

## *Didymocarpus* (Gesneriaceae) in Thailand

Pranee Nangngam<sup>1</sup> and J.F. Maxwell<sup>2</sup>

<sup>1</sup>Department of Biology, Faculty of Science, Naresuan University,  
Phitsanulok, 65000, Thailand

pranee@nu.ac.th (corresponding author)

<sup>2</sup>CMU Herbarium, Department of Biology, Faculty of Science,  
Chiang Mai University, Chiang Mai 50200, Thailand

scopplm@chiangmai.ac.th

**ABSTRACT.** A taxonomic revision of *Didymocarpus* (Gesneriaceae) in Thailand has resulted in eighteen species. Three new species are described: *Didymocarpus inflatus* J.F.Maxwell & Nangngam, *D. jaesonensis* Nangngam & J.F.Maxwell, and *D. payapensis* Nangngam & J.F.Maxwell. A key to the Thai species, detailed descriptions, and notes on distribution, ecology, phenology, salient morphological traits, and illustrations are presented.

**Keywords.** *Didymocarpus*, Gesneriaceae, taxonomic revision, Thailand

### Introduction

Until relatively recently *Didymocarpus* Wall. was a large genus with approximately 180 species (Wang et al. 1998). However, Weber & Burt (1997) split *Didymocarpus* into three genera: *Didymocarpus s.s.*, *Henckelia* Spreng., and *Hovanella* A.Weber & B.L.Burt. *Didymocarpus* was left with about 70 species after the removal of the Madagascan, southern Indian and Sri Lankan, and most Malesian species. The geographical range of *Didymocarpus* is from northwest India, eastwards through Nepal, Bhutan, northeast India, Burma (Myanmar), to southern China, Vietnam, Laos, Cambodia, Thailand, and the Malay Peninsula, with one species, *D. cordatus* Wall. ex DC., reaching northern Sumatra (Weber & Burt 1997).

*Didymocarpus* has been divided into two sections, (1) the entirely Malesian *Didymocarpus* sect. *Elati* Ridl., including *D. corchorifolius* Wall. ex DC., *D. antirrhinoides* A.Weber, *D. sulphureus* Ridl., and *D. robustus* Ridl.; and (2) *Didymocarpus* sect. *Didymocarpus* including all species not in *Didymocarpus* sect. *Elati*, i.e., most of the genus (Weber & Burt 1997). The distinction between the two sections is not very satisfactory, especially for *D. citrinus* D.Don and *D. cordatus* Wall. ex DC. from *Didymocarpus* section *Didymocarpus*, species which are rather similar to those in *Didymocarpus* section *Elati*. The results of molecular phylogenetic studies and character evolution in *Didymocarpus* from Thailand show that *D. citrinus* D.Don is in the same clade as *D. corchorifolius* Wall. ex DC. and *D. antirrhinoides* A.Weber with 100 % bootstrap support (Palee et al. 2006). As the infrageneric classification of *Didymocarpus* requires further research we do not attempt to place the species from Thailand into the existing structure.

Ten species of *Didymocarpus* were published in the *Flore Générale de l'Indo-Chine*, six of them occurring in Thailand (Pellegrin 1930). An additional species, *Didymocarpus bonii* Pellegr. is now recognised as *Petrocodon bonii* (Pellegr.) A. Weber & Mich.Möller (Weber et al. 2011). Surprisingly, none of the 31 species found in China are also found in Thailand (Wang et al. 1998).

Twenty three species of Thai *Didymocarpus* were listed by Barnett (1962a), fourteen of which still belong in *Didymocarpus*, although sometimes now in the synonymy of other taxa. One species, *D. venosus* Barnett, is the type species of the new genus *Tribounia* (Middleton & Möller 2012).

### Materials and Methods

Herbarium specimens were examined from ABD, BCU, BK, BKF, CAL, CMU, E, K, L, PSU, QBG and SING (herbarium abbreviations from Thiers (2012)). Other specimens were collected from field surveys and deposited in the CMU Herbarium. Extra flowers and fruits were preserved in 70% ethanol for morphological, palynological, and taxonomic studies. Pollen and seeds of some species were investigated by scanning electron microscopy and viewed with a JEOL JSM-840 SEM system at 15-20 kV.

### *Didymocarpus* Wall.

*Didymocarpus* Wall., Edinburgh Philos. J. 1: 378 (1819); Don, Prodr. Fl. Nepal. 121 (1825); Clarke in Hooker, Fl. Brit. India 4: 345 (1884); Pellegrin, Fl. Indo-Chine 4(5): 518 (1930); Barnett, Fl. Siam. 3: 211 (1962); Wang et al., Fl. China 18: 349 (1998); Weber & Burt, Beitr. Biol. Pflanzen 70: 333 (1997); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 448 (2000); Burt, Thai For. Bull., Bot. 29: 91 (2001). TYPE SPECIES: *Didymocarpus primulifolius* D. Don

Deciduous perennials, terrestrial or epilithic, often succulent herbs (no shrubs in Thailand). Stems erect, glabrous or pubescent, with few nodes; new vegetative buds produced from the rhizome during the dry season which then develop during the rainy season. Leaves opposite and distichous, less commonly ternate, simple, few to many, usually in unequal pairs (anisophyllous), sometimes isophyllous, new vegetative leaves slightly whorled or tufted in close pairs; exstipulate. Leaf blades mostly subcoriaceous; asymmetrically ovate, lanceolate, elliptic-oblong, oblong, obovate, or orbicular; apex rounded, obtuse or acute; bases obliquely acute or rounded to shallowly cordate; margins variously serrate-dentate; upper surface sparsely to densely sericeous with multicellular hairs, rarely nearly glabrous; lower surface glabrous or pilose, sparsely covered with multicellular eglandular hairs; pigment glands, if present, usually on the undersurface or sparsely so on other organs. Inflorescence cymose, with few to many flowers. Bracts free, paired, ovate, apex rounded; bases broad, margin entire, caducous to persistent. Calyx mostly regular, less commonly irregular; tubular

and free to the base or variously connate, 5-lobed, glabrous or covered with multicellular glandular hairs. Corolla thin, salverform, campanulate or personate; limb bilabiate, 5-lobed, lobes usually rounded; posterior (upper) lip 2-lobed, anterior (lower) lip 3-lobed; glabrous or covered with multicellular glandular hairs. Fertile stamens 2, anterior; anthers coherent, oblong, bilocular, dorsifixed, glabrous or sometimes with white moniliform hairs, villous; locules dehiscent longitudinally; filaments inserted on inside of corolla tube, slender, alternipetalous, glabrous or covered with glandular hairs on the upper part. Staminodes 2–3, posterior, alternipetalous, reduced to minute filaments of unequal length. Pollen spheroidal, tricolpate with long apertures or narrowly elliptic with pointed ends; sculpturing microreticulate, microreticulate-scabrate and rugulate; 10–15 µm diameter. Disc cylindrical or cupular, irregularly and shallowly lobed, glabrous, usually persistent on the capsule. Ovary superior, stipitate, cylindrical, glabrous or with multicellular glandular hairs, 2-locular, with parietal placentation and numerous ovules; style well-developed, glabrous or with glandular hairs; stigma one, capitate or concave. Capsules straight in relation to the pedicel, stipitate, bivalved, dehiscent loculicidally. Seeds numerous, unappendaged; elliptic to reniform; testa reticulate, cell ornamentation straight, cell faces smooth, verrucate, or tuberculate. Basic chromosome numbers  $x = 11, 12, 14, 16,$  and  $18$ .

*Distribution.* About 70 species in North-West India, southern China, South-East Asia and northern Sumatra including 18 species in Thailand.

*Habitat and ecology.* *Didymocarpus* species are usually found in shaded and moist areas, terrestrial, on trees and on various bedrocks. Most species are found between 500–1800 m elevation in primary forests such as mixed evergreen with pine forest and deciduous dipterocarp-oak seasonal hardwood forest, distributed throughout Thailand.

*Habit.* Thai *Didymocarpus* species are perennial herbs usually growing in seasonally moist rocky places. The stems are succulent and somewhat lignified in some species (*D. corchorifolius* Wall. ex DC.), usually curved at base, if erect often with many nodes, up to 1.5 m tall.

Key to Thai *Didymocarpus* species

- 1a. Calyx formed into a tube at base with all calyx lobes less than half the length of the calyx ..... 2
- b. Calyx with lobes free to the base (i.e., at least 2 sepals free) or with a short calyx tube and the lobes more than half the length of the calyx ..... 9
  
- 2a. Corolla salverform, tube geniculate or straight ..... 3
- b. Corolla funnellform, tube gradually widening from the base to the throat ..... 5

- 3a. Corolla  $\geq 3$  cm long (East-Central Thailand) ..... 6. *D. epithemoides*  
 b. Corolla  $\leq 2.5$  cm (North Thailand) ..... 4
- 4a. Corolla tube geniculate, dark violet, lobes whitish or pale green, anthers glabrous  
 ..... 11. *D. kerrii*  
 b. Corolla tube straight, purplish-whitish, lobes purplish, anthers white-bearded  
 ..... 16. *D. purpureopictus*
- 5a. Corolla  $\leq 3.5$  cm long, crimson or violet ..... 6  
 b. Corolla at least 4 cm long or more, of other colours ..... 7
- 6a. Corolla c. 3 cm long, violet; corolla, ovary and anthers glabrous (North Thailand)  
 ..... 10. *D. jaesonensis*  
 b. Corolla c. 3.5 cm long, crimson-red; corolla and ovary covered with  
 multicellular glandular hairs; anthers white-bearded (South Thailand)  
 ..... 12. *D. megaphyllus*
- 7a. Corolla 6–7 cm long, deep maroon-red, paler at anthesis, ovary with pigment  
 glands; leaves with pigment glands; capsule 6 cm long ..... 18. *D. wattianus*  
 b. Corolla  $< 5$  cm long, violet or whitish; ovary glabrous; leaves without pigment  
 glands; capsule 5.5 cm long ..... 8
- 8a. Bracts and calyx not inflated, green-maroon to purple without pinkish hue; calyx  
 asymmetrically campanulate with tube  $< 1.5$  cm long; corolla dark violet with  
 white lines extending to the base of the anterior lip; anthers white-bearded; fila-  
 ments straight, glabrous ..... 3. *D. biserratus*  
 b. Bracts and calyx appearing inflated, dull light violet to white with a faint pinkish  
 hue; calyx campanulate with tube c. 1.5 cm long; corolla tube pale violet to whit-  
 ish, lobes reddish; anthers glabrous; filaments flexed at the middle, upper part  
 pubescent ..... 8. *D. inflatus*
- 9a. Corolla white or pale pinkish ..... 10  
 b. Corolla purple, violet, or distinctly reddish ..... 13
- 10a. Corolla funnelform ..... 11  
 b. Corolla campanulate, personate ..... 12
- 11a. Corolla 3 cm long, with violet or maroon streaks, ovary pubescent (North Thai-  
 land) ..... 1. *D. aureoglandulosus*  
 b. Corolla 1.5 cm long, without streaks, ovary glabrous (Northeast Thailand)  
 ..... 5. *D. dongrakensis*
- 12a. Corolla personate, whitish, with yellow streaks below each sinus of the anterior  
 lip (Peninsula) ..... 4. *D. corchorifolius*

- b. Corolla campanulate, white, without streaks ..... 13. *D. newmanii*
- 13a. Corolla funnellform ..... 14  
 b. Corolla salverform ..... 15
- 14a. Calyx irregular, upper lip composed of 2 free lobes, lower lip connate at base, 3-lobed at apex, leaves opposite (Ranong) ..... 7 *D. geesinkianus*  
 b. Calyx regular, free, 5-lobed to the base, leaves ternate (Northeast Thailand) ..... 9. *D. insulsus*
- 15a. Corolla bicolorous with tube reddish and lobes pale green or whitish (Loei) ..... 2. *D. bicolor*  
 b. Plant not as above ..... 16
- 16a. Calyx campanulate, lobed c. 2/3 to the base, pubescent (North Thailand) ..... 15. *D. payapensis*  
 b. Calyx free, 5-lobed to the base, glabrous (Southeast & Southern Thailand) ... 17
- 17a. Leaves opposite, anisophyllous; pigment glands absent, anthers white-bearded (Southern Thailand) ..... 14. *D. ovatus*  
 b. Leaves ternate or 3-pseudoverticillate; red-brown pigment glands present; anthers glabrous (Chanthaburi) ..... 17. *D. tristis*

An enumeration of the species follows. Appendix A gives an identification list of specimens examined, and Appendix B lists accepted and new species names, as well as synonyms.

### 1. *Didymocarpus aureoglandulosus* C.B. Clarke

Repert. Spec. Nov. Regni Veg. 4: 292 (1907) (as *aureo-glandulosa*); Hosseus, Beih. Bot. Centralbl. 28(2): 439 (1911) (*aureo-glandulosa*); Craib, Bull. Misc. Inform. Kew 1911: 431 (1911); Craib, Aberdeen Univ. Stud. 57: 149 (1912) (*aureo-glandulosa*); Pellegrin, Fl. Indo-Chine 4(5): 525 (1930) (*aureo-glandulosus*); Barnett, Dansk Bot. Ark. 20(2): 202 (1962); Barnett, Fl. Siam. 3(3): 211 (1962); Hilliard & Burt, Edinburgh J. Bot. 52(2): 215 (1995); Weber & Burt, Beitr. Biol. Pflanzen 70: 308 (1997); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 453 (2000); Burt, Thai For. Bull., Bot. 29: 91 (2001). TYPE: *Hosseus* 220, Thailand, Chiang Mai, Doi Sutep [Doi Suthep], 1650 m, 23 Dec 1904 (holotype K; isotypes BM, E, M, P). Fig. 1A.

*Didymocarpus rodgeri* W.W.Sm. & S.C. Banerji, Rec. Bot. Surv. India 6(2): 42 (1913). TYPE: *Roger* 161, Burma, Ruby Mines Div., Mogok, 4000 ft (lectotype CAL, designated by Hilliard & Burt (1995); isotype K).

*Didymocarpus rodergi* var. *siamensis* W.W.Sm. & S.C.Banerji, Rec. Bot. Surv. India 6(2): 43 (1913). TYPE: Kerr 1996, Thailand, Doi Sootep [Suthep], 5200 ft, 27 Aug 1911 (lectotype CAL, designated here; isotypes BM, E).

Deciduous, epiphytic, perennial herb, less commonly epilithic, up to 33 cm tall. **Rhizome** erect to ascending, 1–2 cm long, c. 5–7 mm thick. **Stems** erect, light green to dark maroon, sparsely to densely sericeous, with peltate, red-brown pigment glands and multicellular glandular hairs. **Dry season leaves** dormant from November–May; blades subcoriaceous, light green, symmetrically ovate, 1.5–3.8 cm long, 2.8–6.5 cm wide, apex obtuse, base acute to truncate, margins shallowly serrate, upper surface densely sericeous with silvery-green/grey multicellular eglandular hairs, lower surface sparsely strigose on the main veins, less so otherwise, densely covered with minute, one-celled, red-brown, peltate, sessile pigment glands, midrib with 6–8 ascending pinnate secondary veins on each side, sunken above, raised underneath, finer venation invisible; petioles terete, 1.3–2 cm long, sparsely sericeous and densely covered with red-brown, pigment glands as on the blades underneath. **Rainy season leaves** developing from the dormant ones at the beginning of the rainy season (June–August) and continuing growth until after fruiting in September when they abscise; blades subcoriaceous, asymmetrically oblong to elliptic, upper surface dark green, 9–23 cm long, 6–14 cm wide, apex rounded to obtuse, base obliquely rounded on one side, acute on the other, margins shallowly and coarsely doubly serrate, upper surface moderately strigose with multicellular eglandular hairs, epidermis visible, lower surface main veins sparsely covered with multicellular eglandular hairs, scattered one-celled, pigment glands, midrib with 6–8 ascending pinnate secondary veins on each side, sunken above, raised underneath; petioles terete, 2–9 cm long, sparsely velutinous with multicellular eglandular hairs, dorsally maroon, ventrally light green. **Inflorescences** arising from among the leaves, axillary, erect, laxly cymose, 10–20 cm long, axes sparsely velutinous with multicellular glandular hairs, peduncle pale brown, other axes pinkish-light green; peduncle 10–16 cm long; pedicels 0.5–1.8 cm long. **Bracts** slightly asymmetric, thin, lanceolate, 3–5 mm long, 1–1.5 mm wide, densely covered with multicellular glandular hairs as on the peduncle. **Flowers** several, c. 3 cm long. **Calyx** 5-lobed to the base, lobes symmetrically linear-lanceolate, 9–12 mm long, 2 mm wide, tips acute, outside sparsely covered with multicellular glandular hairs as on bracts, light green-whitish. **Corolla** funnellform, 3 cm long, glabrous, whitish to pale pink-whitish with pale violet or pale maroon streaks; tube 2.5 cm long; anterior (lower) lip 3-lobed, lobes orbicular, 6 × 6 mm; posterior (upper) lip 2-lobed, lobes elliptic, 6 × 3 mm. **Fertile stamens** inserted above the middle of the tube; filaments 3–5 mm long, glabrous on the lower part, upper part covered with glandular hairs, light yellow to white; staminodes 3, reduced to filaments, c. 3–5 mm long, glabrous; anther locules oblong, 2 mm long, tips and bases acute, glabrous, cream, orange or white. **Pollen** spheroidal, 11–12 µm, microreticulate; long aperture partly covered with glandular elements. **Disc** cylindrical, 3 mm long, margin irregularly lobed. **Ovary** cylindrical, 10 mm long, sparsely setulose, with indumentum as on the outside of the calyx, pale pinkish; style glabrous, whitish; stigma capitate, whitish or reddish. **Capsules** erect,

symmetrically cylindrical, glabrous, 2-valved, loculicidally dehiscent, 4.5 cm long, 0.2 cm wide. **Seeds** numerous, narrowly elliptic, 0.5 × 0.5 mm, cell orientation straight.

*Distribution.* Northern Thailand.

*Ecology.* Moist, shaded areas in primary evergreen forest, usually growing on tree trunks or in moist rocky places.

*Phenology.* Flowering July–September, fruiting August–December.

*Vernacular name.* Dok Kra Ding (ดอกกระดิ่ง).

*Etymology.* The specific epithet refers to the golden colour of the pigment glands.

*Notes.* *Didymocarpus aureoglandulosus* is distinct from most species found in northern Thailand in the whitish corolla while the other species have a purple to violet or reddish corolla.

*Specimens examined:* THAILAND. **Chiang Mai.** Doi Sutep [Suthep] Pui National Park, c. 1600 m, 17 Aug 2002, *Palee 524* (CMU); *ibid.*, 12 Nov 2002, *Palee 549* (CMU); *ibid.*, 11 Aug 1996, *BGO staff 7057* (QBG); *ibid.*, 17 Sep 2008, *Middleton et al. 4453* (E); *ibid.*, 13 Aug 2012 *Middleton et al. 5578* (E); *ibid.*, 22 Jul 1958, *Larsen & Hansen 4341* (ABD); *ibid.*, 11 Sep 1958, *Larsen & Hansen 4902* (ABD); Mae Wang District, below Pah Ngaem (limestone cliffs), c. 1700 m, 26 Aug 2004, *Palee 701* (CMU); Mae Awn District, Doi Lohn (Lahn), west side, Jae Sawn National Park, c. 1550 m, 28 Sep 2004, *Maxwell 04-526* (CMU); Jawm Tong [Chom Thong] District, near the summit of Mae Soi Ridge, Mae Soi Subdistrict, c. 1625 m, 5 Sep 1992, *Maxwell 92-496* (CMU); Doi Chiang Dao, c. 1300–1500 m, 15 Aug 1963, *Smitinand & Sleumer 1012* (E); *ibid.*, 24 Feb 2003, *Palee 570* (CMU); Mae On, Doi Lan Ranger Unit, Jae Son National Park, epiphyte on tree, c. 1500 m, *Pooma & Pattharahirantricin 7722* (E). **Nan.** Doi Phu Kha National Park, 19.0° N, 101.0° E, c. 1630 m, 30 Jul 1998, *Srisanga 251* (QBG).

## 2. *Didymocarpus bicolor* Craib

Bull. Misc. Inform. Kew 1926: 168 (1926); Pellegrin, Fl. Indo-Chine 4(5): 521 (1930); Barnett, Fl. Siam. 3(3): 212 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 454 (2000); Burtt, Thai For. Bull., Bot. 29: 91 (2001). TYPE: *Unknown collector 83/3*, cultivated plant grown from seeds collected by Kerr from Pu Tong, Thailand, Loei, 1000–1200 m, which flowered in Aberdeen in 1924 (holotype ABD). Fig. 1B.

Deciduous, epilithic, perennial herb. **Dry season** plants unknown. **Rainy season** stem erect, simple or with a few branches, c. 50 cm tall, green, covered with multicellular eglandular hairs. *Leaves:* blades green above, pale green beneath, broadly ovate or oblong-ovate, c. 7–11 cm long, 5.5–6.5 cm wide, apex obtuse, base cuneate, slightly oblique, margins denticulate-serrate with fine hairs, upper surface sericeous, lower

surface with veins covered with multicellular eglandular hairs, pigment glands absent, midrib with 5–6 ascending pinnate secondary veins on each side, obscure above, prominent underneath; petioles 1–3 cm long, covered with multicellular eglandular hairs. **Inflorescences** cymose; peduncle c. 5.5 cm long; pedicels c. 1 cm long, glabrous or sparsely pilose, often reddish. **Bracts** free, broadly ovate, c. 6 mm long, glabrous or sparsely covered with multicellular gland-tipped hairs, apex green, base reddish. **Flowers** numerous. **Calyx** 5-lobed to the base, lobes linear-lanceolate, 3–3.5 mm long, 1–1.5 mm wide, apex obtuse, glabrous. **Corolla** salverform, 2–2.5 cm long, glabrous, tube pale reddish, lower lobes pale green or whitish, upper lobes dark violet-reddish; tube 1.5–2 cm long, basal diameter c. 4 mm; anterior (lower) lip 3-lobed, lobes oblong, c. 3–5 mm long, c. 3–4 mm wide, tips rounded-truncate; posterior (upper) lip 2-lobed, c. 2 mm long, c. 2.5 mm wide, apex rounded. **Fertile stamens** inserted in the upper part of the corolla tube; anthers with very short hairs; filaments slender, whitish, c. 4 mm long; staminodes 2, whitish, c. 1 mm long, occasionally smaller or not well-developed. **Disc** cylindric, 1.5 mm long. **Ovary** 1.8 cm long; ovary lower part reddish, upper part pale green, with scattered, glandular-capitate hairs; style glabrous, pale green; stigma capitate, papillose, green. **Capsules** erect, cylindric, green, 2 cm long, 2 mm wide. **Seeds** numerous, other details not studied.

**Distribution.** Endemic to Thailand. Only known from Loei province, northeast Thailand.

**Ecology.** Plants grow in shade, near streams with higher humidity, or on rocks in evergreen forest.

**Phenology.** Flowering September–November, fruiting December.

**Vernacular name.** Dok Song See (ดอกสองสี).

**Etymology.** The specific epithet refers to the two different colours in the corolla.

**Notes.** The distinctive character of this species is the bi-coloured corolla, of which the tube is reddish or wine-coloured while the three lower lobes are greenish or whitish.

**Specimens examined:** THAILAND. **Loei.** Phu Luang, 26 Nov 1957, *Dee Bunpheng* 998 (ABD); Phu Ruea National Park, along stream, 9 Sep 2009, *Nangngam* 2552 (CMU); Plants cultivated at Royal Botanic Garden Edinburgh from seeds collected from Phu Luang by T. Smitinand, flowering in 14 Oct 1986, *Accession no.* RBG 19850475 (E).

### 3. *Didymocarpus biserratus* Barnett

Nat. Hist. Bull. Siam Soc. 20(1): 11 (1961); Barnett, Kew Bull. 15(2): 250 (1961); Barnett, Fl. Siam. 3(3): 212 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102:

454 (2000); Burt, Thai For. Bull., Bot. 29: 91 (2001). TYPE: *Smitinand 1870* (R.F.D 9482), Thailand, Loei, Phukrading [Phu Kradueng], c. 1300 m, 20 Aug 1954 (lectotype E, designated by Barnett in Kew. Bull. (1961); isotypes BKF, L). Fig. 1C.

*Didymocarpus siamensis* Barnett, Dansk Bot. Ark. 20(2): 201 (1962); Barnett, Fl. Siam. 3(3): 217 (1962). TYPE: *Larsen 6258*, Thailand, Loei, Poo Kradeng [Phu Kradueng], c. 1250 m, 27 Nov 1958 (holotype ABD; isotypes K, BKF).

Deciduous, epilithic, perennial herb. **Dry season** plants unknown. **Rainy season** stems 8–44 cm tall, sparsely and finely villous with multicellular eglandular hairs; green-maroon. **Leaves** paired, anisophyllous; blades subcoriaceous, pale green, symmetrically suborbicular to elliptic, 6–13.5 cm long, 3–8.5 cm wide, apex obtuse to bluntly acute, base rounded to cordate, margins shallowly (smaller blades) to deeply (larger ones) doubly serrate, lower surface with indumentum as on stem, pigment glands absent on both surfaces, midribs with 6–8 ascending secondary veins on each side, obscure above, prominent underneath; petioles dark green, 1.5–10 cm long, covered with an indumentum as on the stems. **Inflorescences** terminal and also often in the upper leaf axils, cymose, 7–14 cm long, axes glabrous; peduncles 5–8 cm long; pedicels 1.5–4 mm long. **Bracts** paired, thin, suborbicular, c. 7 mm long and wide, tips broadly rounded, glabrous, green-maroon to purple, in pairs below and concealing two pedicels and lower parts of the calyx. **Flowers** numerous. **Calyx** asymmetrically campanulate, glabrous, green-maroon to purple; tube 1–1.3 cm long, diameter 4 mm; lobes subequal, apices broadly rounded, anterior 2 lobes 2.5 mm long, posterior 3 lobes 1.5 mm long. **Corolla** funnellform, 4 cm long, glabrous, dark violet with 4 white lines extending to the base of the anterior lip; tube 3–3.5 cm long, basal diameter c. 3 mm, gradually widening from the base to throat; lobes elliptic, tips broadly rounded; anterior (lower) lip 3-lobed, lobes 4 mm long, 7 mm wide; posterior (upper) lip 2-lobed, slightly smaller. **Fertile stamens** inserted c. 1.8–2 cm from the base of the corolla tube; filaments 7 mm long; anthers oblong, 2 mm long, 1 mm wide, densely villous (white-bearded); filaments straight, glabrous, whitish; staminodes 3, inserted c. 1 mm below the level of the stamens, glabrous, lateral staminodes 2.5 mm long, the other one c. 1 mm long. **Disc** tubular, thickened, margin undulate, c. 1.5 mm long, persistent in fruit. **Ovary** cylindrical, c. 1.2 cm long, glabrous; style continuous with the ovary, c. 4 mm long, glabrous; stigma flat, circular, thin, peltate, c. 2 mm diameter and much wider than the style, level with the middle of the anthers. **Capsules** erect, cylindrical, green and maturing light brown, 4–5.5 cm long, c. 1.5 mm wide. **Seeds** elliptic, 0.4 × 0.2 mm, apex truncate, cell orientation straight, cell shape narrowly lineate-polygonate, cell edges elevated and smooth, cell crests fused, faces depressed and finely verrucate.

**Distribution.** Endemic to Thailand. Only known from Loei province, northeast Thailand.

**Ecology.** Plants grow in shade, near streams with higher humidity, or on rocks in evergreen forest.

*Phenology.* Flowering July–August, fruiting August–October, leaves May–October.

*Vernacular name.* Dok Bai Yak (ดอกใบหยัก).

*Etymology.* The specific epithet refers to the doubly serrate leaf margin.

*Notes.* *Didymocarpus biserratus* is easily recognised by the doubly serrate leaf margin. It differs from *Didymocarpus inflatus* in having smaller bracts and corollas.

*Specimens examined:* THAILAND. **Loei.** Phu Kradueng National Park, Wang Kwang Cave, 1125 m, 5 Oct 2003, *Palee 639* (CMU, E); *ibid.*, 24 Aug 1948, *DE 191* (E); *ibid.* 4 Sep 1967, *Shimizu et al. T8863* (SING); Plant cultivated at the Royal Botanic Garden Edinburgh; originally from Phu Krading [Kradueng] National Park, 1200 m, seeds from *Smitinand 10471* collected 18 Oct 1968, flowered Edinburgh 15 Aug 1969, vouchered Sep 1977 as C6744, *accession no.* 19683012 (E); *ibid.*, C8459, *accession no.* 19741960 (E); *ibid.*, C8460, *accession no.* 19741960 (E); without locality, cultivated at Edinburgh 15 Sep 1961, C3717, *accession no.* 19611998 (E).

#### 4. *Didymocarpus corchorifolius* Wall. ex DC.

Prodromus 9: 265 (1845) (*corchorifolia* R. Br.) [Wall., Numer. List 792 (1829), *nom. nud.*; R.Br. in Benn., Pl. Jav. Rar. 2: 119 (1840), *nom. nud.*]; Clarke, Monogr. Phan. 5 (1): 85 (1883) (*corchorifolia* R. Br.); Clarke, Fl. Brit. India 4: 351 (1884) (*corchorifolia* Wall.); Ridley, Fl. Malay Penins. 2: 508 (1923); Burtt, Notes Roy. Bot. Gard. Edinburgh 21: 204 (1954); Barnett, Fl. Siam. 3(3): 212 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 455 (2000); Burtt, Thai For. Bull., Bot. 29: 91 (2001). TYPE: *Wallich 792*, Malaysia, Penang (lectotype G-DC, designated by Weber & Burtt (1983), isotypes BM, E, G, GZU, K, K-W, L, M, WU). Fig. 1D.

Deciduous, epilithic, perennial herb, up to 60 cm tall. **Dry season** new shoots arising from the rhizome. **Dry season stems** erect, densely covered with multicellular eglandular hairs and sparsely covered with one-celled, conical, brown, pigment glands. **Dry season leaves** anisophyllous; blades subcoriaceous, ovate, 1–1.5 cm long, 0.8–1 cm wide, apex acute-acuminate, base obtuse, slightly oblique, margins crenate-serrate, upper surface densely covered hairs as on stem, lower surface densely covered with one-celled conical, brown, pigment glands, venation pinnate, secondary veins 5–6, ascending, obscure above, raised underneath, with dense multicellular eglandular hairs. **Rainy season stems** erect, zig-zag, all parts of plant always densely covered with one-celled, conical, brown, pigment glands. **Rainy season leaves** anisophyllous; blades subcoriaceous, upper surface dark green, lower surface pale green, oblong-lanceolate, 4–17 cm long, 2–6 cm wide, apex acute, base obliquely acute, margins serrate, covered with multicellular eglandular hairs on both sides, venation pinnate, secondary veins 11–14, ascending, obscure above, raised underneath; petioles 1–2.5



**Fig. 1.** **A.** *Didymocarpus aureoglandulosus* C.B.Clark. **B.** *D. bicolor* Craib. **C.** *D. biserratus* Barnett. **D.** *D. corchorifolius* Wall. ex DC. (Photos A, C, D: P. Nangngam, B: W. Makerd)

cm long, densely multicellular eglandular hairs. **Inflorescences** axillary, cymose, up to c. 9 cm long, few-flowered; peduncles 5–7 cm long, glabrous, light green; pedicels 3–5 mm long, glabrous, light green. **Bracts** paired, broadly ovate, 3 mm long, 5 mm wide, glabrous, light green. **Calyx** 5-lobed to the base, glabrous, lobes symmetrical, lanceolate, c. 3 mm long, 1 mm wide, apex acute, light green. **Corolla** personate, 2 cm long, glabrous, whitish; tube 1.5 cm long, widest at throat with a diameter to c. 1 cm; anterior (lower) lip 3-lobed, with a yellow alternipetalous streak below each sinus of the anterior lip, extending nearly to the base of the corolla, lobes sub-orbicular, 8 mm long, 6 mm wide, much longer than posterior lip, lateral lobes reflexed; posterior (upper) lip 2-lobed, lobes 7 mm long, 5 mm wide. **Fertile stamens** inserted at the base of the corolla tube; anthers orbicular, white, c. 2 mm long, c. 2 mm wide, white-bearded; filaments slender, 5 mm long, with moniliform hairs on the upper part; staminodes 3, reduced to filaments, 1–2 mm long. **Pollen** spheroidal, tricolpate with short apertures and verrucate sculpturing, 10 µm diameter. **Disc** tubular, c. 1.5–2 mm long, margins very irregular. **Ovary** 1 cm long, sparsely covered with glandular hairs; style 3–5 mm long, glabrous; stigma ligular, 2-lobed, the longer lobe thin, c. 1 mm long, the other lobe minute. **Capsules** erect, cylindrical, green, pubescent, 3–4 cm long, c. 1 mm wide. **Seeds** elliptic, cell orientation straight, polygonate, faces smooth to slightly verrucate.

**Distribution.** Southern Thailand and western Peninsular Malaysia.

**Ecology.** Evergreen forest on exposed granite bedrock, along streams or on mossy cliffs and the shaded areas of quartzitic-epilite ridges.

**Phenology.** Flowering July–October, fruiting October–December.

**Vernacular name.** Kra Ding Dok Khao (กระตังดอกขาว).

**Etymology.** The specific epithet refers to having leaves like *Corchorus* (Tiliaceae).

**Notes.** *Didymocarpus corchorifolius* is distinct from the other species by the personate corolla with yellow streaks in the throat.

**Specimens examined:** THAILAND. **Songkhla.** Khao Nam Khang National Park, 2 Nov 2003, *Palee* 662 (CMU, E); *ibid.*, 21 Sep 2010, *Middleton et al.* 5501 (E); *ibid.*, 28 Aug 1995 *Larsen, et al.* 46087 (AAU). **Yala.** Betong District, Ban Ko, 8 Aug 2009, *Wai* 1123 (PSU).

### 5. *Didymocarpus dongrakensis* B.L.Burtt

Thai For. Bull., Bot. 29: 91 (2001). TYPE: *Maxwell* 76-531, Thailand, Si Sa Ket, Kantaralak District, Dongrak Range, Chong Bat Lak, 14°30'N, 104°E, 17 Aug 1976 (holotype AAU; isotypes BK, E, L). Fig. 2A.

Deciduous, epilithic, perennial herb, 20–30 cm tall. *Stems* erect, glabrous, light green, all parts of plant densely covered with 4-celled, red-brown, pigment glands. **Dry season** new shoots arising from the rhizome. **Dry season leaves** anisophyllous, ternate; blades symmetrical, subcoriaceous, lanceolate, 1.5–2 cm long, 0.5–0.8 cm wide, apex acute, base acute, margins very shallowly serrulate, upper surface silver-grey, sericeous, lower surface sparsely sericeous on the veins, densely covered with brown pigment glands, venation pinnate, secondary veins 5–7, ascending, obscure above, prominent underneath. **Rainy season leaves** anisophyllous; blades subcoriaceous, oblong, lanceolate to elliptic, light green above, pale green beneath, 7.5–11.5 cm long, 2.5–4.5 cm wide, apex acute, base acute, slightly oblique, margins shallow serrulate, often entire in the lower half, upper surface sparsely covered with multicellular glandular hairs, lower surface glabrous, venation pinnate, secondary veins 5–7; petioles terete, 1–6 cm long, glabrous. **Inflorescences** axillary, crowded among the upper leaves, cymose, 10–11 cm long; peduncles densely covered with multicellular glandular hairs, dull maroon to pinkish; pedicels 1–3 cm long. **Bracts** thin, lanceolate, 5 mm long, 2 mm wide, glabrous, light green-pale pinkish. **Calyx** symmetric, 5-lobed to the base, lobes linear-lanceolate, 2 mm long, 0.5 mm wide, apices acute, slightly reflexed, glabrous, dull light green. **Corolla** funnellform, c. 1.5 cm long, glabrous, tube light violet-pinkish; tube 1 cm long; anterior (lower) lip 3-lobed, lobes orbicular, c. 6 mm diameter, much longer than the posterior ones; posterior (upper) lip 2-lobed, lobes suborbicular, c. 4 mm long, 3 mm wide. **Fertile stamens** inserted above the middle of the tube; anthers oblong, c. 2 mm long, glabrous, cream; filaments 3–5 mm long, glabrous, white; staminodes 3, minute, posterior, unequal in length. **Pollen** spheroidal, 10 µm diameter, tricolpate, long apertures with granular elements, sculpturing microperforate. **Disc** tubular, margin irregularly lobed, c. 1.5 mm long. **Ovary** cylindrical, c. 1 cm long, glabrous, light green; style glabrous, whitish; stigma capitate, concave, reddish. **Capsules** erect, c. 1.3–1.5 cm long. **Seeds** elliptic, cell orientation straight.

*Distribution.* Northeast Thailand. Probably also in northern Cambodia.

*Ecology.* Shaded, moist, rugged sandstone gully in the upper catchment basin, in deciduous forest.

*Phenology.* Flowering July–August, fruiting August–October.

*Vernacular name.* Muang Dong Rak (ม่วงดงรัก).

*Etymology.* Specific epithet refers to the Dongrak Range.

*Notes.* *Didymocarpus dongrakensis* differs from *D. insulsus* Craib in the smaller and purple corolla. The stems and leaves of both taxa are otherwise quite similar.

*Specimens examined:* THAILAND. **Si Sa Ket.** Panom Dongrak Wildlife Sanctuary, Thai-Cambodia border, Chong Bat Lak area, Bak Dong Subdistrict, c. 610 m, 23 Oct 2003, *Palee 658* (A, BKF, C, CMU, E, L).

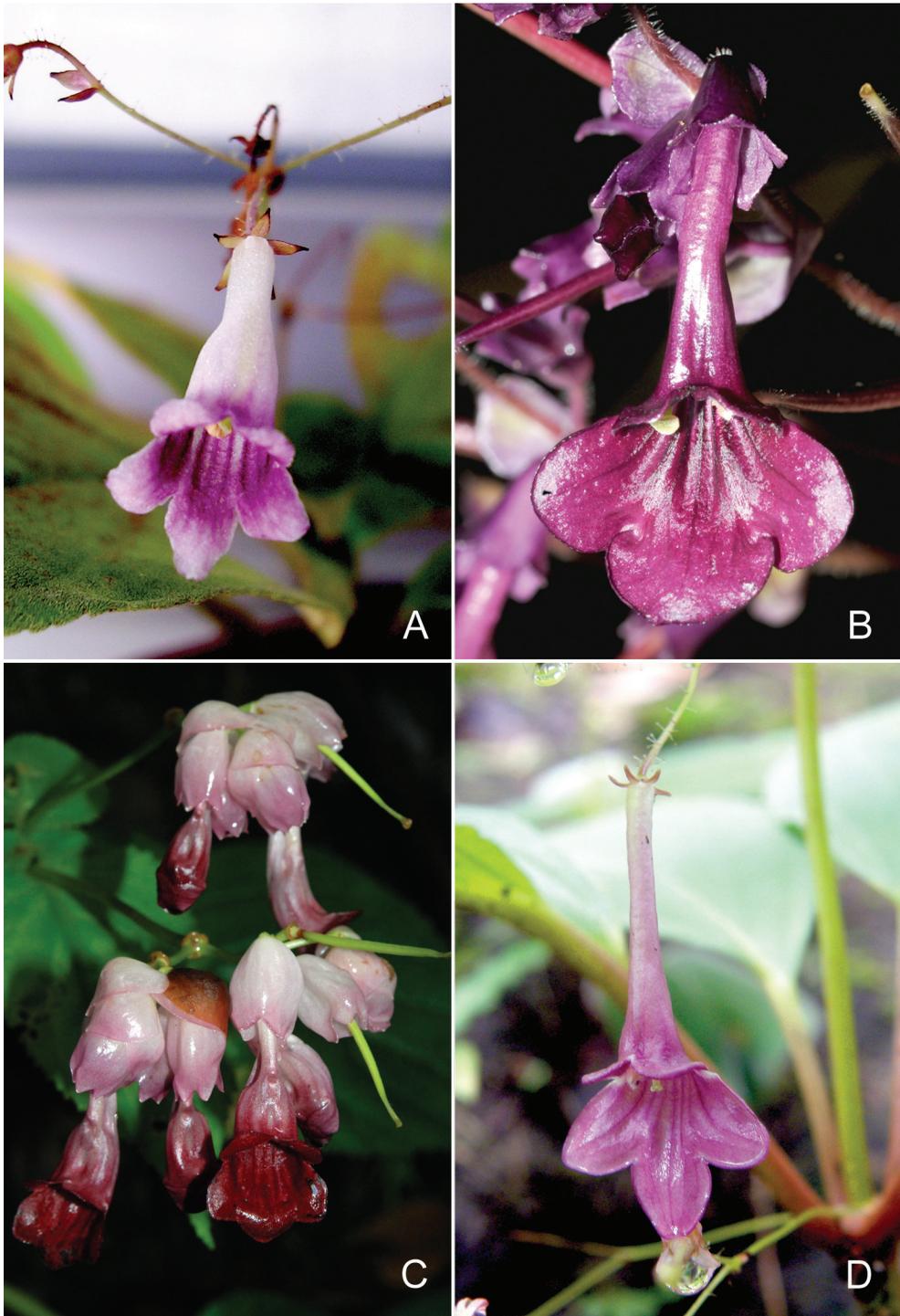
## 6. *Didymocarpus epithemoides* B.L.Burtt

Thai For. Bull., Bot. 29: 92 (2001). TYPE: *Larsen et al. 10683*, Thailand, Nakhon Nayok, Khao Yai National Park, Khao Kieo [Khiao], c. 1350 m, 20 Jul 1963 (holotype E; isotypes AAU, C, E, BKF). Fig. 2B, Fig. 3.

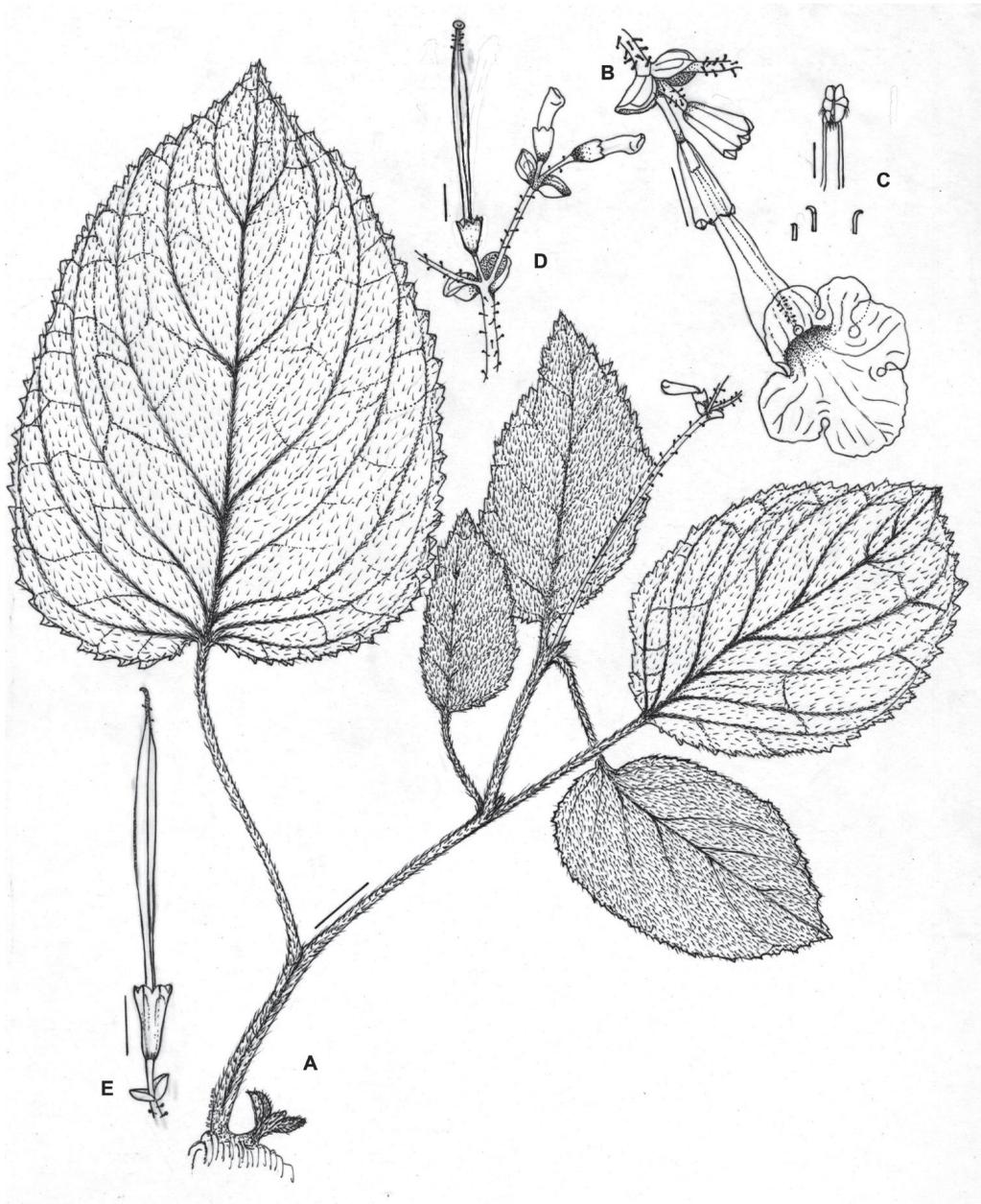
Deciduous, perennial, epilithic herb, 30 cm tall. **Stems** single, erect, densely covered with whitish multicellular eglandular hairs. **Pigment** glands absent. **Dry season** new shoots arising from the rhizome. **Dry season leaves** opposite, anisophyllous; blades subcoriaceous, dark green above, pale green beneath, symmetric, elliptic, 1.5–2 cm long, 1–1.5 cm wide, apex obtuse, base acute, margins shallowly serrate, both sides densely covered with whitish, eglandular, multicellular hairs, venation pinnate, secondary veins obscure on both sides. **Petioles** 1–3 cm long, with indumentum as on the stem. **Rainy season** plants elongating from the rhizome. **Rainy season leaves** often solitary at base, much larger than the upper ones, upper leaves mostly paired and slightly anisophyllous; blades subcoriaceous, suborbicular to broadly ovate, 6–16 cm long, 4.5–15 cm wide, apex acute, base slightly oblique, rounded to shallowly cordate, margins finely serrate or finely doubly serrate, venation pinnate, secondary veins 5–6 pairs, ascending, obscure above, prominent below, upper surface densely covered with eglandular, multicellular hairs, sparsely so on the lower surface; petioles 5–9 cm long, covered with whitish multicellular eglandular hairs as on the stems. **Inflorescences** terminal or from the upper leaf axils, cymose, c. 10 cm long; peduncles 2–7.5 cm long, sparsely covered with multicellular glandular hairs, dull green-dull violet; pedicels 3–5 mm long, glabrous or sometimes with indumentum as on the peduncle, dull green-dull violet. **Bracts** orbicular, 5 mm long and wide, glabrous, violet-pale pinkish. **Calyx** symmetrically campanulate, c. 5 mm long, c. 4 mm diameter, glabrous, violet to maroon, margins shallowly 5-lobed, lobes much less than half the length of the calyx tube, c. 2.5 mm long, apices rounded. **Corolla** salverform, 3–3.5 cm long, glabrous or with few scattered multicellular glandular hairs outside, diameter c. 3 mm, dark violet; tube 2–2.5 cm long; corolla lobes suborbicular; anterior (lower) lip 3-lobed, c. 8 mm long, 6 mm wide; posterior (upper) lip 2-lobed, c. 4 mm long, 4 mm wide. **Fertile stamens** inserted c. 1.5–1.7 cm from the base of the corolla tube; anther locules c. 2 mm long, 1 mm wide, white-bearded; filaments slender, c. 6 mm long, glabrous; staminodes 3, glabrous, reduced to thin filaments of unequal lengths. **Pollen** spheroidal, tricolpate with long apertures, sculpturing microreticulate, 10–15  $\mu\text{m}$  diameter. **Disc** cylindrical, irregularly lobed, c. 2 mm long. **Ovary** c. 15 mm long, glabrous; style c. 3 mm long, sparsely covered with gland-tipped unicellular hairs; stigma capitate, concave, c. 1.5 mm diameter, papillose, cream. **Capsules** erect, symmetrically cylindrical, 2.5–3 cm long, glabrous. **Seeds** narrowly elliptic, cell orientation straight.

*Distribution.* East-central Thailand.

*Ecology.* In evergreen forest.



**Fig. 2.** **A.** *Didymocarpus dongrakensis* B.L.Burtt. **B.** *D. epithemoides* B.L.Burtt. **C.** *D. inflatus* J.F.Maxwell & Nangngam. **D.** *D. insulsus* Craib. (Photos A: P. Nangngam, B & C: P. Triboun, D: W. Makerd)



**Fig. 3.** *Didymocarpus epithemoides* B.L.Burt. **A.** Habit. **B.** Inflorescence. **C.** Stamens and staminodes. **D.** Ovary. **E.** Capsule. Scale bars: A=2 cm, B, D, E=5 mm, C=2 mm. (Drawn by P. Nangngam)

*Phenology.* Flowering June–July, fruiting August–October.

*Vernacular name.* Muang Khao Yai (ม่วงเขาใหญ่).

*Etymology.* The specific epithet refers to a similarity to species of the genus *Epithema* (Gesneriaceae).

*Notes.* *Didymocarpus epithemoides* differs from *D. biserratus* by the shorter corolla.

*Specimens examined:* THAILAND. **Nakhon Nayok.** Khao Yai National Park, Khao Kieo, evergreen forest, 19 Oct 1969, *Shimizu et al. 19724* (BKF); *ibid.*, 1250 m, 20 Jul 1963, *van Beusekom & Charoenpol 1757* (paratype E); *ibid.*, c. 1350 m, 7 Jul 1966, *Larsen et al. 51* (BKF); northeast side of Kow Kiew [Khao Kieo], Pah Deo Dai, 150 m, 14 Aug 2000, *Maxwell 00-404* (CMU); *ibid.*, 1200 m, 10 Jul 2003, *Palee 603* (CMU); *ibid.*, c. 1100 m, 14 Aug 1993, *Kunwasi 9* (BCU); *ibid.*, c. 750 m, 2 Dec 1983, *Fukuoka & Ito T-34993* (BKF); *ibid.*, c. 1170 m, 23 Aug 2012, *Middleton et al. 5653* (E); summit of Khao Kieo, c. 1250 m, 23 Aug 2012, *Middleton et al. 5644* (E).

### 7. *Didymocarpus geesinkianus* B.L.Burt

Thai For. Bull., Bot. 29: 92 (2001). TYPE: *Geesink, Hattink & Charoenphol 7416*, Thailand, Ranong, Khao Pota Luang Kaeo, 8°50'N, 99°E, 700–900 m, 22 Jun 1974 (holotype L; isotypes AAU, BKF).

Deciduous, epilithic, perennial herb. **Dry season** plants unknown. **Rainy season stems** densely appressed-pubescent, c. 11 cm tall. All parts of plant distinctly covered with 4-celled, conical, red-brown, pigment glands. **Leaves** opposite, slightly anisophyllous, crowded at the top of the stem; blades subcoriaceous, oblong to lanceolate, c. 4.5–6.5 cm long, 2.5–4 cm wide, apex acute, base acute to cuneate, usually oblique, margins serrate, upper surface very densely white sericeous, sparsely so on the lower surface, densely on veins, venation pinnate, 5–6 pairs of ascending, secondary veins on each side of midrib, obscure above, raised underneath; petioles 2.5–3.5 cm long, with indumentum as on the stem. **Inflorescences** 1 or 2 from the upper leaf axils, cymose, c. 10 cm long; axes with sparse coarsely multicellular glandular hairs; peduncles 3–8 cm long; pedicels 0.8–1 cm long. **Bracts** paired, elliptic, c. 2–3 mm long, 0.5–2 mm wide, covered with multicellular glandular hairs, and sparsely covered with 4-celled, red-brown pigment glands outside, inside glabrous, soon caducous. **Calyx** irregular, pink; posterior (upper) lip composed of 2 free lobes, lobes lanceolate, c. 2.7–4 mm long, 1.2–1.7 mm wide; anterior (lower) lip of a tube at base and 3-lobed at apex with lobes half the length of the calyx tube, lobes c. 4–5 mm long, 2–8 mm wide, covered with multicellular glandular hairs outside. **Corolla** funnellform, c. 2.5 cm long, c. 2 mm diameter, glabrous, purple, ventral part of tube white, lobes purple; tube c. 1.8–2 cm long; lobes suborbicular; anterior (lower) lip 3-lobed, c. 5 mm long, 4 mm wide, much longer than the upper lip; posterior (upper) lip 2-lobed, slightly oblique. **Fertile stamens** inserted in upper part of the corolla tube; anthers c. 3 mm long, c. 2 mm wide, white-bearded; filaments slender, 5 mm long, glabrous; staminodes 3, posterior, reduced to thin filaments of unequal lengths, hairy at tips. **Ovary** glabrous, 12 mm long;

style glabrous, 2 mm long; stigma capitate, concave, papillose. **Capsules** glabrous, erect, symmetrically cylindrical, 2.2–2.7 cm long. Pollen and seed not seen.

*Distribution.* Southwest Thailand. Known only from the type locality.

*Ecology.* Only known from evergreen forest in an open place on clay-shale.

*Phenology.* Flowering June–July, fruting June–July.

*Vernacular name.* Tian Khao Pho Ta (เทียนเขาพ้อตา).

*Etymology.* The specific epithet honours Dr. Rob Geesink (1945–1992), a botanist from Leiden, the Netherlands.

*Notes.* *Didymocarpus geesinkianus* is a distinct species with readily observable unique characters but is only known from the type collection. It is perhaps a rare species.

### 8. *Didymocarpus inflatus* J.F.Maxwell & Nangngam, **sp. nov.**

*A Didymocarpo biserrato folii basi oblique, bracteis calycibusque albis vel obscure dilute violaceis, calyce maiore (16–17 mm) corollis non purpureis, filamentis prope antheras pillis paucis multicellulosis apicaliter glandulosis, anthers glabris, discis obliquis irregulariter lobatis differt.*

TYPE: *Maxwell 04-490*, Thailand, Chiang Mai, Mae Awn District, west side of Doi Lohn (Lahn) along Mae Gahm Bawng [Mae Kom Pong] Falls, c. 1125 m, 20 Sep 2004 (holotype CMU; isotypes A, BKF, CAS, L, MO). Fig. 2C.

Deciduous, perennial, epilithic herb, 32–60 cm tall. **Dry season** juvenile leaves distinct, blades with much denser indumentum than when mature. **Rainy season** stems succulent, with a few scattered, multicellular glandular hairs, glabrescent, light green. **Pigment** glands absent. **Leaves** opposite, decussate, anisophyllous; blades thin, upper surface dull dark green and drying medium brown, lower side pale light green and drying light brown, ovate, 6–19 cm long, 3.5–11 cm wide, apex acute, base obliquely rounded to cordate, margins serrate, often irregularly so, or doubly serrate, both sides with sparse and scattered, eglandular, multicellular hairs, midrib with 6–7 arching secondary veins on each side, distinct on both surfaces, finer venation reticulate; petioles 0.7–13.5 cm long, with indumentum as on the stems. **Inflorescence** terminal, erect, 14–19 cm long, glabrous, laxly cymose, axes succulent, light green; peduncles 5.5–7.5 cm long; pedicels c. 4 mm long. **Bracts** paired, concealing a pair of pedicels and embracing the lower part of the calyx, thin, elliptic, c. 8 mm long, 14 mm wide, concave, dull light violet to white and often white with a faint pinkish hue to purplish-white.

**Flowers** numerous. **Calyx** campanulate, glabrous, often white on both side; tube c. 1.5 cm long, throat 7–8 mm wide; lobes subequal, apices broadly rounded to acute; anterior 2 lobes 2–2.5 mm long, posterior 3 lobes 1.5–2 mm long. Bracts and calyx appearing inflated. **Corolla** funnellform, 4 cm long, glabrous, tube pale violet to reddish, upper part of the tube light violet to whitish, lower part violet to reddish, lobes very dark violet-reddish; tube gradually widening from the base to the throat, c. 3.5 cm long; lobes suborbicular, broadly rounded; anterior (lower) lip 3-lobed, 5–6 mm long, 7–8 mm wide, posterior (upper) lip smaller and 2-lobed. **Fertile stamens** inserted in the middle of the corolla tube, below the corolla throat; anthers oblong, c. 3 mm long, c. 1 mm wide, glabrous, cream; filaments flexed at the middle, very pale violet-white, c. 8 mm long, upper part covered with several minute, gland-tipped hairs; staminodes 3, inserted slightly below the stamens, lateral ones 4 mm long, the other one 2 mm long, glabrous. **Disc** tubular, thickened, glabrous, margin oblique and irregularly lobed, 2–3 mm high, persistent in fruit. **Ovary** cylindrical, glabrous, light green, c. 2 cm long, 1 mm wide; style continuous with the top of the ovary, c. 5 mm long, glabrous, whitish or light green; stigma discoid, concave medially, whitish, 1 mm diameter. **Capsules** cylindrical, erect, straight, light green and maturing light brown, 4.5–5 cm long, 2.5 mm wide. **Seeds** elliptic, cell ornamentation straight, cell faces finely verrucate.

*Distribution.* Northern Thailand.

*Ecology.* Moist, rugged places in primary evergreen or seasonal, hardwood forests on granite bedrocks.

*Phenology.* Flowering August–September, fruiting September–March, leaves May–October.

*Vernacular name.* Chomphu Phu Hin (ชมพู่ภูหิน).

*Etymology.* The specific epithet refers to the seemingly inflated bracts and calyx.

*Notes.* *Didymocarpus inflatus* differs from *D. biserratus* particularly in the serrate leaf margin and the larger corolla.

*Specimens examined:* THAILAND. **Chiang Mai.** Mae Awn District, west side of Doi Lohn (Lahn) along Mae Gahm Bawng [Mae Kom Pong] waterfalls, c. 1125 m, 2 Mar 2005, *Carrot 4* (CMU); Mae Lai Stream, c. 1150 m, 25 Oct 2005, *Palee 839* (CMU); Mae On, trail to Mae Kom Pong waterfalls, c. 1100 m, 7 Sep 2011, *Pooma et al. 7782* (E). **Phitsanulok.** Nakhon Thai District, Phu Hin Rong Kra National Park, trail to Lan Hin Pum, c. 600 m, 12 Oct 2003, *Palee 642* (CMU); *ibid.*, 25 Sep 2005, *Palee 802* (CMU); *ibid.*, 3 Sep 1988, *Giravatanapan 1* (BCU); *ibid.*, 1200 m, 2 Sep 1995, *Herb trip 1135* (BCU); *ibid.*, 10 Oct 2009, *Middleton et al. 5070* (E).

### 9. *Didymocarpus insulsus* Craib

Bull. Misc. Inform. Kew 1926: 169 (1926) (*insulsa*); Pellegrin, Fl. Indo-Chine. 4(5): 522 (1930) (*insulsa*); Barnett, Fl. Siam. 3(3): 214 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 458 (2000); Burt, Thai For. Bull., Bot. 29: 92 (2001). TYPE: *Unknown collector 93*, plant from Thailand cultivated in Aberdeen from seeds received from Dr. A.F.G. Kerr which flowered in Aberdeen in October 1925; collection locality of seeds not indicated, 3 Oct 1925 (holotype ABD). Fig. 2D.

Deciduous, perennial, epilithic herb; stems single, up to 30 cm tall, erect, glabrous, all parts with scattered, brown, 4-celled pigment glands. **Dry season** new shoots arising from the rhizome. **Dry season stems** glabrous. **Dry season leaves:** blades coriaceous, 2 cm long, 1 cm wide, venation pinnate, obscure above, prominent underneath. **Rainy season leaves** ternate or 3-pseudovercillate, anisophyllous; blades subcoriaceous, dark green above, pale light green beneath, elliptic to oblong, 9.5–20 cm long, 6.5–13.5 cm wide, apex obtuse, base acute, margins shallowly, irregularly serrulate, upper surface sparsely sericeous with minute, multicellular eglandular hairs, lower surface glabrous, sparsely covered with pigment glands as on the stem, venation pinnate, secondary veins 6–9 pairs, ascending, obscure on the upper surface, prominent on the lower surface, brownish; petioles terete, 2–6 cm long, unequal in length, glabrous. **Inflorescences** axillary, cymose, 5–15 cm long, axes sparsely covered with multicellular glandular hairs; peduncles pale green, 2.5–5 cm; pedicels maroon, 0.6–1.3 cm long. **Bracts** elliptic, 3–4 mm long, 3 mm wide, glabrous, green. **Calyx** 5-lobed to the base, lobes linear-lanceolate, 4 mm long, c. 1.5–2 mm wide, apices obtuse, glabrous, light green-reddish. **Corolla** funnellform, 2.5 cm long, pale violet or purple; tube c. 1.5 cm long; lobes suborbicular; anterior (lower) lip 3-lobed, c. 5 mm long, 6 mm wide, much longer than the posterior lobes; posterior (upper) lip 2-lobed, slightly ovate, c. 3 mm long, 6 mm wide. **Fertile stamens** inserted at c. 1.7 cm from the base of the corolla tube; anthers cream, oblong, c. 2 mm long, 1 mm wide, white-bearded; filaments glabrous; staminodes 3, reduced to filaments, 1–2 mm long. **Pollen** spheroidal, rugulate, 12–13  $\mu\text{m}$ . **Disc** slender, irregularly lobed, 2 mm high. **Ovary** glabrous, light green, 2 cm long; style glabrous; stigma capitate, concave, light green, 0.5 mm diameter. **Capsules** erect, symmetrically cylindrical, glabrous, 3–4.5 cm long, 0.2 cm wide, calyx persistent. **Seeds** narrowly elliptic, c. 0.3  $\times$  0.1 mm; testa cell orientation slightly spiral.

*Distribution.* North-Eastern Thailand.

*Ecology.* Moist places in primary evergreen forests on granite bedrock, near streams, on rocks.

*Phenology.* Flowering July–September, fruiting September–October.

*Vernacular name.* Kam Pong Din (กำปองดิน).

*Etymology.* The specific epithet means tasteless, without salt; the allusion of this epithet to this species is not understood.

*Specimens examined:* THAILAND. **Chiang Mai.** Doi Inthanon National Park, c. 600–700 m, dipterocarp forest, on rock by the stream, 19 Jul 1988, *Tamura T-6011* (BKF). **Chaiyaphum.** Pa-Hin Ngam Forest Park, c. 850 m, 4 Sep 1993, *Suddee 169* (BCU); Thep Sathit District, Wat Khao Pratumchumpon, c. 700 m, 20 Sep 1992, *O.T.1252* (BCU). **Nakhon Nayok.** Khao Yai National Park, Pah Da Baek Waterfalls, c. 750 m, 19 Oct 2003, *Palee 645* (CMU, E); *ibid.*, c. 660 m, 20 Aug 2012, *Middleton et al. 5634* (E); Pah Deo Dai, c. 1150 m, 14 Aug 2000, *Maxwell 00-391* (CMU); *ibid.*, c. 1170 m, 23 Aug 2012, *Middleton et al. 5651* (E); Khao Rom, c. 700–1200 m, 2 Dec 1983, *Fukuoka & Ito T-34610* (BKF). **Nakhon Ratchasima.** Sakaerat District, experimental Research Station, c. 360 m, 4 Dec 1983, *Fukuoka & M. Ito T-35034* (BKF); Khao Laem, c. 1100–1200 m, 19 Oct 1969, *van Beusekom & Charoenpol 1756* (E); Plant cultivated at Royal Botanic Edinburgh, originally from Khao Kieo, 1000–1200 m, seeds from *Smitinand 7558*, which flowered at Edinburgh in Sep 1964, vouchered as C4304 E00628027 (E), C4512 & E00628030 (E). **Loei.** Phu Krading National Park, 4–5 km along the way to Wang Kwang Station, c. 1025–1200 m, 5 Oct 2003, *Palee 638* (CMU, E); along the trail to Headquarters National Park, c. 900–1200 m, *Gen Murata et al. T-42099* (BKF); Wat Phra Kaeo (RS-10) to Pha Nok En, sun set cliffs area, c. 1280–1260 m, 5 Sep 1988, *Takahashi & Tamura T-63384* (BKF); Plant cultivated at Royal Botanic Edinburgh, originally from Phu Krading [Kradueng] National Park, 1200 m, seeds from *Smitinand 10477*, collected 18 Oct 1968, which flowered at Edinburgh in Nov 1970, vouchered as C8069 & E00628026 (E).

#### 10. *Didymocarpus jaesonensis* Nangngam & J.F.Maxwell, *sp.nov.*

A *Didymocarpo kerrii* calyce glabro, corollis strictis infundibularibus c. 3 cm longis, filamentis glabris, antheribus basi apiceque subtiliter puberulis, stigmatibus discoideo differt.

TYPE: *Maxwell 96-1093*, Thailand, Lampang, Muang Bahn (Pan) District, Jae Sawn [Chae Son] National Park; 1225–1250 m, 21 Aug 1996 (holotype CMU; isotypes A, BKF, CAS, L, MO). Fig. 4A.

Deciduous, epilithic, perennial herb (4–)16–17 cm tall. **Dry season** plants unknown. **Rainy season** stems with scattered, multicellular eglandular hairs, pigment glands absent throughout plant. **Leaves** paired, anisophyllous; blades subcoriaceous, dark green above, pale light green beneath, oblong to lanceolate, 3.5–7 cm long, 1.5–4.5 cm wide, apex obtuse to bluntly acute, base symmetrically acute, margin shallowly and somewhat irregularly serrate, upper surface with scattered multicellular eglandular hairs, lower surface with indumentum as on upper surface, midrib with 4–5 ascending secondary veins on each side, obscure above, prominent underneath; petioles 2–4.5 mm long, with indumentum as on the stem. **Inflorescences** terminal, laxly cymose, (4–)9–13 cm long, axes with scattered multicellular glandular and eglandular hairs, rapidly glabrescent, dull dark violet, sometime glabrous; peduncle (2.2–)4–8 cm long; pedicels 4 mm long. **Flowers** numerous. **Bracts** paired at the base of a pair

of pedicels, broadly rounded, c. 8 mm long, 8 mm wide, glabrous, violet, caducous. **Calyx** of a campanulate tube and undulate margin, glabrous, violet; tube c. 7 mm long, 3–5 mm diameter. **Corolla** narrowly funnelform, straight, c. 3 cm long, glabrous, tube pale violet, throat with whitish streaks inside, lobes violet; tube c. 2 cm long, diameter c. 2 mm; lobes suborbicular; anterior (lower) lip 3-lobed, c. 5 mm long, 7 mm wide; posterior (upper) lip 2-lobed, slightly smaller. **Fertile stamens** inserted in the upper 1/3 of the corolla tube; anthers oblong, glabrous, cream, c. 2 mm long, 1 mm wide; filaments c. 6 mm long, glabrous in the lower part, multicellular glandular hairs in the upper part; staminodes 3, glabrous. **Disc** cylindrical, coriaceous, margins obscurely undulate-truncate, c. 1 mm high, persistent in fruit. **Ovary** cylindrical, slender, glabrous, dull brown-violet; style c. 4 mm long, continuous with the ovary, glabrous; stigma discoid, centrally depressed, c. 1 mm diameter. **Capsules** 3–4 cm long. **Seeds** elliptic, cell orientation straight, cell faces smooth, cell edges auriculate.

*Distribution.* Northern Thailand. Only known from the type locality.

*Ecology.* In evergreen forest, near streams or waterfalls.

*Phenology.* Flowering August, fruiting August–September, leaves in May–October.

*Vernacular name.* Khao Kam Pha Chae Son. (ข้าวกำผาแจ้ซ้อน).

*Etymology.* The specific epithet refers to Chae Son National Park, the type locality.

*Notes.* *Didymocarpus jaesonensis* resembles *Didymocarpus kerrii* Craib which differs in having multicellular glandular hairs on the calyx and a generally smaller salverform, geniculate corolla.

*Specimens examined:* THAILAND. **Lampang.** Muang Pan District, Chae Son National Park, trail to waterfall, c. 520 m, 12 Aug 2012, *Middleton et al.* 5568 (E).

### 11. *Didymocarpus kerrii* Craib

Bull. Misc. Inform. Kew 1911: 431 (1911); Pellegrin, Fl. Indo-Chine 4(5): 525 (1930); Barnett, Fl. Siam. 3(3): 215 (1962); Barnett, Dansk Bot. Ark. 20(2): 201 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 458 (2000); Burtt, Thai For. Bull., Bot. 29: 91 (2001). TYPE: *Kerr* 786, Thailand, Chiang Mai, Doi Sutep [Suthep]-Pui National Park, on rocks in open jungle area, c. 1350 m, 5 Sep 1909 (holotype K; isotype E). Fig. 4B.

*Didymocarpus squamosa* Craib, Bull. Misc. Inform. Kew 1913: 71 (1913). TYPE: *Kerr* 2636, Thailand, Chiang Mai, Doi Sutep, on damp rocks in evergreen jungle, c. 900 m, 4 Aug 1912 (holotype K; isotype E).

Deciduous, perennial, epilithic herb. **Stems** single, erect, 4–21 cm tall, densely sericeous with multicellular eglandular hairs, all parts of plant sparsely covered with one-celled, golden-brown, peltate, pigment glands. **Dry season leaves:** blades coriaceous, symmetrical, ovate, 1.5 cm long, 1 cm wide, apex acute, base cordate, margins crenate, both sides densely covered with silvery or whitish multicellular eglandular hairs, venation pinnate, obscure on the upper surface, prominent on underneath; petioles c. 1 cm long, densely sericeous, with indumentum as on the stem. **Rainy season leaves** opposite, anisophyllous; blades subcoriaceous, dark green above, broadly elliptic to oblong-ovate, 4–10 cm long, 3–13 cm wide, apex obtuse, base shallowly and unequally cordate, margins coarsely crenate-serrate, venation pinnate, secondary veins 5–6 pairs, ascending, obscure on the upper surface, prominent and covered with indumentum as on the stem underneath, upper surface densely covered with whitish multicellular eglandular hairs, lower surface glabrous, otherwise main veins with scattered, adpressed, brownish multicellular eglandular hairs and pigment glands; petioles terete, 1–13 cm long, pairs slightly unequal, indumentum as on the stems. **Inflorescences** axillary, cymose, up to c. 7 cm long, many-flowered, axes dark green to dark violet; peduncles 2–5 cm long, sparsely covered with multicellular glandular hairs; pedicels dull green-dull violet, 3–5 mm long. **Bracts** suborbicular, 3.5 mm long, 4 mm wide, glabrous, violet-pale pinkish or whitish, caducous. **Calyx** symmetrically campanulate, 5 mm long, 3 mm wide, glabrous or sparsely covered with multicellular glandular hairs, pinkish-white or sometimes dark violet, 5-lobed, lobes less than half the length of the calyx tube, 2 mm long, 3 mm wide at base, apices rounded. **Corolla** salverform, 2–2.5 cm long, tube narrowly geniculate in the upper half, glabrous, tube violet with white lines ventrally, lobes dark violet, sometimes white, sometimes with 2 violet streaks below middle of anterior lip; tube 1.5 cm long; lobes rounded; anterior (lower) lip 3-lobed, lobes 4 mm long, 5 mm wide; posterior (upper) lip 2-lobed, lobes 3 mm long, 4 mm wide. **Fertile stamens** inserted 1.7 cm from the base of the tube; anthers oblong, c. 2 mm long, c. 1 mm wide, white, glabrous; filaments slender, geniculate, 4 mm long, glabrous; staminodes 3, reduced to unequal filaments, glabrous; 1–2 mm long. **Pollen** spheroidal, microreticulate-scabrate, 10–13  $\mu\text{m}$  diameter. **Disc** cylindrical, glabrous, irregularly lobed, 2 mm long. **Ovary** glabrous, 7–8 mm long; style glabrous, 2–3 mm long, 1 mm wide; stigma capitate, papillose, cream. **Capsules** erect, 2 cm long. **Seeds** elliptic,  $0.27 \times 0.12$  mm, cell orientation straight, cell shape narrowly lineate-polygonate; cell edges slightly elevated and smooth, cell crests fused, faces slightly depressed and smooth.

*Distribution.* Northern Thailand.

*Ecology.* In evergreen forest, occurring on both limestone and granite bedrock.

*Phenology.* Flowering July–September, fruiting July–October.

*Vernacular name.* Kam Pong Din Dok Lek (กำแพงดินดอกเล็ก).

*Etymology.* The specific epithet honours Dr. A.F.G. Kerr (1877–1942), a pioneer botanist in Thailand from 1902 to 1932.

*Notes.* The most distinctive character of this species is the strongly geniculate corolla tube.

*Specimens examined:* THAILAND. **Chiang Mai.** Doi Inthanon National Park, Doi Ang Ka, c. 1160 m, 9 Sep 1927, *Garret 441* (ABD); *ibid.*, c. 1300 m, 31 Aug 1958, *Larsen & Hansen 4649* (ABD); *ibid.*, c. 1400–1700 m, *Larsen & Larsen 34408* (AAU); north of km 38, c. 1700 m, 9 Sep 1994, *Maxwell 94-986* (CMU); Wachirathan waterfall, 8 Aug 1988, *H. Takahashi T-62781* (BKF); *ibid.*, 28 Jul 1988, *Phengkhlai et al. 7188* (BKF); Siriphum waterfall, 1360 m, 19 Sep 2008, *Middleton et al. 4506* (E); route to Mae Jaem, c. 1800 m, 26 Aug 1997, *BGO staff 9552* (QBG); Pha Ngaem (limestone cliffs), c. 1850 m, 26 Aug 2004, *Palee 702* (CMU); *ibid.*, c. 1925 m, 5 Oct 2004, *Palee 741* (CMU); Pa Ngem [Pha Ngaem], 6 Apr 1925, *Winit 1425* (K); Bong Noi village, along Huay Yaow stream, c. 1125 m, 15 Dec 2004, *Maxwell 04-804* (CMU); Doi Song Mea, Chom Thong, c. 1600 m, 21 Aug 1999, *Wathana et al. 586* (QBG). Doi Sutep-Pui National Park, Doi Mon Long, c. 1360 m, evergreen forest, 18 Sep 1995, *BGO staff 4544* (QBG), 3 Aug 1996, *BGO staff 6988* (QBG), 28 Sep 1997, *BGO staff 9678* (QBG); summit cliff of Doi Mon Long, c. 1400 m, 9 Aug 2002, *Palee 539* (CMU), 16 Sep 2002, *Palee 550* (CMU); *ibid.*, c. 1450–1475 m, 23 Aug 2002, *Maxwell 02-284* (CMU); Ban Huay Mae Sa Mai, 1275 m, 31 Oct 1989, *Maxwell 89-1338* (E); Huay Khok Ma, 1050–1275 m, 22 Nov 1989, *Maxwell 89-1433* (E); Doi Chang Kien, 1250 m, 28 Oct 1975, *Sadakorn 588* (E); *ibid.*, c. 1100 m, 16 Sep 2002, *Palee & Toktang 668* (CMU); *ibid.*, c. 1350 m, 13 May 1914, *Kerr 3443* (ABD); *ibid.*, c. 1350–1500 m, 9 Jan 1966, *Iwatsuki & Fukuoka 4484* (E); Doi Chiang Dao Wildlife Sanctuary, Huay Mae Gawk [Kok] (Den Yah Kat) Station, c. 1500 m, 22 Feb 2003, *Palee 568* (CMU); *ibid.*, 4 Nov 1995, *Maxwell 95-1066* (CMU); Mae Chaem, Doi Pha Ti Do, c. 1700 m, 21 Sep 2009, *Middleton et al. 4941* (E). **Lampang.** Jae Sawn [Jaeson] National Park, east side, along Mae Mawn stream at Jae Son waterfall, c. 525 m, 22 Aug 1995, *Maxwell 95-533* (CMU); *ibid.*, c. 500 m, 10 Aug 1996, *Panatkol 156* (CMU). **Nan.** Doi Phu Kha National Park, 1800 m, 31 Aug 2000, *Srisanga 1534* (E). **Phitsanulok.** Phu Soi Dao National Park, Tan Sa Wan Waterfalls, c. 1580 m, 14 Aug 2000, *Suksathan 2693* (QBG). **Uttaradit.** Klong Dtrawn [Tron] National Park, ridge above the upper water catchment valley of Klong (stream) Dtrawn, north side of Pu Miang, c. 1300 m, 14 Oct 2005, *Palee 808* (CMU).

## 12. *Didymocarpus megaphyllus* Barnett

Nat. Hist. Bull. Siam Soc. 20: 11 (1961); Barnett, Kew Bull. 15: 250 (1961); Barnett, Fl. Siam. 3(3): 215 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 460 (2000); Burt, Thai For. Bull., Bot. 29: 92 (2001). TYPE: *Kerr 13215*, Thailand, Surat Thani, Ban Kawp, on rocks in evergreen forest, c. 100 m, 5 Aug 1927 (lectotype K, designated by Barnett in Kew. Bull. (1961); isotypes ABD, BK, BKF, BM). Fig. 4D.

Deciduous, perennial, epilithic herb up to 80 cm tall. **Stem** erect, green with sparsely scattered crimson blotches and multicellular eglandular hairs; pigment glands absent throughout plant. **Dry season** new shoots arising from the rhizome. **Dry season leaves**

opposite, decussate; blades subcoriaceous, dark green above, light green beneath, symmetrically ovate, 1.5–3 cm long, 1–1.5 cm wide, apex broadly acute, bases subcordate to truncate, margins crenate, sparsely adpressed puberulous on both sides, venation pinnate, obscure above, prominent underneath, covered with multicellular eglandular hairs along the veins; petioles terete, 3–8 cm long, pubescent as the blades. **Rainy season leaves** numerous, opposite, decussate, the pairs often anisophyllous; blades subcoriaceous, oblong to lanceolate, 12–19 cm long, 4–8 cm wide, apex acute, base oblique, one side somewhat rounded or acute, margins regularly crenulate-serrate, upper surface with scattered white multicellular eglandular hairs, dark green, lower surface glabrous, with scattered crimson blotches, light green, venation pinnate, secondary veins 7–11 pairs, sunken above, prominent underneath, covered with multicellular eglandular hairs; petioles terete, 2.5–10 cm long, pairs unequal, pale light green, with multicellular eglandular hairs or glabrous, and scattered crimson blotches as on the stem. **Inflorescences** axillary, arising from the leaf axils along stem, cymose up to c. 7 cm long; many-flowered; peduncles slender, 2–5 cm long, glabrous or with some multicellular glandular hairs, light green; pedicels 0.3–1.2 cm long, glabrous, light green. **Bracts** paired, hemispheric, 8 mm long, 5 mm wide, overlapping, glabrous, light green to dull green. **Calyx** symmetric, campanulate, c. 8 mm long, 3–4 mm diameter, tube slender, covered with multicellular glandular hairs; shallowly 5-lobed, lobes triangular, c. 2 mm deep, 1.5 mm wide, apices acute. **Corolla** funnellform, c. 3.5 cm long, covered with multicellular glandular hairs outside, crimson-red; tube c. 2 cm long, base narrow, c. 2 mm diameter, widening abruptly, especially on anterior side, widest at throat, diameter c. 1 cm diameter; anterior (lower) lip 3-lobed, lobes rounded, c. 6–8 mm long, 7–9 mm wide and more or less equal; posterior (upper) lip 2-lobed, lobes broadly rounded, 5 mm long, 7 mm wide. **Fertile stamens** inserted c. 2 cm above the base of the corolla; anthers oblong, c. 3 long, 1 mm wide, whitish, tips and bases rounded, white-bearded; filaments sparsely unicellular, gland-tipped hairs on the upper part, slender, 1 cm long; staminodes 3, glabrous, reduced to filaments, c. 3 mm long, tips ciliate. **Disc** cupular, c. 1.5 mm long, margins irregular. **Ovary** cylindrical, c. 3 cm long, glabrous, light green; style red-violet, covered with multicellular glandular hairs; stigma peltate, concave, papillose, whitish. **Capsules** erect, symmetrically cylindrical, 4.5–5 cm long. **Seeds** elliptic, apex truncate,  $0.35 \times 0.15$  mm, cell orientation straight, cell shape lineate-polygonate, cell edges depressed and smooth, cell crests fused, cell faces elevated and tuberculate.

*Distribution.* Southern Thailand.

*Ecology.* In evergreen forest, along streams where the humidity is higher.

*Phenology.* Flowering August–October, fruiting September–December.

*Vernacular name.* Puang Sai Rung (พวงสายรุ้ง).

*Etymology.* The specific epithet is in reference to the large leaves (Greek).

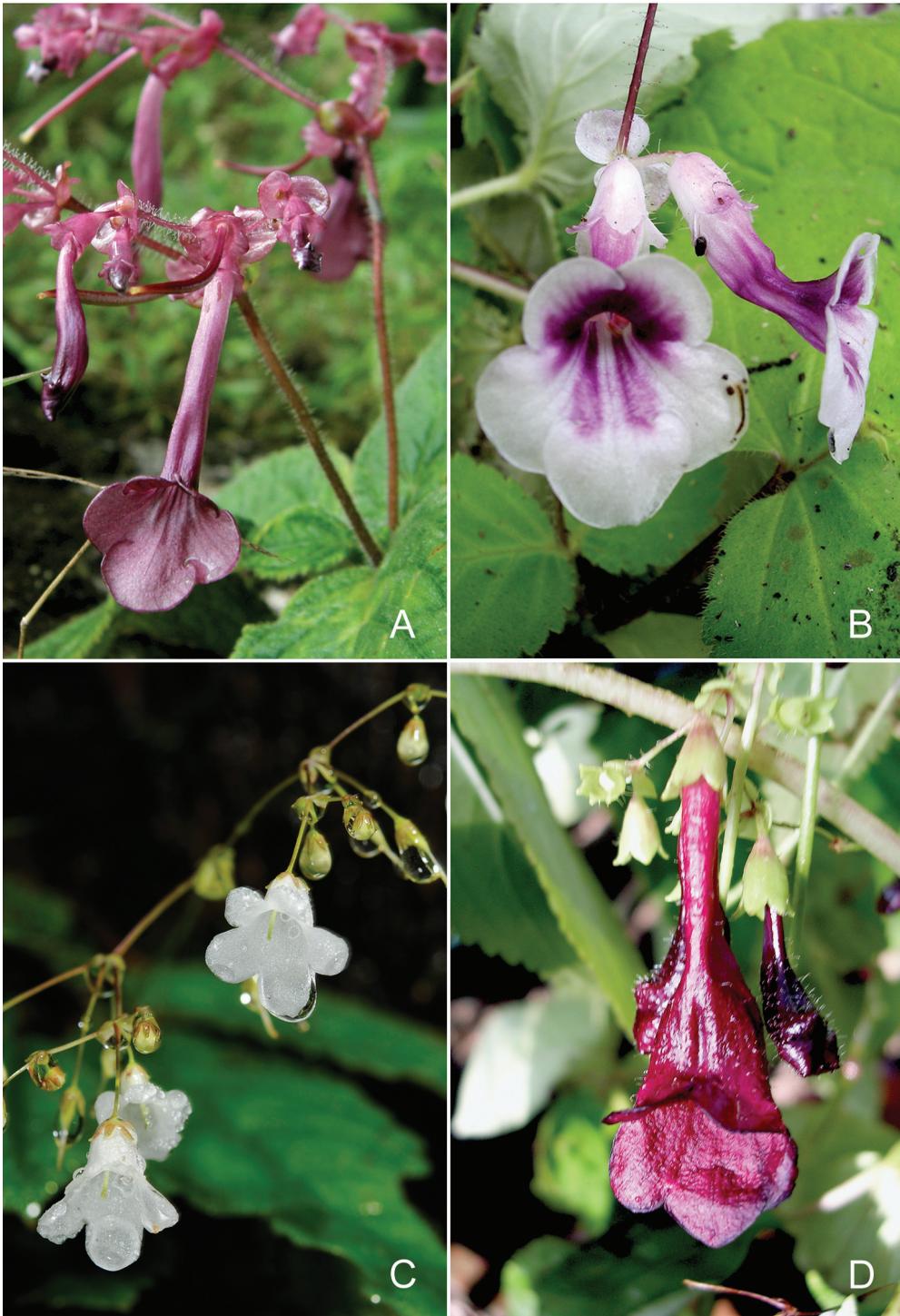
*Notes.* The distinctive characters of this species are the dark red or crimson-red corolla, the overall pubescence, and the inflorescences in the axils of leaves along the stem.

*Specimens examined:* THAILAND. **Trang.** Sai Roong Waterfalls, Nah Chum Het Subdistrict, Yahn Dah Kow District, 175 m, 12 Dec 2003, *Palee 686* (CMU); *ibid.*, 441 m, 5 Oct 2004, *Palee & Tantana 752* (CMU, PSU). **Nakhon Si Thammarat.** Kiriwong, Tam Suae, 400 m, herb 80 cm tall, 19 Dec 1951, *Pternchit 245* (E); Khao Luang National Park, 800 m, 21 Jul 1999, *Wathana et al. 484* (E).

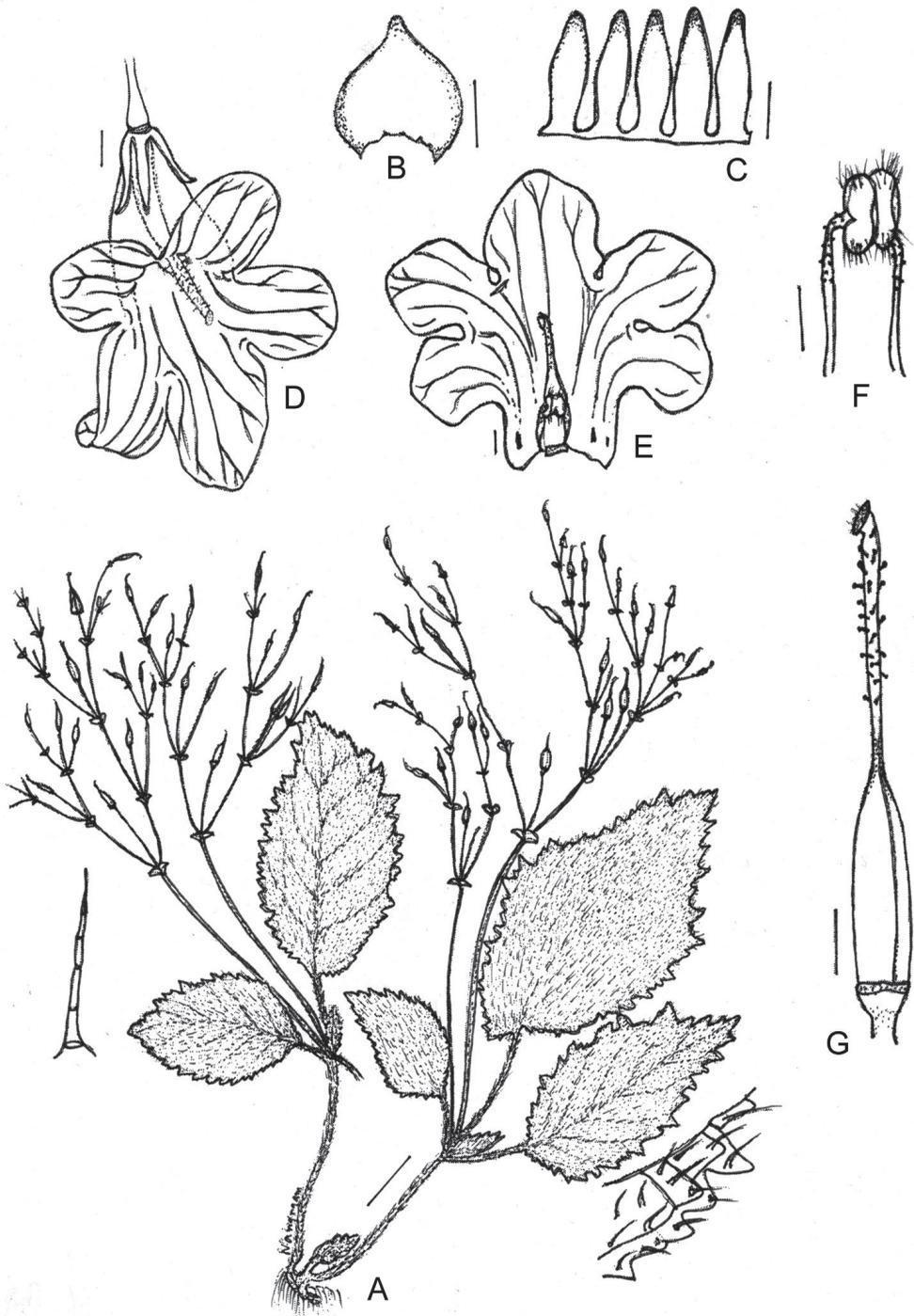
### 13. *Didymocarpus newmanii* B.L.Burt

Thai For. Bull., Bot. 29: 92 (2001). TYPE: *Newman 926*, Thailand, Chanthaburi, Khao Khitchakut, 12°34'N 102°16'E, 20 Jun 1999 (holotype E; isotype BKF). Fig. 4C, Fig. 5.

Deciduous perennial, epilithic herb. **Stems** single, erect, up to 20 cm tall, densely covered with multicellular eglandular hairs; pigment glands absent throughout plant. **Dry season** new shoots arising from the rhizome, bearing dry infructescence of the previous year. **Dry season leaves** ternate, anisophyllous; blades sericeous on both sides as on stem, venation pinnate, veins obscure both sides; petioles 5 mm long, with sparse indumentum as on the stem. **Rainy season leaves** anisophyllous; blades subcoriaceous, dark green above, pale green beneath, asymmetrically elliptic, 6–11.5 cm long, 3–5.5 cm wide, apex acute, base rounded to acute, margins irregularly coarsely doubly dentate, upper surface densely covered with white, multicellular eglandular hairs, concealing the tertiary veins, lower surface sparsely covered with eglandular as on upper surface, densely so on the veins; venation pinnate, with 5–8 pairs of ascending secondary veins on each side, obscure on the upper surface, prominent on lower surface; petioles terete, 1.5–4 cm long, unequal in length, with indumentum as on the stem. **Inflorescences** axillary, terminal, often paired, laxly, cymose, to c. 12 cm long, glabrous; peduncles slender, 2–2.5 cm long, glabrous, light green; pedicels 1–2 cm. **Bracts** ovate-orbicular, c. 2 mm long, 2 mm wide, apex acute, glabrous. **Calyx** 5-lobed to the base, lobes lanceolate, 2 mm long, 1 mm wide, apex obtuse, glabrous, light green. **Corolla** obliquely campanulate, c. 1–1.2 cm long, glabrous, white; tube very short, 3 mm long; anterior (lower) lip 3-lobed, mid-lobe c. 3 mm long, 4 mm wide; posterior (upper) lip 2-lobed, lobes rounded, c. 2 mm long, 3 mm wide. **Fertile stamens** inserted at the base of the corolla tube; anthers cream, bearded, c. 1 mm long; filaments c. 2.5 mm long, upper part sparsely covered with gland-tipped, unicellular hairs; staminodes 3, posterior, reduced to minute filaments. **Disc** annular, margins undulate, c. 0.25 mm high. **Ovary** cylindrical, 4 mm long, glabrous, light green; style whitish, 4 mm long, covered with gland-tipped, hairs. **Capsules** erect, glabrous, green, 7 mm long. **Seeds** numerous, narrowly elliptic, 0.4 × 0.12 mm, cell orientation straight, cell shape narrowly lineate-polygonate.



**Fig. 4.** **A.** *Didymocarpus jaesonensis* Nangngam & J.F.Maxwell. **B.** *Didymocarpus kerrii* Craib. **C.** *D. newmanii* B.L.Burt. **D.** *D. megaphyllum* Barnett. (Photos A: W. Makerd, B & C: P. Nangngam, D: P. Karaket)



**Fig. 5.** *Didymocarpus newmanii* B.L.Burtt. **A.** Habit. **B.** Bract. **C.** Calyx. **D.** Corolla. **E.** Opened corolla. **F.** Stamens. **G.** Capsule. Scale bars=1 mm. (Drawn by P. Nangngam)

*Distribution.* Only known from Chanthaburi Province.

*Ecology.* In evergreen forest, on moist cliffs, granite bedrock.

*Phenology.* Flowering June–July, fruiting August–December.

*Vernacular name.* Khao Tok Rue Si (ข้าวตอกฤๅษี).

*Etymology.* The specific epithet honours the collector of the type specimen, Dr. Mark Newman (born 1959), botanist in Edinburgh, Scotland, UK.

*Notes.* The spelling of the specific epithet has been changed from the spelling “newmannii” in the protologue to the correct spelling “newmanii”. The original “newmannii” is a typographical error to be corrected under Art. 60.1 of the ICN (McNeill et al. 2012).

*Specimens examined:* THAILAND. **Chanthaburi.** Khao Kitchakut National Park, Khao Pra Bat, c. 640 m, 13°27'N 101°58'E, 13 Aug 2000, *Phonsena* 2675 (BKF); *ibid.*, c. 850 m, along the way to the summit of Khao Kitchakut, 8 Jul 2002, *Palee* 532 (CMU); *ibid.*, c. 1200 m, 24 Sep 2003, *Palee* 622 (CMU); *ibid.*, 800 m, 27 Aug 2012, *Middleton et al.* 5672 (E).

#### 14. *Didymocarpus ovatus* Barnett

Nat. Hist. Bull. Siam Soc. 20: 12 (1961); Barnett, Kew Bull. 15: 251 (1961); Barnett, Fl. Siam. 3(3): 216 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 461 (2000); Burt, Thai For. Bull., Bot. 29: 93 (2001). TYPE: *Kerr* 13259, Thailand, Surat, Kao Nawng, on rocks in evergreen forest, c. 900–1200 m, 10 Aug 1927 (lectotype K, designated by Barnett in Kew Bull. (1961); isotypes ABD, BK). Fig. 6A.

Deciduous, epilithic, perennial herb up to 30 cm tall. **Stems** erect, densely sericeous with multicellular eglandular hairs; pigment glands absent throughout plant. **Dry season leaves** opposite, anisophyllous; blades subcoriaceous, ovate, 2 cm long, 1 cm wide, apex acute, base obtuse, margins serrate, densely sericeous on both sides, venation obscure. **Rainy season leaves** opposite, anisophyllous; blades subcoriaceous, dark green above, pale green beneath, ovate, 5–14.5 cm long, 3–5.5 cm wide, apex acute, bases attenuate, upper surface very densely covered with multicellular eglandular hairs, concealing the tertiary veins, lower surface pubescent as on upper surface, more so along the veins; petioles 1.5–9 cm long, unequal in length, with indumentum as on the stem. **Inflorescences** axillary, from the upper node, cymose, up to c. 12 cm long; peduncles 6–9 cm long, sparsely covered with multicellular glandular hairs, green-maroon; pedicels c. 3–5 mm long, densely covered with indumentums as on the peduncles, light green. Lower **bracts** orbicular, c. 4 mm long, 4 mm wide, apex rounded, sometimes carinate, pinkish, glabrous, veins conspicuous; upper bracts smaller than the lower

ones, obovate-oblong, c. 3–4 mm long, 1–1.5 mm wide, pinkish turning whitish. **Calyx** 5-lobed to the base, lobes lanceolate, glabrous, c. 4 mm long, 1.5–2 mm wide, apex acute, violet or greenish-whitish. **Corolla** c. 2.5 cm long, salverform, glabrous, tube dark violet or reddish, becoming paler to white, lobes reddish; tube c. 2 cm long, basal diameter c. 2 mm; anterior (lower) lip 3-lobed, lobes elliptic, c. 4 mm long, 6 mm wide; posterior (upper) lip shallowly, 2-lobed, emarginate. **Fertile stamens** inserted near the middle of the corolla tube; anthers elliptic, c. 2 mm long, 1 mm wide, apex and base rounded, white, densely white-bearded; filaments slender, c. 4.5 mm long, glabrous; staminodes 3, unequal, reduced to filaments, 1–2 mm long, glabrous. **Pollen** spherical, aperture long, sculpturing micro-reticulate, 10–11  $\mu\text{m}$ . **Disc** cylindrical, margins irregularly lobed, 1–1.5 mm long. **Ovary** glabrous, c. 1 cm long; style slender, c. 1.8 cm long, glabrous; stigma globose, peltate, concave, c. 1 mm diameter. **Capsules** erect, c. 2–2.5 cm long, glabrous. **Seeds** numerous, narrowly elliptic, c.  $0.28 \times 0.10$  mm, apex truncate, cell orientation straight.

*Distribution.* Southern Thailand.

*Ecology.* In evergreen forest, along stream and waterfalls, granite bedrock.

*Phenology.* Flowering June–August, fruiting October–November.

*Vernacular name.* Tian Hin (เทียนหิน).

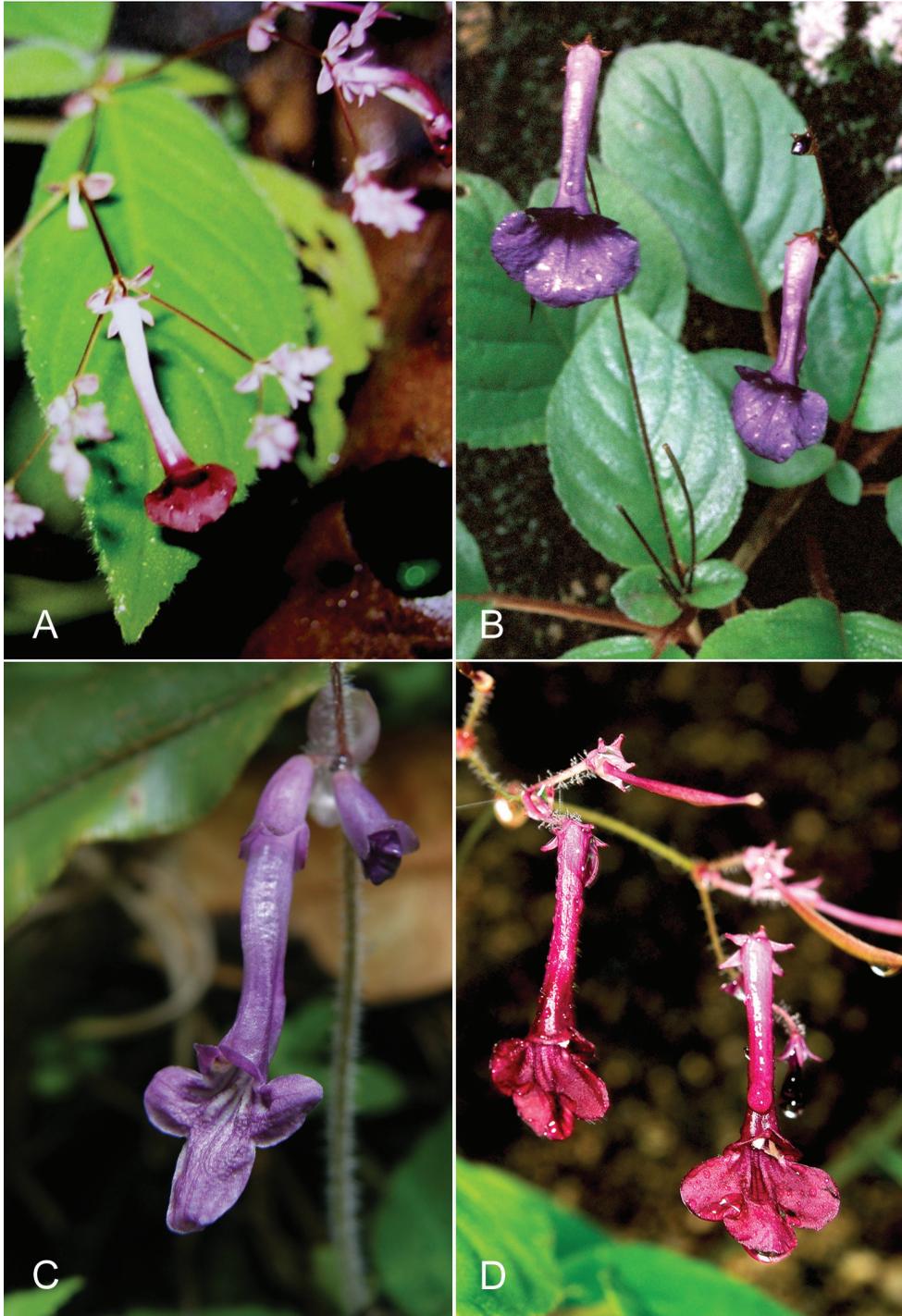
*Etymology.* The specific epithet refers to the shape of the leaves.

*Notes.* *Didymocarpus ovatus* is similar to a number of northern Thai species where the calyx lobes are free to the base but is distinctive in its dark violet to reddish corolla.

*Specimens examined:* THAILAND. **Songkhla.** Dton [Ton] Nga Chang Falls, c. 500 m, near the stream, 21 Aug 1992, *Niyomdham 3130* (AAU, BKF); *ibid.*, c. 475 m, 4 Nov 2003, *Palee 664* (CMU). **Nakhon Si Thammarat.** Khao Luang, c. 1600 m, 25 Jun 1953, *Phloenchit 584* (E); *ibid.*, c. 600 m, 31 Aug 1952, *Phloenchit 418* (E); *ibid.*, c. 1100–1786 m, on mossy rocks in deep shade, 21 Jan 1966, *Tagawa et al. 4852* (E); Nam Tok Yong National Park, c. 50 m, 4 Oct 1972, *Smitinand 11698* (E); *ibid.*, 3 Dec 1972, *Santisuk et al. 262* (E); *ibid.*, c. 140–150 m, 9 Oct 2002, *Palee 553* (CMU); *ibid.*, c. 130 m, 9 Feb 2005, *Williams et al. 1337* (E). **Krabi.** Khao Panom Bencha National Park, c. 1200 m, trail to summit of Khao Panom Bencha, 19 Jun 2006, *Williams et al. 1940* (E). Without locality, cultivated in Aberdeen in 1930, *E00628037*, *Kerr 206*, (E, K, US) & in 1929, *Kerr 197* (K), *Kerr 198* (K).

### 15. *Didymocarpus payapensis* Nangngam & J.F. Maxwell, **sp. nov.**

A *Didymocarpus insulsus* caulibus brevioribus (ad 10 cm longis, nec ad 30 cm longis), calyce c. 2.5 mm longo ad c. 2/3-plo lobato, lobis patentibus ad reflexis (nec liberis erectisque) c. 1.5 mm longis differt.



**Fig. 6.** A. *Didymocarpus ovatus* Barnett. B. *D. payapensis* Nangngam & J.F.Maxwell. C. *D. purpureopictus* Craib. D. *D. tristis* Craib. (Photos A: P. Nangngam, B: S. Gardner, C: W. Maked, D: P. Karaket)

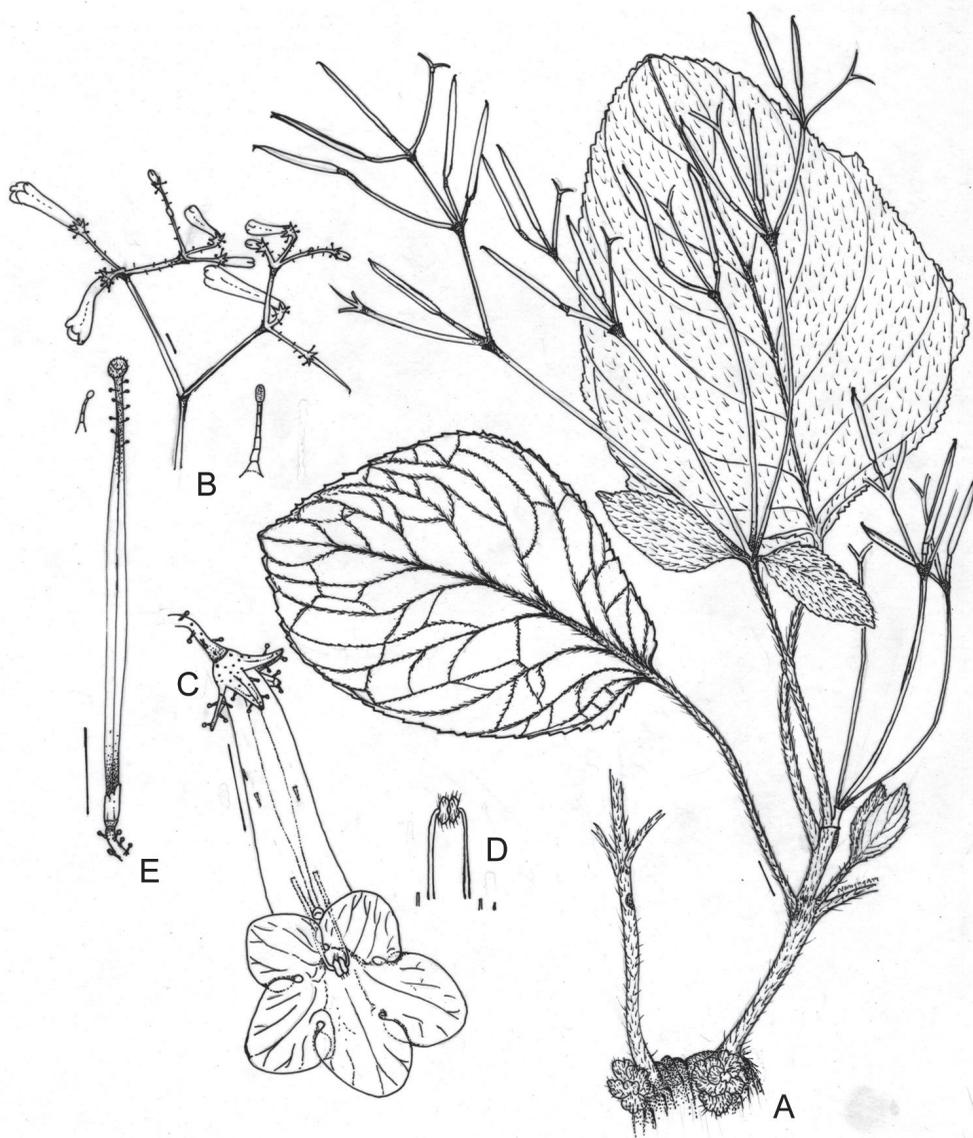
TYPE: *Maxwell 93-1098*, Thailand, Lamphun, Doi Kuhn Dtan [Tan] National Park, 825 m, 24 Sep 1993 (holotype CMU; isotype L). Fig. 6B, Fig. 7.

Deciduous, perennial, terrestrial or epilithic herb. **Rhizome** 1–2 cm long, 0.5–1.5 cm, thick. **Stems** erect, unbranched, up to c. 10 cm tall; sparsely to densely covered with whitish, multicellular eglandular hairs, dull green to medium green, all parts of plant covered with dark brown, 4-celled, pigment glands. **Dry season leaves** clustered on the rhizome; blades 5–10 mm long and wide, densely sericeous with multicellular eglandular hairs above, lower surface mostly glabrous and with scattered pigment glands, venation pinnate, obscure on both sides. **Rainy season leaves** ternate or opposite and decussate, pairs slightly anisophyllous; blades subcoriaceous, medium to dark green above, pale dull light green beneath, elliptic, 6–12 cm long, 2–9 cm wide, apex obtuse, base acute to rounded, margins shallowly and irregularly serrulate, lower part more entire, upper surface sparsely sericeous with minute, multicellular eglandular hairs, lower surface glabrous, except for the main veins, with scattered, 4-celled, dark brown pigment glands, venation pinnate, secondary veins ascending, 5–7 on each side of the midrib, sunken above, prominent underneath; petioles sulcate above, 2–8 cm long, with indumentum as on the stem. **Inflorescences** axillary, laxly and broadly cymose, many-flowered, with occasional multicellular glandular hairs and scattered pigment glands, green to maroon, c. 10 cm long; peduncles 3–7 cm long; pedicels 0.5–1.5 cm long. **Bracts** lanceolate, 2–3 mm long, c. 0.8 mm wide, green, sparsely covered with indumentum as on the inflorescence axes, rapidly caducous. **Calyx** symmetrically campanulate, sparsely covered with multicellular glandular hairs and scattered pigment glands, maroon; calyx tube 2.5 mm long, lobed c. 2/3 to the base; lobes spreading to reflexed, equal, triangular, c. 1.5 mm long, apices obtuse. **Corolla** c. 2.5 cm long, salverform, glabrous, dark purple; corolla tube c. 2 cm long, basal diameter c. 3 mm; anterior (lower) lip 3-lobed, lobes rounded, c. 5 mm high, 6 mm wide; posterior (upper) lip 2-lobed, lobes rounded, c. 3 mm high, 4 mm wide. **Fertile stamens** inserted above the middle of the corolla tube; anthers oblong, c. 2 mm long, cream, tips and bases rounded, white-bearded; filaments slender, c. 5 mm long, glabrous, white; staminodes 3, posterior, reduced to minute filaments, glabrous, whitish-very pale light greenish. **Pollen** 10–11  $\mu$ m, spheroidal, tricolpate with long aperture, sculpturing micro-reticulate. **Disc** cylindrical, margin irregularly lobed, glabrous, c. 1.5 mm high. **Ovary** cylindrical, glabrous, light green, c. 7 mm long; style c. 3.5 mm long, sparsely covered with multicellular glandular hairs; stigma discoid, peltate, reddish, c. 1.2 mm diameter. **Capsules** erect, symmetrically cylindrical, c. 2 cm long, glabrous. **Seeds** elliptic, 0.31  $\times$  0.14 mm, cell ornamentation straight, cell shape lineate-polygonate, cell edges elevated and smooth, cell crests fused, faces depressed and smooth.

*Distribution.* Northern Thailand.

*Ecology.* Open, moist areas in evergreen forest, near streams, on granite bedrock.

*Phenology.* Flowering September, fruiting September–November.



**Fig.7.** *Didymocarpus payapensis* Nangngam & J.F.Maxwell. **A.** Habit (holotype: Maxwell 93-1098, CMU). **B.** Inflorescence. **C.** Calyx and corolla. **D.** Stamens and staminodes. **E.** Capsule. Scale bars: A=1 cm; B, C, E=5 mm. (Drawn by P. Nangngam)

*Vernacular name.* Muang Pha Yap (ม่วงพ้ายัพ).

*Etymology.* The specific epithet refers to the region of north-west Thailand.

*Notes.* Barnett (1962a: 215), under *Didymocarpus insulsus* Craib, indicated that three

specimens (*Kerr 6277*, *Winit 749* and *Winit 1164*), all from northern Thailand, differed from *D. insulsus* in having the calyx lobed c. 1/2–2/3 to the base of the calyx tube. These specimens, along with a number of additional collections, belong to what we describe here as *D. payapensis*. *Didymocarpus insulsus* was described from material cultivated in Aberdeen, Scotland which was grown from seeds collected by Dr. Kerr from a now unknown locality in Thailand. Barnett was reluctant to describe a new species based on these three specimens since environmental conditions were thought to be possible reasons for their differences from the type of *D. insulsus*. Plant stature could possibly be influenced by habitat, but not a morphological feature such as the degree of calyx lobing. We have seen several specimens with this morphology and a molecular phylogenetic study showed a well supported separation between *D. payapensis* and *D. insulsus* (Palee et al. 2006). *Didymocarpus insulsus* Craib, as far as we can determine, is found only in the Chaiyaphum, Loei and Nakhon Nayok (Khao Yai National Park) Provinces.

*Specimens examined*: THAILAND. **Chiang Mai**. Mae Chem, 1500 m, 14 Sep 1922, *Kerr 6277* (K); Aob Kahn National Park, Kuhnwin village, 4 Oct 2001, *Sangkamathawee & Palee 499* (CMU); Mae Awn District, above Mae Lai village, c. 1150 m, 25 Oct 2005, *Palee 836* (CMU); Doi Sutep-Pui National Park, west side of Pah Glawng, above Mae Sa Mai village, c. 1300 m, 5 Dec 2007, *Maxwell 07-718* (CMU). **Chiang Rai**. Doi Tung, Mae Sai District, in front of the entrance to Wat Pra Tat Doi Dtung [Tung], c. 1375–1400 m, 5 Nov 2004, *Palee 761* (CMU); *ibid.*, 30 Oct 2005, *Palee 871* (CMU). **Lampang**. Mae Ngow, c. 440 m, 26 Aug 1922, *Winit 749* (K); *ibid.*, c. 300 m, 4 Sep 1923, *Winit 1164* (K). **Lamphun**. Doi Kuhn Tan National Park, along the trail to Mah Meun station, c. 825 m, 29 Sep 2001, *Palee 495* (CMU); *ibid.*, 10 Oct 2003, *Palee 641* (CMU). **Uttaradit**. Klong Tron National Park, Nam Pad District, west slope of Pu Miang, along the way to Huay Sai waterfalls, c. 1550 m, 16 Oct 2005, *Palee 815* (CMU).

## 16. *Didymocarpus purpureopictus* Craib

Bull Misc. Inform. Kew 1911: 431 (1911); Pellegrin, Fl. Indo-Chine 4(5): 523 (1930) (*purpureo-pictus*); Barnett, Fl. Siam. 3(3): 217 (1962) (*purpureo-pictus*); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 464 (2000); Burt, Thai For. Bull., Bot. 29: 93 (2001). TYPE: *Kerr 1414*, Thailand, Chiang Mai: Doi Sutep [Suthep], on rocks by a stream, 750 m, 25 Sep 1910 (holotype K; isotypes BM, E). Fig. 6C.

Deciduous, perennial, epilithic herb. **Stems** erect, 15–30 m high, densely covered with whitish multicellular glandular hairs, all plant parts sparsely covered with one-cell, globose, red-brown, pigment glands. **Dry season leaves** opposite, decussate; blades subcoriaceous, ovate, c. 2 cm long, 1.5 cm wide, apex acute, base subcordate, margins serrulate, upper surface covered with whitish multicellular eglandular sericeous hairs, concealing the veins, lower surface sparsely covered with indumentum as on the upper surface and with scattered pigment glands; petioles terete. **Rainy season** stems simple, erect, densely covered with multicellular eglandular hairs, caducous. **Rainy season**

**leaves:** blades subcoriaceous, dark green above, pale light green beneath, elliptic to oblong, 12–20.5 cm long, 7–9 cm wide, apex bluntly acute, basal oblique, subcordate, margins serrulate, upper surface densely covered with multicellular eglandular hairs, lower surface glabrous, with scattered pigment glands, venation pinnate with 4–8 pairs of ascending secondary veins, curved near the margin, concealed by indumentum, prominent underneath; petioles 4–8 cm long, with indumentum as on the stem. **Inflorescences** cymose, terminal, and axillary from the upper nodes, up to c. 8 cm long, axes covered with multicellular glandular hairs, sometimes glabrescent, light green; peduncles 5–6 cm long; pedicels 3–5 mm long. **Bracts** ovate-orbicular, c. 3–4 mm long, c. 5 mm wide, glabrous, pale green-dull green, caducous. **Calyx** symmetrically campanulate, glabrous, whitish; tube c. 3–4 mm long, 2–3 mm diameter; shallowly 5-lobed, lobes triangular, 2.5 mm deep, 3 mm wide, apices acute. **Corolla** salverform, 2.5 cm long, glabrous, purplish; tube c. 1.5 mm long, narrow not enlarged, c. 3–4 mm diameter; anterior (lower) lip 3-lobed, c. 4 mm long, 4 mm wide, posterior (upper) lip 2-lobed, c. 3 mm long, 3 mm wide. **Fertile stamens** inserted at c. 1 cm from the base of the tube; anthers whitish, elliptic, white-bearded; filaments slender, 5 mm long, with sparsely unicellular, gland-tipped hairs in the upper part; staminodes 2, slender, reduced to filaments. **Disc** cylindric, margin irregularly lobed, glabrous, c. 1.5 mm long. **Ovary** cylindric, glabrous, pale pinkish, stalk c. 5 mm long, ovary c. 1 cm long, 3 mm wide; style c. 5 mm long, covered with gland-tipped hairs; stigma capitate, reddish. **Capsules** erect, cylindric, slightly curve, up to 3 cm long. **Seeds** not studied.

**Distribution.** North-Eastern Thailand.

**Eccology.** Moist areas in evergreen forest and sometimes in degraded areas on granite bedrock.

**Phenology.** Flowering July–August, fruiting August–September.

**Vernacular name.** Pra Dap Pha (ประดับผา).

**Etymology.** The specific epithet refers to the purplish colour of the corolla.

**Notes.** *Didymocarpus purpureopictus* is most easily recognised by the tubular calyx and the pale violet to whitish corolla.

**Specimens examined:** THAILAND. **Mae Hong Son.** Bahng Mah Pah District, 400 m, 5 Aug 1999, *Maxwell 99-82* (CMU). **Chiang Mai.** Doi Suthep Pui National Park, Mahidol Falls, 1250 m, 9 Feb 2003, *Palee 567* (CMU); *ibid.*, 1250 m, 14 Sep 2003, *Palee 667* (CMU); (CMU); Huay Mae Nai, 1200 m, 17 Aug 1988, *Maxwell 88-1008* (CMU); *ibid.*, 650 m, Mae Sa Botanical Garden, along Mae Sa Noi Stream, 8 Aug 1989, *Maxwell 89-1011* (CMU); Mae Lai village, Huay Kaew Subdistrict, c. 1175 m, 24 Oct 2005, *Palee 827* (CMU). **Nan.** Doi Phuoka National Park, Bua District, 1300 m, 22 Sep 1996, *Pooma 1373* (CMU, BKF). **Loei.** Phu Ruea district, Phu Luang Wildlife Sanctuary, 1560 m, 15 Oct 2009, *Middleton et al. 5160* (E); *ibid.*, 1475

m, 15 Oct 2009, *Middleton et al.* 5138 (E); Cultivated at Royal Botanic Garden Edinburgh in 21 Oct 2010 originally from Loei, Phu Ruea, Phu Luang Wildlife Sanctuary, 1505 m, 15 Oct 2009, collected as *Middleton et al.* 5152, accessioned as 20091940\*A, vouchered as *Middleton* 5231 (E).

### 17. *Didymocarpus tristis* Craib

Bull. Misc. Inform. Kew 1926: 170 (1926); Pellegrin, Fl. Indo-Chine 4(5): 522 (1930); Barnett, Fl. Siam. 3(3): 218 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 467 (2000); Burt, Thai For. Bull., Bot. 29: 93 (2001). TYPE: *Unknown collector*; plant cultivated in Aberdeen which flowered for the first time in Oct 1925, from seeds collected by Dr. Kerr at Khao Soi Dao, Chanthaburi Province, 1400 m, on rocks (lectotype K [K000858323], designated here; isotype ABD (no. 97, leaf only)). Fig. 6D.

Deciduous, perennial, epilithic herb. **Stems** simple, erect, sparsely covered with multicellular eglandular hairs, green, up to 36 cm tall, all parts of plant covered with 4-celled, conical, dark brown or red-brown, pigment glands. **Dry season leaves** ternate or 3-pseudoverticillate, anisophyllous; blades subcoriaceous, ovate, 1.5–2 cm long, 1 cm wide, apex acute, base shallowly cordate, upper surface silvery sericeous, lower surface very densely covered with pigment glands, venation obscure above, prominent underneath. **Rainy season leaves** ternate or 3-pseudoverticillate, anisophyllous; blades subcoriaceous, glossy dark green above, light green beneath, oblong to lanceolate, 4–15 cm long, 3–7 cm wide, apex acute, base obliquely, rounded to cordate, margins finely serrulate, upper surface densely covered with multicellular eglandular hairs, concealing the veins, lower surface sparsely covered with multicellular eglandular hairs and scattered pigment glands, venation pinnate, with 4–6 ascending secondary veins on each side, prominent beneath; petioles 4–9 cm long, slightly unequal in length, covered with indumentums as on leaves surface, light green. **Inflorescences** axillary, from the upper node, cymose, 15 cm long, many-flowered, axes light green-cream to light maroon; peduncles 6–14 cm long, densely covered with multicellular glandular hairs, light maroon; pedicels c. 0.5–1 cm long, sparsely covered with indumentum as on the peduncles, light green or light maroon. **Bracts** elliptic, c. 2.5–4 mm long, 1.5–2 mm wide, apex acute, maroon, glabrous, caducous. **Calyx** 5-lobed to the base, lobes lanceolate, not reflexed, glabrous, c. 3–4 mm long, 1 mm wide, apices obtuse, green-dull maroon. **Corolla** salverform, c. 2–2.5 cm long, glabrous, dark violet-dull reddish; tube c. 1.5–2 cm long, basal diameter of corolla tube 2 mm; anterior (lower) lip 3-lobed, lobes rounded, midlobe 5 mm long, 6 mm wide; posterior (upper) lip 2-lobed, rounded, 3 mm long, 3 mm wide. **Fertile stamens** inserted c. 1.2 cm from the base of the corolla tube; anthers oblong, c. 2 mm long, 1 mm wide, light violet-whitish glabrous, ; filaments c. 2.4 mm long, glabrous; staminodes 3, unequal, reduced to filaments, c. 1–2 mm long, glabrous. **Disc** cylindrical, margin irregularly lobed, 1–2 mm long. **Ovary** glabrous, 1 cm long, light green; style c. 5 mm long, glabrous, light

green; stigma capitate, concave, cream. **Capsules** erect, 3 cm long. **Seeds** numerous, reniform, c.  $0.27 \times 0.13$  mm, cell orientation straight.

*Distribution.* South-Eastern Thailand, only known from Chanthaburi.

*Ecology.* Moist, rugged, rocky and fog-covered areas in primary evergreen forest on granite and limestone bedrock.

*Phenology.* Flowering July–September, fruiting August–December.

*Vernacular name.* Ra Yab Mok (ระยั้งหมอก).

*Etymology.* The specific epithet refers to the dull colour of the corolla.

*Notes.* *Didymocarpus tristis* differs from *D. insulsus* most obviously in the opposite rather than 3-pseudoverticillate leaves.

*Specimens examined:* THAILAND. **Chanthaburi.** Khao Kitchakut National Park, Khao Pra Bat, 600 m, 13 Aug 2000, *Phonsena* 2674 (BKF); *ibid.*, c. 1200 m, 24 Sep 2003, *Palee* 625 (CMU); *ibid.*, c. 920 m, 20 Jul 1999, *Newman* 927 (BKF, E); *ibid.*, c. 800 m, 27 Aug 2012, *Middleton et al.* 5673 (E); Khao Soi Dao, 1400 m, 14 Dec 1924, *Kerr* 9648 (K); Plant cultivated in Aberdeen from seeds collected from Khao Soi Dao, 1400 m, 14 Dec 1924 by Kerr 9648 (K).

### 18. *Didymocarpus wattianus* Craib

Gard. Chron. 72: 363 (1922) (*wattiana*); Craib, Gard. Chron. 75: 89 (1924) (*wattiana*); Barnett, Fl. Siam. 3(3): 218 (1962); Barnett, Dansk Bot. Ark. 20(2): 202 (1962); Weber et al., Ann. Naturhist. Mus. Wien, B 102: 468 (2000); Burt, Thai For. Bull., Bot. 29: 93 (2001). TYPE: Specimen not found (the species was described from a plant which flowered in November 1922, grown by James Cromar Watt in Aberdeen from seed collected by Kerr without a known locality). NEOTYPE: Specimen collected from “Type plant” cultivated in Aberdeen, 31 Oct 1930 (neotype K [K000858325], designated here).

Deciduous, perennial, epilithic herb. **Stems** covered with multicellular eglandular hairs, c. 6–18 cm tall. **Leaves** opposite; blades subcoriaceous, dark green above, pale green beneath, oblong-elliptic, elliptic or ovate-lanceolate, to 9 cm long, to 5.5 cm wide, apex subacute to acuminate, base slightly obliquely cordate, margins denticulate, densely covered with whitish multicellular eglandular hairs and golden pigment glands, secondary with sparse indumentum as on the upper surface and sparse golden pigment glands; venation pinnate, sunken, with c. 12 ascending secondary veins on each side, prominent; petioles up to 8 cm long, with indumentum as on the stem. **In-florescences** terminal, or from the axils of upper leaves, cymose, up to c. 7 cm long,

several flowered, axes covered with spreading, white multicellular glandular hairs and sparsely covered with one-celled, sessile, golden, pigment glands; peduncles 6 cm long; pedicels 5 mm long, with glandular, capitate hairs, sometimes with some pigment glands. **Bracts** 2, caducous, glabrous. **Flowers** several, pendulous in bud. **Calyx** campanulate, c. 1.9 cm long, c. 1 cm diameter, slightly asymmetric, glabrous, dark pink; shallowly 5-lobed, lobes triangular, c. 3 mm deep, 2 mm wide, apex rounded. **Corolla** c. 6–7 cm long, funnelform, glabrous, buds glossy, deep maroon-red, paler at anthesis; tube c. 4–4.5 cm long, base narrow, c. 3 mm diameter, widening at 2 cm from the base, throat c. 1 cm diameter; anterior (lower) lip 3-lobed, lobes rounded, c. 8 mm long, 9 mm wide; posterior (upper) lip 2-lobed, lobes, rounded, smaller than the anterior lobes, 5 mm long, 7 mm wide. **Fertile stamens** inserted at c. 3–3.5 cm above the base of the corolla; anthers oblong, c. 3 mm long, c. 2 mm wide, white-bearded; filaments glabrous, c. 1 cm long; staminodes 3, glabrous, reduce to filaments. **Disc** tubular, c. 2 mm long, margins irregular. **Ovary** cylindrical, 4.5 cm long including stalk and style, light green, covered with multicellular glandular hairs; stigma peltate, concave, papillose. **Capsules** erect, c. 6 cm long. Pollen and seeds not studied.

*Distribution.* Northern Thailand, only known from Nan.

*Ecology.* Moist areas near streams in evergreen forest.

*Phenology.* Flowering September, fruiting October–December.

*Vernacular name.* Muang Dok Yai (ม่วงดอกใหญ่).

*Etymology.* The specific epithet honours James Cromar Watt, a contemporary of Craib and horticulturist in Aberdeen.

*Notes.* We have been unable to locate a specimen which is unequivocally original material. The neotype we have chosen states it is a collection from the same living plant in cultivation in Aberdeen but from several years after the protologue was published. No provenance information was given in the protologue but the seed that Kerr sent to Aberdeen could have been collected on Kerr's tour through northern Thailand to Nan via the mountainous district of Muang Pua in early 1921. Our evidence for this is that the cultivated neotype specimen is a close match to *Srisanga 1708* (E) from Doi Phu Kha in Pua District. Barnett (1962a, 1962b) included in this species *Larsen 490*, collected on 11 Sep 1958 from Doi Suthep (Chiang Mai) at 1500 m. We have also been unable to locate this specimen.

*Specimens examined:* THAILAND. **Nan.** Doi Phu Kha National Park, Pua, 19°13'N 101°05'E, 25 Sep 2000, 1170 m, *Srisanga 1708* (E). **Chiang Mai.** Doi Suthep-Pui National Park, Mahidol Falls, 1250 m, 8 Nov 1989, *Maxwell 89-1377* (E).

ACKNOWLEDGEMENTS. Financial support from the Thailand Research Fund through the Royal Golden Jubilee Ph.D. Program (grant no. PHD/0188/2543) to Pranee Nangngam (formerly Pranee Palee) and Assoc. Prof. Dr. Vilaiwan Anusarnsunthorn is gratefully acknowledged. A part of this work was supported by the TRF/BIOTEC Special Program for Biodiversity Research and Training (grant no. BRT R\_147011) along with financial support from the Faculty of Science, Naresuan University to the first author in 2013 to travel to the Royal Botanic Garden Edinburgh. We would like to thank the staff of all National Parks in Thailand which we visited and where we collected specimens for this study. Dr. J.F. Veldkamp (National Herbarium, Leiden, Netherlands) is thanked for correcting our Latin diagnoses. We thank the curators and staff at all herbaria for permission to examine their collections and for the loan of some specimens. We thank Dr. David Middleton for his comments on the manuscript. Finally, we would like to thank the reviewers for their suggestions.

## References

- Barnett, E.C. (1961) Contributions to the Flora of Thailand: LV. *Kew. Bull.* 15: 249–259.
- Barnett, E.C. (1962a) Gesneriaceae. *Florae Siamensis Enumeratio* 3(3): 196–238. Bangkok: Siam Society.
- Barnett, E.C. (1962b) Gesneriaceae. *Dansk Bot. Ark.* 20(2): 200–203.
- Hilliard, O.M. & Burt, B.L. (1995) Old World Gesneriaceae IV. Notes on *Didymocarpus* and *Lysionotus*. *Edinburgh J. Bot.* 52: 215–224.
- McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prudhomme van Reine, W.F., Smith, G.F., Wiersema, J.H. & Turland, N.J. (2012) *International Code of Nomenclature for Algae, Fungi, and Plants (Melbourne Code)*. <http://www.iapt-taxon.org/nomen/main.php> (Articles 60.1, 118.)
- Middleton, D.J. & Möller, M. (2012) *Tribounia*, a new genus of Gesneriaceae from Thailand. *Taxon* 61(6): 1286–1295.
- Palee, P., Denduangboripant, J., Anusarnsunthorn, V. & Möller, M. (2006) Molecular phylogeny and character evolution of *Didymocarpus* (Gesneriaceae) in Thailand. *Edinburgh J. Bot.* 63(2&3): 231–251.
- Pellegrin, F. (1930) Gesnériaceae (Cyrtandrees). *Flore Générale de L'Indo-Chine* 4(5): 456–608.
- Thiers, B. (2012) (continuously updated). Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/>
- Wang, W., Kaiyn, P., Zhengu, L., Weitzman, A.L. & Skog, L.E. (1998) Gesneriaceae. *Flora of China* 18: 349–358. Beijing: Science Press & St. Louis: Missouri Botanical Garden.
- Weber, A. & Burt, B.L. (1983) *Didymocarpus corchorifolius* and its allies (Gesneriaceae). *Blumea* 28: 291–309.
- Weber, A. & Burt, B.L. (1997) Remodelling of *Didymocarpus* and associated genera (Gesneriaceae). *Beitr. Biol. Pflanzen* 70: 293–363.
- Weber, A., Wei, Y.G., Puglisi, C., Wen, F., Mayer, V. & Möller, M. (2011) A new definition of the genus *Petrocodon* (Gesneriaceae). *Phytotaxa* 23: 49–67.

**Appendix A.** Identification list.

All collections examined are identified according to this species list:

- 1=*Didymocarpus aureoglandulosus* C.B.Clarke
- 2=*Didymocarpus bicolor* Craib
- 3=*Didymocarpus biserratus* Barnett
- 4=*Didymocarpus corchorifolius* Wall. ex DC.
- 5=*Didymocarpus dongrakensis* B.L.Burt
- 6=*Didymocarpus epithemoides* B.L.Burt
- 7=*Didymocarpus geesinkianus* B.L.Burt
- 8=*Didymocarpus inflatus* J.F.Maxwell & Nanggam
- 9=*Didymocarpus insulsus* Craib
- 10=*Didymocarpus jaesonensis* Nanggam & J.F.Maxwell
- 11=*Didymocarpus kerrii* Craib
- 12=*Didymocarpus megaphyllus* Barnett
- 13=*Didymocarpus newmanii* Barnett
- 14=*Didymocarpus ovatus* Barnett
- 15=*Didymocarpus payapensis* Nanggam & J.F.Maxwell
- 16=*Didymocarpus purpureopictus* Craib
- 17=*Didymocarpus tristis* Craib
- 18=*Didymocarpus wattianus* Craib

Adisai 925:18 — Geesink et al. 7416:7 (type) — BGO staff 7057:1, 9552:11, 4544:11, 6988:11, 9678:11 — C6744 accession no. 19683012:3, C8459 accession no. 19741960:3, C8460 accession no. 19741960:3, C3713 accession no. 19611998:3, C4304 E00628027:9, C4512 E00628030:9, C8069E00628026:9 — Carrot 4:8 — DE 191:3 — Dee Bunpheng 998:2 — E00421472 accession no. 20091940\*A:16, E00628037 Kerr 206:14, E00628037 Ker 197:14, E00628037 Kerr 198:14 — Fukuoka and Ito T-34993:6, T-35034:9, T-34610:9 — Garret 441:11 — Geesink, Hattink, and Charoenphol 7416:7 (type).—Gen Murata et al.T-42099:9 — Giravatanapan 1:8 — Herb trip 1131:8 — Hosseus 220:1 (type) — Iwasuki & Fukuoka 4484:11 — Jatupol 08-409:2 — Kerr 1996:1 (type of syn.), 786:11 (type), 3443:11, 3215:12 (type), 13259:14 (type), 6277:15, 1414:16 (type), 9648:17 — Kunwasi 9:6 — Larsen 6258:3 (type) — Larsen 490:16 — Larsen & Hansen 4341:1, 4902:1, 4649:11 — Larsen & Larsen 34408:11 — Larsen, et al. 46087:4, 51:6, 10683:6 (type) — Maxwell 04-526:1, 92-496:1, 76-531:5 (type), 00-404:6, 04-490:8 (type), 00-391:9, 96-1093:10 (type), 02-284:11, 04-804:11, 89-1338:11, 89-1433:11, 94-986:11, 95-533:11, 95-1066:11, 07-718:15, 93-1098:15 (type), 88-1008:16, 89-1011:16, 89-1377:16, 99-82:16, 89-1377:18 — Middleton 5653:6 — Middleton et al. 4453:1, 5578:1, 5501:4, 5644:6, 5070:8, 5634:9, 5651:9, 5568:10, 4506:11, 4941:11, 5672:13, 5138:16, 5152:16, 5160:16, 5673:17 — Nanggam 2552:2 — Newman 926:14 (type), 927:17 — Niyomdham 3130:14 — O.T. 1252:9 — Palee 524:1, 549:1, 570:1, 701:1, 639:3, 662:4, 658:5, 603:6, 642:8 (type), 802:8, 839:8, 638:9, 645:9, 539:11, 550:11, 568:11, 668:11, 702:11, 741:11, 808:11, 686:12, 532:13, 622:13, 553:14, 664:14, 495:15, 641:15, 761:15, 815:15, 836:15, 871:15, 567:16, 667:16, 827:16, 543:17, 551:17, 625:17 — Palee & Tantana 752:12 — Palee & Toktang 668:11 — Panatkol 156:11 — Phengkhilai et al. 7188:11, 6736:15, 7188:11 — Phonsena 2675:13, 2674:17 — Pleoenchit 418:14 — Plernchit 245:12, 584:14 — Pooma 1373:16 — Pooma & Pattharahirantricin 7722:1 — Pooma et al. 7782:8 — Put 401:17 — RBG 19850475:2 — Roger 161:1 (type of syn.) — Sadakorn 588:11 — Sangkamathawee & Palee 499:15 — Shimizu et al. T8863:3, 19724:6 — Smitinand 11698:14 — Smitinand and

Sleumer 1012:1; 1870:3 (type); 10471:3 — Smitinand et al. 262:14 — Santisuk et al. 262:14 — Srisanga 251:1, 1534:11, 1708:18 — Suddee 169:9 — Suksathan 2693:11 — S. P. et al. 57663:9 — Tagawa et. al. 4852:14 — Takahashi and Tamura T-63384:9, T-62781:11 — Tamura T-6011:9 — van Beusekom and Charoenpol 1757:6, 1756:9 — Wai 1123:4 — Wallich 792:4 (type) — Watthana et al. 586:11, 484:12 — Williams et al. 1337:14, 1940:14 — Winit 1425:11, 749:15, 1164:15.

## Appendix B. Index to names.

Numbers refer to the species number given in the text. Synonyms are in *italics* and new taxa are in **bold**:

- Didymocarpus aureoglandulosus C.B.Clarke 1  
 Didymocarpus bicolor Craib 2  
 Didymocarpus biserratus Barnett 3  
 Didymocarpus corchorifolius Wall. ex DC. 4  
 Didymocarpus dongrakensis B.L.Burt 5  
 Didymocarpus epithemoides B.L.Burt 6  
 Didymocarpus geesinkianus B.L.Burt 7  
**Didymocarpus inflatus** J.F.Maxwell & Nangngam 8  
 Didymocarpus insulsus Craib 9  
**Didymocarpus jaesonensis** Nangngam & J.F.Maxwell 10  
 Didymocarpus kerrii Craib 11  
 Didymocarpus megaphyllus Barnett 12  
 Didymocarpus newmanii B.L.Burt 13  
 Didymocarpus ovatus Barnett 14  
**Didymocarpus payapensis** Nangngam & J.F.Maxwell 15  
 Didymocarpus purpureopictus Craib 16  
*Didymocarpus rodgeri* W.W.Sm. 1  
*Didymocarpus rodgeri* W.W.Sm. var. *siamensis* W.W.Sm. 1  
*Didymocarpus siamensis* Barnett 3  
*Didymocarpus squamosa* Craib 11  
 Didymocarpus tristis Craib 17  
 Didymocarpus wattianus Craib 18