

Studies on the Bryophyte Flora of Vanuatu. 5. Metzgeriales and Marchantiales (Hepaticae)

Tatsuwo FURUKI*

The liverworts of Vanuatu, formerly the New Hebrides Islands, have been reported by many authors (Mitten 1871, Stephani and Watts 1914, Jovet-Ast 1951, Tixier 1972, 1973, 1974 and so on), and about 140 species were recognized. However, it seems that they are not so complete, especially for the species of the orders Metzgeriales and Marchantiales. Only ten species were reported for these orders. This paper deals with these orders of Hepaticae in Vanuatu based on the collections of Dr. M. Higuchi in 1996 and Mr. K. Sugimura in 1997. The detailed data of the collection are listed in the first part of this series (Higuchi 2002).

METZGERIALES

PALLAVICINIACEAE

Key to the genera of Pallaviciniaceae in Vanuatu

1. Pseudoperianth present. Female involucre cup- or tube-like *Pallavicinia*
1. Pseudoperianth lacking. Female involucre scale-like *Symphyogynopsis*

1. *Pallavicinia ambigua* (Mitt.) Steph., Spec. Hepat. 1: 312 (1900).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 24, 1966 (Higuchi 32210), 1200 m alt., Nov. 23, 1996 (Higuchi 32170, 32189); Mt. Vutimena, 870 m alt., Oct. 18, 1997 (Sugimura 1656), 1250 m alt., Oct. 16, 1997 (Sugimura 1545, 1598).

Habitat. On wet soil, rocks and rotten logs at stream and cliff.

Distribution. India, China, Thailand, Japan, Philippines (Luzon), Seram, Borneo and New Guinea (cf. Grolle and Piippo 1986). New to Vanuatu.

Notes. Stephani and Watts (1914) reported *Pallavicinia ridleyi* Steph. also from this area. It was reduced synonym of *P. lyellii* (Hook.) Carruth. by Grolle and Piippo (1986). *P. ambigua* differs from *P. lyellii* by the habit of plants and the shape of female involucre; *P. ambigua* has blackish, rigid thalli when dry and tube-like, somewhat appressed female involucre, but *P. lyellii* has green, soft thalli and cup-like involucre.

2. *Symphyogynopsis filicum* (Nadeaud) Grolle in Grolle & Piippo, Acta Bot. Fennica 133: 73 (1986).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 25, 1966 (Higuchi 32250); Mt. Tabwemasana, 1000 m alt., Nov. 6, 1996 (Higuchi 31553, 31582, 31590); Butmas, lower montane forest, 560 m alt., Oct. 23, 1997 (Sugimura 1734).

*Department of Plant Sciences, Natural History Museum and Institute, Chiba, 955-2 Aoba-cho, Chuo-ku, Chiba-shi, Chiba, 260-8682 Japan.

Habitat. On trunks and boulders.

Distribution. Malay Peninsula, Philippines (Luzon), Java, Sumatra, Seram, New Guinea, Caroline Islands, Fiji, Samoa and Tahiti (cf. Grolle and Piippo 1986). New to Vanuatu.

HYMENOPHYTACEAE

3. *Hymenophytum flabellatum* (Labill.) Dumort., Rec. d'Obs. Jungerm.: 25 (1835).

Specimens examined. Espiritu Santo Isl., Mt. Tabwemasana, 1500 m alt., Nov. 7, 1996 (Higuchi 31734), 1650 m alt. (Higuchi 31709); Mt. Vutimele, 1200 m alt., Nov. 23, 1996 (Higuchi 32152).

Habitat. On trunks of tree fern, rotten logs and humus.

Distribution. New Caledonia, Fiji, New Zealand, Australia and S. America (cf. Miller *et al.* 1983). New to Vanuatu.

Note. This species is easily distinguishable by the underground rhizomes and dendroid thalli like umbrella.

ANEURACEAE

This paper deals with some species of the family preliminarily, and the further studies will be contributed in the near futures.

Key to the genera of Aneuraceae in Vanuatu

1. Rhizoids born on ventral surface of more than 0.8 the thallus in width, lacking along the lateral margins *Lobatiriccardia*
1. Rhizoids born on ventral surface of less than 0.7 the thallus in width.....2
 2. Female branches short, mound-like; archegonia in many rows or clusters on female branches..... *Aneura*
 2. Female branches long; archegonia in 2 rows on female branches *Riccardia*

4. *Aneura kaguaensis* Hewson, Proc. Linn. Soc. New South Wales 94: 190 (1969).

Specimens examined. Espiritu Santo Isl., Mt. Tabwemasana, 890 m alt., Nov. 5, 1996 (Higuchi 31505), 1000 m alt., Nov. 6, 1996 (Higuchi 31569), Nov. 8, 1996 (Higuchi 31798); Butmas, lower montane forest, Oct. 23, 1997 (Sugimura 1736).

Habitat. On rotten logs.

Distribution. New Guinea (cf. Hewson 1970a) and Caroline Islands (cf. Proskauer 1971, as discussed below). New to Vanuatu.

Notes. The most distinguishing feature of this species is the presence of pluricellular gemmae with stalk from gemmiferous shoots, the character which separates this species from all other members of *Aneura* in the world. Although this species was only reported from New Guinea (Hewson 1970a), Proskauer (1971) reported the same gemmae as those of this species from Caroline Islands for *Riccardia pinguis* (= *Aneura pinguis*). The plants from Caroline Islands can be treated as *Aneura kaguaensis*.

5. *Aneura maxima* (Schiffn.) Steph., Spec. Hepat. 1: 270 (1899).

Specimens examined. Espiritu Santo Isl., Mt. Tabwemasana, 1400 m alt., Nov. 7, 1996 (Higuchi 31069), 1440 m alt. (Higuchi 31752).

Habitat. On fallen logs.

Distribution. India, Nepal, China, Japan, Java, Sumatra, New Caledonia and N. America (cf. Hurlimann 1976, Furuki 1991, Furuki and Higuchi 1995). New to Vanuatu.

6. *Lobatirricardia alterniloba* (Hook. f. & Taylor) Furuki, J. Hattori Bot. Lab. 70: 319 (1991).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 24, 1996 (Higuchi 32203, 32227), Nov. 25, 1996 (Higuchi 32267), 1200 m alt., Nov. 23, 1996 (Higuchi 32151); Mt. Tabwemasana, 890 m alt., Nov. 6, 1996 (Higuchi 31512); Mt. Vutimena, 870 m alt., Oct. 18, 1997 (Sugimura 1637), 1240 m alt., Oct. 16, 1997 (Sugimura 1542), 1260 m alt. (Sugimura 1588).

Habitat. On rotten logs, trunks of tree fern, boulders and humus.

Distribution. New Zealand and Australia (cf. Hewson 1970a). New to Vanuatu.

Notes. The most remarkable character of the genus is the rhizoids occurred densely on all over the ventral surface of thalli.

7. *Riccardia albomarginata* (Steph.) Schiffn., Consp. Hepat. Archip. Ind.: 53 (1898).

Specimen examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 23, 1996 (Higuchi 32120).

Habitat. On trunks of tree.

Distribution. Philippines (Luzon), Java, Borneo and New Guinea (cf. Furuki 1995). New to Vanuatu.

Notes. This species is well characterized by the dorso-ventrally differentiated thalli which have enlarged ventral epidermal cells, and small dorsal epidermal and inner cells in cross section.

8. *Riccardia crassa* (Schwägr.) C. Massal., Nuovo Giorn. Bot. Ital. 17: 254 (1885).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 22, 1996 (Higuchi 32064, 32074), Nov. 24, 1996 (Higuchi 32207), 1200 m alt., Nov. 23, 1996 (Higuchi 32084), 1400 m alt. (Higuchi 32120); Mt. Vutimena, 1340 m alt., Oct. 16, 1997 (Sugimura 1548).

Habitat. On rotten logs and cliff.

Distribution. Japan, Philippines (Luzon), Sumatra, New Guinea, New Caledonia, New Zealand, Australia and S. America (cf. Hewson 1970b, Miller *et al.* 1983, Furuki 1991). New to Vanuatu.

Notes. The strong verrucae on surface of thalli distinguish well this species from others of the genus.

9. *Riccardia elata* (Steph.) Schiffn., Denkschr. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. 67: 169 (1898).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 22, 1996 (Higuchi 32063, 32070), Nov. 24, 1996 (Higuchi 32204, 32234), 1200 m alt., Nov. 23, 1996 (Higuchi 32161, 32176); Mt. Vutimena, 1280 m alt., Oct. 16, 1997 (Sugimura 1587).

Habitat. On soil, rocks and rotten logs.

Distribution. Java (cf. Schiffner 1898). New to Vanuatu.

Notes. This species is characterized by the erect cylindrical axis and well developed, thin ultimate branches with wide wings.

Campbell (1971) and Hurlimann (1976) treated this species as synonym of *Riccardia plumosa*

(Mitt.) E.O.Campb., however, this species clearly differs from the latter in the size of trigones of cells at wings of thalli. The trigones of *R. elata* are indistinct and small, whereas those of *R. plumosa* are distinct and large.

10. *Riccardia graeffei* (Steph.) Hewson, J. Proc. Linn. Soc. New South Wales 95: 118 (1970).

Specimens examined. Espiritu Santo Isl., Tanafo - Matantas, 350 m alt., Oct. 8, 1997 (Sugimura 1429); Mt. Tabwemasana, 1000 m alt., Nov. 8, 1996 (Higuchi 31570, 31793).

Habitat. On rotten logs and cliff.

Distribution. India, Vietnam, Japan, Singapore, Java, Sumatra, Caroline Islands, New Guinea, New Caledonia, Samoa, Fiji, Tonga, Tahiti and Australia (cf. Hewson 1970b, Hurlimann 1976, Furuki 1991). New to Vanuatu.

Notes. This species is characterized by the wide wings of thallus and heteroicous sexual condition with male, female and paroicous branches (Furuki 1991).

11. *Riccardia heteroclada* Schiffn., Denkschr. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. 67: 175 (1898).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 24, 1996 (Higuchi 32236), Nov. 25, 1996 (Higuchi 32277), 1200 m alt., Nov. 23, 1996 (Higuchi 32159), 1400 m alt. (Higuchi 32144).

Habitat. On rotten logs, humus and trunks of tree fern.

Distribution. Malay Peninsula, Philippines (Negros), Borneo, Java, Sumatra and Solomon Islands (cf. Furuki 1998). New to Vanuatu.

Notes. This species is easily distinguishable by the micro-thalloid branchlets (Furuki 1998).

12. *Riccardia womersleyana* Hewson, Proc. Linn. Soc. New South Wales 95: 98 (1970).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 22, 1996 (Higuchi 32076), 1200 m alt., Nov. 23, 1996 (Higuchi 32158).

Habitat. On rotten logs.

Distribution. New Guinea (cf. Hewson 1970b). New to Vanuatu.

Notes. This species is characterized by the presence of mucilage hairs on both ventral and dorsal surfaces of thallus in 2 rows and also along margin. On the contrary most species of the genus has mucilage hairs only on ventral surface in 2 rows (Furuki 1991).

METZGERIACEAE

Three species are recognized in this collection, and *M. hebridensis* Steph. was also reported from this area by Kuwahara (1960, 1966). They may be separated from each other by the following key.

1. Marginal hairs of wing paired.....*M. leptoneura*
1. Marginal hairs of wing single2
 2. Cell surface of thalli verrucose*M. hebridensis*
 2. Cell surface of thalli smooth3
 3. Ventral epidermal cells of midrib in 3 or 4 rows.....*M. densiseta*
 3. Ventral epidermal cells of midrib in 2 rows.....*M. pauciseta*

13. Metzgeria densiseta Steph., Spec. Hepat. 6: 49 (1917).

Specimen examined. Espiritu Santo Isl., Mt. Tabwemasana, 1440 m alt., Nov. 7, 1996 (Higuchi 31738).

Habitat. On trunks.

Distribution. New Caledonia, Vanuatu, Fiji and Australia (cf. Kuwahara 1966).

14. Metzgeria leptoneura Spruce, Trans. Proc. Bot. Soc. Edinburgh. 15: 555 (1885).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 25, 1996 (Higuchi 32252, 32264).

Habitat. On trunks.

Distribution. Widely distributed in the world.

Notes. Kuwahara (1969) treated *Metzgeria longipila* Steph. described from this area as synonym of this species.

15. Metzgeria pauciseta Steph., Spec. Hepat. 6: 58 (1917).

Specimen examined. Espiritu Santo Isl., Mt. Vutimele, 1200 m alt., Nov. 23, 1996 (Higuchi 32183).

Habitat. On rock-cliff.

Distribution. Endemic to Vanuatu (cf. Kuwahara 1960, 1966).

MARCHANTIALES**TARGIONIACEAE****16. Cyathodium foetidissimum** Schiffn., Denkschr. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. 67: 154. 1898.

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 24, 1996 (Higuchi 32211), 1200 m alt., Nov. 23, 1996 (Higuchi 32190); Mt. Tabwemasana, 950 m alt., Nov. 6, 1996 (Higuchi 31515), 1000 m alt., Nov. 8, 1996 (Higuchi 31807, 31831), Nov. 9, 1996 (Higuchi 31903).

Habitat. On soil, rocks and cliff.

Distribution. India, Java, Sumatra and Tahiti (cf. Srivastava and Dixit 1996). New to Vanuatu.

Notes. The thalli of *Cyathodium* appear goldish by the reflection of light.

WIESNERELLACEAE**17. Dumortiera hirsuta** (Sw.) Nees in Reinw. *et al.*, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 410 (1824).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 25, 1996 (Higuchi 32285), 1200 m alt., Nov. 23, 1996 (Higuchi 32175, 32185); along Pialapa River, 290 m alt., Oct. 19, 1997 (Sugimura 1697); Mt. Vutimena, 1270 m alt., Oct. 16, 1997 (Sugimura 1589); Mt. Tabwemasana, 950 m alt., Nov. 6, 1996 (Higuchi 31513), 1000 m alt. (Higuchi 31521), Nov. 8, 1996 (Higuchi 31822), 1170 m alt., Nov. 7, 1996 (Higuchi 31600). Efate Isl., Pang Pang, 20 m alt., Oct. 3, 1997 (Sugimura 1414, 1417).

Habitat. On soil, rocks and cliff.

Distribution. Widely distributed in the world. New to Vanuatu.

Notes. The most diagnostic character of this species is the cilia making reticulations on the dorsal surface of thallus.

MARCHANTIACEAE

From this area Bischler-Causse (1989) reported 2 species of *Marchantia*, and *M. streimannii* Bischl. are newly reported in this paper. They may be separated from each other by the following key.

1. Epidermal pores of thallus more than 95 μm in diameter. Margin of thallus not bordered by thick-walled cells. Couples without papillae on outer surface. Female receptacles with involucre alternate with lobes; lobes without median groove on dorsal surface and truncate or emarginate at apices.....
.....*M. emarginata* subsp. *lecordiana*
1. Epidermal pores of thallus less than 95 μm in diameter. Margin of thallus bordered by thick-walled cells. Couples with papillae on outer surface. Female receptacles with involucre located underneath the lobes; lobes with median groove on dorsal surface and split at apices2
2. Appendage of median scale not bordered by smaller cells.....*M. carrii*
2. Appendage of median scale bordered by smaller cells than those at middle.....*M. streimannii*

18. *Marchantia carrii* Bischl., Bryol. Bibliot. 38: 256 (1989).

Specimen examined. Espiritu Santo, Mt. Vutimena, 540 m alt., Oct. 16, 1997 (Sugimura 1404).

Habitat. On rocks.

Distribution. Sulawesi, New Guinea and Vanuatu (cf. Bischler-Causse 1989).

Notes. Bischler-Causse (1989) reported this species from Vanuatu, based on the incompletely labelled specimen, and she pointed out that the confirmation of the presence of this species on this area was needed.

19. *Marchantia emarginata* Reinw., Blume & Nees subsp. *lecordiana* (Steph.) Bischl., Cryptogamie, Bryol. Lichenol. 10: 78 (1989).

Specimens examined. Espiritu Santo Isl., Tanafo - Matantas, 370 m alt., Oct. 8, 1997 (Sugimura 1444); Butmas, 540 m alt., Oct. 23, 1997 (Sugimura 1741). Efate Isl., Pang Pang, 20 m alt., Oct. 3, 1997 (Sugimura 1418).

Habitat. On soil and rocks.

Distribution. New Caledonia and Vanuatu (cf. Bischler-Causse 1989).

20. *Marchantia streimannii* Bischl., Bryol. Bibliot. 38: 250 (1989).

Specimens examined. Espiritu Santo Isl., Mt. Vutimele, 1100 m alt., Nov. 22, 1996 (Higuchi 32189, 32083b), 1200 m alt., Nov. 23, 1996 (Higuchi 32186); Mt. Tabwemasana, 950 m alt., Nov. 6, 1996 (Higuchi 31511), 1000 m alt., Nov. 8, 1996 (Higuchi 31830), 1500 m alt., Nov. 7, 1996 (Higuchi 31735, 31736).

Habitat. On soil and cliff.

Distribution. Borneo, New Guinea and New Caledonia (cf. Bischler-Causse 1989). New to Vanuatu.

Acknowledgements

I would like to thank Dr. M. Higuchi of the National Science Museum and Mr. K. Sugimura of the Graduate School of Science and Technology of Chiba University who gave me the chance to study their collections. Collection of plant materials was supported by Grant-in-Aid for Scientific Research Program, No. 08041165, of the Ministry of Education, Culture, Sports, Science and Technology in Japan.

Summary

Twenty species belonging to 10 genera and 7 families of Metzgeriales and Marchantiales (Hepaticae) were recognized based on about one hundred specimens collected from Vanuatu in 1996 and 1997. Among them 15 species are newly reported from this area.

References

- Bischler-Causse, H., 1989. *Marchantia* L. Bryol. Bibliot. **38**: 1–317. J. Cramer, Berlin-Stuttgart.
- Campbell, E. O., 1971. Liverworts collected in Fiji by A. C. Smith and W. Greenwood. J. Roy. Soc. New Zealand **1**: 7–30.
- Furuki, T., 1991. A taxonomical revision of the Aneuraceae (Hepaticae) of Japan. J. Hattori Bot. Lab. **70**: 293–397.
- , 1995. Taxonomic studies of Asiatic species of Aneuraceae (Hepaticae) II. *Riccardia* subgen. *Hyaloneura* Schust. J. Hattori Bot. Lab. **78**: 111–118.
- , 1998. Taxonomic studies of Asiatic species of Aneuraceae (Hepaticae) VI. *Riccardia fruticosa* (Steph.) Furuki, comb. nov., described from New Guinea and its related species. Nat. Hist. Res. **5**: 1–10.
- and M. Higuchi, 1995. Hepaticae from Nepal collected by the botanical expedition of the National Science Museum, Tokyo in 1988. 2. Metzgeriales and Marchantiales. In Watanabe, W. and H. Hagiwara (eds.), Cryptogams of the Himalaya Vol. 3. Nepal and Pakistan. Department of Botany, National Science Museum, Tsukuba. pp. 143–149.
- Grolle, R. and S. Piippo, 1986. Bryophyte flora of the Huon Peninsula, Papua New Guinea. XVI. Pallaviciniaceae (Hepaticae). Acta Bot. Fennica **133**: 59–79.
- Hewson, H. J., 1970a. The family Aneuraceae in Australia and New Guinea: 1. The genus *Aneura*. Proc. Linn. Soc. New South Wales **94**: 173–193.
- , 1970b. The family Aneuraceae in Australia and New Guinea: 2. The genus *Riccardia*. Proc. Linn. Soc. New South Wales **95**: 60–121.
- Higuchi, M., 2002. Studies on the bryophyte flora of Vanuatu. 1. Introduction and Mniaceae (Musci). Ann. Tsukuba Bot. Gard. **21**: 73–77.
- Hurlimann, H., 1976. Hepaticae aus dem Gebiete des sudlichen Pazifik IV. Bauhinia **5**: 191–213.
- Jovet-Ast, S., 1951. Hepatiques des Nouvelles-Herbrides. Recoltes de E. Aubert de la Rue, 1934. Rev. Bryoil. Lechenol. **20**(1–2): 96–98.
- Kuwahara, Y., 1960. The genus *Metzgeria* in Pacific Oceania. J. Hattori Bot. Lab. **23**: 3–28.
- , 1966. The family Metzgeriaceae in North and South East Asia, Pacific Oceania, Australia and New Zealand. Rev. Bryol. Lichenol. **34**: 191–239.
- Miller, H. A., H. O. Whittier and B. A. Whittier, 1983. Prodrum florae hepaticarum Polynesiae. Bryol. Bibliot. **25**: 1–423. J. Cramer, Vaduz.
- Proskauer, J., 1971. Notes on Hepaticae-V. Bryologist **74**: 1–9.
- Schiffner, V., 1898. Expositio Plantarum Itinere suo Indico Annis 1893/4. Suscepto Collectarum. Denkschr. Kaiserl. Akad. Wiss. Math.-Naturwiss. Kl. **67**: 153–203.
- Srivastava, S. C. and R. Dixit, 1996. The genus *Cyathodium* Kunze. J. Hattori Bot. Lab. **80**: 149–215.
- Stephani, F. and W. W. Watts., 1914. Hepaticae Australes. J. Proc. Roy. Soc. New South Wales **48**: 94–135.
- Tixier, P., 1972. Mousses exotiques. Bull. Mus. Hist. Nat. (Paris), sér. 3, **48**: 89–98.
- , 1973. Bryophytes exotiques. Bull. Mus. Hist. Nat. (Paris), sér. 3, **190**: 73–86.
- , 1974. Bryophytes exotiques-Bryophytes de Nouvelles-herbrides (expedition de la Royal Society). Bull. Mus. Hist. Nat. (Paris), sér. 3, **269**: 33–45.