N, 99°30'00" E, 20 Jan. 2004. Fig. 5.

Subshrub/herb; branches round, hairy, drying light greenish, not fissuring, creeping, rooting with axillary roots from branch nodes; flowering branches 0.7–0.8 mm thick. Indumentum of white, patent hairs, most parts hirsute. Stipules triangular, 2–3.2 by 0.6–0.8 mm, only hairy outside, light green when dry, persistent. Leaves alternate, simple; petiole 0.7–2 mm long, flattened above, hairy; blades dimorphic, basal ones on branches small, rhomboid to circular, 0.6–1 by 0.7–1.4 cm, length/width index 0.7–1, with base truncate and apex rounded, upper ones on branches larger, elliptic, 2.4–5.3 by 1.4–2.5, length/width ratio 1.7–2.1, variegated, base cuneate, apex acute, all subcoriaceous, symmetric, margin entire, recurved, upper

surface dull, dark green, slightly hairy on major veins, lower surface dull, lighter green, hairy, venation reticulate, visible on both sides, raised on lower surface, nerves 4–8 per side, looped and closed near the margin. Staminate buds single or in pairs per node; pedicel round, thin, slightly broadening upwards, glabrous; calyx almost round, slightly lobed, glabrous, lobes 6, indistinct; scales present; androphore short, anthers small. Young fruits single per node, ca 5.3 mm in diam.; pedicel ca 4.3 mm long, round, broadening upwards, hirsute; calyx consisting of 6 basally connate lobes, subcoriaceous, lobes rhomboid, outside hairy, outer lobes ca 1.4 by 1.8 mm, 3 inner lobes ca 1.8 by 2.3 mm; ovary with 2 ovules per locule, smooth, apex flat, without rims, stigmas flat, apex split and curved for ca 180°, papillate. Fruits not seen.

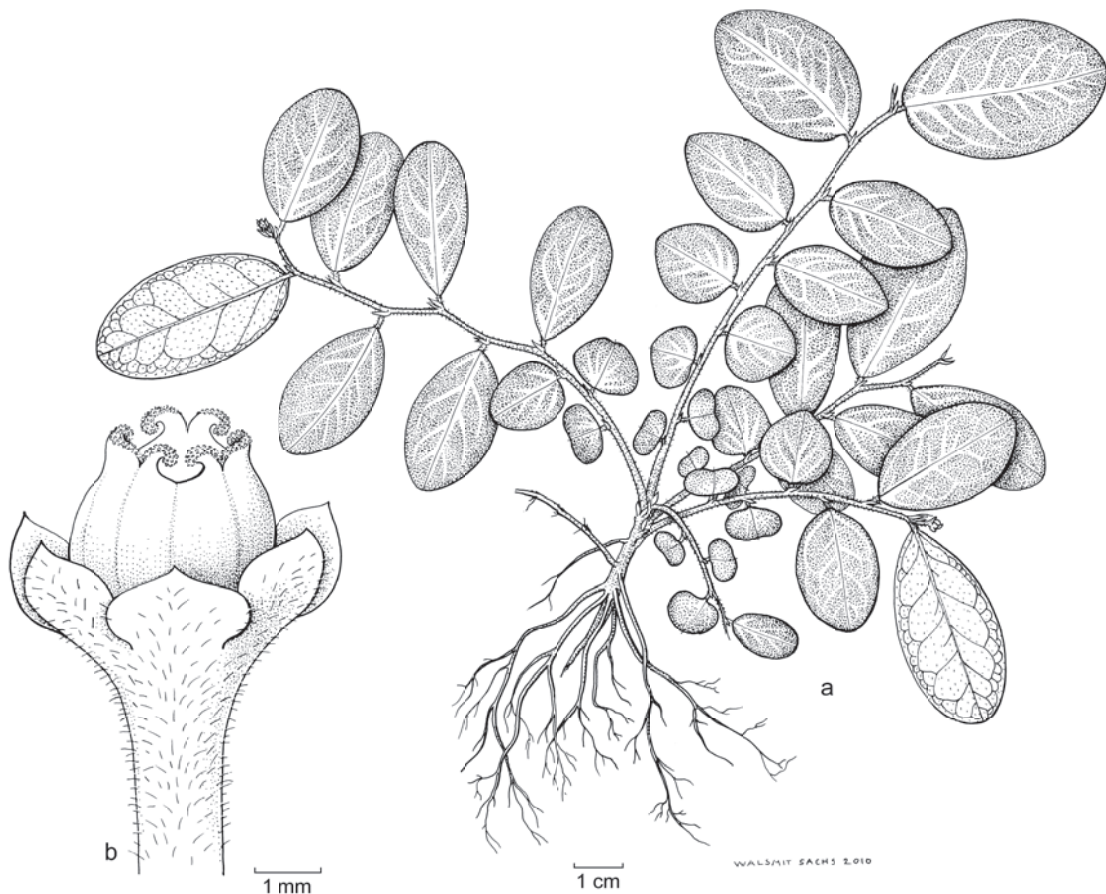


Figure 5. *Breynia repens* Welzen & Pruesapan: a. habit; b. pistillate flower (Middleton, Pooma, Suddee, Suwanachat & Williams 2287, L). Drawing by Anita Walsmit Sachs, 2010.

Thailand.—SOUTHWESTERN: Prachuap Khiri Khan [Kaeng Krachan National Park, *Middleton et al.* 2287 (A, BKF, E, L)].

Distribution.— Endemic to southwestern Thailand.

Ecology.— Creeping in deep shade of secondary forest, probably on limestone. Flowering/fruiting: January.

Notes.— Only known from the type. Diagnostic characters include the smaller leaves along the lower half of the branches and the larger, variegated leaves along the upper part of the branches. Variegated leaves are often typical for ground dwelling plants in tropical forests, other examples can be found in Gesneriaceae, Begoniaceae, etc.

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