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Recent changes in Thai Euphorbiaceae *sensu lato*

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ABSTRACT. *Alchornea trewioides* (Benth.) Müll.Arg. appears to be a misapplied name in Thailand, the correct name for the species is *A. parviflora* (Benth.) Müll.Arg. The variety *Alchornea rugosa* var. *macrocarpa* Airy Shaw is not recognized any longer. The monotypic genus *Chorisandrachne* Airy Shaw is reinstated, and separated again from *Leptopus* Decne based on phylogenetic evidence. The circumscription of *Mallotus* Lour. has changed drastically. A part of *Mallotus* is separated as *Hancea* Seem., while *Trewia* Lour. is united with *Mallotus. Koilodepas* Hassk. appears to be present in Thailand with three species instead of one, and *Galearia* Zoll. & Moritzi is present with two instead of a single species. The genera *Richeriella* Pax & K.Hoffm. and *Flueggea* Willd. are united under the latter name.

KEY WORDS: *Alchornea*, *Chorisandrachne*, Euphorbiaceae, *Flueggea*, *Galearia*, *Hancea*, *Koilodepas*, *Leptopus*, *Mallotus*, *Richeriella*.

INTRODUCTION

Since the publication of the Euphorbiaceae in the Flora of Thailand series (Chayamarit & Welzen, 2005; Welzen & Chayamarit, 2007) continued revisions of genera caused changes in species concepts, while molecular phylogenetic studies altered several generic circumscriptions. The latest changes, including a fully updated key which incorporates the changes discussed in this paper, can be viewed on the website www.nationaalherbarium.nl/thaieuph.

ALCHORNEA

The genus *Alchornea* Sw. occurs with three species in Thailand. *Alchornea rugosa* (Lour.) Müll.Arg. has obovate leaves, while the other two species have ovate leaves. During a revision of the Malesian and Thai species the latter two species appeared to be part of widespread species (Welzen, 2007) with complex variation. *Alchornea tiliifolia* (Benth.) Müll.Arg. now includes the synonym *A. villosa* Benth., a form that is more hairy and with much larger stipellae. *Alchornea tiliifolia* specimens from Central Thailand tend to be rather glabrous, usually have smaller, even gland-like stipellae and the fruits are only slightly muricate near the style; northern and especially southern specimens are very hairy, have larger stipellae and distinctly muricate fruits. *Alchornea trewioides* (Benth.) Müll.Arg. is a misapplied name; this species only occurs in south China and northern Vietnam. The species in Thailand is actually *A. parviflora* (Benth.) Müll.Arg., a

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species known under various names in the Philippines, Borneo, Sumatra, and the Malay Peninsula. *Alchornea parviflora* differs from *A. trewioides* in various characters (data for *A. trewioides* always second): slender leaves (length/width ratio) 1.6–3 versus 1.2–1.6, stipellae shorter (1.2–2.5 mm) versus longer (2.3–10 mm), staminate buds and sepals hairy versus glabrous, staminate and pistillate bracts shorter (0.6–0.7 mm, 0.8–4 mm respectively) versus 0.6–1.2 mm and 2.3–5 mm respectively; the ovary warty versus smooth and finally the apex of the columella T-shaped versus apically not widened.

The variety *A. rugosa* var. *macrocarpa* Airy Shaw cannot be maintained. Study of more specimens, especially those of the Malay Peninsula, showed the deviating leaf shape (elliptic with an acute base) to grade into the common shape (obovate with a narrowly cordate base). Only the type specimen showed the large fruits, which, in the light of the many specimens now studied, is now only regarded as an exceptional form.

CHORISANDRACHNE VERSUS LEPTOPUS

The Thai monotypic genus *Chorisandrachne* Airy Shaw is reinstated. Webster (1994) united this genus with *Leptopus* Decne. Recent molecular research (Kathriarachchi *et al.*, 2005) shows that *C. diplosperma* Airy Shaw (*L. diplospermus* (Airy Shaw) G.L.Webster) and *Leptopus* are members of different clades. Hoffmann *et al*. (2006) formalised the new classification of the Phyllanthaceae (formerly Euphorbiaceae subfam. Phyllanthoideae); *Leptopus* is placed in tribe Poranthereae and *Chorisandrachne* in tribe Wielandieae subtribe Wielandiinae.

The key to the genera (Chayamarit & Welzen, 2005) has to be changed:

Insert under 78 first lead the key to the species of *Leptopus* (Welzen & Chayamarit, 2007) as follows:

78’ Shrubs to trees, to 8.5 m high. Leaves 1–2.5 by 0.7–1.6 cm. Petals longer than sepals. Disc annular. Fruit lobed **Chorisandrachne**

78’ Woody herb (to subshrub), to 50 cm high. Leaves 1–7.6 by 0.5–3.4 cm. Petals shorter than sepals. Disc consisting of 5 V-shaped or 10 lobes. Fruits not lobed, triangular in transverse section **Leptopus (australis)**

The website (see Introduction) contains unpublished drawings of *Chorisandrachne diplosperma* (Fig. 1).

GALEARIA

A revision of *Galearia* Zoll. & Moritzi for Flora Malesiana (ms.) showed that not only *G. fulva* (Tul.) Miq. occurs in Thailand, also *G. maingayi* Hook.f. is present in Narathiwat. Both species belong to different subgenera, *G. fulva* is classified in subgenus *Galearia* and *G. maingayi* in subgenus *Orthopetalum* Forman. The two subgenera are easy to separate (see key) and, therefore, both species are easy to identify:

1. Petals convex or cucullate, glabrous except often for a few apical hairs. Fruits laterally flattened, wall thin, ca 0.4 mm thick, entire. Petioles flat above to round. Filaments and connectives glabrous. Ovaries 2-locular **G. fulva**

1. Petals ± straight and flat, completely hairy. Fruits subglobular to ovoid to angular-subglobular; wall 8–17 mm thick, with cavities. Petioles channelled above. Filaments and connectives hairy. Ovaries 4-or 5(6)-locular **G. maingayi**

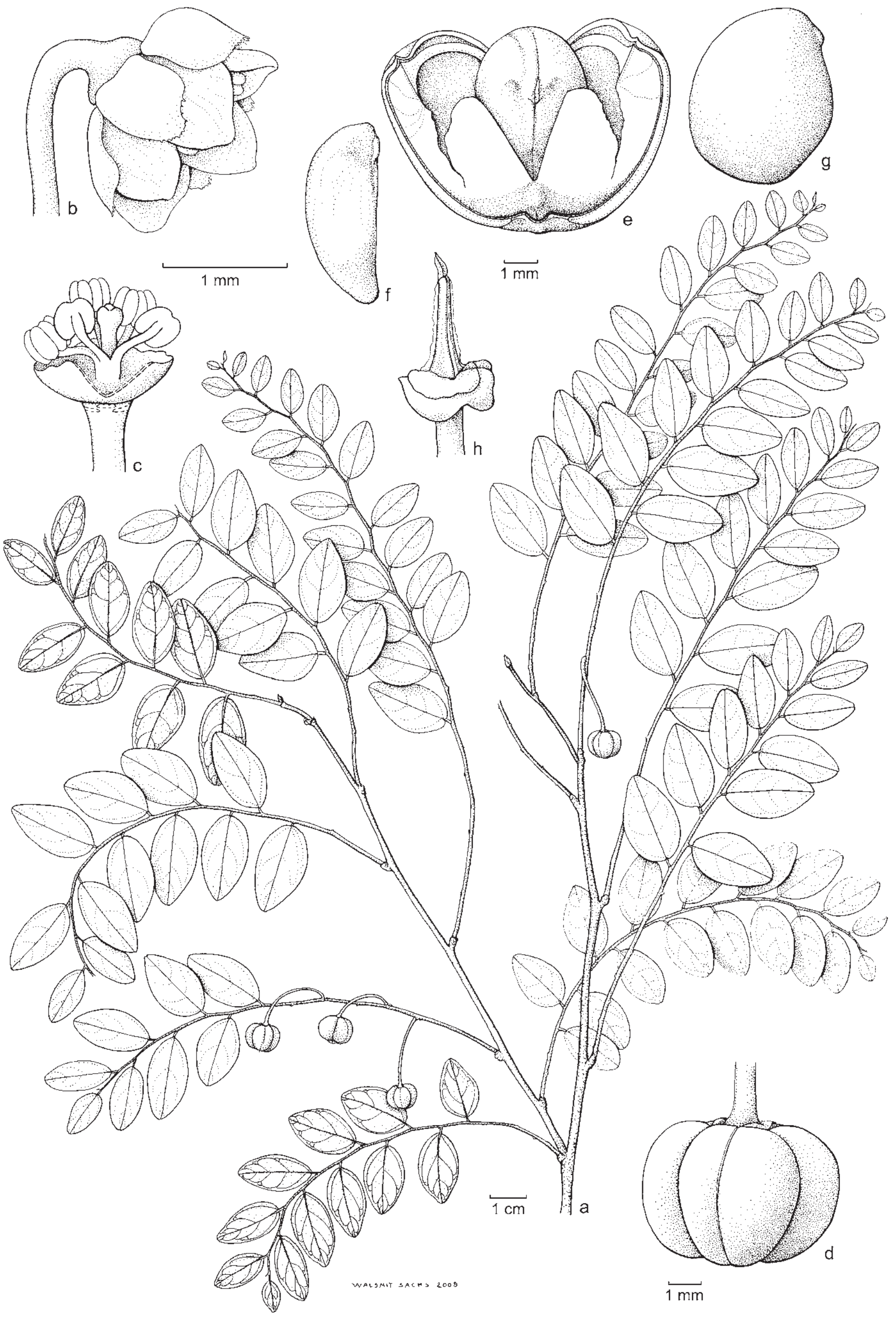

Figure 1. *Chorisandrachne diplosperma* Airy Shaw: A. habit; B. opening staminate flower; C. staminate flower with sepals and petals removed, showing disc and androphore with pistillode; D. fruit; E. mericarp partly split loculicidally, with two seeds; F. seed in front view with hilum; G. seed in side view; H. columella (A (partly), E-H: *Larsen et al.* 45346, L; A (partly): photo by R. Pooma in Van Welzen & Chayamarit, 2007; B, C: *Kerr* 20537, L). Drawn by Anita Walsmit Sachs, 2008.

Galearia maingayi Hook.f., Fl. Brit. India 5: 377. 1887; Forman, Kew Bull. 14: 311. 1960; Kew Bull. 20: 312, fig. 1.2. 1966; Kew Bull. 26: 158, fig. 1a, 2a1-2. 1971; Whitmore, Tree Fl. Malaya 2: 98. 1973; Airy Shaw, Kew Bull. Add. Ser. 4: 221. 1975; Kew Bull. 36: 367. 1981. Fig. 2.

(Big) trees, to 35 m high; sometimes fluted or buttresses present, to 3 m tall; branchlets sericeous-tomentose. *Stipules* triangular, very early caducous. *Leaves*: petiole stout, 5.5–13 mm long, channelled above, (sub)glabrous; blade ovate to elliptic, 5.2–20.5 by 2.1–6.7 cm, length/width ratio 2.5–3.1, base shortly attenuate to acute, apex bluntly acuminate, upper surface glabrous (to few hairs when young), lower surface glabrous to subsericeous when young, venation distinct on both sides, nerves in 9–11 pairs. *Inflorescences* to 18 cm long, sericeous; bracts to 0.8 by 0.3 mm. *Flowers*: calyx ca 1.5 mm deep, glabrous inside, lobes triangular, ca 0.2 by 0.2 mm; petals elliptic, 3.1–3.5 by 0.8–1 mm, apex acute, hook-like, bend inwards, tomentellous on both sides, greenish white to white. *Staminate flowers* ca 4 mm in diam. (young flower); pedicel to 12 mm long; petals probably spreading horizontally; stamens free, filaments round, hirsute, of two lengths, to 1.7 mm long, connective with hairy apical appendix to 0.3 mm long, anthers ca 0.4 by 0.6 mm; pistillode ca 2 by 0.5 mm, hairy. *Pistillate flowers* ca 2 mm in diam., not fully open, pedicel ca 1. 5 mm long, elongating to 4.5 mm in fruit; ovary 4- or 5(6)-locular, ca 1.2 by 1.2 mm, ribbed, apically narrowing and with crater-like opening, stigmas only seen as split bands on inside of apical opening, ca 0.4 mm long. *Fruits* subglobular to ovoid to angular-subglobular, 1.5–3.8 cm high by 2.1–4.5 cm diam., fleshy, woody when dry; wall very thick, 8–17 mm. *Seeds* flattened, boomerang-like in transverse section with hollow side extrorse, ca 7.5 mm long.

Thailand.— PENINSULAR: Narathiwat.

Distribution.— Malay Peninsula (types), Sumatra, Borneo.

Ecology.— Primary forest, pole dipterocarp forest, disturbed forest, alluvial zone, sandy peat swamp, belukar; soil: sandy loam, sandstone derived soil, shales, clayey soil; bedrock basalt; altitude: 20–800 m. Flowering: April, May, July; fruiting: January to November, eaten by animals.

KOILODEPAS

A recent revision (Welzen, submitted) of *Koilodepas* Hassk. showed that there are three instead of a single species (*K. longifolium* Hook.f.) in Thailand. Also *K. bantamense* Hassk. and *K. hainanense* (Merr.) Croizat are present. *Koilodepas bantamense* occurs in South-western and Peninsular Thailand, Laos, the Malay Peninsula, Java, and Borneo; *K. longifolium* has an almost similar distribution, it is present in Peninsular Thailand, the Malay Peninsula, Sumatra, and Borneo (absent in Java and Laos); while *K. hainanense* is found in China (Hainan), N. Vietnam and South-eastern and South-western Thailand.

The three species differ in the leaf margin and the pistillate calyx and stigmas. They can be keyed out as follows:

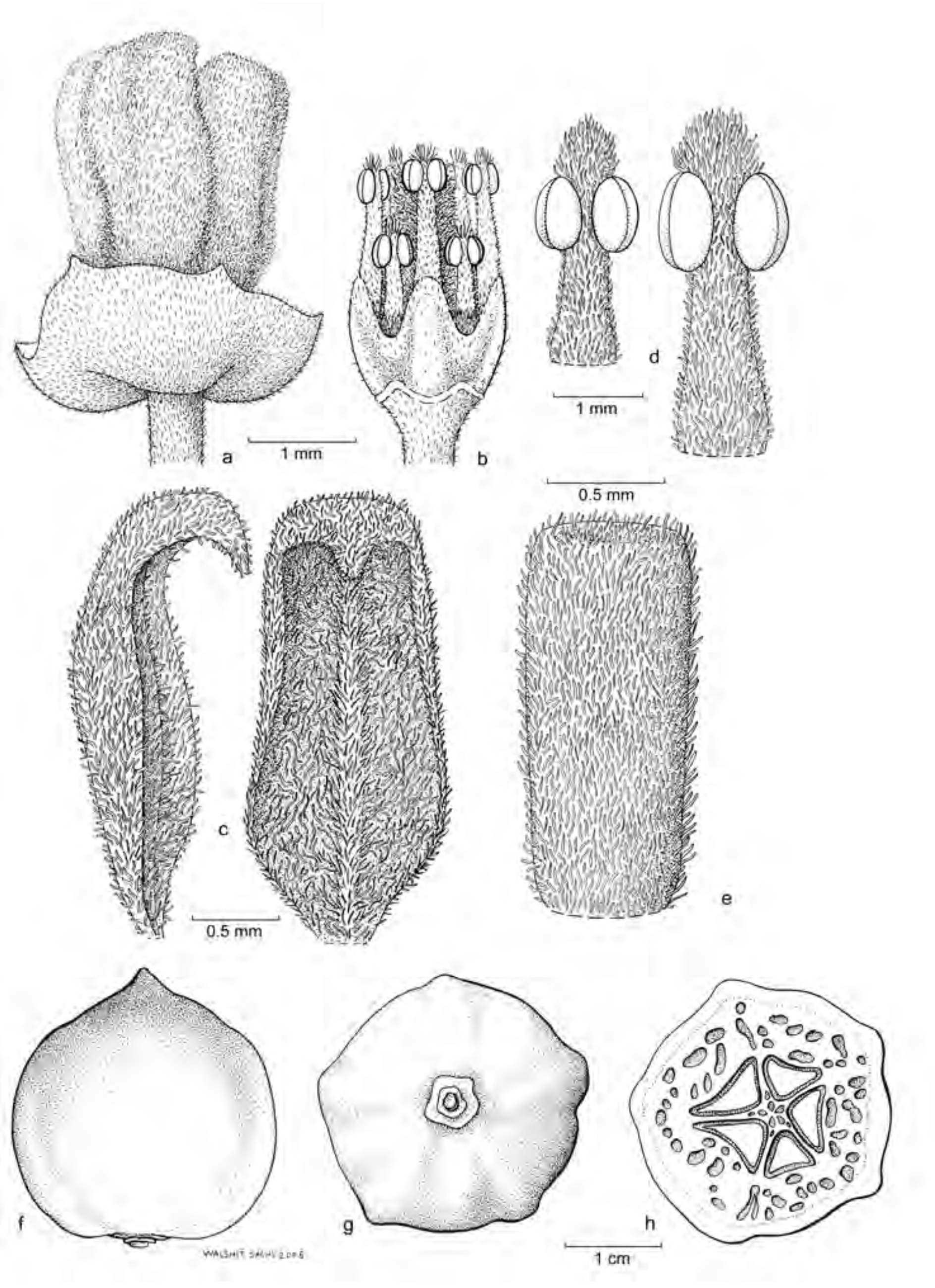

Figure 2. *Galearia maingayi* Hook.f.: A. Staminate flower; B. idem, with petals removed; C. petals in lateral and adaxial view; D. short and long stamen; E. pistillode; F. fruit in lateral view; G. fruit in basal view; H. transverse section showing thick wall and cavities (A-E: *Maingay* KD 1412, K; F-H: *Whitmore* in FRI 4462, L). Drawn by Anita Walsmit Sachs, 2008.

1. Pistillate calyx only enveloping lower half of ovary, not or hardly enlarging in fruit. Blade teeth ending in a small and narrow gland. Stigmas not strongly splitting, separately visible **K. longifolium**
1. Pistillate calyx enveloping ovary completely (n.b. sometimes very tightly so and then seemingly absent), not or strongly enlarging in fruit. Blade teeth generally ending in a broad, marginal gland. Stigmas separately visible or not due to strong apical splitting
  2. Pistillate calyx tightly urceolate around ovary (seemingly absent), not to slightly enlarging in fruit (to 5 mm high). Fruits 16–18 mm wide **K. bantamense**
  2. Pistillate calyx loosely folded over ovary, enlarging in fruit (to 18 mm deep). Fruits 12–15 mm wide **K. hainanense**

MALLOTUS

The circumscription of *Mallotus* Lour. has changed drastically following molecular phylogenetic research (Kulju *et al.*, 2007a). *Mallotus* appears to be paraphyletic. A part of *Mallotus*, combined with *Cordemoya* Baill., and former *Deuteromallotus* Pax & K.Hoffm. is now placed in the newly re-erected *Hancea* Seem. (Sierra *et al.*, 2007). For Thailand the species of former *Mallotus* section *Hancea* (Seem.) Pax & K.Hoffm. and section *Oliganthae* Airy Shaw are transferred to *Hancea*. Morphologically, *Mallotus* and *Hancea* became much more homogeneous, *Mallotus* has extra-floral nectaries on the leaves and the typical scale-like glandular hairs, while *Hancea* always lacks the extra-floral nectaries and scale-like glandular hairs, but can possess long-stalked glandular hairs. Species in former section *Hancea* are distinctive because of their opposite leaves one of which is stipule-like.

The genera can be keyed out as follows in two places in the main key to the genera (Chayamarit & Welzen, 2005):

24a. Lower leaf surfaces and/or inflorescences with stellate hairs and/or glandular scales (microscope or hand lens; sometimes only along the basal margin; check especially young parts) **Mallotus**
24b. Leaves and inflorescences glabrous or with simple hairs
  25a. Opposite leaf stipule-like (inflorescences opposite normal leaf). **Hancea**
  25b.Leaves of each pair equal in size and shape continue with 26
128a.: **Hancea (subpeltata)** instead of *Mallotus* (*subpeltatus*).

The species of Hancea can be keyed out as follows:

1a. All or most leaves alternate. Inflorescences to 1 cm long **4. H. subpeltata**
1b. All leaves opposite, but one of each pair stipule-like and when caducous, then inflorescence opposite to leaf. Inflorescences to 15 cm long
  2a. Petioles less than 2 cm long **3. H. stipularis**
  2b. Petioles longer than 2 cm
    3a. Leaf blades hairy underneath **1. H. kingii**
    3b. Leaf blades glabrous underneath **3. H. penangensis**

The genus *Trewia* Lour. is now synonymised with *Mallotus* and the species placed under the latter name (Kulju *et al.*, 2007b) and couplet 25b in the key has changed to key out *Hancea* (see above). *Trewia nudiflora* L. has now become *Mallotus nudiflorus* (L.) Kulju & Welzen. There is still one problem, the genus name *Trewia* predates the name *Mallotus* and in fact, all *Mallotus* species should be placed in *Trewia*. However, Kulju & Welzen have sent a proposal to Taxon to conserve the name *Mallotus* against *Trewia*.

FLUEGGEA AND RICHERIELLA

Hoffmann *et al*. (2006) united the genera *Richeriella* Pax & K.Hoffm. and *Flueggea* Willd. under *Flueggea*. *Richeriella* was probably a monotypic genus (two species described but seemingly representing a single species, e.g., Welzen & Chayamarit, 2007). *Richeriella gracilis* (Merr.) Pax & K.Hoffm. has become *Flueggea gracilis* (Merr.) Petra Hoffm. (Hoffmann *et al*., 2006). Typically *Flueggea*, including *F. gracilis,* possess staminate flowers with a pistillode consisting of three more or less linear structures that are apically bent. However, *Flueggea gracilis* is aberrant within *Flueggea* because of its deviating inflorescence, a panicle instead of fascicled flowers. However, other Phyllanthaceae / Euphorbiaceae s.l. show a similar variation, e.g. *Phyllanthus* and especially *Sauropus.*

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