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Dioscorea pseudonitens Prain & Burkill (Dioscoreaceae) is conspecific with *Dioscorea nitens* Prain & Burkill

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ABSTRACT. New data generated from overlooked and newly collected specimens demonstrate that there is continuous variation between *D. pseudonitens* of Thailand and *D. nitens* of China (Yunnan). A revised key, illustrations and conservation status assessment are provided. The need for population-based research on species limits in *D.* sect *Shannicorea* is highlighted.

KEY WORDS: *Dioscorea*, taxonomy, morphology, Thailand, China (Yunnan), *D.* sect. *Shannicorea*.

INTRODUCTION

Dioscorea sect. *Shannicorea* Prain & Burkill is a relatively homogeneous group of species in morphological and biogeographical terms. As treated in Ding & Gilbert (2000), it comprises eight species. Four are endemic to southern China: *D. yunnanensis* Prain & Burkill, *D. subcalva* Prain & Burkill, *D. nitens* Prain & Burkill and *D. martini* Prain & Burkill (Ding & Gilbert 2000). *D. hemsleyi* Prain & Burkill is distributed from central and southern China to Indochina and Burma but is not in Thailand. Two further species, *D. tentaculigera* Prain & Burkill and *D. velutipes* Prain & Burkill, occur in Northern Thailand and adjacent Burma with the former otherwise restricted to southwestern Yunnan in China and the latter more widely encountered in Southern China (Wilkin & Thapyai 2010). *D. pseudonitens* Prain & Burkill is endemic to Thailand and therefore the only species of *D.* sect. *Shannicorea* not found in China. A specimen from northern Vietnam attributable to *D. velutipes* has also been seen by the first author. The principal differences between the species are vegetative characters; leaf shape (length/width ratio) and the degree and nature of their pubescence. The most distinct species is *D. tentaculigera* which has unique fine aculeolate projections on its inflorescence axes and a seed wing extending from the seed base and apex which is narrowly obovate to narrowly ovate. The remaining species possess seeds with apical wings. *D. tentaculigera* was referred to *D.* sect. *Stenophora* Uline by Prain & Burkill (1936), although it has subsequently been shown to possess a tuber and not the rhizome characteristic of that section. *Dioscorea tentaculigera* is not sister to *D. pseudonitens* in the phylogenetic tree presented in Wilkin et al. (2005) but is found in a systematically isolated position. However, sampling of *D.* sect. *Shannicorea* is limited in that paper. Subsequent unpublished molecular systematic research using further plastid regions suggests that while *D. nitens*, *D. pseudonitens* and *D. subcalva* form a clade, *D. tentaculigera* is not embedded within it and it remains in an isolated position.

Prain & Burkill (1936) regarded *D. pseudonitens* as distinct from the Yunnan endemic *D. nitens* through the "fewer and much larger capsules" of *D. pseudonitens*. Ding & Gilbert (2000) stated that the capsule of *D. nitens* was ca. 2 cm long, with a wing width of 5–8 mm (i.e. the capsule is ca. 10–16 mm wide on a herbarium sheet), the tepals ca. 1.5 mm long and it was pubescent on its leaves and inflorescences. *D. pseudonitens* was maintained as a separate species by Wilkin & Thapyai (2010) because its capsules were 21–26 by 14–18.5 mm, its tepals not less than 2.2 mm long and it

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was reported to be wholly glabrous. Other useful characters for identification of this species were said to include its low stature, relatively large, erect tepals, apically winged seeds and preference for lower montane pine (*Pinus kesiya*)-oak forest. However, three overlooked specimens attributable to *D. pseudonitens* recently came to light which were quite strongly pubescent on both vegetative and floral organs; *Phengklai et al. 4188*, *4189* and *4198*. These specimens prompted a reevaluation of the species limits in *D. pseudonitens* and *D. nitens*.

MATERIALS & METHODS

The Dioscoreaceae treatment for the Flora of Thailand was based on examination of 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 (PNU) and QSBG. Abbreviations (except PNU) follow Holmgren & Holmgren (1990). The specimens used in this study and in particular for scoring the characters in Table 1 are cited below. Data published in Ding & Gilbert (2000) was incorporated with that scored from specimens and the Wilkin & Chirdsak (2010) measurement ranges for *D. pseudonitens* were rechecked. The concept of *D. nitens* used followed the key in Ding & Gilbert (2000); those specimens with leaves longer than wide and lacking dense white or tawny hairs on the leaf lower surface were identified as *D. nitens*. However, as stated in the notes below, the taxa of *D.* sect *Shannicorea* may intergrade.

RESULTS

The ranges of variation in the characters used to support the separation of *D. nitens* and *D. pseudonitens* are given in Table 1, with the data from the three new specimens presented in a separate column.

Table 1 shows the overlapping ranges of variation in indumentum, leaf and capsule dimensions. For male tepal length, the ranges are 1.6–3.1 mm in *D. pseudonitens*, 1.6–2.5 in the three newly studied Thai specimens and 1–1.5 mm in *D. nitens*. Thus they are almost continuous in this character, with the newly studied specimens falling in the lower part of the range of *D. pseudonitens*. Tepal width is 1.3–1.9 mm in *D. pseudonitens*, 0.5–1.0 mm in the newly studied specimens and 0.4–0.6 mm in *D.*

Table 1. A comparison of the indumentum and leaf, male tepal and capsule dimensions in *D. pseudonitens*, *D. nitens* and the newly discovered specimens. All measurements in mm.

	D. pseudonitens	New specimens	*D. nitens*
Indumentum density and distribution	In flower sparsely to densely pubescent on leaf veins (lower surface) and petiole apex, sparsely so on male flower tepals at anthesis, ultimately glabrescent	In flower densely pubescent on leaf veins (lower surface), petiole apex and sometimes male flower tepals at anthesis, ultimately glabrescent	Sparsely pubescent on male flower tepals in in buds and sometimes at anthesis , usually pubescent on veins of leaf lower surface, cymule bracts, male flower tepals and ovary, glabrescent
Leaf length	25–110	49–122	34–116 mm
Leaf width	15–65	25–95	47–79 mm
Male tepal length	1.6–3.1	1.6–2.5	1.0–1.5 mm
Male tepal width	1.3–1.9	0.5–1	0.4–0.6 mm
Capsule length	18–26	n/a	18–21 mm
Capsule width	14–19	n/a	10–16 mm

nitens; here the newly studied specimens overlap in range with *D. nitens*, not *D. pseudonitens*, and fall between the two in their range. These measurements suggest that a better sampled study of populations across both species and their close relatives in *D.* sect *Shannicorea* that includes material from throughout its range is desirable to re-examine all species limits. The authors could find no other character data to maintain the separation of *D. nitens* and *D. pseudonitens*. Thus the latter name is placed in synonymy with the former below to highlight the conspecific nature of the less strongly pubescent elements of *D.* sect. *Shannicorea* with longer leaves from northern Thailand and Yunnan.

TAXONOMY

Dioscorea nitens Prain & Burkill, J. Proc. Asiat. Soc. Bengal 10: 18. 1914; R.Knuth in Engl., Pflanzenr. 4, 43: 319. 1924; H.Li, Fl. Yunnanica 3: 736 (1983); C.T.Ting, Fl. Reip. Pop. Sin. 16(1): 87 (1985); Z.Ding & Gilbert, Fl. China 24: 277. 2000. Type (selected by Prain & Burkill, 1936: 106): China, Yunnan, Szemao forests, ♂fl. without date, *Henry 12338* (holotype **K!**; isotypes **A**, **K!**).— *Dioscorea pseudonitens* Prain & Burkill, Bull. Misc. Inform. Kew 1927: 231. 1927; Prain & Burkill in Fl. Gén. I.-C. 6: 716. 1934; Prain & Burkill, Ann. Roy. Bot. Gard. (Calcutta) 14(1): 106. 1936; Wilkin & Thapyai in Fl. Thailand 10(1): 105, fig. 60. 2009. Type: Thailand, Chiang Mai, Me Chem District, ♀ immature fr. 15 July 1922, *Kerr 6279* (holotype **K!** isotypes **BK!**, **BM!**, **E!**, **K** (♂ fl.)**!**)

Climber to 0.5–1(–1.5) m. *Tubers* (Fig. 2N) one per growing season, often with withering tuber of previous season, 14–16 by 1–1.5 cm, cylindric, vertically oriented, subtended by a small crown. *Indumentum* of hairs present on at least immature flower buds, often on axillary buds, stems, petioles (often dense at apices) leaf blade lower surfaces (Fig. 2M) and inflorescences where it is sometimes dense on cymule bracts and tepals in males and ovaries and tepals in females, all parts glabrescent. Stems 1.5–3 mm in diam., twining to the left, terete, annual, small prickles occasionally present towards base, otherwise unarmed. *Leaves* (Fig. 1A) simple, alternate, blades narrowly to broadly ovate or subdeltoid, 5–7-veined, chartaceous, sometimes with pale variegation, margins entire, base subcordate to cordate, apex acuminate; *petioles* 1.1–4.6 cm long; cataphylls (Fig. 2B) 5.5–6.5 by 2.2–2.7 mm, ovate; *bulbils* and *lateral nodal organs* absent. *Inflorescences* pendent, tepals inserted on discoid torus, pale yellow when fresh, fused at the base, erect, thinly chartaceous, with narrowly oblong brown cystoliths clearly visible and sometimes coalescing so tepals appear brown when dry (except translucent margins); *male inflorescences* (Fig. 2A) simple, 1–2 per axil, racemose with cymules of (1–)2–3 flowers on a short branch at each node (Fig. 1D), peduncles 1–4.2 cm long, axes 2.5–10 cm long, often weakly flexuous; *female inflorescences* (Fig. 2A) spicate, simple, 1 per axil. *Male flowers* (Fig. 1F, G) 1.6–3.3 mm in diam. at anthesis, (sub) sessile, outer tepals (Fig. 1J) 1.6–3.1 by 1.3–1.9 mm, narrowly obovate, inner tepals (Fig. 1K) 1.6–3.1 by 1.2–1.9 mm, obovate, stamens 6. *Female flowers* as in Fig. 2B–H, ovary green to reddish-brown. *Capsules* as in Fig. 2J, K, 18–26 by 10–19 mm. *Seeds* (Fig. 2K, L) 3.2–4.8 by 2–3 mm, ovoid-lenticular to lenticular-reniform, wing 10–11 by 5–6 mm, obovate to oblong, extending from seed apex, a small basal wing sometimes also present (Fig. 2L)].

Thailand.— NORTHERN: Chiang Mai, Doi Angkhang [Ban Parong, ♂ fl. 26 May 1998, *Wongprasert s.n.* (**BKF!**)]; Doi Chiang Dao [♀ fr. 14 Sept. 1995, *Maxwell 95-723* (**BKF!**, **CMU!**); Doi Chiang Dao, Den Ya Khad, trail to summit of Doi Chiang Dao, ♂ fl. 14 July 2002, *Thapyai 440* (**BKF!**, **NU!**); Same locality, ♂ fl. 14 July 2002, *Thapyai 443* (**BKF!**, **NU!**); Same locality, ♀ fl. 14 July 2002, *Thapyai 452* (**BK!**, **BKF!**, **NU!**, **QSBG!**); Same locality, ♀ fl. 14 July 2002, *Thapyai 453* (**BK!**, **BKF!**, **NU!**, **QSBG!**); Same locality, ♀ fr. 26 Oct. 2002, *Thapyai 485* (**BKF!**, **NU!**); Same locality, ♀ fr. 26 Oct. 2002, *Thapyai 487* (**BKF!**, **NU!**)]; Mae Chem [♀ immature fr. 15 July 1922, *Kerr 6279* (holotype **K!**, isotypes **BK!**, **BM!**, **E!**, **K** (♂ fl.)**!**)]; Kongloi [♂ fl. 29 June 1978, *Phengklai, Tamura, Niyomdham & Sangkachand 4198* (**BKF!**)]; Hot [Omkoi, ♂ fl. 29 June 1978, *Phengklai, Tamura, Niyomdham & Sangkachand 4189* (**BKF!**); same locality, ♂ fl. 29 June 1978, *Phengklai, Tamura, Niyomdham & Sangkachand 4188* (**BKF!**)]; Chiang Rai?, Doi Hua Mot [Mae Lao, ♂ fl. 27 May 1933, *Garrett 781* (**BKF!**, **K!**); same locality, ♀ fr. 27 May 1933, *Garrett 786*

(**BKF!**, **K!**)]; Lampang, Wang Nua [Doi Luang National Park, ♂ & ♀ fl. 28 June 1998, *Maxwell 98-686* (**BKF!**, **CMU!**)]. China.— Yunnan, Mengtze, ♂ fl. & ♀ fl. without date, *Henry 10287* (**BM** ♀**!**, **K**♂**!**; Yunnan, Szemao forests, ♂fl. without date, *Henry 12338* (type, **A**, **K!**); Yunnan, Szemao, S mts , ♂fl. without date, *Henry 12338A!*; Yunnan, Szemao forests, ♀ fr. without date, *Henry 12338B* (**K!**); Yun-nan-sen, received Nov. 1906, ♂ fl., *Maire 1149* (**BM!**, **E**); Same locality, received Nov. 1906, ♂ fl., *Maire 1148* (**BM!**, **E**); Chungtien, Lomahua ♀ fr. 11 Nov. 1937, *Yu 10916* (**BM!**, **GH**); Yunnan, Kunming, Near Zhuàn Lóng town, along the Xǐ Mǎ Hé (River) on X035 road, 25.94° N, 102.84° E, ♀ fl. 18 July 2010, *Osborne, Borosova, Guo, Landrein & Liu 907a* (**K!**, **KUN**).

Distribution.— Only known from Northern Thailand and China (Yunnan).

Ecology.— Found in the ground layer of hill evergreen to secondary forests, often associated with *Pinus*, at altitudes from 900 to 2000 m. Flowering May–July, fruiting September–December.

Vernacular.— Not known in Thailand. Ding & Gilbert (2000) give 光亮薯蓣 (*guang liang shu yù*) as the vernacular name in China.

Uses.— Unknown.

Conservation Status.— The distribution of *Dioscorea nitens* in northern Thailand and Yunnan suggests that the level of threat to this species is lower than that published for *D. pseudonitens* in Wilkin & Thapyai (2010). If it is found in the intervening areas of Burma then its IUCN red list category would probably be LC (IUCN 2001). However, the absence of this data plus further taxonomic uncertainty (see notes below) suggests a provisional DD status.

Notes.— Study of specimens of the species of *D.* sect *Shannicorea* suggests that a complete revision is needed based on population level data derived from research centred in southern China but extending across its distributional range. Ideally such a project should use molecular markers as well as morphology and include *D. lijiangensis* C.H. Long & Y.H.Li (Long & Li 2000) and *D. nanlaensis* H.Li (Li 1983). With the exception of *D. tentaculigera* it is possible that these two taxa plus *D. hemsleyi*, *D. martini*, *D. nitens*, *D. subcalva*, *D. velutipes* and *D. yunnanensis* all form a single highly variable species. Such a population-based study is needed to scientifically inform a strategy for the conservation of these taxa and should involve detailed examination of fruit, seed and floral morphology as well as an investigation of whether indumentum and leaf shape characters are continuous or discrete.

REVISED KEYS TO THE SPECIES OF *DIOSCOREA* IN THAILAND

The keys of Wilkin & Thapyai (2010) to both male and female plants have been revised below from couplet 3 to reflect the taxonomic change above and improved understanding of morphology. *D. nitens* has been retained in the sequence of species in the position of *D. pseudonitens* pending further taxonomic changes (see Notes above).

KEY TO MALE PLANTS (INCLUDING VEGETATIVE CHARACTERS)

3. Flower with 6 fertile stamens
  5. Indumentum absent or of papillae or aculeolate projections
    6. Lateral nodal flanges (Fig. 10J) present as a pair of membranous semicircular projections to ca. 5 mm in diam. which clasp stem, margins sometimes erose. Bulbils abundant (Fig. 10A), 0.2–12 cm in diam. Partial inflorescences with solitary, sessile flowers **5. D. bulbifera**
    6. Lateral nodal flanges absent, lateral nodal spines sometimes present or petiole base broad and flattened but not clasping stem. Bulbils sometimes present but not abundant. Flowers cymulose or pedicellate
      7. Indumentum present as fine aculeolate projections mainly on inflorescence axes (Fig. 73B, C, 74B). Bulbils sometimes present, especially in male plants, 3–10 mm in diam. Flower outer tepals not more than 1 mm long **40. D. tentaculigera**
      7. Indumentum absent. Bulbils rarely present where stems touch soul, 0.7–3.0 cm in diam. Flower outer tepals at least 1.4 mm long
        8. (Partial) inflorescences racemose with solitary flowers
          9. Torus shallowly bowl-shaped, depth not more than 1/10 th length of tepals, flowers ca. 5–5.5 mm in diam. at anthesis (Fig. 19F) **10. D. daunea**
          9. Torus cup-shaped or goblet-shaped, depth up to 2/3 of length of tepals, flowers not more than ca. 4 mm in diam. at anthesis
            10. Torus depth ca. 1/3 length of tepals, outer tepals 1.6–2 mm long **15. D. garrettii**
            10. Torus depth ca. 1/2 to 2/3 length of tepals, outer tepals 2.6–2.8 mm long **28. D. paradoxa**

8. (Partial) inflorescences spicate with (1–) 2–3 flowers in (sub)sessile cymular clusters
11. Leaf margins usually deeply 3-lobed (always 3-lobed towards base), thinly chartaceous. Lateral nodal spines usually present, curved, to 4 mm long. Outer tepals 1.9–2.3 mm long, narrowly obovate to obovate-oblong **25. D. membranacea**
11. Leaf margins always entire throughout, chartaceous to subcoriaceous. Lateral nodal spines absent. Outer tepals 1.4–1.8 mm long, narrowly elliptic-oblong **32. D. prazeri**

5. Indumentum of hairs present
12. Hairs T-shaped. flowers solitary on (partial) inflorescences **13. D. esculenta**
12. Hairs not T-shaped. Cymules of 1–3 flowers on (partial) inflorescences
13. Stem base spines and lateral nodal spines absent, plant wholly unarmed. Plants not exceeding 2 m in height
14. Hairs always present on immature flower buds, often on axillary buds, stems, petioles, leaf blade lower surfaces and inflorescences but glabrescent ; narrowly oblong brown cystoliths clearly visible in tepals **33. D. nitens**
14. All parts pubescent even when past anthesis or in fruit; cystoliths diffuse and not clearly visible in tepals **41. D. velutipes**
13. Stem base spines or lateral nodal spines present. To at least 15 m in height
15. Leaves thinly chartaceous, margins often shallowly lobed. Tepals glabrous on dorsal surfaces or with a few hairs scattered along midrib **36. D. rockii**
15. Leaves chartaceous to coriaceous, margins entire. Tepals densely pubescent on dorsal surfaces
16. Stem basal nodes swollen, with 6–8 hard, vertically oriented flanges (Fig. 54C). Leaves subdeltoid to ovate on the upper stems, coriaceous when mature **30. D. petelotii**
16. Stem basal nodes not swollen, possessing lateral spines but lacking vertically oriented flanges. Leaves broadly ovate to orbicular, chartaceous **3. D. birmanica**

KEY TO FEMALE (FRUITING) PLANTS

3. Indumentum not present or present as fine aculeolate projections mainly on inflorescence axes
4. Ovary or capsule positively geotropic at all developmental stages (i.e. flower or persistent tepals orientated towards soil and making an obtuse angle with axis)
5. Capsular stipe 20–60 mm long. Tepals 3.6–3.9 mm long **10. D. daunea**
5. Capsular stipe 4–15 mm. Tepals not more than 2.1 mm long (unknown in D. paradoxa but unlikely to be much larger than 2.1 mm)
6. Vegetative stem leaves narrowly ovate to ovate or ovate-deltoid. Capsular stipe 4–5 mm long **15. D. garrettii**
6. Vegetative stem leaves broadly to very broadly ovate. Capsular stipe 8–15 mm long **28. D. paradoxa**
4. Mature capsule negatively geotropic (i.e. persistent tepals and capsule apex orientated towards sky and making an acute angle with axis)
7. Capsule longer than broad, seeds winged at base or apex only or in the centre of a narrowly ovate to narrowly obovate wing
8. Lateral nodal flanges (Fig. 10J) present as a pair of membranous semicircular projections to ca. 5 mm in diam. which clasp stem, margins sometimes erose. Bulbils abundant (Fig. 10A), 0.2–12 cm in diam. Seed wing basal **5. D. bulbifera**
8. Lateral nodal organs not present. Indumentum present as fine aculeolate projections mainly on inflorescence axes (Fig. 73B, C, 74B). Bulbils sometimes present, 0.3–1 cm in diam. Seed in the centre of a narrowly ovate to narrowly obovate wing **40. D. tentaculigera**
7. Capsule broader than long to equal in length and width, seeds with a ± circular wing all round margin
9. Leaf margins usually deeply 3-lobed (always 3-lobed towards base), thinly chartaceous. Lateral nodal spines usually present, curved, to 4 mm long. Capsules 25–40 mm wide **25. D. membranacea**
9. Leaf margins always entire throughout, chartaceous to subcoriaceous. Lateral nodal spines absent. Capsules 16–21 mm wide **32. D. prazeri**

3. Indumentum of hairs or papillae present
10. Papillae (Fig. 15C), 0.1–0.6 mm long on veins of leaf lower surface, sometimes on young stems and inflorescence axes, hairs absent from all parts including inflorescences and inftuctescences **8. D. collettii**
10. Papillae absent, hairs present, usually not confined to leaf lower surface and often dense on inflorescences
11. Hairs T-shaped (i.e. with a short stalk and longer body, Fig. 25B), often dense, soft and greyish. Capsules very rarely seen and mature seeds not reported from Thailand. (Cultivated or near sites of (former) human settlement) **13. D. esculenta**
11. Hairs unbranched, not T-shaped. Capsules and seeds usually plentiful
12. Leaf blades thinly chartaceous. Ovary or capsule glabrous **36. D. rockii**
12. Leaf blades chartaceous to coriaceous. Ovary and capsule pubescent, later sometimes glabrescent but hairs persistent near axis
13. Capsule ± equal in length and width, seeds with a ± circular wing all round margin **3. D. birmanica**
13. Capsule longer than broad, seeds winged at base or apex only
14. Large forest climber to at least 30 m. Stem basal nodes swollen, with 6–8 hard, vertically orientated flanges (Fig. 54C). Leaves coriaceous when mature. Seed wing apical **30. D. petelotii**
14. Slender climber to no more than 3 m. Stem nodes undifferentiated. Leaves chartaceous. Seed wing apical or basal
15. Leaf base rounded to shallowly cordate, margins entire to deeply 3-lobed. Seed wing basal **22. D. kerrii**
15. Leaf base cordate, margins entire. Seed wing apical
16. All parts pubescent even when past anthesis or in fruit; seed wing 8–12 by 6–7 mm, oblong **41. D. velutipes**
16. Hairs always present on immature flower buds, often on axillary buds, stems, petioles, leaf blade lower surfaces and inflorescences but glabrescent; seed wing 4.5–5.5 by 3.5–4.5 mm, obovate to oblong **33. D. nitens**

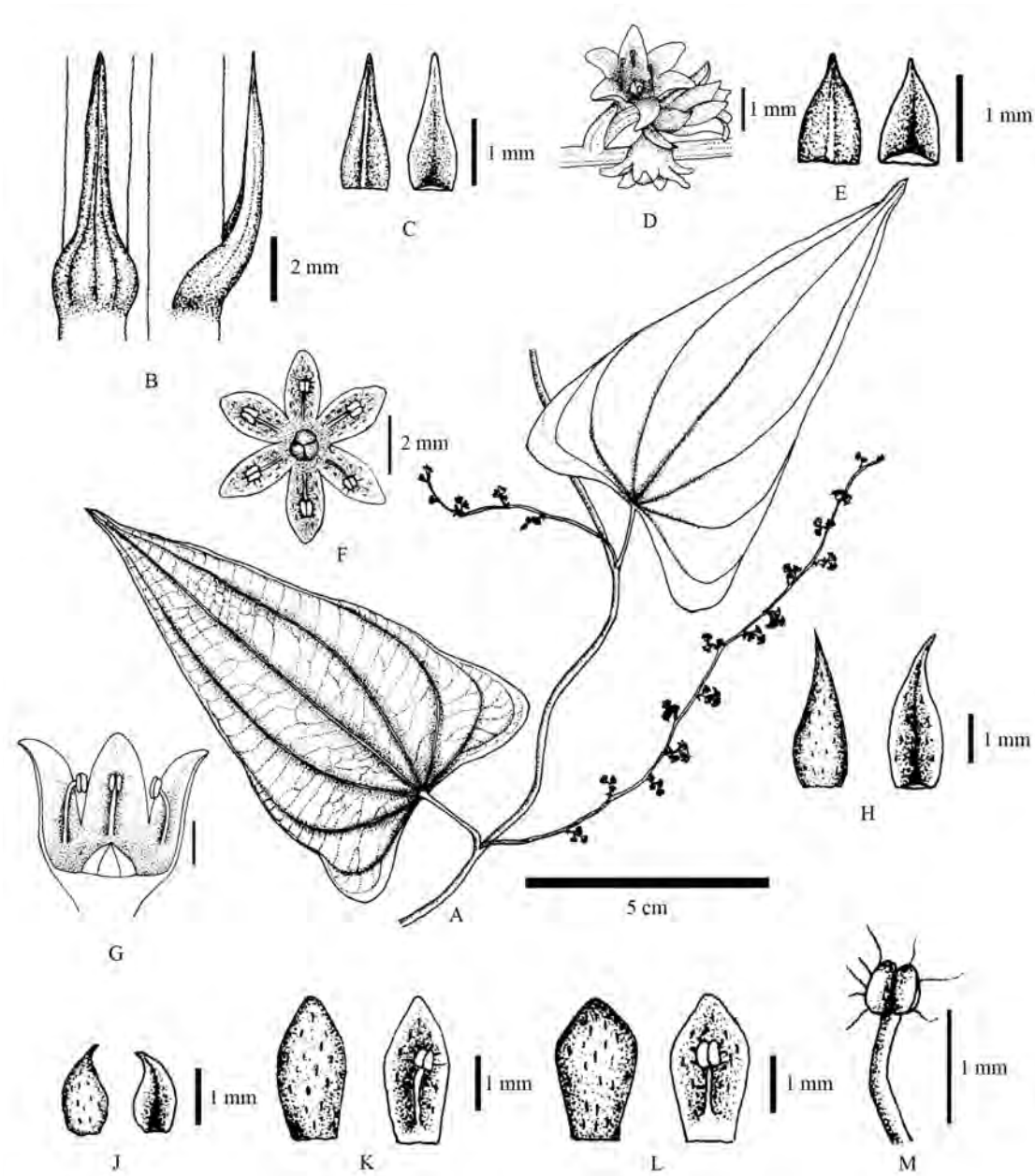

Figure 1 *Dioscorea nitens* Prain & Burkill: male plant, A. habit with inflorescences; B. cataphylls; C. primary bract dorsal and ventral surfaces; D. partial inflorescence, with flowers in cymules; E. cymular bract dorsal and ventral surfaces; F–L. flower; with cystoliths on floral bract; bracteole and tepals; F. top view; G. l-section showing stamens and pistillode; H, J. floral bract and bracteole dorsal and ventral surfaces respectively; K, L. outer and inner tepal dorsal and ventral surfaces respectively, showing position of stamen inserttion; M. stamen with fungal hyphae on anther (A. from *Garrett 781*; B–M. from *Thapyai 443*). Drawn by Chirdsak Thapyai.

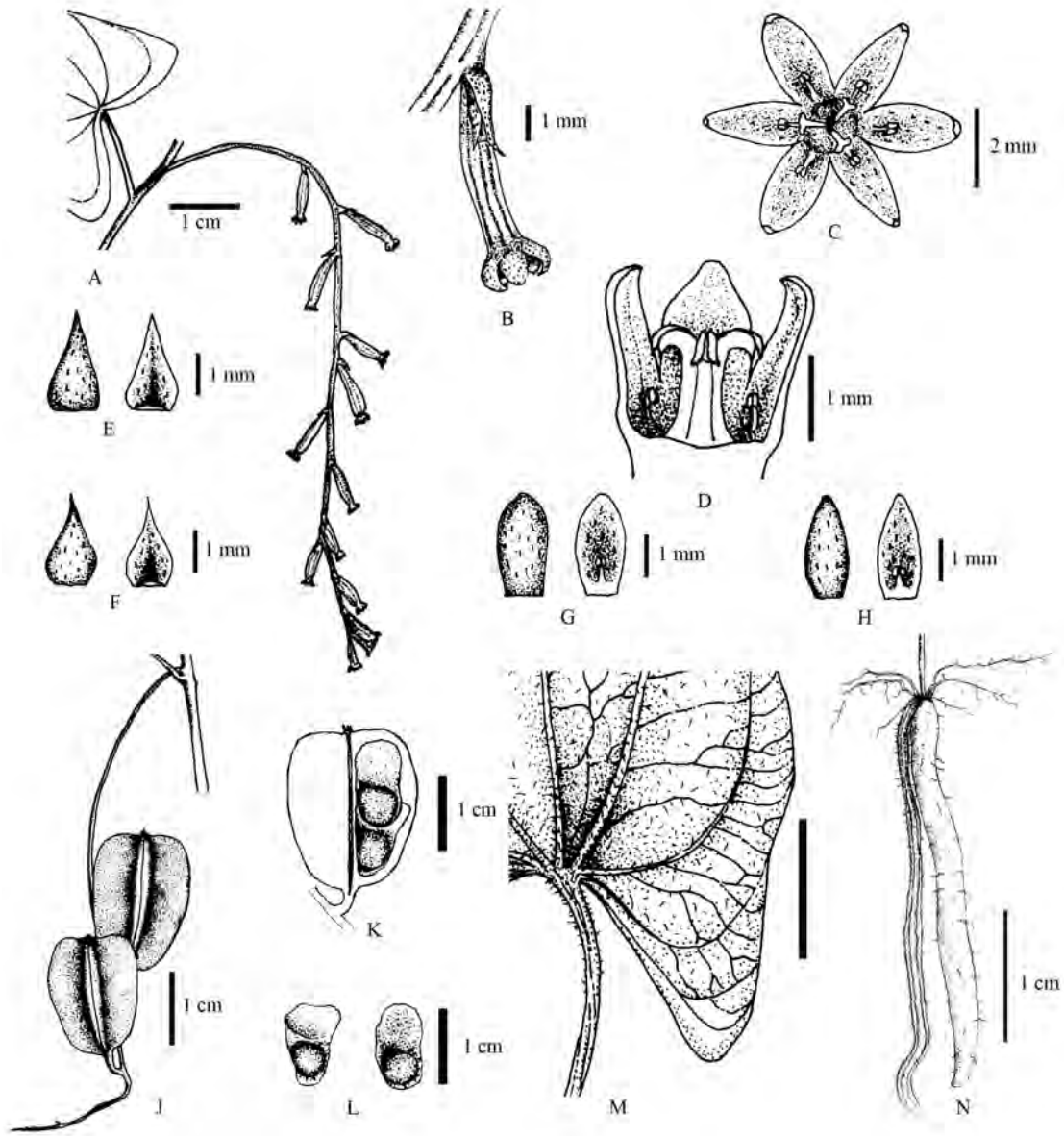

Figure 2 *Dioscorea nitens* Prain & Burkill: female plant; A. inflorescence; B–H. female flower, with cystoliths on floral bract, bracteole and tepals; B. side view; C. top view; D. l-section (excluding ovary) showing staminodes, style and stigmas; E, F. floral bract and bracteole dorsal and ventral surfaces respectively; G, H. outer and inner tepal dorsal and ventral surfaces respectively, showing position of staminode insertion; J. infructescence; K. mature capsule, l-section showing seed position in locule; L. seeds, probably immature, showing apical wing; M. petiole and leaf base showing indumentum; N. tubers, one growing and one withering (from previous growing season) (A,B. from *Garrett 786*; C–H. from *Thapyai 449*; J. from *Kerr 6279*; K, L. from from *Thapyai 489*; M – N. from *Thapyai 443*). Drawn by Chirdsak Thapyai.

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