

Taxonomical studies of the Family Aneuraceae (Marchantiophyta) of Singapore

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Abstract The Aneuraceae in Singapore were taxonomically studied, and seven species are recognized: *Aneura blasioides* (Horik.) Furuki, *Riccardia crenulata* Schiffn., *R. elater* (Steph.) Schiffn., *R. graeffei* (Steph.) Hewson, *R. latifronoides* Schiffn., *R. singapurensis* Schiffn. and *R. tenuicostata* Schiffn. *Aneura pinguis* is excluded from the known hepatic flora of Singapore, and *A. blasioides* is newly added. New synonyms are proposed: *Riccardia ridleyi* Schiffn., *R. elata* var. *angustior* Schiffn., *R. elata* var. *stephanii* Schiffn. and *Aneura dicrana* Steph. under *R. elata* (Steoh.) Schiffn.; *R. bliklika* Hewson var. *bliklika* under *R. singapurensis* Schiffn.; *Aneura exigua* Steph. and *A. papulosa* Steph. 1917 (non *A. papulosa* Steph. 1893) under *R. tenuicostata* Schiffn. Lectotypes are newly designated here for *Riccardia elata* var. *angustior* Schiffn., *R. elata* var. *stephanii* Schiffn., and *Riccardia tenuicostata* Schiffn.

Kew words: Taxonomy, Marchantiophyta, Aneuraceae, Singapore.

The Aneuraceae in Singapore have not been studied taxonomically since Schiffner (1898) who reported 31 species of the family, including twenty 29 species of *Riccardia*, based on his own collections made in Java, Sumatra, Singapore and their adjacent regions. In his publications, Schiffner did not designate holotype, but he listed many specimens that were the syntypes. Syntypes collected in Singapore were listed for five of the Schiffner's new species, namely, *Riccardia crenulata* Schiffn., *R. latifronoides* Schiffn., *R. ridleyi* Schiffn., *R. singapurensis* Schiffn. and *R. tenuicostata* Schiffn. In 1917 Stephani described *Riccardia flavescens* Steph. from Singapore. Recently, Piippo et al. (2002a, b) reported *Aneura pinguis* (L.) Dumort. and *R. graeffei* (Steph.) Hewson from the island country. We taxonomically revised the types of all reported species from Singapore and the recently collected specimens of this family kept at the herbaria of the National University of Singapore (SINU) and Singapore Botanic Gardens (SING). We also conducted the field survey at the type localities of these species and other places in Singapore in 2005

and 2008.

Taxonomy

One species of the genus *Aneura* and six species of the genus *Riccardia* are recognized, and they can be separated from each other by the following key.

1. Thalli more than 2 mm wide, archegonia and antheridia irregularly arranged in more than 2 rows (genus *Aneura*) *A. blasioides*
1. Thalli less than 2 mm wide, archegonia and antheridia regularly arranged in 2 rows (genus *Riccardia*) 2
2. Mucilage hairs on lateral margin of thallus.....
..... *R. tenuicostata*
2. Mucilage hairs on ventral surface of thallus.....3
3. Thallus strongly differentiated into a creeping main axis and lateral branches *R. elata*
3. Thallus weakly differentiated into a prostrate main axis and prostrate to ascending lateral branches ... 4
4. Dioicous 5

4. Monoicous 6
 5. Marginal cells of thallus, smaller, oblong, 15–40 × 15–40 µm, strongly tumid *R. crenulata*
 5. Marginal cells of thallus, larger, nearly quadrate, 50 × 50 µm, slightly tumid *R. latifrontoides*
 6. Thalli smaller, to 0.4 mm wide in ultimate branches, oil bodies 1-4 in wing cells and inner cells, rarely in epidermal cells of middle part of thallus.....
 *R. singaporensis*
 6. Thalli larger, to 0.8 mm wide in ultimate branches, oil bodies numerous, more than 5 in all cells of thallus *R. graefferi*

1. *Aneura blasioides* (Horik.) Furuki

Aneura blasioides (Horik.) Furuki, J. Hattori Bot. Lab. 70: 311 (1991).

For synonyms see Furuki (1991).

Specimens examined. NUS university greenhouse, 10 Sept. 2000, B.C. Tan, s.n. (SINU) as *Aneura pinguis* (L.) Dumort.; Bukit Batok, West Avenue 5, on soil, at housing garden, 2 Mar. 2008, B.C. Ho, s.n. (SING, dupl. in CBM).

Description and illustration. The morphological characters of Singaporean plants agree well with those described by Furuki (1991) for *Aneura blasioides*.

Habitat. On exposed, wet soil at margin of forest or along road.

Distribution. Singapore, Japan and Himalaya (Furuki, 1991; Furuki and Higuchi, 1995). New to Singapore, probably introduced.

Remarks. This species is easily recognized by the translucent viridian plants when fresh, the large prostrate thalli, the thalli ill-differentiated into main axis and lateral branches, and the gametangia arranged irregularly. Piippo *et al.* (2000a, b) reported *Aneura pinguis* (L.) Dumort. from Singapore; however, the voucher specimen at SINU Herbarium is *A. blasioides*, judging from its translucent viridian plants. *Aneura pinguis* has opaque green thalli.

2. *Riccardia crenulata* Schiffn.

Riccardia crenulata Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 173 (1898). Type: Java, Prove Preanger, Apud fontes calidos supra Tjiburru, prope Tjibodas ad truncos ptrido, 2 May 1894, Schiffner 204-lectotype (PR!), designated by Furuki (2001).

For synonyms see Furuki (2001).

Specimen examined. In monte Bukit Timah, prope fontem, regio calida, alt. 100–150 m s.m., 6 Nov. 1893, Schiffner 205-syntypus (PRC!), mixed with *Riccardia singaporensis* and *R. tenuicostata*.

Description and illustration. *Riccardia crenulata* and its related species were taxonomically studied by Furuki (2001), which provided a full description and illustrations.

Habitat. On wet rocks.

Distribution. Singapore, Philippines, Malaysia (Malay Peninsula and Borneo) and Indonesia (Java and Sumatra) (Schiffner, 1898; Furuki, 2001).

Remarks. The diagnostic characters for this species include (1) small thalli, (2) strongly crenulate margin of thallus, (3) oblique marginal cells of thallus, (4) 3–5 cells wide unistratose alar portion of ultimate branches, and (5) dioicous condition.

Schiffner (1898) described this species as new species from Java, Sumatra and Singapore, and listed five syntypes including one specimen collected from Singapore, which is the only specimen of this species known from Singapore.

3. *Riccardia elata* (Steph.) Schiffn.

(Fig. 1)

Riccardia elata (Steph.) Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 169 (1898); *Aneura elata* Steph., Hedwigia 32: 19 (1893). Type: Java, s. d., Prof. Stahl 5 (G!-holotype).

Riccardia ridleyi Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 170 (1898); *Aneura ridleyi* (Schiffn.) Steph., synonymized by Furuki (2006). Type: Insula Singapore, in monte Bukit Timah, Schiffner 194 (W!-holotype, JE!-isotype, PR!-isotype), mixed with *Riccardia singaporensis*.

Riccardia elata (Steph.) Schiffn. var. *angustior* Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 169 (1898), *syn. nov.* Type: Java, Prov. Batavia, in monte Salak, in silivis primaevus ad latus septentr., ad saxa, regio pluvialis, alt. 900 m, s.m., 5 Dec. 1893, Schiffner 163 (W!-lectotype designated here, JE! and PRC!).

Riccardia elata (Steph.) Schiffn. var. *stephanii* Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 169 (1898), *syn. nov.* Type: Java, Prov. Batavia, ad decliv, septentr. Montis Salak, in faucibus torrentis Tjiapus ad saxa, regio pluvialis alt. 800 m, 28 Jan. 1894, Schiffner 165 (G!-lectotype designated here).

Aneura dicrana Steph., Spec. Hepat. 1: 224 (1899),

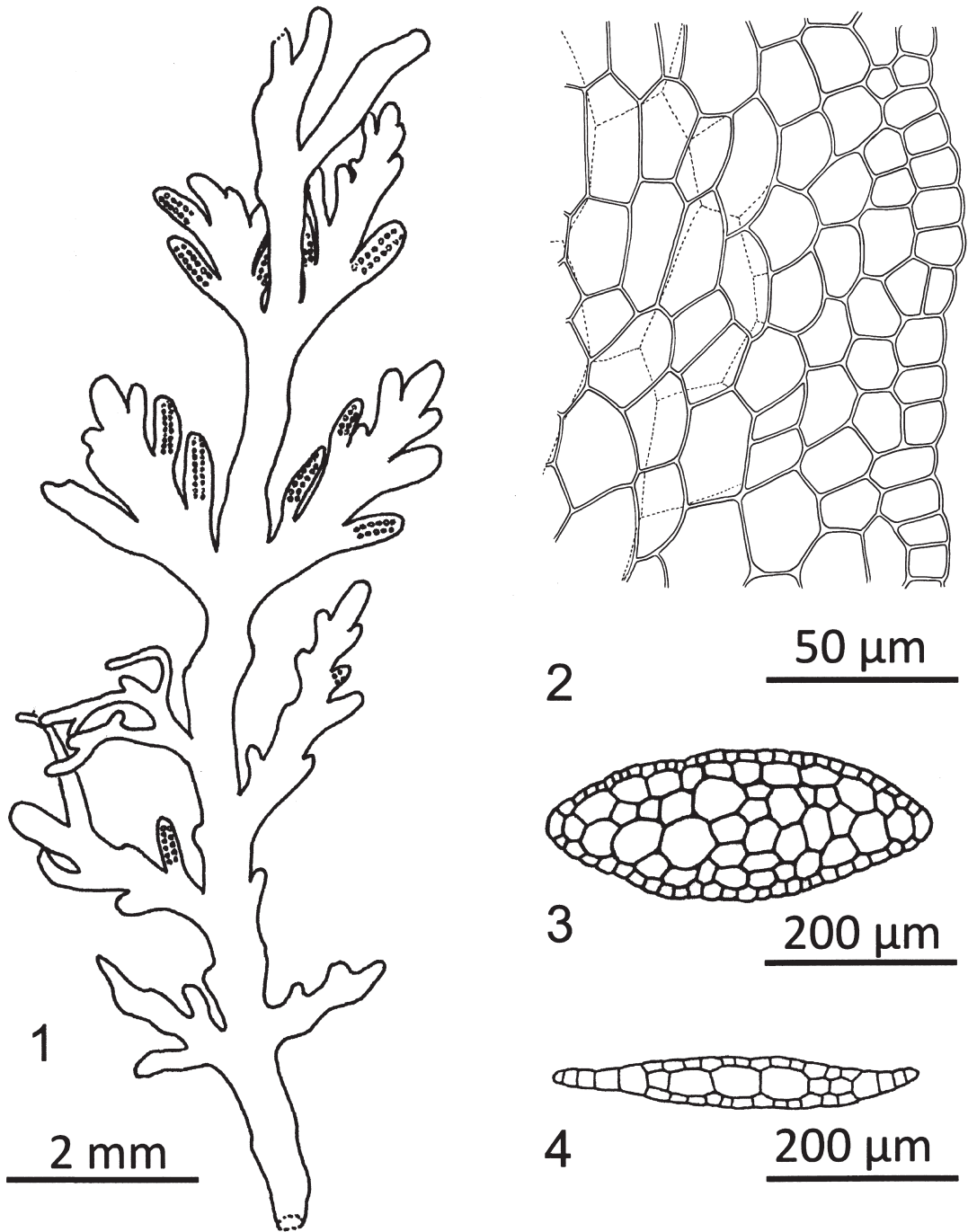


Fig. 1. *Riccardia elata* (Steph.) Schiffn. 1, male plant. 2, marginal cells of ultimate branches. 3, cross section of main axis. 4, cross section of ultimate branch. All drawn from holotype (*Schiffner 194* in W) of *Riccardia ridleyi* Schiffn.

syn. nov. Typus: Sumatra, Insula Engano, 1894, Modigilani, s.n. hb. Levier 156 (G-025997!-holotype).

Specimen examined. Only the holotype of *Riccardia ridleyi* is seen from Singapore.

Description. Thallus median to large, viridian to deep green when fresh, brown in herbarium, tri- to quadri-pinnately branched, strongly differentiated into a creeping main axis and subopposite winged lateral branches, long between lateral branches, smooth on surface. Geotropical stolons often present near base of axis. Main axis erect, to 10 cm long, 0.5–0.8 mm wide; cross sections elliptical 7–10 cells (to 250 µm) thick, obtuse to winged (unistratose alar portion (0-) 1–2 (-3) cells wide) at margin. Ultimate branches to 3 mm long, to 0.3 mm wide; cross sections linear 3 cells (to 70 µm) thick, winged at margin (unistratose alar portion 4–6 cells wide). Epidermal cells of middle part of thallus polygonal, irregular in size, 25–60 × 10–20 µm, about 1/3 the inner cell in size, thin walled. Inner cells polygonal, 100–125 × 50–75 µm, thin walled in central part, weakly thick walled near epidermal cells.

Cells of alar portion of thallus decreasing toward margin, thin walled with small trigones; marginal cells smaller than submarginal cells. Mucilage hairs in 2 rows on ventral surface of thallus. Gemmae rare. Rhizoids scattered near the base of axis.

Dioicous. Male branches lateral on secondary branches; lateral wings obliquely to horizontally spreading, 3–4 cells high. Female branches lateral on main axis; paraphyses fringed scale like. Calyptrae covered with scattered enlarged cells. Sporophytes unknown.

Habitat. On wet soil along stream.

Distribution. Singapore, Indonesia (Java, Sumatra). Malaysia (Malay Peninsula and Borneo) and Philippines (Schiffner, 1898; Furuki, 2006).

Remarks. The gross morphology of *Riccardia elata* was provided on the basis of specimens collected from the range of the species as well as the type materials listed above. This species is well characterized by (1) thalli strongly differentiated into a creeping main axis and subopposite lateral branches, (2) long internodes between lateral branches, (3) wide unistratose alar portion of ultimate branches, (4) small trigones of cells of alar portion, (5) wide and short marginal cells of ultimate branches, (6) 3 cells thick of ultimate branches, (7) calyptrae nearly smooth before maturity, and (8) dioicous condition. This species can be easily distinguished from other species of the genus in Singapore by the thalli strongly differentiated into a creeping main axis and subopposite winged lateral branches.

Schiffner (1898) described *Riccardia ridleyi* based on holotype collected from Bukit Timah in Singapore, and *R. ridleyi* was reduced to a synonym of *Riccardia elata* by Furuki (2006). The occurrence of this species

could not be reconfirmed by our recent field survey at the type locality, and only the holotype of *R. ridleyi* has been known for this species in Singapore.

In the type material of *Riccardia ridleyi*, the plants are male and smaller than the typical form of *R. elata*, and they resemble *R. diminuta* Schiffn. *Riccardia ridleyi* differs from *R. diminuta* in having long internodes of main axis between lateral branches, the wider unistratose wings of ultimate branches with 3–7 celled width and the rather wide and long marginal cells. *R. diminuta* has short internodes of main axis between lateral branches, the narrower unistratose wings of ultimate branches with 2–5 celled width and the rather narrow and long marginal cells. The morphological features of *R. ridleyi* are identical with those of *R. elata*.

Meijer (1959: fig. 4) provided illustrations of this species drawn from two specimens collected by himself in Java and Borneo. Figure 4a and 4b were drawn from Meijer, s.n. (in L) collected in Borneo, and figure 4c and 4d were from Meijer 5875 (in L) collected in Java. Meijer, s.n. is *Riccardia nobilis* (Steph.) Schiffn., and Meijer 5875 is *R. elata*. *Riccardia elata* can be distinguished from *R. nobilis* by the wide midribs, the wide and short marginal cells of ultimate branches, and the small trigones. In *R. elata* the midribs of ultimate branches are wider than wing, and the marginal cells of ultimate branches are wider and shorter than submarginal cells, and the trigone of wing cells are small, whereas the midribs are narrower than wings, and the marginal cells are as large as submarginal cells, while the trigones are medium to large in *R. nobilis*. Verdoorn (1938) also mixed specimens of *R. nobilis* with *R. elata* in the packet of his Hepaticae Selectae et Criticae Series X, no. 483, labeled as *R. elata*.

Riccardia elata (Steph.) Schiffn. var. *angustior* Schiffn., *R. elata* (Steph.) Schiffn. var. *stephanii* Schiffn. and *Aneura dicrana* Steph. agree well with *R. elata* in above mentioned diagnostic characters.

4. *Riccardia graeffei* (Steph.) Hewson

Riccardia graeffei (Steph.) Hewson, Proc. Linn. Soc. N.S.W. 95: 118 (1970); *Aneura graeffei* Steph., Hedwigia 32: 21 (1893). Type: Fiji Levu, 1864, Graeffe 1629, ex hb. Jack (G-025999!-holotype, G-012209!-isotype).

Riccardia latifrondoides Schiffn. fo. *major* Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 168 (1898), synonymized by Furuki (1991). Type: Insula Singapore, in monte Bukit Timah,

Schiffner 160 (W!-lectotypus, G-12885! and PR!).
Riccardia flavescens Steph., Spec. Hepat. 6: 26 (1917),
 synonymized by Furuki (1991). Type: Singapore,
 March, 1917, Ridley 17 ex hb. Lillie (G!-holotype).
 For further synonyms see Furuki (1991).

Specimens examined. In monte Bukit Timah, prope fontem, regio calida, alt. 100-150 m alt., s. m, 6 Nov. 1893, Schiffner 132 (W) as *Riccardia singaporensis*; on rotten logs in valley in Bukit Timah Nature Reserve, A. Juslén 728; on stone in primary evergreen tropical forest, 16. 1998, coll. A. Juslén 739 (SINU); 130 m alt., on fallen logs in evergreen forest in Bukit Timah Nature Reserve, 7 Sept. 2005, B.C. Tan & T. Furuki 20367 (SINU, dupl. in CBM); Nees Soon fresh water swamp, on rotten logs in forest, 9 Nov. 1998, A. Juslén 569 (SINU); on clay on road side, 9 Nov. 1998, A. Juslén 506 (SINU); NUS Campus area, Kent Ridge Hall, Block B, on moist clay, 7 Nov. 1998, A. Juslén 526 (SINU). Pulau Ubin Island, on coconut in dense second growth evergreen tropical forest, 8 Nov. 1998, coll. A. Juslén 559 (SINU).

Description and illustration. Furuki (1991) studied this species taxonomically, and fully provided a description and illustrations, which agree well with the diagnostic characters of Singaporean plants.

Habitat. On wet rocks, fallen logs and soil at lowland.

Distribution. Widely distributed in tropical Asia, Australasia and the Pacific (Furuki 1991).

Remarks. This species is characterized by (1) yellowish green to green thalli when fresh, pale brown in herbarium, (2) wide unistratose alar portion (3-5 cells wide) of ultimate branches, (3) absence of gap between wing cells and epidermal cells of thallus in size, (4) botryoidal oil bodies numerous in all cells of thallus, and (5) heteroicous condition with male, female and paroicous branches.

Although Furuki (1991) listed G-012209 as the holotype for *Riccardia graeffei*, it may be the isotype. The holotype of this species may be G-025999, judging from its label on which the "original data" were shown.

5. *Riccardia latifronoides* Schiffn.

(Fig. 2)

Riccardia latifronoides Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 168 (1898). Type: Insula Singapore, in monte Bukit Timah, prope fontem. Regio calida, alt. 100-150 m, 6. Nov. 1893, Schiffner 159 (JE!-isotype).

Specimen examined. Only a type specimen is known.

Description. Thalli medium, whitish green in herbarium, smooth, truncate to dissected at apices, pinnately to bipinnately branched. Geotropic stolons rarely present. Main axis prostrate, to 1.5 cm long, to 1.0 mm wide; cross sections elliptical, 4-5 cells (150-200 µm) thick, obtuse to winged at margin. Ultimate branches prostrate to ascending, to 2.0 mm long, to 1.0 mm wide; cross sections linear, 4 cells (to 140 µm) thick, winged at margin (unistratose alar margin 2 cells wide). Epidermal cells of middle part of thallus polygonal, irregular in size, 75-100 × 40-75 µm, ca. 1/2 the inner cell in size, thick-walled. Marginal cells of ultimate branches, slightly tumid, nearly quadrate, 50 × 50 µm. Inner cells 150-200 × 100-120 µm, thick-walled. Oil bodies unknown. Mucilage hairs in 2 rows on ventral surface of thallus. Rhizoids scattered on ventral surface of prostrate thallus.

Dioicous. Male branches lateral on main axis or base of primary branches; lateral wing obliquely spreading, 1-2 cells high. Female branches lateral on main axis; paraphyses hair to scale like, 4-6 cells high. Calyptrae to 2.0 mm long, to 0.8 mm wide, covered with elongate unicellular papillae all over the surface. Gemmae and sporophytes unknown.

Habitat. Unknown.

Distribution. Endemic to Singapore.

Remarks. This species is characterized by (1) medium sized thalli, (2) large cells of thalli, (3) branches 4 celled-thick in cross section, (4) calyptrae covered with elongate uni-cellular papillae, and (5) dioicous condition. This species is easily distinguished from other species of the genus by the very large cells of thalli.

Schiffner (1898) described *Riccardia latifronoides* based on Schiffner 159. Only one specimen can be located in JE with hand-written label, and it may be one of duplicates of holotype. However, other type materials of this species may be located in the world and the specimen deposited in JE is treated as isotype here.

More material should be critically studied to circumscribe the species concept of this taxon, and to distinguish it from other species.

6. *Riccardia singaporensis* Schiffn.

(Fig. 3)

Riccardia singaporensis Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 174 (1898).

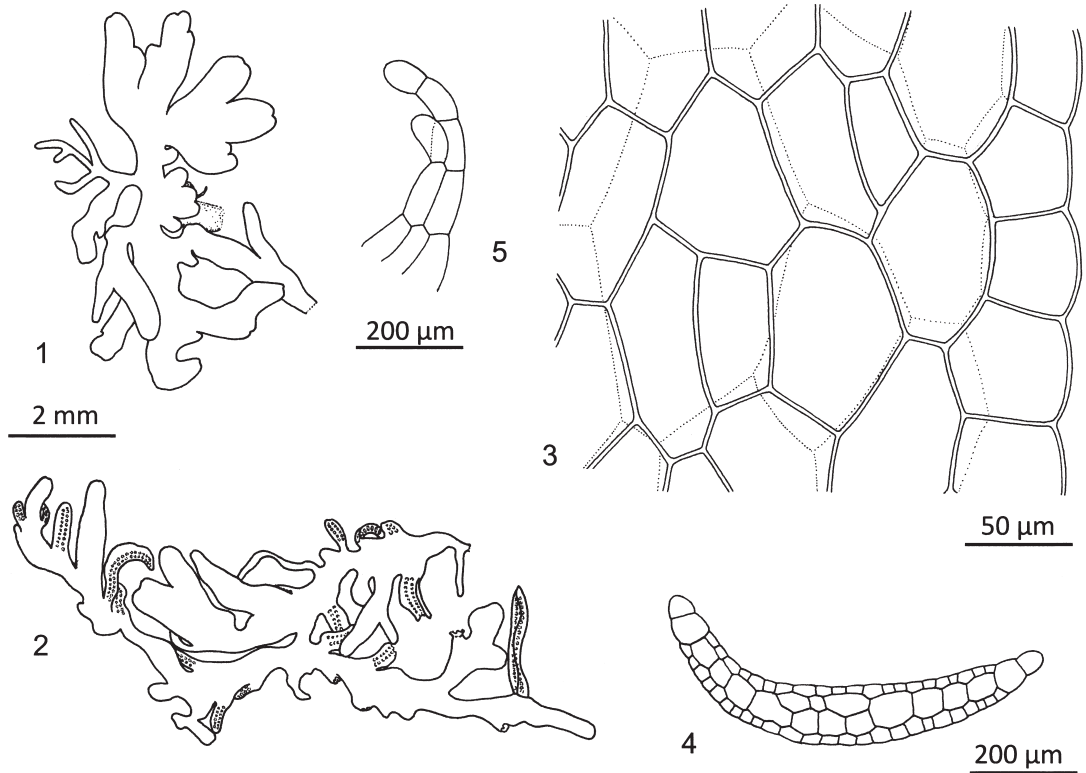


Fig. 2. *Riccardia latifrontoides* Schiffn. 1, male plant. 2, female plant with calyptrae. 3, marginal cells of ultimate branch. 4, cross section of ultimate branch. 5, paraphysis. All drawn from isotype (*Schiffner 159* in JE).

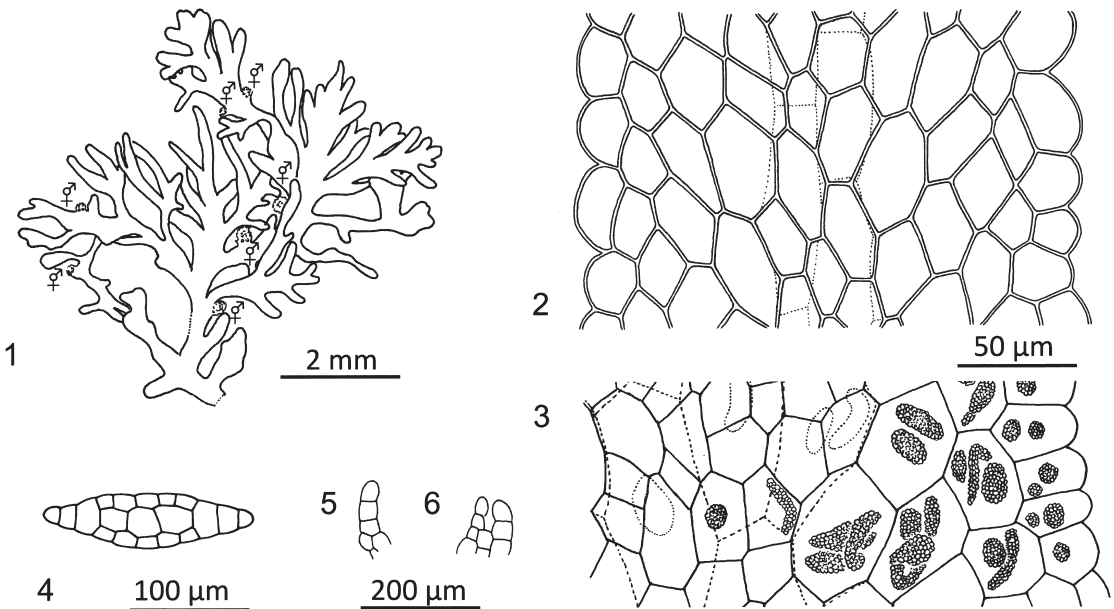


Fig. 3. *Riccardia singaporensis* Schiffn. 1, plant. 2, 3, marginal cells of ultimate branches; 3 with oil bodies when fresh. 4, cross section of primary branch. 5, 6, paraphyses. 1, 2 and 4–6 drawn from holotype (*Schiffner 132* in PR), 3 from *Tan & Furuki 21810* (SINU, dupl. in CBM).

Type: Insula Singapore, in monte Bukit Timah, prope fontem, regio calida, alt. 100–150 m alt., 6 Nov. 1893, Schiffner 132 (PR!-holotype, JE!-isotype).

Riccardia bliklika Hewson var. *bliklika*, Proc. Linn. Soc. N.S.W. 95: 83 (1970), *syn. nov.* Type: Australia, North Queensland, Vision Falls, Lake Eacham, Athereton Tableland, on weathering basalt in rainforest, 20 Aug. 1964, H. J. Hewson, H64.68.387 (NSW!-holotype).

Specimens examined. Bukit Timah Nature Reserve, 130 m alt., on wet rocks, 6 Sept. 2005, B. C. Tan & T. Furuki, 20368, 20370; *ibid*, 3 Mar. 2008, B. C. Tan & T. Furuki, 21810 (SINU, dupl. in CBM); Nees Soon fresh water swamp on clay on road side in forest, 9 Nov. 1998, A. Juslén 570 (SINU); MacRitchie Reservoir, 100 m alt., on soil in evergreen forest, 6 Sept. 2005, B. C. Tan & T. Furuki 20349 (SINU, dupl. in CBM)

Description. Thalli small, green to brownish green when fresh, brownish green in herbarium, smooth, truncate to dissected at apices, tripinnately branched. Geotropic stolons often present. Main axis prostrate, to 8.0 mm long, to 0.5 mm wide; cross sections elliptical, 4–5 cells thick, winged at margin. Ultimate branches prostrate to ascending, to 1.0 mm long, to 0.4 mm wide; cross sections linear, 3 cells thick, winged at margin (unistratose alar portion 4 cells wide). Epidermal cells of middle part of thallus polygonal, irregular in size, 35–50 × 10–25 µm, ca. 1/2 the inner cell in size, thin-walled. Inner cells 50–75 × 25–35 µm, thin-walled. Oil bodies pale brownish, composed of granules, globose to elliptical, 7.5–75.0 × 7.5–12.5 µm, with small, distinct granules, 1–4 in all wing and inner cells, rarely in epidermal cells of middle part of thallus. Mucilage hairs arranged in 2 rows on ventral surface of thallus. Gemmae rare. Rhizoids scattered on ventral surface of prostrate thallus.

Heteroicous with male and paroicous branches. Male branches rare, lateral on main axis or on base of primary branches, on branched, with 4–6 pairs of chambers; lateral wing obliquely spreading, 2–3 cells wide. Female branches not found. Paroicous branches common, lateral on main axis or on base of primary branches. Paraphyses hair to scale like, 3–5 cells high.

Calyptrae to 0.6 mm long, to 0.15 mm wide, covered with scattered enlarged cells. Capsule-valves 240–280 µm long, 60–80 µm wide; cells of outer layer thickened on adaxial radial and inner tangential walls, sometimes extending slightly to outer tangential walls; cells of inner layer thickened on slightly on adaxial

radial and inner tangential walls. Elaters 100–200 µm long, 6–10 µm thick. Spores 9–11 µm in diam.

Habitat. On wet rocks and fallen logs in forest or along stream.

Distribution. Singapore and Australia (North Queensland) (Schiffner, 1898; Hewson, 1970).

Remarks. This species is characterized by (1) green to brownish green thalli when fresh, (2) small thalli, (3) the wide uni-storatose alar portion (4–5 cells wide) of ultimate branches, (4) tumid marginal cells of thalli, (5) oil bodies 1–4 in all wing and inner cells of thalli and rarely in epidermal cells, and (6) monoicous condition.

Schiffner (1898) described *Riccardia singaporensis* as a new species based on his own collection with no. 132 made from Bukit Timah of Singapore. This specimen might have been distributed as an exsiccate to some herbaria, and we could locate three specimens in PR, JE and W. Furuki (1991) reduced this species to a synonym of *Riccardia graeffei* as pro parte, judging from his study of a specimen deposited in W. However, the label of this specimen was hand-written, and it may be not the original specimen, and the plants included in it differ somewhat from the duplicates deposited in PR and JE. *Riccardia singaporensis* often intermingles with *R. graeffei* on wet rocks and fallen logs along stream in the type locality in Singapore. The protologue of this species (Schiffner, 1898) was very brief and based on which alone *R. singaporensis* can not be distinguished from *R. graeffei*. Schiffner (1898) also distinguished *Riccardia platyclada* Schiffn., which is considered to be a synonym of *R. graeffei* (Furuki 1991), as a new species being distinct from *R. singaporensis*. This suggests that *R. singaporensis* was separated from *R. graeffei* by Schiffner (1898). The specimen deposited in PR is the only specimen with an original label and may be treated as holotype, while that in JE has a hand-written label.

In Malesia and adjacent regions *Riccardia singaporensis* seems to be rather common, and some species closely related to this species were described. Among them *Riccardia bliklika* Hewson var. *bliklika* described from Australia by Hewson (1970) is identical with this species in having the botryoidal oil bodies 1–4 in wing and inner cells of thallus, a wide unistratose alar portion of branches, and the monoicous plants. However, *R. bliklika* var. *porcina* Hewson described from New Guinea differs from this species by the very large cells of thallus and the dioicous plants. For other related species, such as *Riccardia multifidioides* Schiffn. described from Indonesia and R.

loriana (Steph.) H.A. Miller from New Guinea, the fresh materials should be studied to make clear the critical distinctions between these taxa.

7. *Riccardia tenuicostata* Schiffn.

Riccardia tenuicostata Schiffn., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 67: 166 (1898); *Aneura tenuicostata* (Schiffn.) Steph., Spec. Hepat. 1: 245 (1899), non *R. tenuicostata* Schiffn., Arch. Hydrobiol. Suppl. 21: 390 (1955). Type: Insula Singapore, in monte Bukit Timah, Schiffner 140-syntype (W! and JE!); ad truncos putridos in silva primaeva, Schiffner 142 (W!-lectotype, JE!), lectotype designated here.

Aneura exigua Steph., Spec. Hepat. 6: 25 (1917), *syn. nov.* Type: Seychelles, 1911, leg. Gardner, ex herb. K (G-17336!-holotype).

Aneura papulosa Steph., Spec. Hepat. 6: 37 (1917), non *A. papulosa* Steph., Hedwigia 32: 25 (1893), *syn. nov.* Type: Seychelles, 1911, leg. Gardner 35, ex herb. K (G-17337! -holotype).

For further synonyms see Furuki (1994).

Specimens examined. National University of Singapore Campus area, Kent Ridge Hall, Block B, on sand in tropical forest, 5 Nov. 1998, A. Juslén 491 (SINU); on concrete in tropical forest, 5 Nov. 1998, A. Juslén 498 (SINU); 100 m alt., on rocks, 6 Sept. 2005, B. C. Tan & T. Furuki 20361 (SINU, dupl. in CBM); Sime Road, on rotten stumps on brook side, 13 Nov. 1998, A. Juslén 669 (SINU); on decorticated logs in second growth evergreen tropical forest, full shade, 13 Nov. 1998, A. Juslén 676 (SINU); on fallen logs in dense forest, 13 Nov. 1998, A. Juslén 685 (SINU); Bukit Timah Nature Reserve, on rotten logs on brook side in primary evergreen tropical forest, 16 Nov. 1998, A. Juslén 732 (SINU); 130 m alt., on rotten logs in evergreen forest, 7 Sept. 2005, B. C. Tan & T. Furuki 20362 (SINU, dupl. in CBM); on soil in evergreen forest, 7 Sept. 2005, B. C. Tan & T. Furuki 20365 (SINU, dupl. in CBM). MacRitchie Reservoir, 100 m alt., on rotten logs in evergreen forest, 6 Sept. 2005, B. C. Tan & T. Furuki 20350, 20351, 20353 (SINU); on soil, 6 Sept. 2005, B. C. Tan & T. Furuki 20359 (SINU, dupl. in CBM).

Description and illustration. Schiffner (1898) described this species based on two syntypes collected in Singapore, and Furuki (1994) restudied them and fully provided a description and illustrations.

Habitat. Very common on fallen logs, soil and rocks.

Distribution. Singapore, Malaysia (Peninsular Malaya and Borneo), Indonesia (Sumatra), Papua New Guinea, Australia (North Queensland) and Seychelles (Furuki, 1994).

Remarks. By the marginal mucilage hairs, the small thalli and the dioicous plants, this species is very easy to recognize.

Aneura exigua Steph. and *Aneura papulosa* Steph., both described from Seychelles by Stephani (1917), are conspecific with *Riccardia tenuicostata* in having the small thalli, the mucilage hairs lateral on margin of thallus, and the dioicous plants.

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シンガポール産タイ類スジゴケ科の 分類学的研究

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シンガポール産のタイ類スジゴケ科については、Schiffner (1898)によって5新種が記載されて以来、分類学的研究が行われていなかった。今回、Schiffner (1898)が記載した新種のタイプ標本とシンガポール大学の標本庫に保管されていた標本を分類学的に再検討すると共に、タイプ産地で現地調査を行い、採集した標本を研究した。その結果、次ぎの2属7種を認めた：*Aneura blasioides* (Horik.) Furuki, *Riccardia crenulata* Schiffn., *R. elater* (Steph.) Schiffn., *R. graeffei* (Steph.) Hewson, *R. latifronoides* Schiffn., *R. singaporensis* Schiffn., *R. tenuicostata* Schiffn. この内、*Aneura blasioides* はシンガポール新産である。