

## Studies on the bryophyte flora of Vanuatu. 8. Field studies in 2000 and 2001 and Haplomitriaceae and Treubiaceae (Hepaticae)

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**Abstract** The second Botanical expedition of 2000 and 2001 to Vanuatu arranged by the Botanical Garden, National Science Museum, Tokyo was outlined with special reference to the collections of bryophytes. Two hepatic families, Haplomitriaceae and Treubiaceae, are newly recorded from Vanuatu based on the collections made in 1996, 1997 and 2001. Ecological and taxonomic notes and figures of *Haplomitrium blumii* and *Treubia insignis* are presented.

**Key words:** Haplomitriaceae, Treubiaceae, liverworts, *Haplomitrium blumii*, *Treubia insignis*, Vanuatu.

In 2000 and 2001 the Botanical Garden, National Science Museum, Tokyo organized the second botanical expedition for studying the montane flora of Vanuatu in collaboration with the Environment Unit and the Department of Forestry of Vanuatu (cf. Iwashina *et al.* 2002). In October–November 2000 Mr. K. Sugimura collected bryophyte specimens as a member of the expedition, and Higuchi did in October–November 2001.

### Study area in 2000 and 2001

Sugimura visited the islands of Espiritu Santo and Efate, and Higuchi stayed the islands of Tanna and Anatom Islands in addition to Espiritu Santo and Efate Islands. Collecting sites are shown in Fig. 1, and locations are described below. Those of Espiritu Santo and Efate Islands were listed in Higuchi (2002).

#### Tanna

1. Lenakel (19°31'S, 169°16'E)
2. Loanialu (19°29'S, 169°20'E)

#### Anatom

1. Mt. Ukapaerek (20°10'S, 169°47'E)
2. Mt. Nidwon Nelcau (20°12'S, 169°49'E)
3. Anelghowhat (20°13'S, 169°46')

This paper deals with taxa of the families Haplomitriaceae and Treubiaceae occurring in Vanuatu, based on the collections made by Higuchi in 1996 and 2001 and by Mr. K. Sugimura in 1997 (cf. Higuchi 2002).

The following descriptions are based on the plants from Vanuatu.

### Haplomitriaceae

*Haplomitrium blumii* (Nees) R.M.Schust., J. Hattori Bot. Lab., 26: 225 (1963).

Plants large, bright-green. Leafy shoots to 7 cm long, arising from the lower part of older leafy shoots, growing upward after development, erect or suberect, usually unbranched, anisophyllous, naked at the basal part. Rhizomes pale-green to whitish, arising from the prostrate part of leafy stems, leafless. Leaves in three rows, variable in size, erect-spreading in suberect leafy shoots, sometimes wide-spreading nearly at 90° in erect shoots, longer than broad, 3–4-stratose in a small but distinct median-basal part: lower leaves much smaller than upper ones. Lateral leaves usually succubously inserted, transversely inserted only in suberect shoots, elliptic to lingu-

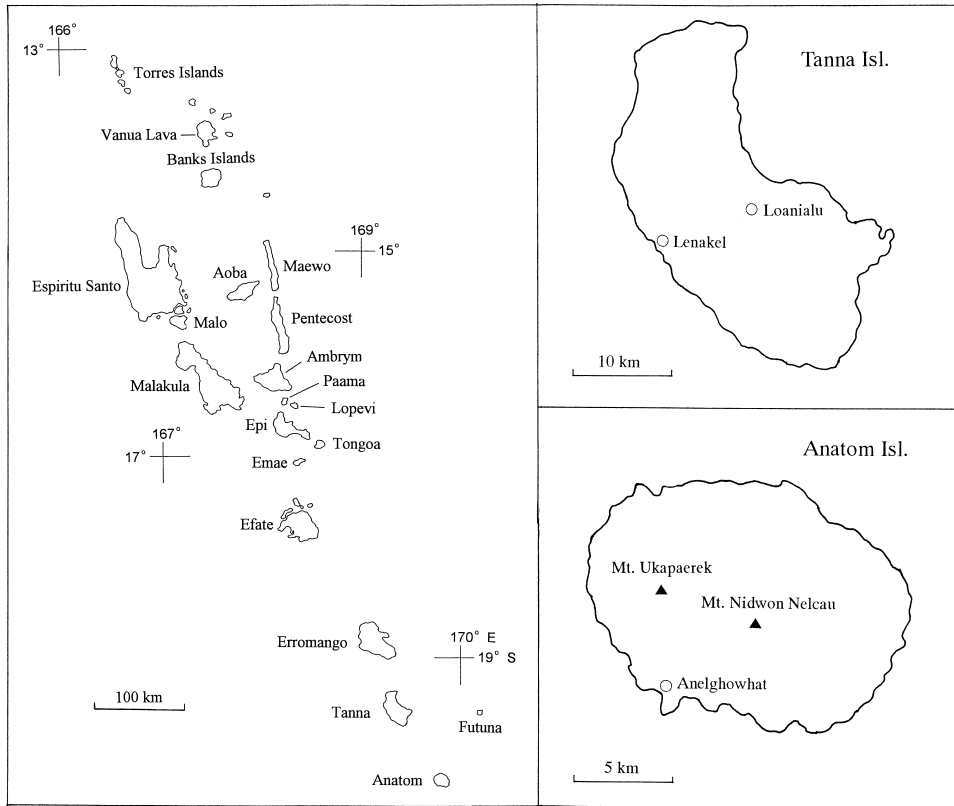


Fig. 1. Outline map of Vanuatu. Collecting sites in Tanna and Anatom Isls. in 2001.

late, broadly rounded at the apex, often narrowed at the base,  $3.6\text{--}4.4 \times 2.4\text{--}2.6$  mm at the middle part of the leafy shoot; margins entire; marginal cells not differentiated from median cells. Dorsal leaves usually much smaller than lateral ones, transversely inserted, lingulate,  $2.0\text{--}3.4 \times 0.9\text{--}1.6$  mm at the middle part of the leafy shoot.

Dioecious. Antheridia clavate with long stalk, numerous, at shoot apex, in flat, dilated terminal disc; perigonial bracts ovate with more acute apex but almost similar to lateral leaves, wide-spreading nearly at  $90^\circ$  at maturity; slime papillae interspersed with antheridia, usually mounted on a stalk of 1 cell, the slime cell clavate to lump-shape. Archegonia numerous, with number and position similar to antheridia, in flat, dilated terminal disc; perichaetial bracts similar to lateral leaves but with obtuse lateral angulations, wide-spreading nearly at  $90^\circ$  at maturity; accessory bracts (bractlets) often present, much

smaller than bracts, lingulate with irregular shaped apex; slime papillae interspersed with antheridia, usually mounted on a stalk of 1 cell, the slime cell clavate to lump-shape. Calyptra long-tubular, smooth. Sporophyte not seen.

Specimens examined. Espiritu Santo Isl., Mt. Vutimele (40 km north of Mt. Tabwemasana), 1100 m alt., on soil, Nov. 22, 1996 (*Higuchi 32078*), on rock-cliff (*Higuchi 32083e*), on rotten log, Nov. 24, 1996 (*Higuchi 32202*), on boulder (*Higuchi 32233*), on decaying stump, Nov. 25, 1996 (*Higuchi 32278*), 1200 m alt., on rock-cliff, Nov. 23, 1996 (*Higuchi 32196*); 2nd Camp — Mt. Vutimena (30 km north of Mt. Tabwemasana), 850 m alt., on soil, Oct. 18, 1997 (*Sugimura 1633*).

Distribution. India, southern China, Malaysia (Malaya Peninsula), Sumatra, Java, Philippines (Luzon, Mindanao) and New Guinea (cf. Bartholomew-Began 1991). New to Vanuatu.

**Ecology.** This species grows on shaded rock-cliff (2 specimens), boulder (1), decaying stump (1), rotten log (1) and soil (1) at 850–1200 m in humid montane forests.

By the examination of above collections, *Haplomitrium blumii* (Nees) R.M.Schust. was recognized. The genus and the family are new to the flora of Vanuatu. This species is characterized by its larger size (Fig. 2: A, B, Fig. 3: A) and basally polystratose leaves (Fig. 2: G).

The genus *Haplomitrium* is rather widespread in distribution, but most of the species are very rare, restricted in range. According to Bartholomew-Began (1991), the genus consists of seven species, a highly plastic, plesiomorphic taxon, probably of Gondwanian origin. It is notable that the genus occurs in the islands of Vanuatu which were newly formed by volcanic activities.

There were observed two types of male plants with male inflorescences (=androecia). The first type has longer, suberect leafy shoots with succubously inserted lateral leaves (Fig. 2: A), and the second one has shorter, erect leafy shoots with transversely inserted lateral leaves (Fig. 2: B). There is no difference of the number and position of antheridia between them.

Bartholomew-Began (1991) referred Andean *Haplomitrium andinum* to the synonymy of *H. blumii*. I cannot mention the relationship of both species here, because I do not have chance to examine any material of the former species.

### Treubiaceae

*Treubia insignis* K.I.Goebel, Ann. Jard. Bot. Buitenzorg, 9: 1 (1890).

Plants large, thick-green, flat, prostrate, sometimes branched by lateral-intercalary branches; branches arising from the side of the axis beneath the posterior part of leaves, to 10 cm long, 2 cm wide. Axis ca. 25 cell rows high with a central strand and cortical layers of small cells, slightly concave or flat dorsally, convex ventrally, bearing rhizoids in a ventral rhizoid-bearing furrow. Leaves slightly imbricate, broadly lingulate, en-

tire, 6–9 mm long, 5–7 mm wide; unistratose margin ca. 18 cells wide. Dorsal scales transversely inserted, suberect or erect-spreading, broadly semicircular, 1.5–2.0 mm long, 2–3 mm wide. Dorsal scales near the axis apex with long, obliquely decurrent wing on the axis. Cells of axis, leaves and dorsal scales sometimes contain a single large oil-body. Gemmae in axils of dorsal scales and decurrent wing when present, 3–5-celled, short-stalked.

Dioecious. Archegonia in axils of dorsal scales, mixed with slime papillae, sticky when young. Scale-like appendages in axils of dorsal scales rather far from the axis apex. Antheridia and sporophytes not seen.

Specimen examined. Espiritu Santo Isl., Mt. Tabwemasana, 1400 m alt., on rotten log, Oct. 23, 2001 (*Higuchi 39874*).

Distribution. Sumatra, Java, Philippines (Luzon) and Papua New Guinea (cf. Schuster 1969). New to Vanuatu.

**Ecology.** This species grows on rotten log at 1400 m in humid montane forest.

The family Treubiaceae has never been reported from Vanuatu. *Treubia insignis* was found at Mt. Tabwemasana in Espiritu Santo Isl., which is a new record for the flora of Vanuatu. *Treubia* species may generally be recognized in the field by its unique shiny thick-green colour of plants. This species is characterized by its oil-cells similar to other leaf cells in size (Fig. 4: C), dorsal scales remote, inserted on a nearly transverse line and gemmae of 3–5-celled (Fig. 4: F).

There is no protective structure for the sex organs in all species of *Treubia*. In Vanuatu plants scale-like appendages were observed in axils of dorsal scales rather far from the axis apex (Fig. 4: H), where archegonia were not seen. Archegonia were probably unfertilized, shrivelled and disappeared (cf. Goebel 1930, Fig. 713: 13). The shoot-calyptra with scale-like appendages (protuberances) is known in some species of *Treubia* and *Apotreubia* (cf. Higuchi 1998). The scale-like appendages found on Vanuatu plants may possibly be homologous with those of shoot-calyptra.

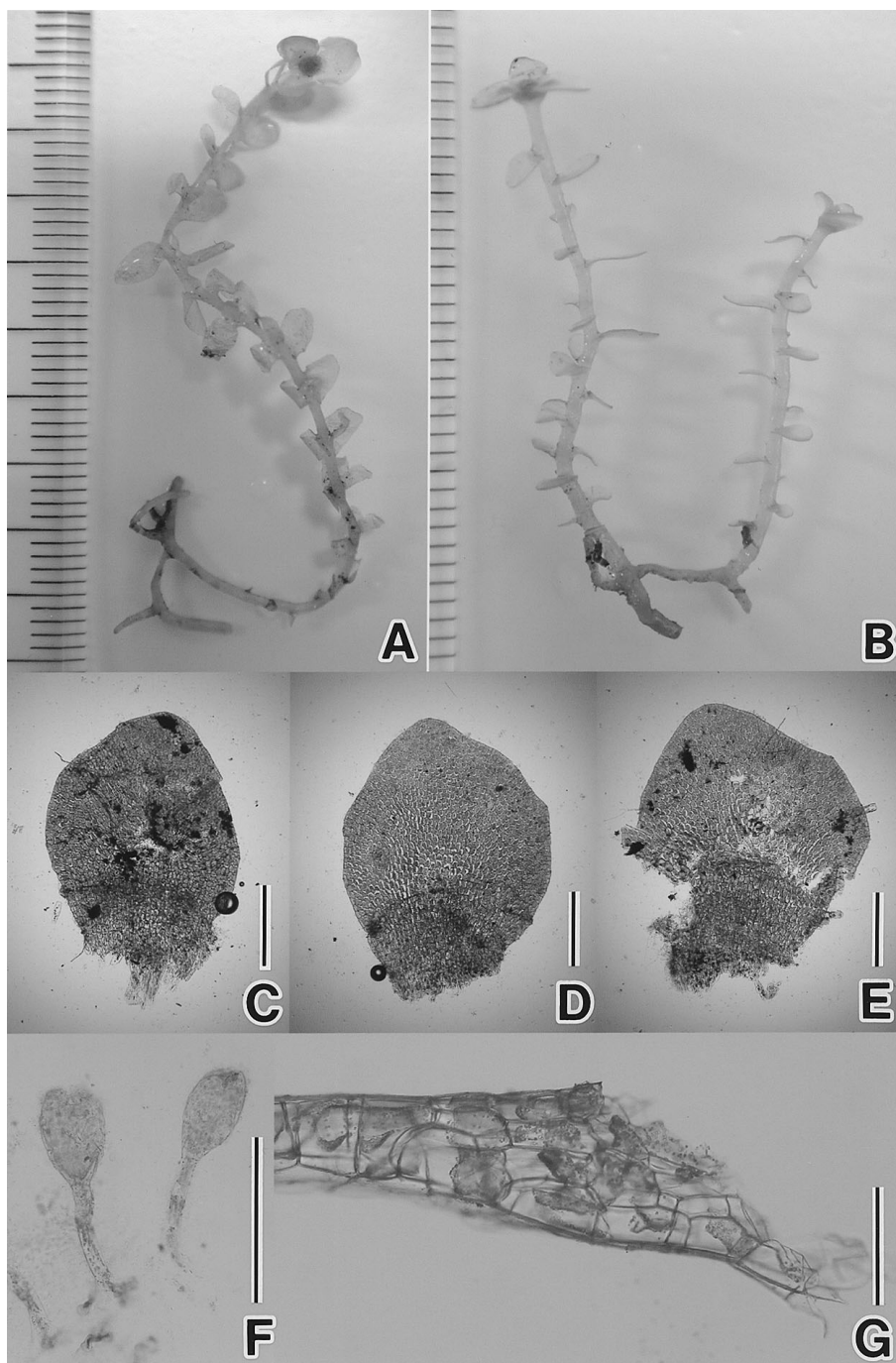


Fig. 2. Male plants of *Haplomitrium blumii*. A, B. Plants with male inflorescence. Scales=1 mm. C-E. Perigynial bracts. Scales=1 mm. F. Antheridia. Scale=0.5 mm. G. A part of cross-section of basal part of leaf. Scale=0.2 mm. All taken from Higuchi 32202.

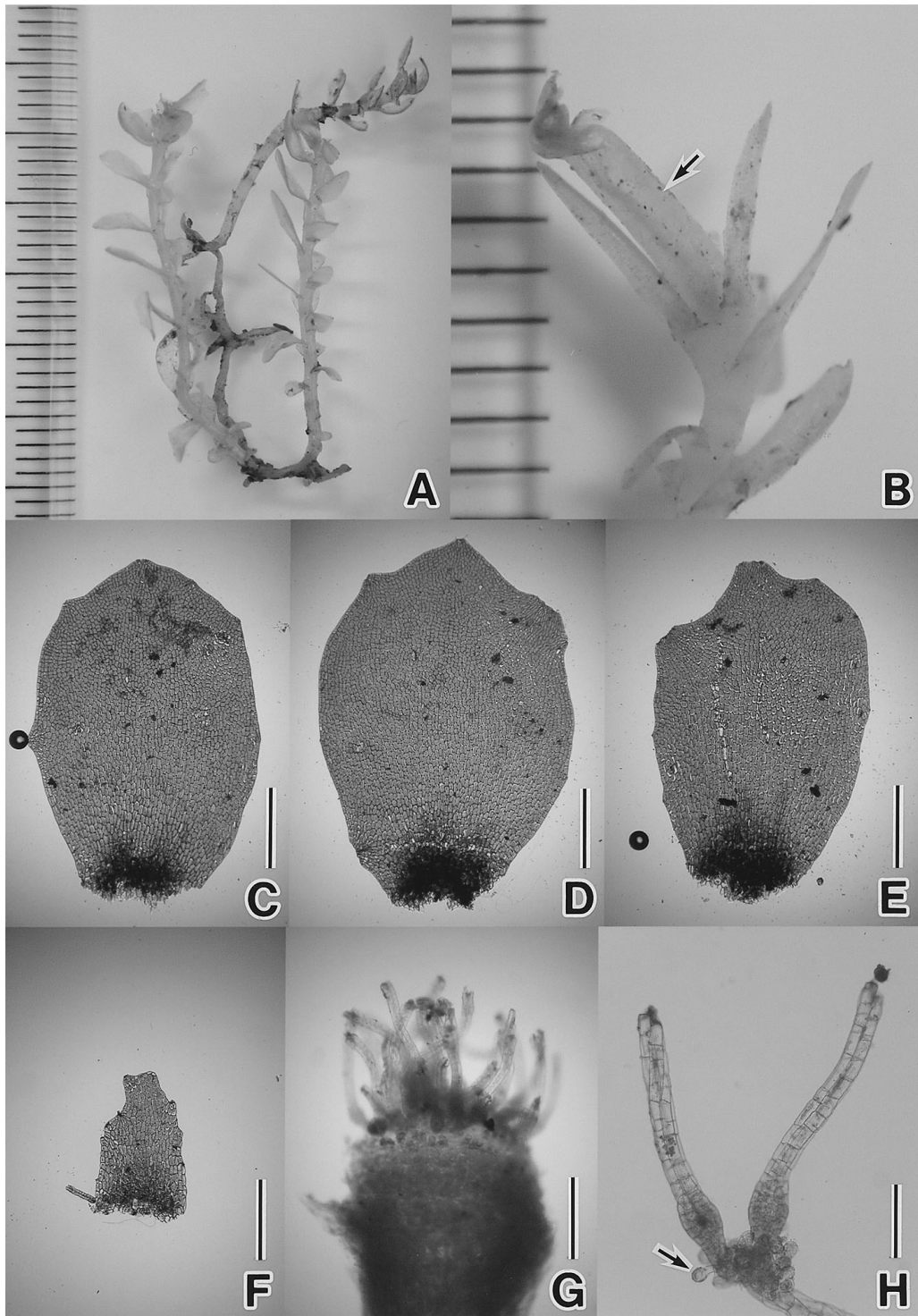


Fig. 3. Female plants of *Haplomitrium blumii*. A. Plants with female inflorescence. Scale=1 mm. B. Leafy shoot apex with calyptra. Arrow shows calyptra. Scale=1 mm. C–E. Perichaetial bracts. Scale=1 mm. F. Bractlet. Scale=1 mm. G. Female inflorescence without bracts. Scale=0.5 mm. H. Archegonia. Arrow shows slime papilla. Scale=0.2 mm. All taken from *Higuchi 32202*.

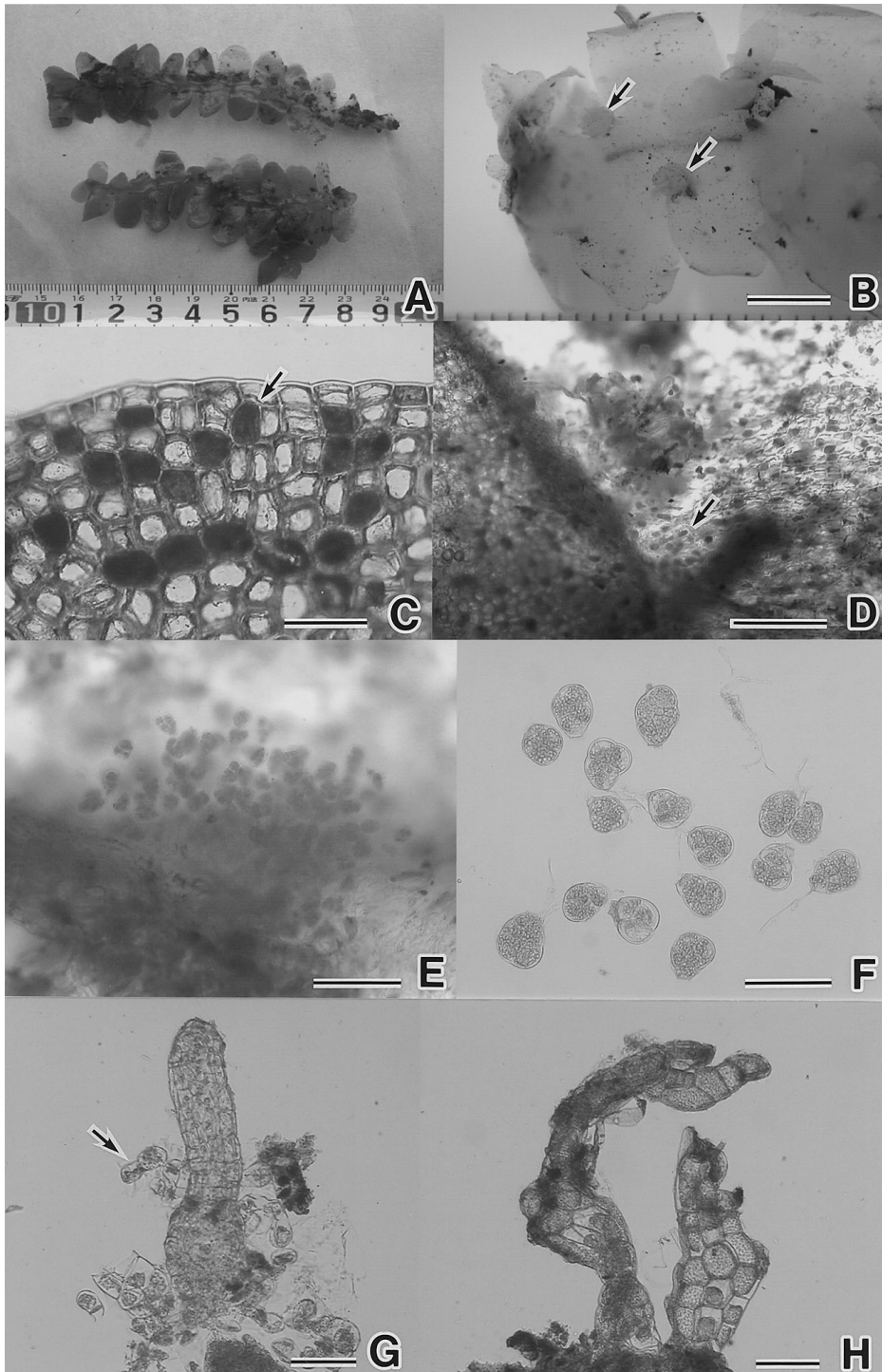


Fig. 4. *Treubia insignis*. A. Plants. Scale=1 mm. B. Ventral view of tip of plant. Arrows show young branches. Scale=5 mm. C. Apical margin of leaf. Arrow shows oil-cell. Scale=0.1 mm. D. Axil of dorsal scale with archegonia and gemmae. Arrow shows gemmae. Scale=0.5 mm. E. Gemmae in axil of dorsal scale. Scale=0.2 mm. F. Gemmae. Scale=0.1 mm. G. Archegonium. Arrow shows slime papilla. Scale=0.1 mm. H. Scale-like appendages in axil of dorsal scale. Scale=0.1 mm. All taken from Higuchi 39874.

The genus *Treubia* is also rather widespread in distribution, but the species are very rare, restricted in range. Schuster and Scott (1969) considered that *T. insignis* is a widespread tropical-oceanic taxon, which has differentiated into geographical populations that are distinguishable by minor characters. These geographical populations were treated as four subspecies: subsp. *insignis* (Sumatra, Java, Philippines (Luzon) and Papua New Guinea), subsp. *bracteata* (Samoa), subsp. *vitiensis* (Fiji) and subsp. *caledonica* (New Caledonia). I have collected plants of *Treubia* in Fiji and New Caledonia. I will discuss the taxonomic relationship of *T. insignis* in a separate paper.

#### Acknowledgements

I thank Mr. E. Bani, Head of Environment Unit, and staffs of Department of Forestry, Republic of Vanuatu, for their kind help of the filed researches. The material was collected with aid

of a Grant-in-Aid for Scientific Research Program (no. 08041165 to Dr. T. Iwashina) of the Ministry of Education, Culture, Sports, Science and Technology in Japan.

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