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The *Dioscorea* species of Doi Chiang Dao with particular reference to *Dioscorea collettii* Hook.f. (Dioscoreaceae), a new record for Northern Thailand

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ABSTRACT. *Dioscorea collettii* Hook.f. is presented as a new record for Thailand, from Doi Chiang Dao in Chiang Mai Province. It is a Sino-Himalayan species, occurring at high altitude in Thailand. A complete description and illustrations are provided, including the underground parts. Its distinctive morphological characters are discussed. 10 *Dioscorea* L. species, over 20% of the total in Thailand, occur on Doi Chiang Dao. Its unique contribution to the diversity of the genus is discussed.

INTRODUCTION

Dioscorea collettii Hook. f. was described by Hooker (1892) from specimens collected by Collett at Naungtaya in the Shan Hills, now in Myanmar. A fuller description of the plant and its above-ground parts was given by Prain & Burkill (1936), who also provided an extensive synonymy and cited many specimens from China. The most recent treatment of this species was that of Ding & Gilbert (2000). They followed an earlier Chinese treatment which divided the species into two varieties, var. *collettii* and var. *hypoglauca* (Palibin) C.T. Ting et al. through sinking *D. hypoglauca* Palibin into *D. collettii*. According to Ding & Gilbert, the two taxa differ through var. *collettii* having an opaque leaf margin and an anther connective usually as wide to twice as wide as the anther, and var. *hypoglauca* a transparent leaf margin (usually) and the connective about half as wide as the anther. The distribution of the species as a whole was given by Ding & Gilbert (2000) as including Vietnam, Laos and Thailand as well as China, India and Myanmar. However, following an extensive survey of herbarium specimens of *Dioscorea* from Thailand (see Materials & Methods below) we believe that this distribution was not based on specimen data and that collections made in 2002 are the first from Thailand. The treatment of Ding & Gilbert is also inconsistent in that var. *collettii* is cited as occurring in China, India and Myanmar and var. *hypoglauca* in China alone; the Indochinese countries are not included.

Several visits were made to Doi Chiang Dao as part of research for the Flora of Thailand Dioscoreaceae treatment. The main aim of these trips was to collect the three endemic or near-endemic species of the mountain (Prain & Burkill 1936) and to search for

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any new ones. In July 2002 the first author collected three specimens which were subsequently discovered to be *D. collettii*. The opportunity was taken to study its underground parts in particular, and a full description is given below.

MATERIALS & METHODS

The treatment of Dioscoreaceae for the Flora of Thailand is based on examination of 1220 specimens from Thailand at the following herbaria or on loan: AAU, B, BK, BKF, BM, CMU, E, K, L, P, Biology Department, Naresuan University, Phitsanulok (abbreviated as PNU in this paper) and QBG. Abbreviations follow Holmgren & Holmgren (1990). Comparative morphology was used to delimit species in all cases. Information on female flowers and infructescence morphology in this study is wholly based on Chinese specimens. *Dioscorea collettii* Hook. f. var. *hypoglauca* (Palibin) C.T. Ting *et al*. was not included in this study because it is a Chinese endemic. Thus we have no new information on its conspecificity with *D. collettii*.

DESCRIPTION

Dioscorea collettii Hook.f. in Fl. Brit. Ind. 6: 290. 1892; Prain & Burk. in Ann. Roy. Bot. Gard. (Calcutta) 14(1): 39.1936.— *Dioscorea gracillima* Miq.var. *collettii* (Hook.f.) Uline ex R. Knuth in Pflanzenr. 4:43:253 (1924). Type: Myanmar (Burma), Shan Hills, Naungtaya, G fl. May 1888, *Collett* 775 (holotype K!).— *D. huii* R. Knuth in Repert. Spec. Nov. Regni Veg. 21: 80 (1925). Type: China, Kiang-Si, Twe-Chuen-Hsien, G fl. 1921, *Hu* 902 (holotype B, not seen.— *Dioscorea kelungensis* Hayata in Icon. Pl. Formos. 10: 36.1921. Type: Taiwan (Formusa), Kelung, G fl. & E fl. 19 Mar. 1916, *Hayata* 419 (holotype K!).— *Dioscorea nigrescens* R.Knuth in Pflanzenr. 4(43): 253. 1924. Type: China, Yunnan, G fl. without date at K, *Henry* 12338C (holotype B; isotype K!).— *Dioscorea oenea* Prain & Burkill in J. & Proc. Asiat. Soc. Bengal 10: 16. 1914. Type: China, Szechuan (Su-tchuen), Tchen-kéou-tin, E young fr. July 1890, *Farges* 90 (holotype P!).— *D. seniavinii* Prain & Burkill , Bull. Misc. Inform. Kew 1925: 59. 1925. Type: China, "China Australior", 1838–51 Phenology unknown, *Seniavin* s.n. (holoype LE not seen, *Fide* Diag & Gilbert (2001)).—*Dioscorea tashiroi* Hayata in Icon. Pl. Formos. 10:44. 1921. Type: Taiwan (Formosa), Kotosho, date and phenology unknown, Toshiro s.n. (holotype? T1, not seen, *Fide* Prain & Burkill). Figs. 1 & 2.

Climber to 3 m in height. *Underground parts* rhizomatous (Fig. 1B), richly and irregularly branched and lobed, approximately 5.5–16.5 by 0.8–2 cm, shallowly buried, epidermis chartaceous, grey-brown to dark brown, parenchyma yellow to orange in colour. *Indumentum* present as papillae (Fig. 1C), 0.1–0.6 mm long, usually on abaxial veins, sometimes on young stems and inflorescence axes. *Stems* 2–6 mm in diameter, twining to the left, annual, unarmed, terete, sometimes with shallow longitudinal ridges, pale green to mid green, but often wine-red in full sun. *Leaves* simple, alternate, blades 2–12 by 1.9–10 cm, ovate to broadly ovate or deltate, chartaceous, pale green to mid-green above, paler and glaucous below, turning black when dried, margins usually entire, sometimes with 3–5 shallow lobes, 7-nerved, only main vein and first vein pair reaching apex, basal vein pair bifid, base widely cordate to sub-cordate, sometimes auriculate, sinus 3–25 mm deep, apex 3–13 mm long, acuminate; forerunner tips 1–3 mm long, yellow-brown to brown; *petioles* (0.8–)3.2–9.5 cm long, slender, terete, channeled above, colour as stem. *Cataphylls*, *lateral*

nodal spines and *bulbils* absent. *Inflorescences* pendent, axes angled, colour as stem; all bracts and tepals thinly chartaceous; tepals fused at base and inserted on cup-shaped torus, free above, pale green to yellow-green, apex recurved. *Male inflorescences* (Fig. 1A) usually simple, rarely compound, compound inflorescences 1(– 2) per axil, 3–11 cm long; simple/partial inflorescences 1–2(– 3) per axil, spicate, with apparently sessile cymules of 1–3 *flowers* (Fig. 1D), peduncles 0.3–2 cm long, axes 3–18 cm long; flowers 3.1–0.6 mm in diameter at anthesis. Floral bracts (Fig. 1F) 0.9–1.2 by 0.7–1 mm, ovate to broadly ovate, apex acute; bracteoles (Fig. 1G) 0.8–1.2 by 0.5–0.8 mm, ovate to broadly ovate, apex acute; outer tepals (Fig. 1H) 1.1–1.5 by 1.1–1.2 mm, oblong, apex obtuse to rounded; inner tepals (Fig. 1I) 1.2–1.8 by 0.7–1 mm, oblong, apex obtuse to rounded; stamens 3, inserted on tepal bases, filaments 0.3–0.4 mm long, filiform, connective bifid to form two divergent arms (Fig. 1E), anthers 0.25–0.4 by 0.1–0.3 mm, ovate-oblong, dorsifixed at the arm tips (Fig. 1E, 1J); staminodes 3 (Fig. 1E), 0.25–0.4 mm long, filiform, inserted on inner tepal bases; pistillodes 3 (Fig. 1E), 0.2–0.5 by 0.2 –0.25 mm, erect. *Female inflorescences* (Fig. 2A) spicate, 1 per axil, peduncles 1–9 cm long, axes 2.1–19 cm long, *flowers* orientated at angle of 30°–60° to axis when receptive. Floral bracts (Fig. 2D) 1.1–1.4–by 1.2–1.4 mm, elliptic-oblong, apex 0.2–0.45 mm long, acuminate; bracteoles (Fig. 2E) 0.7–1 by 0.5–1 mm, elliptic-oblong, apex 0.4 mm long, acute to acuminate; outer tepals (Fig. 2F) 1.2–1.5 by 0.7–1.0 mm, oblong, apex obtuse; inner tepals (Fig. 2G) 1.2–1.3 by 0.8–1 mm, oblong, apex obtuse; ovaries (Fig. 2B) 3.2–7.5 by 1–1.5 mm, narrowly elliptic in outline, pale green to yellow-green; staminodes 6 (Fig. 2C), 0.2–0.3 mm long, filiform, inserted on tepal bases, outer whorl staminodes staminiform, inner whorl staminode filiform; styles (Fig. 2C) 0.6–0.8 by 0.3–0.6 mm, fused to form an erect column; stigmas 0.1–0.2 mm long, recurved. *Infructescences* (Fig. 2H) 8.5–25 cm long; *capsules* (Fig. 2H, I) 20–23 by 20–25 mm, oblong to obovate-oblong in outline, base truncate to rounded; apex truncate to shallowly retuse, sinus (where present) to 0.7 mm deep; capsular stipes 2.5–4 by 1–2.5 mm, narrowly obconic; immature capsules pale green to yellow-green; mature capsules reflexed at an angle of 120°–160° to axis, dry capsules dark brown to dark colour. *Seeds* (Fig. 2I, J) 3.5–4 by 5–6 mm, ovoid-lenticular, wings 12.5–15.5 by 9.5–11 mm, extending all around seed margin, oblong to ovate-oblong with a straight edge along capsule axis.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, trail to the summit of Doi Chiang Dao, G fl. 14 July 2002, *Thapyai* 458, 459 & 460 (BK, BKF, NU, QBG)].

Distribution.— India, Myanmar (Type), China and Thailand.

Ecology.— Found in open areas of hill evergreen forests between 1450 and 1500 m in elevation. Flowering June to August, fruiting September to November.

Vernacular name.— Not known.

Conservation.— In Thailand it has only been found so far on Doi Chiang Dao. Thus while it appears rare in Thailand, on a regional level *D. collettii* appears to be relatively abundant and occurs over a wide geographical area. IUCN rating: LC (IUCN 2001).

Notes.— This species is easily recognised by the presence of papillae on the veins of the lower surface of the leaf blade. The male flowers have three fertile stamens with bifid connectives, forming two elongate, divergent arms, and three filamentous staminodes. The Thai material appears to belong to var. *collettii* following Ding & Gilbert (2000). This is not surprising given that var. *collettii* also occurs in Myanmar, while *D. collettii* var.

leaves are rather thinly chartaceous. The closely related *D. deltoidea* Wall. ex Hook. f. has *hypoglauca* has not been collected further South than Hunan and Guangdong provinces in South-Central China.

Dioscorea collettii is a member of *D*. sect. *Stenophora* Uline, the taxa of which all have a branching horizontal rhizome (Prain & Burkill 1936). Often the papillae on its leaves, but there are six fertile stamens in its male flowers. *Dioscorea gracillima* Miquel has similar male flowers, with only three fertile stamens, but the connectives are short and not divergent. In addition, the leaves of *D. collettii* tend to dry black, while those of *D. gracillima* remain green. The switch to three fertile stamens and three staminodes in *D. collettii* suggests that is has changed its mode of pollination.

DISCUSSION

Doi Chiang Dao is one of the most remarkable localities for species of *Dioscorea* in Thailand. Five endemics or near-endemics to the mountains of Northern Thailand are all found there at higher altitudes. The first is *D. velutipes* Prain & Burkill, which grows on Doi Chiang Dao and in Myanmar. *Dioscorea tentaculigera* Prain & Burkill is found in Chiang Mai and one mountain in Lampang. *Dioscorea pseudo-nitens* Prain & Burkill occurs in just three localities: on Doi Chiang Dao plus Doi Hua Mot in Chiang Rai and Doi Luang National Park in Lampang. *Dioscorea garrettii* Prain & Burkill and *D. rockii* Prain & Burkill are both endemic to montane habitats in Northern Thailand and adjoining parts of the North-East in the case of *D. rockii*. Other widespread species present in the lower altitude deciduous vegetation are: *D. pentaphylla* L., *D. bulbifera* L., *D. glabra* Roxb. and *D. hispda* Dennst.. Thus there are at least 10 species (including *D. collettii*) or over 20% of Thailand's species on this mountain alone. This can even be viewed as ca. 2% of World's *Dioscorea* species on Doi Chiang Dao. Both these figures underline its importance in terms of biodiversity and conservation.

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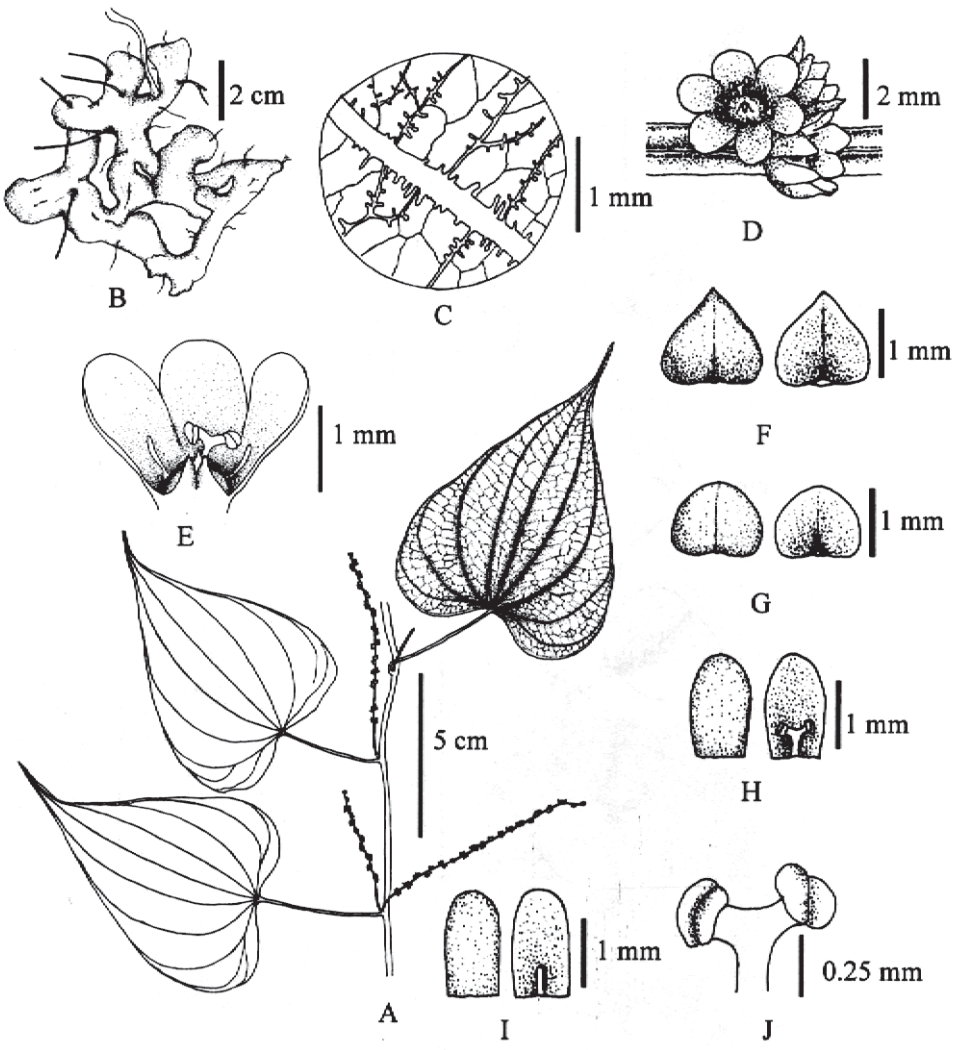

Figure 1. *Dioscorea collettii* Hook.f. male plant: A. habit with inflorescences; B. rhizome, showing irregular branching; C. papillae on midrib and veins of abaxial leaf surface; D.–K. flowers;D. node of inflorescence showing flowers in a cymule; E. longitudinal section showing stamen, two staminodes and pistillode; F. floral bract dorsal and ventral surfaces; G. bracteole dorsal and ventral surfaces; H. outer tepal dorsal and ventral surfaces with stamen inserted at base of latter; I. inner tepal, showing position of filiform staminode insertion; J. stamen showing anther and bifid connective with two divergent arms. A, C.–K. from *Thapyai* 458; B. from *Thapyai* 460. Drawn by C. Thapyai.

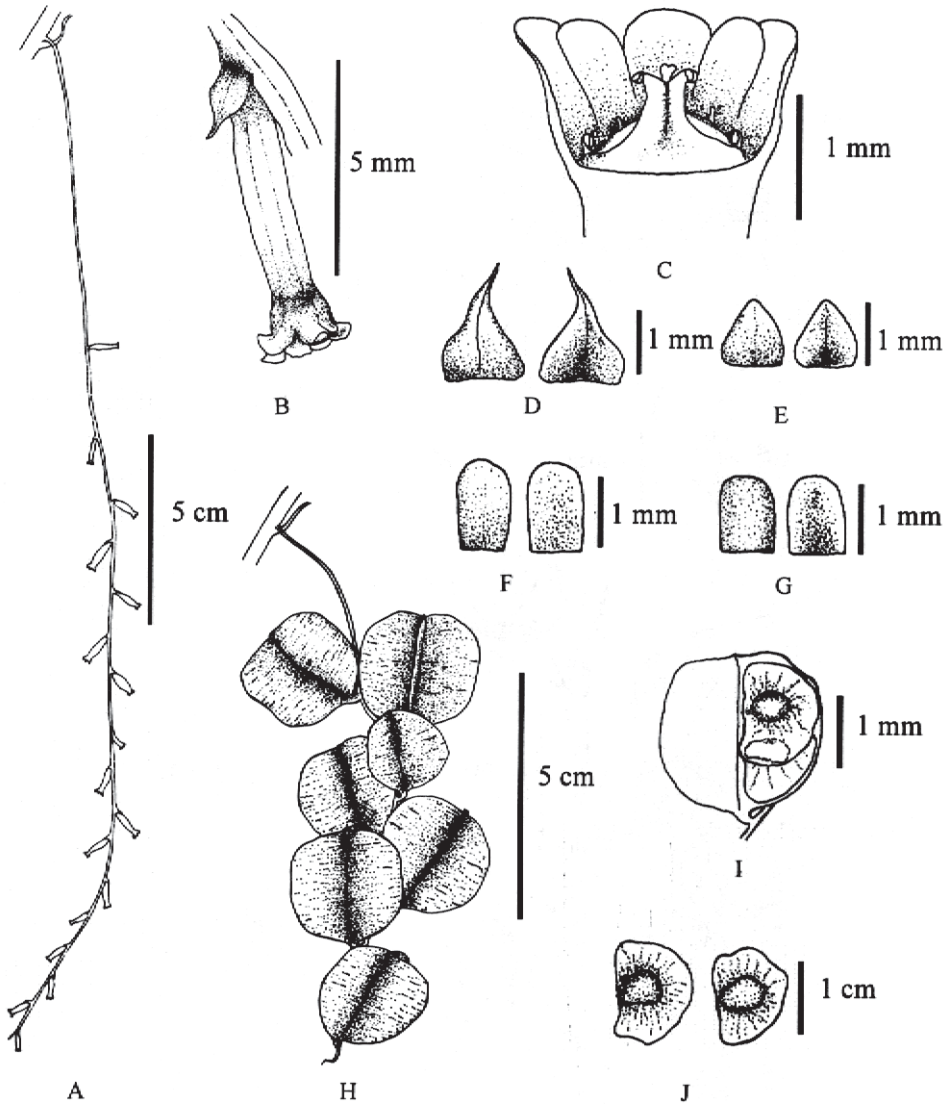

Figure 2. *Dioscorea collettii* Hook.f. female plant:A. inflorescence; B.–G. flower; B. side view showing long, terete ovary, torus and tepals; C. longitudinal section (excluding ovary) showing staminodes, style and stigmas; D. floral bract dorsal and ventral surfaces; E. bracteole dorsal and ventral surfaces; F. outer tepal dorsal and ventral surfaces; G. inner tepal dorsal and ventral surfaces; H. infructescence; I. mature capsule, longitudinal section showing seed position in locule; J. seeds. A.–G. from *Wang* 23294; I.–J. from *Wang* 13C. Drawn by C. Thapyai.

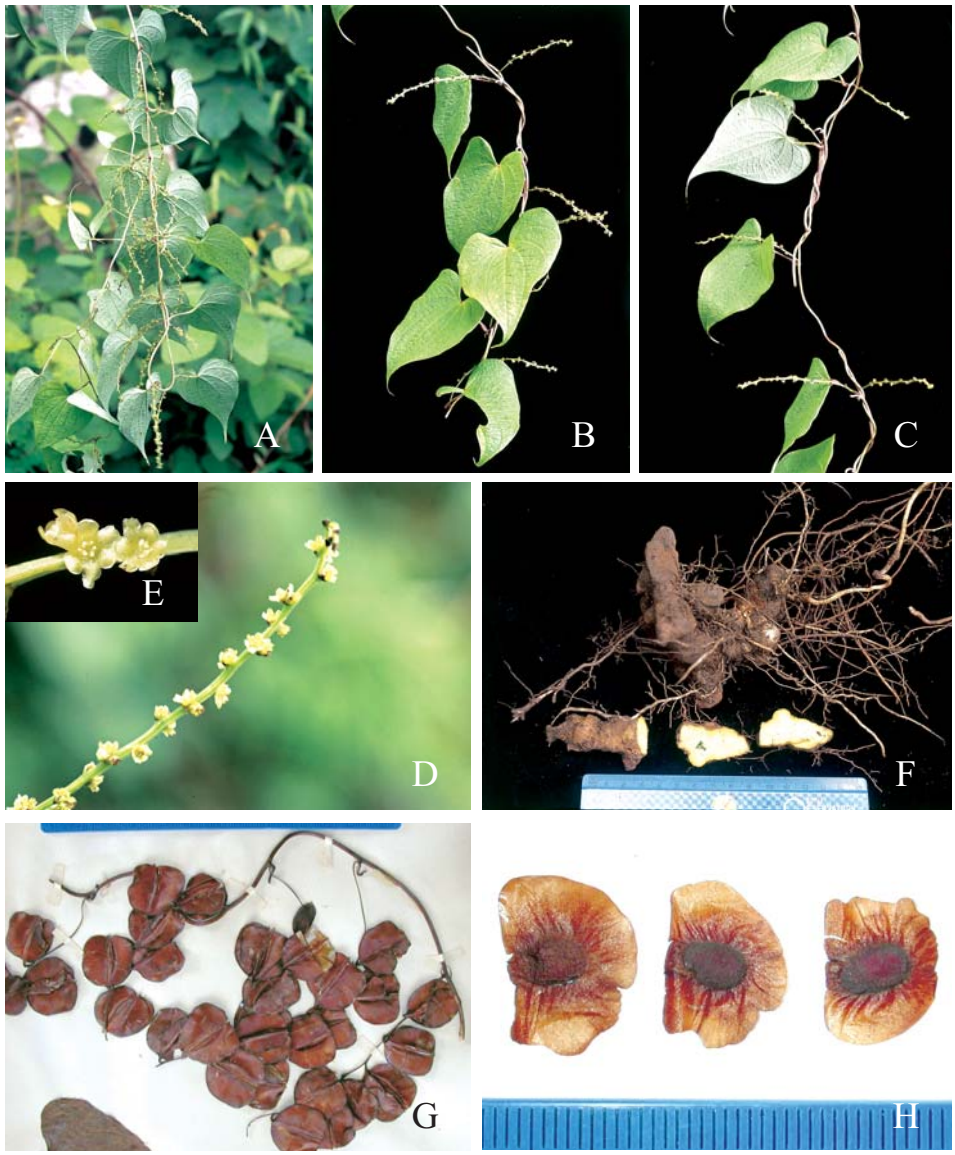

Figure 3. *Dioscorea collettii* Hook.f.: A.–C. plant habit with male inflorescences; D.–E. male inflorescence showing flowers in cymules which appear sessile, with up to three flowers per node; F. rhizome with numerous feeding roots; G. mature infructescences; H. mature seeds with wings all around seed margin. Photographed by C. Thapyai.