

## Studies on the Bryophyte Flora of Vanuatu. 12. Hypnodendraceae and Hypopterygiaceae (Musci)<sup>1</sup>

**Masanobu Higuchi**

Department of Botany, National Museum of Nature and Science,  
4-1-1 Amakubo, Tsukuba, Ibaraki 305-0005, Japan  
E-mail: higuchi@kahaku.go.jp

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**Abstract** Four species in one genus of Hypnodendraceae and six species in three genera of Hypopterygiaceae are reported from Vanuatu based on collections made by Higuchi and Sugimura. A rare species, *Hypnodendron flagelliferum*, is reported from Espiritu Santo Island. The occurrences of *Cyathophorum spinosum* and *Lopidium struthiopteris* in Vanuatu are reconfirmed.

**Key words** : bryophytes, Hypnodendraceae, Hypopterygiaceae, mosses, Vanuatu.

This paper deals with the Hypnodendraceae and Hypopterygiaceae occurring in Vanuatu, based on the collections made by K. Sugimura in 1997 and 2000 and Higuchi in 1996 and 2001 (cf. Higuchi, 2002, 2005). The specimens examined are kept in the herbarium of the Department of Botany, National Museum of Nature and Science (TNS), and the duplicates in the herbarium of the Department of Forestry, Republic of Vanuatu (PVNH). The keys and previously published distribution data are mainly based on the taxonomic revision presented by Touw (1971) and Kruijer (2002).

### Hypnodendraceae

Higuchi (1996) listed seven species of *Hypnodendron* in Hypnodendraceae as occurring in Vanuatu. Species delimitation and name follow Touw (1971), although Bell *et al.* (2007) proposed a new classification of the family. By the examination of above collections, four species in the genus were recognized.

**1. *Hypnodendron dendroides*** (Brid.) Touw, Blumea 19: 320 (1971).

Specimens examined. Espiritu Santo Isl., 2nd Camp — Mt. Vutimena, 1300m, on tree-trunk at steep slope, Oct. 16, 1997 (Sugimura 1578, 1580); Mt. Tabwemasana, Base Camp — 1st Camp, 1000–1300m, on tree-trunk, Oct. 25, 2001 (Higuchi 39893). Anatom Isl., Anelghohat — Mt. Nidwon Nelcai, 120m, on rotten log, Nov. 6, 2001 (Higuchi 40176).

Distribution. Ceylon, Annam, Malesia, Solomon Islands, Vanuatu, Fiji and îl des Pins (?) (cf. Touw, 1971).

Notes. This is a very variable species, which is characterized by having entirely tomentose stipe. As pointed out by Touw (1971), this species is less common in Vanuatu and sporophytes are rare.

**2. *Hypnodendron flagelliferum*** Broth. & Watts, J. Roy. Soc. New South Wales 49: 156 (1915).

Specimens examined. Espiritu Santo Isl., Butmas, 580m, on prop root of *Pandanus* sp., Oct. 28, 2001 (Higuchi 39983, 39989).

Distribution. Vanuatu (Anatom Isl.) and Fiji (?) (cf. Touw, 1971). New to Espiritu Santo Island.

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Notes. On *Hypnodendron flagelliferum* only two specimens from Fiji and Anatom Island had been known except the syntypes (cf. Touw, 1971; Tixier, 1972). However, Touw (1971) stated that the occurrence of the species in Fiji seems rather unlikely. This rare and localized species is made immediately recognizable by its flagelliform branchlets. As compared with the figures of the species in Touw (1971), the plants from Espiritu Santo Island are a little smaller and have more thick flagelliform branchlets. Tixier (1972) reported the specimen (Schmid 181) of the species collected at 550–600 m from Anatom Island. In Espiritu Santo Island the specimens were collected at 580 m above sea level. *Hypnodendron flagelliferum* is growing at rather lower elevation as compared with other species in Vanuatu, although the data is insufficient.

**3. *Hypnodendron fusco-mucronatum*** (Müll. Hal.) A. Jaeger subsp. ***chalmersii*** (Mitt.) Touw, *Blumea* 19: 337 (1971).

Specimens examined. Espiritu Santo Isl., 2nd Camp — Mt. Vutimena, 870 m, on soil at steep slope, Oct. 18, 1997 (Sugimura 1651); Mt. Vutimele, 40 km north of Mt. Tabwemasana, 1100 m, on boulder at stream, Nov. 24, 1996 (Higuchi 32200, 32286), 1200 m (Higuchi 32164, 32169, 32177); Mt. Tabwemasana, Base Camp — 1st Camp, 1000–1300 m, on rotten log, Oct. 25, 2001 (Higuchi 39901), 1170 m, on boulder, Nov. 7, 1996 (Higuchi 31596).

Distribution. Ceram, New Guinea, Bismarck Archipelago, Solomon Islands and Vanuatu (cf. Touw, 1971).

Notes. The plants of this subspecies are usually taller and bear a larger number of sporophytes than those of subsp. *fusco-mucronatum* (Touw, 1971).

**4. *Hypnodendron vitiense*** Mitt. in Seem., *Fl. Vit.* 401 (1873).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele — Peavot, 800–1000 m, on root, Nov. 26, 1996 (Higuchi 32310); Mt. Vutimele, 40 km north of Mt. Tabwemasana, 1100 m, on root,

Nov. 25, 1996 (Higuchi 32269), on trunk of tree fern, Nov. 24 (Higuchi 32206), on rotten log, Nov. 22, 1996 (Higuchi 32075), 1200 m, on humus, Nov. 23, 1996 (Higuchi 32091), 1350 m, on humus, Oct. 23, 2001 (Higuchi 39790), 1400 m, on humus, Nov. 23, 1996 (Higuchi 32133); Mt. Tabwemasana, 1300 m, on soil, Nov. 7, 1996 (Higuchi 31602), 1400 m, on tree-trunk (Higuchi 31610), on rotten log (Higuchi 31625), on soil (Higuchi 31603, 31627), 1500 m, on humus (Higuchi 31728, 31729), Oct. 23, 2001 (Higuchi 39847). Anatom Isl., Anelghowhat — Mt. Ukapaerek, 650 m, on humus, Nov. 5, 2001 (Higuchi 40134).

Distribution. Japan (Ryukyu), Taiwan, Annam, Philippines, Borneo, Molucca, New Guinea, Bismarck Archipelago, Solomon Islands, Vanuatu, New Caledonia, Fiji, Samoa and N. Queensland (cf. Touw, 1971).

Notes. The subspecies *vitiense* occurs in Vanuatu, which is distinguished from subsp. *australe* by having germinate marginal teeth of branch leaves. This is the commonest in *Hypnodendron* species of Vanuatu, and it is growing on various substrates in moist forests.

### Hypopterygiaceae

Higuchi (1996) listed three species of *Hypopterygium* and a species of *Lopidium* in Hypopterygiaceae and two species of *Cyathophorella* in Daltoniaceae as occurring in Vanuatu. Kruijer (2002) revised the Hypopterygiaceae in the world, and included seven genera, *Canalohypopterygium*, *Catharomnion*, *Cyathophorum*, *Dendrocycathophorum*, *Dendrohypopterygium*, *Hypopterygium* and *Lopidium*, in the family. Species delimitation and name follow Kruijer (2002). By the examination of above collections, six species in three genera were recognized.

#### Key to the genera of Hypopterygiaceae in Vanuatu

1. Stems usually not branched . . . *Cyathophorum*
1. Stems branched . . . . . 2

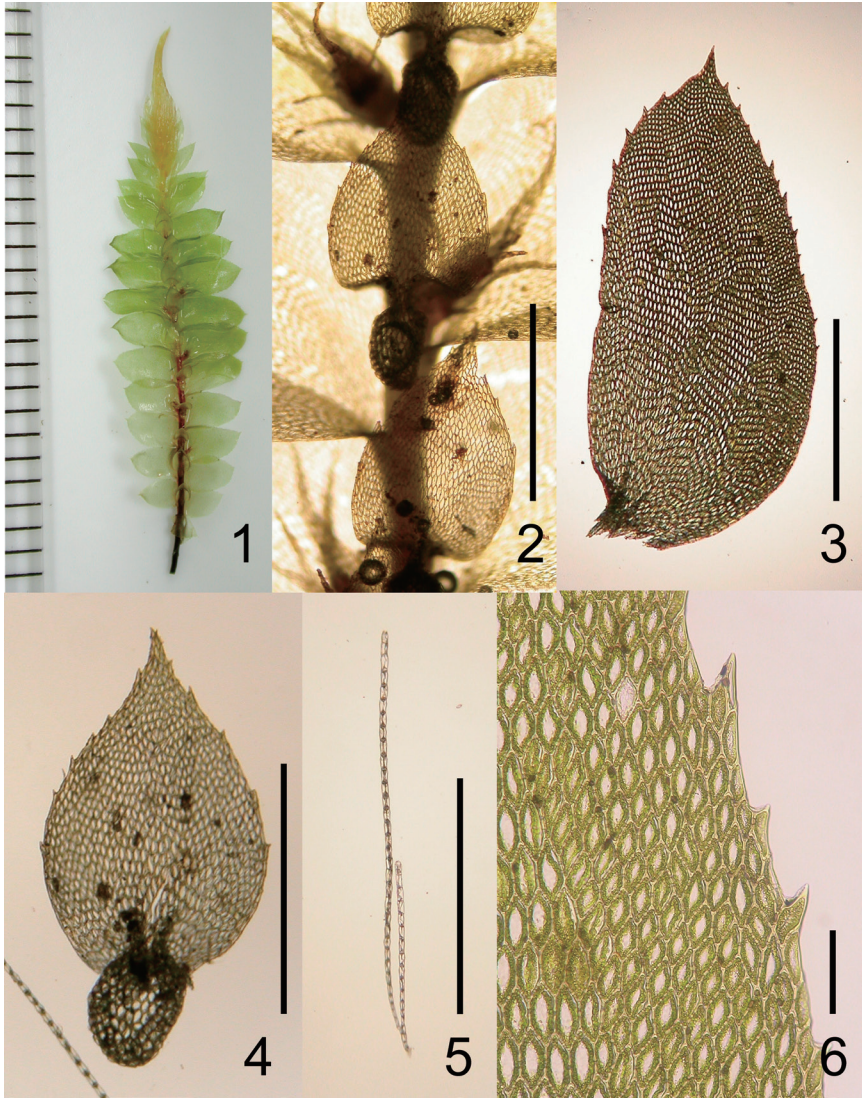


Fig. 1. *Cyathophorum tahitense*. 1. Plant. 2. A part of plant. 3. Leaf. 4. Amphigastrium having sac-like structure, named as “pouch,” at the base. 5. Gemma. 6. Median marginal cells of leaf. Scales for 1–5 in 1 mm, for 6 in 0.1 mm. (All from Higuchi 40111)

- 2. Costa of lateral leaves percurrent; median laminal cells thick-walled, especially in cell corners ..... *Lopidium*
- 2. Costa of lateral leaves ending below the apex; median laminal cells thin-walled. .... *Hypopterygium*

**5. *Cyathophorum tahitense*** Besch., Ann. Sci. Nat. Bot. 7: 20 (1859).

Specimens examined. Anatom Isl., Anelghow-

hat — Mt. Ukapaerek, 550 m, on tree-trunk, Nov. 5, 2001 (Higuchi 40111), 600 m (Higuchi 40115, 40122).

Distribution. Vanuatu, Fiji, Samoa and Society Islands (cf. Kruijer, 2002).

Notes. This species is characterized by having sac-like structure, named as “pouch,” at the base of the amphigastria (Fig. 1). Brotherus and Watts (1915) recorded this species from Anatom Island, and Tixier (1974) also reported it from Espiritu



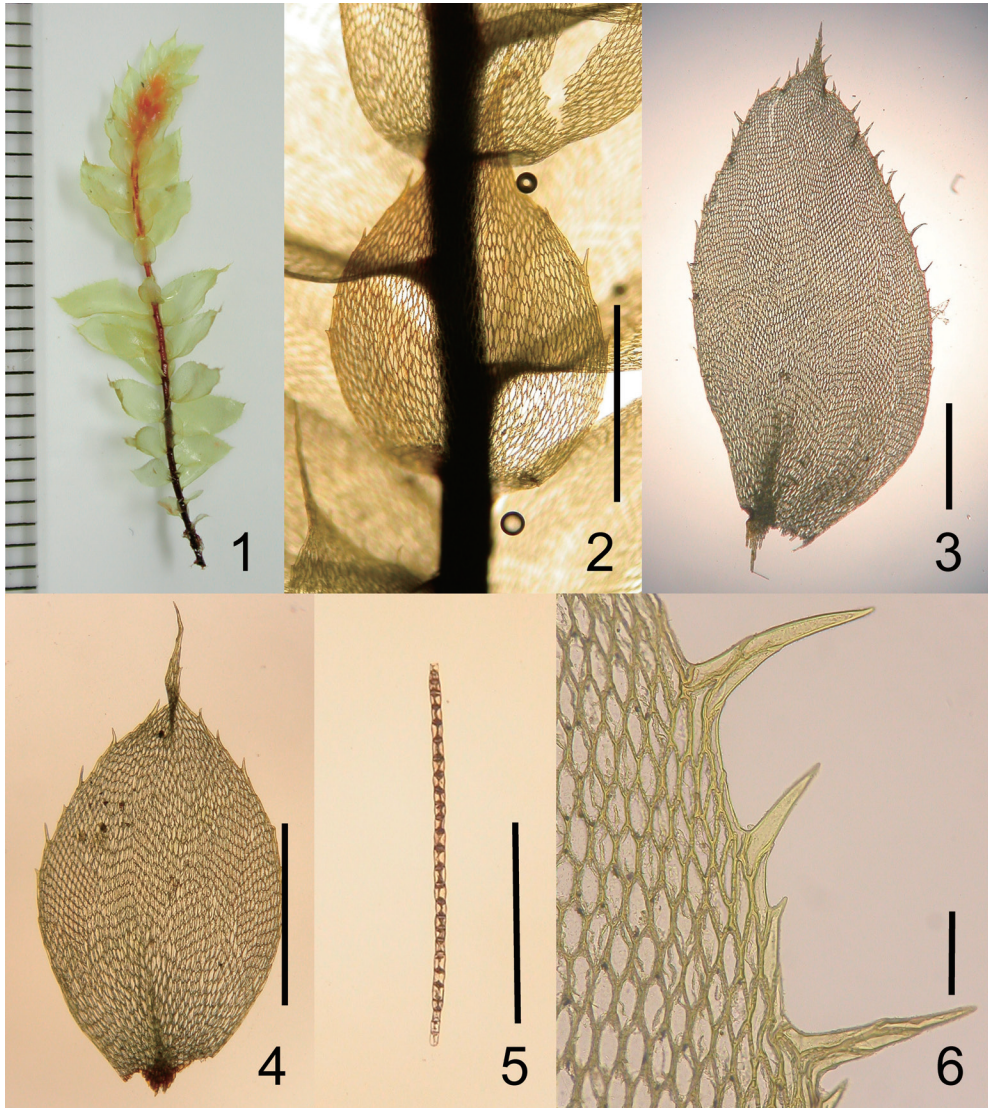


Fig. 2. *Cyathophorum spinosum*. 1. Plant. 2. A part of plant. 3. Leaf. 4. Amphigastrium. 5. Gemma. 6. Median marginal cells of leaf. Scales for 1–4 in 1 mm, for 5 in 0.5 mm and for 6 in 0.1 mm. (All from Higuchi 39970)

Santo Island. Sporophytes of this species are unknown. The plants collected this time were also sterile. The numerous filamentous gemmae are probably effective in the propagation (Fig. 1).

**6. *Cyathophorum spinosum* (Müll.Hal.) H.Akiyama, Acta Phytotax. Geobot. 43: 114 (1992).**

Specimen examined. Espiritu Santo Isl., Butmas, 580m, on tree-trunk, Oct. 28, 2001 (Higuchi 39970).

Distribution. Philippines, Malaysia, Indonesia, Papua New Guinea, Solomon Islands (cf. Kruijer, 2002). The occurrence of this species in Vanuatu is reconfirmed.

Notes. This species is distinguished from *C. tahitense* by the absence of “pouch” at the base of the amphigastria (Fig. 2). *Cyathophorum spinosum* also has more dentate margins of lateral leaves. Brotherus & Watts (1915) recorded this species from Espiritu Santo Island. Kruijer



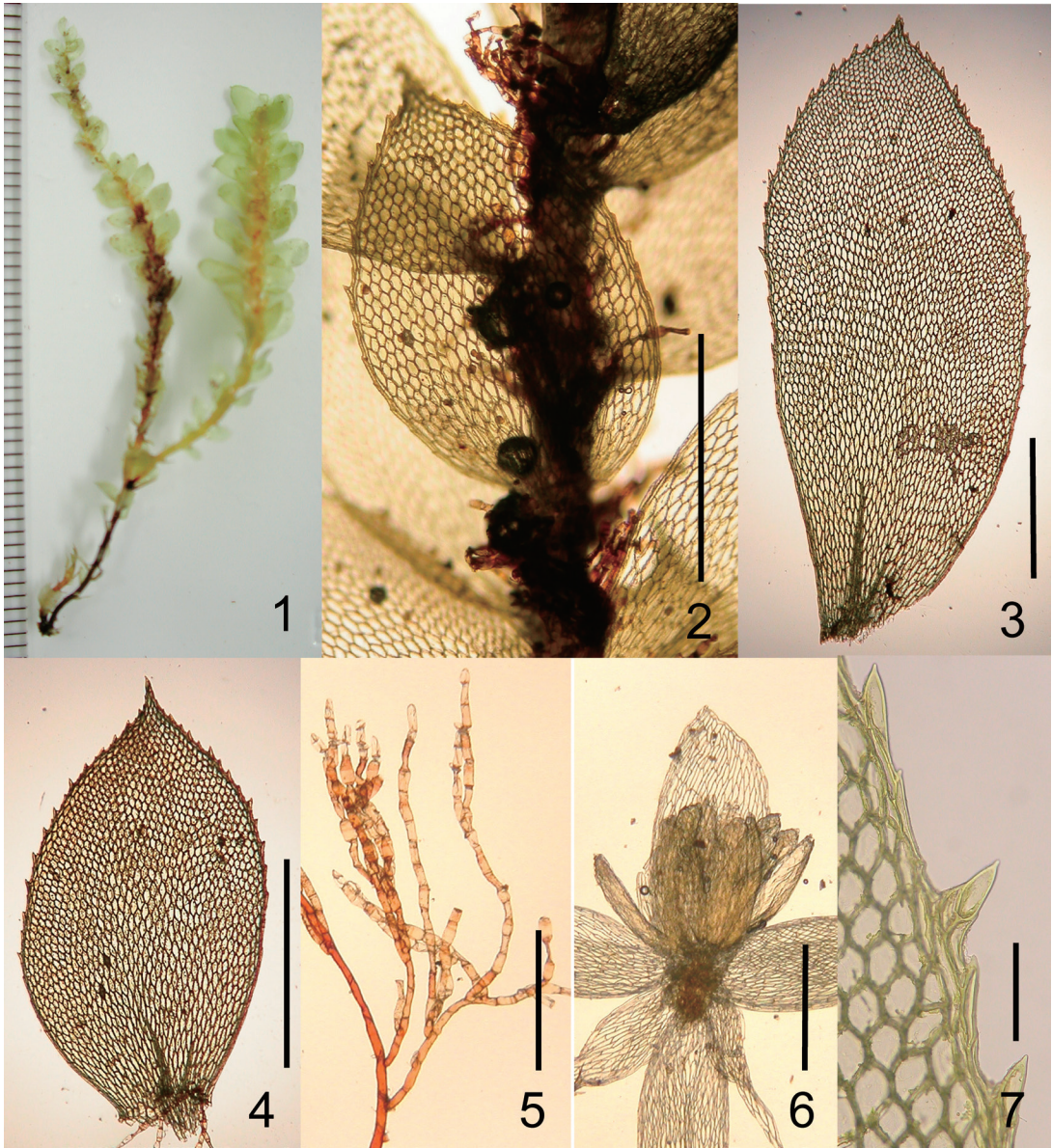


Fig. 3. *Cyathophorum* sp. 1. Plant. 2. A part of plant. 3. Leaf. 4. Amphigastrium. 5. Gemmae. 6. Perigonium. 7. Median marginal laminal cells of leaf. Scales for 1–4 in 1 mm, for 5 & 6 in 0.5 and for 7 in 0.1 mm. (All from Higuchi 32213)

(2002), however, have stated that this species probably does not occur in Vanuatu because of the absence of authentic specimens.

#### 7. *Cyathophorum* sp.

Specimens examined. Esprititu Sant Isl., 2nd Camp — Mt. Vutimena, 870 m, on rock-cliff,

Oct. 18, 1997 (Sugimura 1654, 1659), 1240 m, on humus, Oct. 16, 1997 (Sugimura 1543) ; Mt. Vutimele (40 km north of Mt. Tabwemasana), 1100 m, on soil, Nov. 22, 1996 (Higuchi 32068), Nov. 24, 1996 (Higuchi 32213), 1200 m, on rock-cliff, Nov. 23, 1996 (Higuchi 32160).

Notes. The plants of above specimens cited

have in common serrate leaf margins, brown coloured and branched gemmae and wavy leaves when dry, and they lack perigonal paraphyses (Fig. 3). It is hardly likely to be included in the variation of *Cyathophorum spinosum*. This species occurs on rock-cliff or soil at higher elevation as compared with other species of the genus which usually grows on tree-trunk.

**8. *Lopidium struthiopteris* (Brid.) M.Fleisch., Musci Buitenzorg 3: 1073 (1908).**

Specimens examined. Espiritu Santo Isl., Mt. Tabwemasana, 1000m, on basal part of tree-trunk, Nov. 8, 1996 (Higuchi 31765), Nov. 9, 1996 (Higuchi 31895), Base Camp, 1050m, on tree-trunk, Oct. 22, 2001 (Higuchi 39711), near Nokovula, 1100m, Oct. 31, 2000 (Sugimura 3501); 1st Camp — 2nd Camp, along Pialapa River, 520m, Oct. 19, 1997 (Sugimura 1679). Anatom Isl., Anelghowhat — Mt. Ukapaerek, 600m, Nov. 5, 2001 (Higuchi 40128).

Distribution. São Tomé e Príncipe, Congo, Tanzania, Malawi, Zimbabwe, South Africa, Comoros, Madagascar, Mascarenes, India, Sri Lanka, China, Taiwan, Japan, Thailand, Laos, Vietnam, Philippines, Malaysia, Indonesia, Papua New Guinea, Bismarck Archipelago, Australia, Solomon Islands, Vanuatu, New Caledonia, Fiji, Samoa and Society Islands (cf. Brothrus and Watts, 1915; Kruijer, 2002).

Notes. This species is characterized by having crisped leaves when dry, laminal cells with thick-walled and gemmae. Brothrus and Watts (1915) recorded this species from Anatom Island as *Hypopterygium javanicum* (Hampe) A.Jaeger. The occurrence of *Lopidium struthiopteris* in Vanuatu is reconfirmed, and this species is new to Espiritu Santo Island.

**9. *Hypopterygium tamarisci* (Sw.) Brid. ex Müll.Hal., Syn. Musc. Frond. 2: 8 (1850).**

Specimens examined. Espiritu Santo Isl., between Matantas and Butmas, 30m, on rock, Nov. 7, 2000 (Sugimura 3625); Butmas, 560m, on rock, Oct. 23, 1997 (Sugimura 1731), 580m, on tree-trunk, Oct. 28, 2001 (Higuchi 39971), on

root (Higuchi 39980, 39987); Rotal, Santo Forest Research Station, 140m, Oct. 30, 2001 (Higuchi 40032); 1st Camp — 2nd Camp, along Pialapa River, 500m, on rotten log, Oct. 19, 1997 (Sugimura 1669); 2nd Camp — Mt. Vutimena, 710m, on tree-trunk, Oct. 19, 1997 (Sugimura 1520); Peavot — Mt. Vutimele, 600m, on basal part of tree-trunk, Nov. 21, 1996 (Higuchi 31975), 650m (Higuchi 31986), 750m, on soil (Higuchi 31992); Mt. Vutimele, 1100m, on root, Nov. 25, 1996 (Higuchi 32259); Mt. Tabwemasana, 780m, on root, Nov. 5, 1996 (Higuchi 31491), 1000m, on basal part of tree-trunk, Nov. 6, 1996 (Higuchi 31528), on tree-trunk, Nov. 8, 1996 (Higuchi 31764), Nov. 9, 1996 (Higuchi 31879), on boulder (Higuchi 31897), 1050m, on tree-trunk, Oct. 22, 2001 (Higuchi 39706), near Nokovula, 1100m, on tree-trunk, Oct. 31, 2000 (Sugimura 3499), 1140m, on tree-trunk, Nov. 2, 2000 (Sugimura 3582), 1700m, on soil, Nov. 7, 1996 (Higuchi 31686). Anatom Isl., Anelghowhat — Mt. Nidwon Nelcai, 120m, on boulder, Nov. 6, 2001 (Higuchi 40174); Anelghowhat — Mt. Ukapaerek, 170m, on boulder, Nov. 5, 2001 (Higuchi 40070), 550m (Higuchi 40112).

Distribution. Tropical and subtropical Africa, Asia and America (cf. Kruijer, 2002).

Notes. According to the taxonomic treatment by Kruijer (2002), this is a wide-spread and very variable species, including several regional variants. The plant in Vanuatu is considered to be "Oceanian variant 2" showing dendroid forms with closely set branches, etc.

**10. *Hypopterygium vriesei* Bosch & Sande Lac., Bryol. Jav. 2: 11 (1861).**

Specimens examined. Espiritu Santo Isl., Rotal, Santo Forest Research Station, 140m, on tree-trunk, Oct. 30, 2001 (Higuchi 40025, 40028); 1st Camp — 2nd Camp, along Pialapa River, 510m, on tree-trunk, Oct. 19, 1997 (Sugimura 1681); Butmas, 520m, on tree-trunk, Oct. 24, 2000 (Sugimura 3449, 3450), 580m, on root, Oct. 28, 2001 (Higuchi 39987).

Distribution. India, Thailand, Vietnam, Philippines, Malaysia, Indonesia, Papua New Guinea,

Bismarck Archipelago, Vanuatu, Fiji and New Caledonia (cf. Kruijer, 2002).

Notes. This species is distinguished from *H. tamarisci* by having pinnate to flabellate branching, stems and branches with crowded clusters of gemmae in leaf axils and serrate-dentate leaf margins.

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