

Taxonomic Enumeration of Podostemaceae of Cambodia and Vietnam

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Abstract This is a preliminary floristic report of Podostemaceae in Cambodia and Vietnam. It enumerates two genera and three species in Cambodia and three (probably two) genera and four species in Vietnam. They include new records of *Polypleurum wallichii* and *P. schmidtianum* from Cambodia, and an apparently local species, *Diplobryum minutale*, endemic to southern Vietnam. They represent two subfamilies, Podostemoideae and Tristichoideae. Identification of *Hydrobryum japonicum* occurring in northern Vietnam is verified. Podostemaceae of Cambodia and Vietnam are still poorly known and need further exploration.

Key words: aquatic plants (river-weeds), *Cladopus*, *Diplobryum*, *Hydrobryum*, *Polypleurum*, *Terniola*.

Introduction

Podostemaceae are an aquatic eurosids I angiosperm family that is the most closely related to Hypericaceae (Soltis *et al.*, 2000; Savolainen *et al.*, 2000; Gustafsson *et al.*, 2002; Davis *et al.*, 2005; Tokuoka and Tobe, 2006; Wurdack and Davis, 2009) and distributed in the tropical to warm-temperate seasonal-climates of the world (Kato, 2006b). Vegetative plants grow submerged on rock surfaces in rapids and waterfalls during the rainy season, when the water level is high, and subsequently plants are exposed and dried, while flowering and fruiting during the dry season, when the water level is lowered. In this extreme environment, the plants adhere to the water-worn rock surfaces by the creeping roots or shoots, or their disk-like bases (Rutishauser, 1997; Cook and Rutishauser, 2007). All species of Cambodia and Vietnam have roots that are subcylindrical, ribbon-like or crustose (foliose). It is suggested that large-gap morphological changes happened in the evolution of Podostemaceae. Partly because of such ecology and phenology, Podostemaceae have been relatively

rarely collected. Nonetheless, recent studies with increasing specimens have discovered the species-rich Podostemaceae in Thailand, Laos, and India (Kato, 2004, 2006a; Kato and Koi, 2009; Koi and Kato, 2010; S. Koi and M. Kato, unpubl. data; Asian Podostemaceae website: <http://www.kahaku.go.jp/research/db/botany/podostemaceae/1index.html>).

Podostemaceae in Cambodia and Vietnam, in contrast, are little known at present. The first record was made by Lecomte (1909) who described *Terniola carinata* from Cambodia and Laos. Cusset (1972) described *Diplobryum minutale* from southern Vietnam, and Cusset (1973a) described *Cladopus fallax* and recorded *C. pierrei*, both from southern Vietnam, and *Hydrobryum griffithii* (see *H. japonicum* below) from northern Vietnam. Then, those taxa were dealt with by floristic studies of Cusset and Cusset (1988) and Cusset (1992).

This paper examines all described species of Podostemaceae in Cambodia and Vietnam using specimens from all recorded places, in hopes that it provides useful material for further understanding the complete flora of the family. Recent col-

lections include new records from Cambodia. As a result of this study, I suggest that future exploration will discover the flora of the areas richer.

Key to the species of Cambodia and Vietnam

- 1a. Leaves lanceolate, univeined, bracts carinate, flowers 3-merous with 3-lobed calyx, 3 stamens, 3 stigmas, obtetragonal 3-locular capsules; Cambodia (subfamily Tristichoideae) **1. *Cussetia carinata***
- 1b. Leaves filiform, not veined, bracts not carinate, flowers 2-merous with 2 reduced filiform tepals, 1 or 2 stamens, 2 stigmas, ellipsoidal or globose 2-locular capsules (subfamily Podostemoideae) **2**
- 2a. Roots ribbon-like **3**
- 2b. Roots crustose **6**
- 3a. Tufts of leaves and flowering shoots borne on flank of root, bracts simple, capsules ellipsoid, flattened, ribbed **4**
- 3b. Tufts of leaves and flowering shoots borne at sinuses between root branches, bracts digitate, capsules globose, smooth **5**
- 4a. Roots to 6 mm wide, stamens 2, capsules to 2 mm long, stalks to 15 mm long; SW Cambodia **2. *Polypleurum wallichii***
- 4b. Roots 2–3 mm wide, stamens 1, capsules 1.2–1.7 mm long, stalks 4–9 mm long; SW Cambodia ··· **3. *Polypleurum schmidtianum***
- 5a. Stamens 1; S Vietnam ··· **4. *Cladopus fallax***
- 5b. Stamens 2 with forked filaments; S Vietnam **5. *Cladopus pierrei***
- 6a. Bracts 4–5, capsule-ribs 12; N Vietnam **6. *Hydrobryum japonicum***
- 6b. Bracts 6–8, capsule-ribs ca. 20; S Vietnam **7. *Diplobryum minutale***

1. *Cussetia carinata* (Lecomte) M. Kato, Acta Phytotax. Geobot. 57: 54. 2006—*Terniola carinata* Lecomte, Bull. Soc. Bot. Fr. 56: 96. 1909; Fl. Gén. Indochin. 5: 45, f. 5A, B, 1–4. 1926—*Lawia carinata* (Lecomte) Koidz., in Doi, Fl. Satsum. 1(4): 53. 1929—*Dalzellia carinata* (Lecomte) C. Cusset, Fl. Cambodge, Laos, Viêt-Nam 14: 78, pl. 12, f. 4–7. 1973; Cusset & Cus-

set, Bull. Mus. Natl. Hist. Nat. Paris, 4^e sér., sect. B, Adansonia 10(2): 173. 1988. *Type*. Cambodia, *M. Julien s.n.*, 6 June 1874 (P!) (lectotyped by Cusset [1973b]).

Root creeping, adhering to rock surface, ribbon-like, 1–2 mm wide, branched, with many shoots rather closely arranged (0.5–1 mm apart) on both flanks. Shoot aggregations comprising floriferous shoot usually associated with much shorter vegetative shoot; vegetative shoot flattened (in dry specimens), 1.5–4 mm long, 0.5–0.7 mm thick including scales, scales shorter than wide, to 0.5 mm long; flowering shoots 5–9 mm long excluding flowers, 1.5–2.5 mm wide including leaves, leaves (bracts) in 6 ranks, 5–9 per rank, deltoid-ovate, apex obtuse, keeled in middle on abaxial surface, oblique, subfalcate, 1.5–2.5 mm × 0.5–1 mm, thick, upper leaves larger, coriaceous; flower 1, at shoot apex; pedicelled; tepal ca. 2.5 mm long, lobed 2/5–1/2 to base, lobes 3, membranous, univeined, pale; stamens 3, alternate to tepal-lobes, longer than ovary, 1.5–3.3 mm long, filaments membranous in basal half, anthers deltoid; ovary 3-locular, obdeltoid-ellipsoidal, apex subtruncate, 1.2–2.5 mm long, 0.8–1.7 mm wide, placentation axile; stigmas 3, separate from each other, ca. 0.5 mm long, multilobed; capsule stalked (stalks 5–10 mm long), obovoid, trigonous, ribs 9; seeds ellipsoid, warty.

Specimen examined. Cambodia, *Julien s.n.* (P!).

Distribution. Cambodia, Laos (southern).

Notes. *Cussetia carinata* is most similar and closely related to *C. diversifolia*, the other species of the bispecific genus, in the absence of obvious bracts, carinate leaves in 6 ranks on the prominent flowering shoot, and tepal-like, pale filaments. Therefore, the two species are classified as congeneric (Kato, 2006a). *Cussetia diversifolia* is distinct from *C. carinata* in the shoot comprising a middle vegetative and two lateral flowering branches (vs. a vegetative and a flowering branch in *C. carinata*), carinate leaves on the vegetative shoot (vs. scale-like), 2 or 3 leaves per rank on flowering shoots (vs. 5–9), and stigma

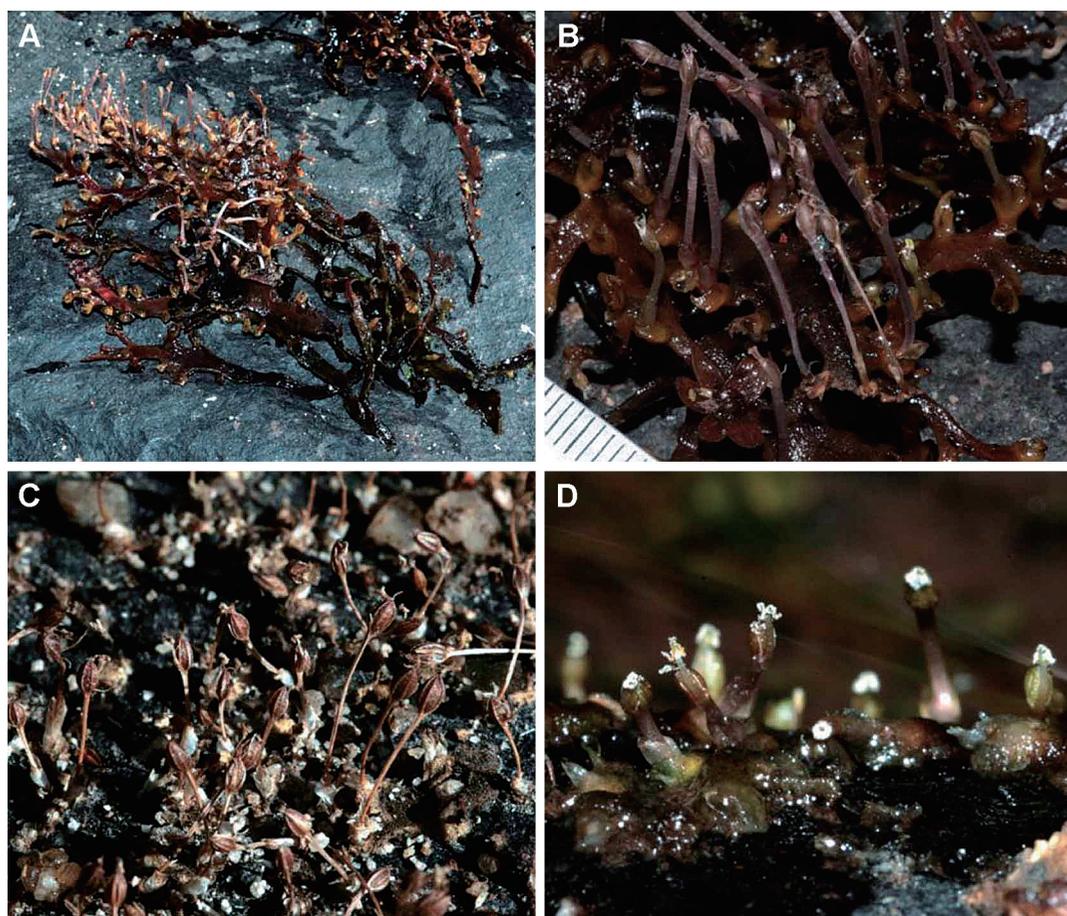


Fig. 1. *Polypleurum* in Cambodia. Photo taken by L. Cecilio in Thma Baing District, Koh Kong Province, Cambodia in December 2008. A, B. *Polypleurum wallichii*. Pink flowers are borne on flanks of ribbon-like roots. C, D. *Polypleurum schmidtianum*. Stalked capsules with 8 ribs are erect on roots and flowers have single stamens with pale, ruptured anthers.

filamentous, entire (vs. branched, lobulate). *Cussetia carinata* is distributed in Cambodia and southern Laos, while *C. diversifolia* occurs in eastern Thailand (Lecomte, 1926; Cusset, 1973b; Cusset and Cusset, 1988; Kato, 2006a). It is the only species of subfamily Tristichoideae from Cambodia, and no species is recorded from Vietnam (Kato, 2006b; for differences from Podostemoideae see Key 1).

Cussetia is similar to *Terniopsis*, one of six genera of Tristichoideae, in the ramuli on the flank of the creeping root as well as the reproductive characters, but their phylogenetic relationship is uncertain.

2. *Polypleurum wallichii* (R.Br. ex Griff.) Warm., *Danske Vidensk. Selsk. Skrift.*, ser. 6, *Nat. Math.* 11(1): 57. 1901; Cusset, *Bull. Mus. Natl. Hist. Nat. Paris*, 4^e sér., sect. B, *Adansonia* 14(1): 42, f. 8. 1992; Raveendran & Mathew, *Rheedea* 2: 106, f. 1. 1994; Kato, *Acta Phytotax. Geobot.* 57: 36. 2006—*Podostemum wallichii* R. Br. ex Griff., *Asiat. Res.* 19: 103, tab. 17. 1836—*Dicraeia wallichii* (R.Br. ex Griff.) Tul., *Ann. Sci. Nat.* ser. 3, 11: 101. 1849; Willis, *Ann. Roy. Bot. Gard. Peradeniya* 1: 223. 1902. *Type*. India: Cherrapunji, *Griffith s.n.* (K!).

Dicraeia minor Wedd., in DC., *Prodr.* 17: 71. 1873; Willis, *Ann. Roy. Bot. Gard. Peradeniya* 1:

223. 1902—*Podostemum minor* (Wedd.) Benth., in Benth. & Hook. f., Gen. Pl. 3: 112. 1880; Hook. f., Fl. Brit. Ind. 5: 67. 1886—*Polypleurum minor* (Wedd.) Nagendran, Arekal & Subramanyan, Plant Syst. Evol. 128: 217. 1977. *Type*. India: Mts. Khasi, *Griffith 2437* (holotype K!, isotype P).

Dicraea wallichii (R.Br. ex Griff.) Tul. var. *khasiana* Willis, Ann. Roy. Bot. Gard. Peradeniya 1: 224. 1902. *Syntypes*. India: Maomloo River, Cherrapungi, *Wallich*; Sylhet rivers, *Gomez*; Sylhet Mts., *Griffith*, *Hooker*, *Clarke*, *Willis* (C!).

Dicraea wallichii (R.Br. ex Griff.) Tul. var. *striata* Willis, Ann. Roy. Bot. Gard. Peradeniya 1: 225. 1902. *Syntypes*. Myanmar: Moulmen, *Lehmann 3*; *Wallich 33*; *Parish s.n.* (K!).

Root attached to rock by base, distally free, floating, ribbon-like, to 6 mm wide, irregularly and often branched. Flowering shoots on both flanks of roots; bracts 4, lanceolate to ovate-lanceolate, acute or acuminate, apex often caducous; flower 1, bud covered by spathe, spathe 2–4 mm long, ruptured near apex at anthesis; pedicel 10–15 mm long; tepals 2, 1 on each side of stamen, to 1.5 mm long; stamens 2, branched below apex, as long as ovary or slightly longer, 2.5–3 mm long, anthers caducous; ovary ellipsoidal, slightly flattened, to 2.5 mm long; stigmas 2, equal, forked at base, filiform, to 1 mm long; ovules covering entire septum surface, 40–50 per locule; capsule ribs 8–9.

Specimens examined. SW Cambodia. Mondul Kiri district: Kabal Satian waterfall, Strung Ruesay Chrum Kandal River, Phnom Sumkot Wildlife Sanctuary, interior to Kaoh Kong City, *M. Wongnak s.n.* (TNS). Koh Kong district: Thma Baing, Ruessei Chrum, 11°39'39.2"N, 103°23'58.7"E, 342 m alt., *M. Newman et al. 2158* (TNS).

Distribution. Thailand (northern, central, eastern), India (northeastern, southern), Myanmar (southeastern), Laos (northern central, southern), Cambodia (southwestern).

Note. This is a new record from Cambodia and isolated from the eastern and central Thailand

localities (Kato, 2006a). The Cambodian plants are referable to var. *wallichii*.

3. *Polypleurum schmidtianum* Warm. in Schmidt, Bot. Tidsskr. 24(3): 258. 1901; Danske Vidensk. Selsk. Skrift. ser. 6. Nat. Math. 11(1): 3, f. 1–6. 1901; Cusset, Bull. Mus. Natl. Hist. Nat. Paris, 4^e sér., sect. B, Adansonia 14(1): 38. 1992; Kato, Acta Phytotax. Geobot. 57: 40. 2006—*Polypleurella schmidtiana* (Warm.) Engl., Bot. Jahrb. Syst. 61: 9. 1927; Royen, Dansk Bot. Ark. 23: 185. 1965. *Type*. Thailand: Klong Sarlakpet, Koh Chang, 600 ft, southeastern, *Schmidt s.n.* (=C 3160) (C, not seen).

Root ribbon-like, 2–3 mm wide, irregularly and often branched (vegetative plants not available). Flowering shoots on both flanks of root; bracts 2–3 or possibly more, in 2 ranks, ca. 2 mm long, sheathed, distally linear; flower 1, bud covered by ellipsoidal spathe, spathe ruptured near apex at anthesis, ruptured spathe ca. 1.5 mm long; pedicel 4–8 mm long; tepals 2, 1 on each side of stamen, 0.5–0.7 mm long; stamen 1, as long as ovary or longer, ca. 1.5 mm long; ovary 2-locular, ellipsoidal, slightly flattened, 1.2–1.7 mm long, 0.7–1 mm wide; stigmas 2, subequal, forked at base, filiform, tapering to apex, 0.3–0.6 mm long; ovules covering entire septum surface, ca. 35 per locule; capsule stalked (4–9 mm long), ribs 8.

Specimen examined. SW Cambodia. Koh Kong district: Thma Baing, Ruessei Chrum, 11°39'39.2"N, 103°23'58.7"E, 340 m alt., *M. Newman et al. 2159* (TNS).

Distribution. Thailand (southeastern, central [Cusset, 1992]), Cambodia (southwestern), northern central Laos (Bolikhamsai).

Note. This species has been regarded as endemic to Thailand, but it also occurs in northern central Laos (S. Koi and M. Kato, unpubl. data). This paper reports the third locality in southwestern Cambodia nearby Trat province and an offshore island, Ko Chang, southeastern Thailand (Kato, 2006a). In Cambodia, this occurs along with *Polypleurum wallichii* (*M. Newman*, person. commun.).

4. *Cladopus fallax* C. Cusset, Fl. Cambodge, Laos, Viêt-Nam 14: 72, pl. 10, f. 10, 11. 1973; Kato, Acta Phytotax. Geobot. 57: 32. 2006. *Type*. Vietnam: Massif du Lang Biang between Klou and Da Nhim, Tuyên Doc, southern, 900–1200 m alt., *Chevalier 30946a* (P!).

Cladopus nymanii auct. (non H. Möller); C. Cusset, Bull. Mus. Natl. Hist. Nat. Paris, 4^e sér., sect. B, Adansonia 14(1): 22, f. 2, 4–7. 1992, p.p.

Root creeping, adhering to rock surface, ribbon-like, 1–2 mm wide, branched, with tufts of leaves near edge on both flanks of root at all sinuses of root branches (vegetative plants not available). Flowering shoot very short; bracts 6–12, in two ranks, digitate, lobes 5–8, oblong, 0.5–1 mm long, 0.2–0.3 mm wide, papillate with silica; flower 1, pedicelled, bud covered by spathella, spathella globose, ca. 1 mm long, irregularly ruptured near apex at anthesis; tepals 2, 1 on each side of stamen, linear, ca. 0.8 mm long; stamen 1, to 1.3 mm long, longer than ovary; ovary globose-ellipsoidal, 1–1.2 mm long, 0.8–1 mm thick, 2-locular, with 2 nearly vertical grooves; septum hemispherical in central part, margins membranous; stigmas 2, forked near base, ca. 0.4 mm long, linear to subulate, entire, procumbent; ovules covering entire septum surface, ca. 25 per locule. Capsule stalked (stalk to 1–1.5 mm long), globose, 1.5 mm long, smooth.

Specimen examined. S Vietnam: Massif du Lang Biang, between Klou and Da Nhim, Tuyên Doc, *Chevalier 30946a* (P).

Distribution. Thailand (southeastern), Vietnam (southern).

Notes. Cusset (1992) reduced *Cladopus fallax* to *C. nymanii* in the very broad sense including local species of China and Japan. This treatment resulted in a polymorphic and widely distributed *C. nymanii*; however, molecular evidence refutes this Cusset's (1992) lumping (Kita and Kato, 2001, 2004). *Cladopus fallax* is the most closely related to *C. taiensis* (Koi *et al.*, 2008). Morphologically, *C. fallax* differs considerably from *C. nymanii* in that the root is up to 2.5 mm wide (vs. to 5 mm in *C. nymanii* sensu stricto, the stamen is up to 1.5 mm long (vs. 2.5 mm), and the ovules

are ca. 25 per locule (vs. up to 50) (Kato and Hambali, 2001; Kato, 2006a). *Cladopus fallax* is also distinct from *C. taiensis* in the digitate bracts with lobes thick and somewhat rough on the surface, while the bracts are lobed, thin and smooth in *C. taiensis* (Kato, 2006a).

5. *Cladopus pierrei* (Lecomte) C. Cusset, Fl. Cambodge, Laos, Viêt-nam 14: 73. 1973; Bull. Mus. Natl. Hist. Nat., B, Adansonia 14(1): 25. 1992—*Mniopsis pierrei* Lecomte, Not. Syst. 1: 8. 1909. *Type*. Laos: Bassac, Champassak, *F.(A.)F.J. Harmand s.n.* (as *Pierre 5194*) (P!).

Roots ribbon-like, ca. 1.5 mm wide; leaves at sinuses between root branches. Flowering shoots at sinuses of root branching, solitary, erect, to 3 mm tall; bracts 8–10 in two files, digitate with 6–10 lobes, base membranous, lobes cylindrical, hard, papillate with silica, 1–1.2 mm long; spathella enclosing young flower flattened, ellipsoidal, 2–2.5 mm long, membranous, rupturing into several lobes at apex at anthesis, funnel-like; pedicellate; tepals on top of pedicel 2, 1 on each side of stamen, linear, ca. 1 mm long; stamens 2 with common andropod; ovaries single, sessile, 2-locular, globose; stigmas 2, subulate, ca. 0.3 mm long, forked at base; ovules on whole septum surface; capsules-stalks 2.5–4 mm long, capsules chestnut-brown, globose, ca. 1.5 mm long, ca. 1 mm wide, smooth but with two stripes, dehiscing by 2 equal or subequal valves.

Specimen examined. S Vietnam: Massif du Lang Biang, between Klou and Da Nhim, Tuyên Doc, *Chevalier 30945 p.p.* (P).

Distribution. Laos (southern, central), Vietnam (southern).

Notes. Cusset (1973a, 1992) divided the genus *Cladopus* by the number of stamens into two sections, *Cladopus* with one stamen and *Griffithella* with two stamens on the common andropod, the latter of which comprises *C. pierrei* and south Indian *C. hookerianus* (Tul.) C. Cusset, type of the section. Phylogenetically, *C. pierrei* is so close to *C. doianus* (Koidz.) Koriba (= *C. japonicus* Imamura; Kato, 2008) as to be inseparable even at the section level (S. Koi, unpubl. data). The

genus *Lecomtea* Koidz. was proposed for *Cladopus pierrei* (Koidzumi, 1929), but it is not warranted. An unpublished result of S. Koi's molecular phylogenetic analysis also suggests that *C. hookerianus* belongs to the *Polypleurum-Zeylandidium* clade, sister to a clade comprising the *Cladopus* clade and the *Hydrobryum* clade.

6. *Hydrobryum japonicum* Imamura, Bot. Mag. Tokyo 42: 376. 1928; *l.c.* 43: 332. 1929; Ohwi, Fl. Jap. 394. 1965; Shin, Wild Fl. Jap. Herb. Pl. 2: 214. 1982; Cusset, Bull. Mus. Natl. Hist. Nat., B, Adansonia 14(1): 46. 1992, p.p. excl. *H. floribundum* (Koidz.) Koidz. et *H. puncticulatum* Koidz.; Kato, Acta Phytotax. Geobot. 55: 157. 2004—*Hydroanzia japonica* (Imamura) Koidz., Acta Phytotax. Geobot. 4: 28. 1935. *Type*. Japan: Ohnejime, Kagoshima, Kyushu, *Senokuchi s.n.* (TI, not seen).

Hydrobryum griffithii auct. (non [Wall. ex Griff.] Tul.); Cusset, Fl. Cambodge, Laos, Viêt-Nam 14: 68. 1973.

Root crustaceous, irregularly lobed (vegetative plants not available). Flowering shoots appressed, with flowers solitary at tip; bracts ca. 4, in 2 ranks, uniform, ovate, abaxially convex; spathella irregularly ruptured near apex at anthesis; ovary-stalk short; tepals 2 on both sides of stamen, inserted near base of stalk, linear-lanceolate, 1.5–2 mm long; stamens 2, branched above middle, ca. 2.5 mm long (when young), much longer than ovary; ovary 2-locular, ellipsoidal, 2–2.5 mm long, septum fissured above sterile thick central area; stigmas 2, equal, ca. 0.5 mm long, linear, pointed or obtuse at tip, branched above base, often reflexed; ovules ca. 14 per locule, on marginal surface of septum; capsule short-stalked (up to 0.5 mm long), ellipsoidal, flattened, ribs 12.

Specimen examined. N Vietnam. Lao Kay, near Chapa, 1300 m alt., *Pételot 3370* (P).

Distribution. Thailand (northern, northeastern; central [Cusset, 1992]), Vietnam (northern), China (Yunnan prov. [Kato and Kita, 2003]), Japan (southern Kyushu).

Note. This species from northern Vietnam was

first regarded as *H. griffithii* (Cusset, 1973a), but later identified to be *H. japonicum* (Cusset, 1992). This is verified here by the linear stigma (vs. cristate in *H. griffithii*) and molecular (*matK*) phylogenetic data (M. Kato, unpubl. data).

7. *Diplobryum minutale* C. Cusset, Adansonia, ser. 2, 12: 279, f. 1. 1972; Fl. Cambodge, Laos, Viêt-nam 14: 70, f. 11. 1973; Bull. Mus. Natl. Hist. Nat., B, Adansonia 14: 49. 1992. *Type*. Vietnam: Lang Bian, between Klou and Dauhin, 900–1200 m, southern, *Chevalier 30946bis* (P!).

Roots crustose, irregularly lobed, with rhizoids in pads on ventral surface, coriaceous. Flowering shoots dense on dorsal surface of root, appressed; bracts 6–8 in 2 files, uniform but basal ones smaller, ovate, hood-shaped, obtuse at apex, papillate, 1–1.8 mm long; spathella enclosing young flower, ellipsoidal, obtuse at apex, papillate except in center, 2–2.5 mm long, longitudinally or apically split at anthesis, persistent; tepals not seen (in Cusset's [1992] description: 2, 1 on each side of stamen, 0.5 mm long); stamens fallen with single andropods (in Cusset's [1992] description: 2, branched); ovaries single, staked, 2-locular, ellipsoidal, flattened, protruding from spathella; stigmas fallen (Cusset's [1992] description: 2, capitate); ovules roughly 25 per locule, borne on whole septum surface; capsules stalked (stalks 2–3 mm long), ellipsoidal, flattened, 2–3 mm long, 1–1.2 mm wide, ca. 20-ribbed, dehiscing by 2 equal valves; seeds ellipsoidal, longitudinally weakly ridged.

Specimen examined. S Vietnam: Lang Bian, *Chevalier 30946bis* (P).

Distribution. Endemic to southern Vietnam.

Notes. Genus *Diplobryum* sensu Cusset (1972), which was treated in a broader sense by Cusset (1992), is distinguished from *Hydrobryum* only by the number of capsule ribs (see Key). Since Lao *D. vientianense*, which appears close to this species, is placed within *Hydrobryum* in a molecular phylogenetic tree (S. Koi and M. Kato, unpubl. data), the two crustose-rooted species may also be assignable to *Hydrobryum*. *Diplobryum minutale* is distinct from *H. japonicum* in

the numbers of bracts and capsule-ribs (see Key) and ovule arrangement, and also perhaps the stigma, but similar to *D. vientianense* and its closely related northeastern Thai *H. loeicum* in the crustose root, longitudinally split spathella, prominent ovary-stalk, and 18–20-ribbed capsule.

The specimen examined has only old bracts and fruits on root fragments, so that new material is needed to describe the species in more detail. Cusset's (1972, 1973) flower diagram should be re-examined.

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