

Hepaticae and Anthocerotae of the Iwo (Volcano) Islands, Northwestern Micronesia

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Abstract A list of Hepaticae and Anthocerotae of the Iwo (Volcano) Islands, northwestern Micronesia, is presented. Forty-two species of Hepaticae and three species of Anthocerotae are enumerated, including five unidentified ones. Among them, 18 species are new additions to the known hepatic flora of the islands, and two species are new to Japan: *Lejeunea sordida* and *Lejeunea umbilicata*. Four species are excluded from the islands. Localities, specimens examined and miscellaneous notes are provided for each species.

Key words: Iwo Islands, bryoflora, Hepaticae, Anthocerotae.

The Natural History Museum and Institute, Chiba, is carrying out a research project on the natural history in the Izu–Mariana Arc in order to study the origin and evolution of their fauna and flora. As a member of the project, the author studied the Hepaticae and Anthocerotae of the Arc, focusing on the Ogasawara (Chichijima Islands and Hahajima Islands) Islands (Furuki *et al.*, 1991) and the northern Mariana Islands (Furuki, 1994). The present communication deals with the Hepaticae and Anthocerotae flora of the Iwo (Volcano) Islands.

The Iwo Islands are located in the western Pacific between 24°14'–25°25'N, 141°16'–141°28'E. The Islands consist of three small, volcanic islands: Kita-Iwo, Naka-Iwo (Iwo) and Minami-Iwo. These islands are 50–60 km distant from each other. The northernmost island, Kita-Iwo, is situated about 250 km south of Hahajima Island of the Ogasawara Islands, and the southernmost island, Minami-Iwo, is about 500 km north of Uracas Island in the northern Marianas. Minami-Iwo and Kita-Iwo are both conical in shape with a steep slope, and their highest peaks being 916 m, and 792 m above sea level, respectively. Naka-Iwo is uniformly flat, and the highest peak is only 120 m above sea level.

The Hepaticae and Anthocerotae of the Izu–Mariana Arc was studied in detail by Inoue (1977) for the Izu Islands, Inoue (1970), Inoue and Iwatsuki (1969, 1970) and Furuki

et al. (1991) for the Ogasawara Islands, and Furuki (1994) for the northern Mariana Islands. However, those of the Iwo Islands are poorly known. The first record from the Iwo Islands was made by Horikawa (1936a), who reported only three species. He later reported four other species (Horikawa, 1936b, 1951), based on his own collection. Inoue and Iwatsuki (1984) reported 19 species of Hepaticae and one species of Anthocerotae from Minami-Iwo based on the collection of Dr. H. Ohba of the University Museum, Tokyo University, and Mr. S. Takiguchi of the Nature Conservation Society of Japan, made in June 1982. In those papers, 25 species of Hepaticae and 3 species of Anthocerotae were recorded.

The purpose of the present study was to create an inventory of Hepaticae and Anthocerotae collected from the Iwo Islands by studying specimens that remained unidentified and by reexamination of the voucher specimens cited in the previous reports.

Materials and Methods

The materials studied in the present investigation were all dried specimens deposited in herbaria. Their collection localities, dates, collectors, and depositions were as follows.

KITA-IWO ISLAND. From mid-slope to summit area, ca. 200–700 m alt., 11–13 July 1993, collected by T. Yasui, 10 unidentified specimens (NICH); at summit area, 21 Nov.

1935, collected by T. Tuyama, three unidentified specimens in herb. Y. Horikawa (HIRO); s.l., 13 June 1981, collected by T. Nakaike, one unidentified specimen (TNS).

NAKA-IWO (IWO) ISLAND. Near Mt. Motoyama and Mt. Paipuyama, 1–2 Apr. 1936, collected by H. Horikawa, four unidentified specimens (HIRO).

MINAMI-IWO ISLAND. From coastal lowland to summit area, 0–916 m alt., 30 March, 1 Apr. 1936, collected by Y. Horikawa, 47 specimens (HIRO), most specimens were unidentified; 700 m alt., 22 Oct. 1932, collected by T. Ishida, one unidentified specimen in herb. Y. Horikawa (HIRO); from mid-slope to summit area, ca. 200–916 m alt., collected by H. Ohba and S. Takiguchi, 57 specimens (TNS), all cited by Inoue and Iwatsuki (1984).

Results

Enumeration of Species

The arrangement of families follows Furuki and Mizutani (1994), and that of genera and species is in alphabetical order. Each species name is followed by details of the specimens examined (with associated species), previous records and notes.

Hepaticae

Family Pseudolepicoleaceae

1. *Mastigophora diclados* (Brid.) Nees ex Schiffn.

Specimens examined. KITA-IWO: Sanman-tsubo, 700 m alt., Yasuda 5 (with *Lejeunea mizutanii*); summit area, Tuyama in herb. Horikawa 14940, 14950. MINAMI-IWO: mid-slope, Horikawa 15159 (with *Bazzania japonica*, *Lejeunea umbilicata* and *Lejeunea* sp. 3), 15162 (with *Lejeunea* sp. 3 and *Radula javanica*), 15166 (with *Lejeunea* sp. 3), Takiguchi 72 (with *Lejeunea mizutanii*), 73 (with *Lejeunea mizutanii*); 650 m alt., Takiguchi 65 (with *L. mizutanii* and *Lopholejeunea nigricans*), 90 (with *B. japonica* and *Lejeunea ulicina*); 680 m alt., Takiguchi 91 (with *Frullania serrata*); 700 m alt., Ishida in herb. Horikawa 15012b; summit area, Horikawa 15177 (with *B. japonica*, *Colura tenuicornis* and *L. mizutanii*), 15180 (with *Jungermannia truncata* and *L. mizutanii*), 15186 (with *L. mizutanii*, *L. umbilicata*, *R. javanica*, *Radula retroflexa*), 15201 (with *L. mizutanii*, *R. javanica* and *R. retro-*

flexa), 15210 (with *L. mizutanii*); Ohba 75 (with *L. mizutanii*), 79 (with *L. mizutanii* and *L. umbilicata*), 85 (with *B. tridens*), 98 (with *B. japonica* and *B. tridens*), 103 (with *B. japonica* and *L. mizutanii*).

Previous record. Minami-Iwo (Horikawa, 1936b; Inoue and Iwatsuki, 1984).

Family Lepidoziaceae

2. *Bazzania japonica* (Lac.) Lindb.

Specimens examined. KITA-IWO: Sanman-tsubo, 700 m alt., Yasui 2. MINAMI-IWO: mid-slope, Horikawa 15160 (with *Bazzania tridens*, *Lejeunea anisophylla* and *Lejeunea mizutanii*), 15169 (with *Lejeunea umbilicata*), 15208 (with *Bazzania tridens* and *Plagiochila boninensis*); 650 m alt., Takiguchi 90 (with *Lejeunea ulicina* and *Mastigophora diclados*); 700 m alt., Takiguchi 106 (labeled as *B. tridens*); 860 m alt., Ohba 78, 98 (with *B. tridens* and *L. ulicina*), Takiguchi 89, 94 (with *B. tridens*); summit area, Horikawa 15175 (with *L. mizutanii*), 15177 (with *Colura tenuicornis*, *L. mizutanii* and *M. diclados*), 15194 (with *Dendroceros tubercularis*, *L. exilis*, *L. flava*, *L. mizutanii* and *Lopholejeunea eulopha*), 15215 with *L. mizutanii*, *Lejeunea* sp. 2 and *Plagiochila sciophila*.

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

3. *Bazzania tridens* (Reinw. et al.) Trev.

Specimens examined. KITA-IWO: mid-slope, 200 m alt., Yasui 8; 230 m alt., Yasui 7; 280 m alt., Yasui 11. MINAMI-IWO: mid-slope, 15160 (with *Bazzania japonica*, *Lejeunea anisophylla* and *Lejeunea mizutanii*), Horikawa 15161 (with *Cephalozia zoopsioides* and *Jungermannia comata*), Horikawa 15208 (with *B. japonica* and *Plagiochila boninensis*); 500 m alt., Takiguchi 74 (with *Frullania ramuligera* and *Heteroscyphus argutus*); 700 m alt., Takiguchi 69 (with *Lejeunea* sp. 3); 770 m alt., Takiguchi 99; 820 m alt., Takiguchi 81 (with *L. anisophylla*), 71 (with *L. mizutanii*); summit area, Takiguchi 76 (with *L. mizutanii*), 94 (with *B. japonica*), 105, 109, Ohba 85 (with *Mastigophora diclados*), 98 (with *B. japonica* and *M. diclados*).

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

Family Calypogeiaceae

4. *Calypogea tosana* (Steph.) Steph.

Specimen examined. MINAMI-IWO: summit area, Horikawa 15205 (with *Lejeunea anisophylla* and *Lejeunea* sp. 3).

New to Iwo Islands.

Family Cephaloziaceae

5. *Cephalozia zoopsioides* Horik.

Specimen examined. MINAMI-IWO: mid-slope, Horikawa 15161 (with *Bazzania tridens* and *Jungermannia comata*).

New to Iwo Islands and to Izu-Mariana Arc.

Family Jungermanniaceae

6. *Jungermannia comata* Nees

Specimens examined. MINAMI-IWO: mid-slope, Horikawa 15161 (with *Cephalozia zoopsioides* and *Bazzania tridens*), 15163.

New to Iwo Islands.

7. *Jungermannia truncata* Nees

Specimens examined. MINAMI-IWO: summit area, Horikawa 15180 (with *Lejeunea mizutanii* and *Mastigophora diclados*), 15193, 15199.

New to Iwo Islands.

Family Geocalycaceae

8. *Heteroscyphus argutus* (Reinw. et al.) Schiffn.

Specimens examined. MINAMI-IWO: s.l., Horikawa 15148; 500 m alt., Takiguchi 74 (with *Bazzania tridens*), 82 (with *Lejeunea sordida* and *Radula javanica*), 83, 100.

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

9. *Heteroscyphus coalitus* (Hook.) Schiffn.

Specimen examined. MINAMI-IWO: s.l., Horikawa 15158.

New to Iwo Islands.

Family Plagiochilaceae

10. *Plagiochila arbuscula* (Brid.) Lehm. et Lindenb.

Specimen examined. KITA-IWO: Sanman-tsubo, 700 m alt., Yasui 1 (with *Lejeunea mizutanii*).

New to Iwo Islands and to Izu-Mariana Arc.

11. *Plagiochila boninensis* Inoue

Specimens examined. KITA-IWO: Sanman-tsubo, 700 m alt., Yasui 4 (with *Dendroceros tubercularis* and *Radula javanica*). MINAMI-IWO: Horikawa 15208 (with *Bazzania japonica* and *B. tridens*); mid-slope, Horikawa 15207 b (labeled as *Plagiochila minor*).

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

Horikawa (1936a) reported *Plagiochila minor* Horik., now a synonym of *Plagiochila trabeculata* Steph., from the Iwo Islands. Later Inoue (1970) pointed out that it was *P. acanthophylla* ssp. *japonica*, now a synonym of *P. sciophila*. However, the author reexamined the voucher specimen (Horikawa no. 15207b) and confirmed that it was identical to *Plagiochila boninensis*. *P. boninensis* is very close to *P. trabeculata* in having narrow leaves, but differs from the latter by the presence of underleaves. *P. boninensis* has minute underleaves, while *P. trabeculata* usually lacks them.

12. *Plagiochila sciophila* Nees

Specimen examined. MINAMI-IWO: summit area, Horikawa 15215 (with *Bazzania japonica* and *Lejeunea mizutanii*).

New to Iwo Islands.

Inoue (1970) reported this species from Minami-Iwo Island based on Horikawa's collection. However, it was identical with *Plagiochila boninensis*, as discussed under *P. boninensis*.

Family Radulaceae

13. *Radula javanica* Gott.

Specimens examined. KITA-IWO: s.l., Nakaike, s.n.; Mt. Paipuyama, Horikawa 15233; mid-slope, 230 m alt., Yasui 6; 400 m alt., Yasui 9; Sanman-tsubo, 700 m alt., Yasui 4 (with *Dendroceros tubercularis* and *Plagiochila boninensis*). MINAMI-IWO: s.l., Horikawa 15154; mid-slope, Horikawa 15162 (with *Lejeunea* sp. 3 and *Mastigophora diclados*), 15207 (with *Lejeunea anisophylla*); 500 m alt., Takiguchi 70 (with *Frullania zennoskeana*), 82 (with *Heteroscyphus argutus* and *Lejeunea sordida*); summit area, Horikawa 15186 (with *Lejeunea mizutanii*, *Lejeunea umbilicata*, *M. diclados* and *Radula retroflexa*), 15189, 15195 (with *L. mizutanii*, *Lejeunea* sp. 3 and *Radula retroflexa*), 15201 (with *L. mizutanii*, *Lejeunea* sp. 3, *M. diclados*, *R. javanica* and *R. retroflexa*)

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984; Furuki and Yamada, 1986).

14. *Radula kojana* Steph.

Specimens examined. MINAMI-IWO: summit area, Horikawa 15185 (with *Lejeunea* sp. 3 and *Riccardia graeffei*), 15190 (with *Riccardia graeffei*).

Previous record. Minami-Iwo (Furuki and Yamada, 1986)

15. *Radula retroflexa* Tayl.

Specimens examined. MINAMI-IWO: summit area, Horikawa 15186 (with *Lejeunea mizutanii*, *Lejeunea umbilicata*, *Mastigophora diclados* and *Radula javanica*), 15195 (with *L. mizutanii*, *Lejeunea* sp. 3 and *R. javanica*), 15201 (with *L. mizutanii*, *L. mizutanii*, *Lejeunea* sp. 3, *M. diclados* and *R. javanica*); Takiguchi 92.

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984; Furuki and Yamada, 1986).

Family Frullaniaceae

16. *Frullania bonincola* Hatt.

Specimens examined. KITA-IWO: summit area, Takiguchi 10 (labeled as *Frullania zenoskeana*). MINAMI-IWO: 500 m alt., Takiguchi 80 (with *Lejeunea flava* and *Lejeunea sordida*).

Previous record. Minami-Iwo: (Inoue and Iwatsuki, 1984).

17. *Frullania ramuligera* (Nees) Mont.

Specimens examined. MINAMI-IWO: 500 m alt., Takiguchi 74 (with *Bazzania tridens* and *Heteroscyphus argutus*); 680 m alt., Takiguchi 77 (with *Lejeunea flava*).

New to Iwo Islands.

18. *Frullania serrata* Gott.

Specimens examined. MINAMI-IWO: 680 m alt., Takiguchi 91 (with *Mastigophora diclados*), 97 (with *Dendroceros tubercularis* and *Lejeunea flava*).

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

19. *Frullania zennoskeana* Hatt.

Specimens examined. KITA-IWO: summit area, Tuyama in herb. Horikawa 14972. MINAMI-IWO: 400 m alt., Takiguchi 88 (with *Cheilolejeunea* sp., *Lejeunea anisophylla* and *Lejeunea cucullata*); 500 m alt., Takiguchi 70 (with *Radula javanica*), 87, 93. (with *Lopholejeunea eulopha*).

Previous record. Minami-Iwo (Inoue and

Iwatsuki, 1984).

Family Lejeuneaceae

20. *Cheilolejeunea* sp.

Specimen examined. MINAMI-IWO: 400 m alt., Takiguchi 88 (with *Frullania zennoskeana*, *Lejeunea anisophylla* and *Lejeunea ulicina*).

It resembles *Cheilolejeunea intertexta* (Lindenb.) Steph. in having round leaves, but lacks microphyllous branches which are diagnostic characters of *C. intertexta*. All plants are sterile, then the positive identification could be impossible.

21. *Cololejeunea stylosa* Steph.

Specimen examined. MINAMI-IWO: 220 m alt., Takiguchi 66 (with *Lejeunea anisophylla*).

New to Iwo Island.

22. *Colura tenuicornis* (Evans) Steph.

Specimens examined. MINAMI-IWO: summit area, Horikawa 15171, 15177 (with *Bazzania japonica*, *Lejeunea mizutanii* and *Mastigophora diclados*), 15183, 15198.

New to Iwo Islands and to Izu-Mariana Arc.

23. *Drepanolejeunea* sp.

Specimens examined. KITA-Iwo: Sanmansubito, 700 m alt., Yasui 1 (with *Lejeunea mizutanii* and *Plagiochila arbuscula*), 5 (with *L. mizutanii* and *Mastigophora diclados*).

24. *Lejeunea anisophylla* Mont.

Specimens examined. MINAMI-IWO: s.l., Horikawa 15209 (with *Reboulia hemisphaerica* subsp. *orientalis*); mid-slope, Horikawa 15160 (with *Bazzania japonica*, *Bazzania tridens* and *Lejeunea mizutanii*), 15207 (with *Radula javanica*); 220 m alt., Takiguchi 66 (labeled as *Lejeunea borneensis*, with *Cololejeunea stylosa*); 400 m alt., Takiguchi 88 (with *Cheilolejeunea* sp., *Frullania zennoskeana* and *Lejeunea cucullata*); 820 m alt., Takiguchi 81 (labeled as *L. borneensis*, with *B. tridens*); summit area, Horikawa 15204 (with *Marchantia paleacea* subsp. *diptera*), 15205 (with *Calypogeia tosana* and *Lejeunea* sp. 3).

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984, as *Lejeunea borneensis* Steph.).

25. *Lejeunea cucullata* (Reinw. et al.) Nees

Specimens examined. MINAMI-IWO: near beach, Horikawa 15146 (labeled as *Lejeunea*

lunulatiloba); 400 m alt., Takiguchi 88 (with *Frullania zennoskeana*, *Lejeunea anisophylla* and *Lejeunea ulicina*).

New to Iwo Islands.

26. *Lejeunea exilis* (Reinw. et al.) Grolle

Specimens examined. MINAMI-IWO: summit area, Horikawa 15188 (with *Dendroceros tubercularis*, *Lejeunea mizutanii* and *Pallavicinia levieri*), 15194 (verified by M. Mizutani, with *Dendroceros tubercularis*, *L. mizutanii*, *Lejeunea* sp. 3 and *Lopholejeunea eulopha*), 15200 (with *Pallavicinia levieri*), 15216 (labeled as *Drepanolejeunea tenuis*).

Previous record. Iwo Islands, localities not indicated (Miller et al., 1963).

Horikawa (1936b) reported *Drepanolejeunea tenuis* (Reinw. et al.) Spruce, now a synonym of *Drepanolejeunea angustifolia* (Mitt.) Grolle, from Minami-Iwo Island based on his own collection on 31 March 1936. The author was able to find only one voucher specimen (Horikawa 15216), and confirmed that it may be *Lejeunea exilis*.

The plants of Minami-Iwo Island sometimes have reduced, unlobed lanceolate underleaves, corresponding to those of *Lejeunea exilis*. The leaves of *Lejeunea exilis* are twice as long as the lobules (Grolle, 1979), but those of specimens from Minami-Iwo are 2.0–2.5 times longer. These variations were found in the population for the northern Mariana Islands.

Miller et al. (1963) listed the Ogasawara and Iwo Islands within the distribution area of this species with the proviso s.l.spec., but they did not indicate the localities and specimens. No other report of this species from these areas has been made, and the author reconfirmed the occurrence of this species on the Iwo Islands.

27. *Lejeunea flava* (Sw.) Nees

Specimens examined. MINAMI-IWO: 680 m alt., Takiguchi 77 (with *Frullania ramuligera*), 97 (with *Dendroceros tubercularis* and *Frullania serrata*).

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

28. *Lejeunea mizutanii* Grolle

Specimens examined. KITA-IWO: Sanman-tsubo, 700 m alt., Yasui 1 (with *Plagiochila arbuscula*), 5 (with *Mastigophora diclados*). MINAMI-IWO: mid-slope, Horikawa 15160

(with *Bazzania japonica*, *Bazzania tridens* and *Lejeunea anisophylla*); Takiguchi 72 (with *M. diclados*), 73 (labeled as *Lejeunea flava*, with *M. diclados*); 650 m alt., Takiguchi 65 (labeled as *Lejeunea flava*, with *Lopholejeunea nigricans* and *M. diclados*); 700 m alt., Takiguchi 68 (verified by M. Mizutani); 820 m alt., Takiguchi 71 (labeled as *Lejeunea flava*, with *B. tridens*); summit area, Horikawa 15175 (with *B. japonica*), 15177 (with *B. japonica*, *Colura tenuicornis*, *Mastigophora diclados*), 15178 (with *Lopholejeunea nigricans*), 15179, 15180 (with *Jungermannia truncata* and *M. diclados*), 15186 (with *Lejeunea umbilicata*, *M. diclados*, *Radula javanica* and *Radula retroflexa*), 15188 (with *Dendroceros tubercularis*, *Lejeunea exilis* and *Pallavicinia levieri*), 15194 (with *D. tubercularis*, *L. exilis*, *Lejeunea* sp. 3 and *Lopholejeunea eulopha*), 15195 (with *Lejeunea* sp. 3, *R. javanica* and *R. retroflexa*), 15201 (with *Lejeunea* sp. 3, *M. diclados*, *R. javanica* and *R. retroflexa*), 15210 (with *M. diclados*), 15215 (with *B. japonica*), Takiguchi 67 (labeled as *Lejeunea flava*, with *D. tubercularis*), Ohba 75 (labeled as *Lejeunea flava*, with *M. diclados*).

Previous record. Minami-Iwo. (Inoue and Iwatsuki, 1984).

29. *Lejeunea sordida* (Nees) Nees

Specimens examined. MINAMI-IWO: 400 m alt., Takiguchi 86 (labeled as *Lejeunea borneensis*); 500 m alt., Takiguchi 82 (labeled as *Lejeunea borneensis*, with *Heteroscyphus argutus* and *Radula javanica*).

New to Japan.

The plants of the Iwo Islands have large, retuse underleaves, which agree with those of *Lejeunea sordida* mentioned by Mizutani (1970). This species is widely distributed in tropical southeast Asia and also in the Pacific islands (Hurlimann, 1993), and is a new addition to the known hepatic flora of Japan. A description, figures and discussion based on the plants from the Iwo Islands will be provided in a separate paper.

30. *Lejeunea ulicina* (Tayl.) Gott. et al.

Specimens examined. NAKA-IWO: s.l., Horikawa 15229. MINAMI-IWO: s.l., Horikawa 15152; 650 m alt., Takiguchi 90 (with *Bazzania tridens* and *Mastigophora diclados*).

Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

31. *Lejeunea umbilicata* (Nees) Spruce

Specimens examined. MINAMI-IWO: mid-slope, Horikawa 15159 (with *Bazzania japonica*, *Lejeunea* sp. 3 and *Mastigophora diclados*), 15169 (with *Bazzania japonica*, verified by M. Mizutani); 650 m alt., Takiguchi 64 (labeled as *Lejeunea mizutanii*, with *Lejeunea cucullata*, *Lejeunea ulicina* and *Lopholejeunea eulopha*); summit area, Horikawa 15186 (with *Lejeunea mizutanii*, *M. diclados*, *R. javanica* and *R. retroflexa*); Ohba 79 (with *L. mizutanii* and *M. diclados*).

New to Japan.

The plants of the Iwo Islands have a long, keel-less perianth and an obtuse or lunate sinus, agreeing well with the diagnostic characteristics of *Lejeunea umbilicata* mentioned by Mizutani (1970). This species has been reported from Malaya, the Caroline Islands, New Guinea, New Caledonia, Fiji, Samoa and Tahiti (Hürlimann 1993), and is a new addition to the known hepatic flora of Japan. A description, figure and discussion based on plants from the Iwo Islands will be provided in a separate paper.

32. *Lejeunea* sp. 1

Specimen examined. MINAMI-IWO: near beach, Horikawa 15146 (labeled as *Microlejeunea lunulatiloba*, with *Lejeunea cucullata*).

33. *Lejeunea* sp. 2

Specimens examined. MINAMI-IWO: summit area, Horikawa 15214, 15215 (with *Bazzania japonica*, *Lejeunea mizutanii* and *Plagiochila sciophila*).

34. *Lejeunea* sp. 3

Specimens examined. MINAMI-IWO: mid-slope, Horikawa 15159 (with *Bazzania japonica*, *Lejeunea umbilicata* and *Mastigophora diclados*), 15162 (with *M. diclados* and *Radula javanica*), 15166 (with *M. diclados*), 15168 (with *Pallavicinia levieri*); 700 m alt., Takiguchi 69 (with *Bazzania tridens*); summit area, 31 March 1936, Horikawa 15204 (with *Lejeunea anisophylla*, *Marchantia paleacea* subsp. *diptera* and *Riccardia graeffei*), 15171 (with *Dendroceros tubercularis*), 15185 (with *R. graeffei* and *Radula kojana*), 15194 (with *D. tubercularis*, *Lejeunea mizutanii*, *L. exilis* and *Lopholejeunea eulopha*), 15195 (with *L. mizutanii*, *R. javanica* and *Radula retroflexa*), 15201 (with *L. mizutanii*, *M. diclados*, *R. javanica* and *R. retroflexa*), 15205 (with *Calypogeia*

tosana and *L. anisophylla*).

As all plants are sterile, positive identification could be impossible.

35. *Lopholejeunea nigricans* (Lindenb.) Schiffn.

Specimens examined. MINAMI-IWO: 650 m alt., Takiguchi 65 (with *Lejeunea mizutanii*); summit area, Horikawa 15178 (with *L. mizutanii*).

New to Iwo Islands.

36. *Lopholejeunea eulopha* (Tayl.) Schiffn.

Specimens examined. KITA-IWO: summit area, Tuyama in herb. Horikawa 14972 (labeled as *Lopholejeunea toyoshimae* with *Frullania zennoskeana*). MINAMI-IWO: 650 m alt., Takiguchi 64 (labeled as *Lopholejeunea subfusca*, with *Lejeunea cucullata*, *Lejeunea ulicina* and *Lejeunea umbilicata*); summit area, Horikawa 15194 (with *Dendroceros tubercularis*, *Lejeunea exilis*, *Lejeunea mizutanii* and *Lejeunea* sp. 3).

New to Iwo Islands.

Family Pallaviciniaceae

37. *Pallavicinia levieri* Schiffn.

Specimens examined. MINAMI-IWO: mid-slope, Horikawa 15168 (with *Lejeunea* sp. 3); summit area, Horikawa 15188 (with *Dendroceros tubercularis*, *Lejeunea exilis* and *Lejeunea mizutanii*), 15197 and 15200 (with *L. exilis*).

New to Iwo Islands.

Although Horikawa (1936a) and Inoue and Iwatsuki (1984) reported *Pallavicinia lyellii* (Hook.) Carruth. from the Iwo Islands, the author re-examined the material cited by them and confirmed that all of them were *Pallavicinia levieri*. The plants of the Iwo Island have terminal branches and male scales covering the midrib, and these characteristics agree well with those of *P. levieri*.

Family Aneuraceae

38. *Riccardia graeffei* (Steph.) Hewson

Specimens examined. MINAMI-IWO: summit area, Horikawa 15185 (with *Lejeunea* sp. 3 and *Radula kojana*); Horikawa 15190 (with *Radula javanica*).

New to Iwo Islands.

Family Wiesnerellaceae

39. *Dumortiera hirsuta* (Sw.) Nees
Specimens examined. KITA-IWO: Sanmantsubo, 700 m alt., Yasui 1 (with *Lejeunea mizutanii*, *Mastigophora dicladus* and *Plagiochila arbuscula*), Yasui 5.
Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

Family Marchantiaceae

40. *Marchantia paleacea* Bert. subsp. *diptera* (Mont.) Inoue
Specimen examined. MINAMI-IWO: summit area, Horikawa 15204 (labeled as *Marchantia diptera*, with *Lejeunea anisophylla*).
Previous record. Minami-Iwo (Horikawa, 1936b, as *Marchantia diptera*).

Family Aytoniaceae

41. *Reboulia hemisphaerica* (L.) Raddi subsp. *orientalis* Schust.
Specimens examined. MINAMI-IWO: s.l., Horikawa 15164, 15206, 15209 (with *Lejeunea anisophylla*).
Previous record. Naka-Iwo (Horikawa, 1936b, as *Anthoceros formosae*).

Family Ricciaceae

42. *Riccia glauca* L.
Specimens examined. NAKA-IWO: Mt. Motoyama, Horikawa 15224. MINAMI-IWO: s.l., Horikawa 15153; 220 m alt., Takiguchi 101.
Previous record. Naka-Iwo (Horikawa, 1936b); Minami-Iwo (Inoue and Iwatsuki, 1984).

Anthocerotae

Family Anthocerotaceae

43. *Anthoceros angustus* Steph.
Specimen examined. NAKA-IWO: Motoyama, Horikawa 15225 (labeled as *Anthoceros formosae*).
 New to Iwo Island and to Izu-Mariana Arc.
 44. *Dendroceros tubercularis* Hatt.
Specimens examined. MINAMI-IWO: mid-slope, Horikawa 15171 (with *Lejeunea* sp. 3); summit area, Horikawa 15188 (with *Lejeunea exilis*, *Lejeunea mizutanii* and *Pallavicinia levieri*), 15194 (with *L. mizutanii*, *L. exilis*, *Lejeunea* sp. 3 and *Lopholejeunea eulopha*)
Previous record. Minami-Iwo (Inoue and Iwatsuki, 1984).

45. *Folioceros fuciformis* (Mont.) Bharadw.
Specimen examined. MINAMI-IWO: near the shore, Horikawa 15145 (labeled as *Aspiromitus miyabeanus* Steph.).
Previous record. Minami-Iwo (Horikawa, 1936a, as *Aspiromitus miyabeanus* Steph.).

Species to be Excluded from the Iwo Islands

1. *Drepanolejeunea angustifolia* (Mitt.) Grolle
 Horikawa (1936b) and Inoue and Iwatsuki (1984) reported this species from Minami-Iwo Island. The author re-examined the voucher specimens (Horikawa 15216 and Takiguchi 61) and confirmed that they were identical with *Lejeunea exilis*. Further discussion is made under *L. exilis*.
 2. *Lopholejeunea subfusca* (Nees) Steph.
 Inoue and Iwatsuki (1984) reported this species from Minami-Iwo Island based on specimens of 64 and 104 of S. Takiguchi. The plants of Takiguchi 64 have large underleaves and correspond to those of *Lopholejeunea eulopha*. The plants of Takiguchi 104 have acute leaves, corresponding to those of *Lopholejeunea nigricans*.
 3. *Pallavicinia lyellii* (Hook.) Carruth.
 Horikawa (1936a) and Inoue and Iwatsuki (1984) reported *Pallavicinia lyellii* from Minami-Iwo Island. The voucher specimens were identical with *Pallavicinia levieri*, as discussed under *P. levieri*.
 4. *Plagiochila trabeculata* Steph.
 Horikawa (1936a) reported *Plagiochila minor* Horik., now a synonym of *Plagiochila trabeculata* Steph., from Minami-Iwo Island. The voucher specimen was identical with *Plagiochila boninensis*, as discussed under *P. boninensis*.

Discussion

The hepatic flora of the Iwo Islands is very similar to that of the Ogasawara Islands and northern Marianas, except for the epiphytic family Lejeuneaceae and Frullaniaceae. Seventeen species in six genera of Lejeuneaceae were recognized from the Iwo Islands, while 26 species in 10 genera from the Ogasawara Islands (Furuki *et al.*, 1991) and 35 species in 10 genera from the northern Marianas (Furuki, 1994). Among the genera of epiphytic families, *Cololejeunea* and *Cheilolejeunea* are remarkably poorly represented on the

Iwo Islands, and there is only one species for each of the genera. On the other hand, they are richly represented on the Ogasawara Islands and the northern Marianas, eight species of *Cololejeunea*, including two endemic species, and six species of *Cheilolejeunea*, including one endemic species, were reported (Furuki *et al.*, 1991), and nine species and seven species from the northern Marianas, respectively (Furuki *et al.*, 1991). However, the more epiphytic species have been present, judging from the presence of *Lejeunea exilis* and *Lejeunea umbilicata* in the summit area of the Iwo Islands. They usually occur on the trunks and/or leaves of trees in tropical rain forests (Mizutani, 1970). This suggests that many other epiphytic species might occur on the Iwo Islands, but have not been collected previously. A critical comparison between the hepatic flora of the Iwo Islands and that of other islands can not be made, unless a further field survey is done in the future.

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硫黄（火山）列島のタイ類及びツノグケ類

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著者は、中央博物館が進めている伊豆-マリアナ島孤における生物誌研究の一環として、タイ類およびツノグケ類相を研究している。そこで、今回は硫黄（火山）列島を対象とした。研究は、これまでに採集され既に諸標本庫に納められている標本を借覧することで進めた。それによって未同定標本、並びにこれまで研究論文に引用された標本をほとんど全て再研究することができた。その結果、タイ類 16 科 21 属 42 種、ツノグケ類 1 科 3 属 3 種が確認された。なお、その中には、タイ類の種まで同定できなかった 5 種も含まれている。種まで同定された中では、18 種が硫黄列島から初めての記録となるもので、そのうち次の 2 種は日本

新産であった：*Lejeunea sordida*, *Lejeunea umbilicata*. 全体的なフロラは小笠原諸島と似ているが、小笠原諸島と比較するとクサリゴケ科やヤスデゴケ科の数が非常に少ない。この2科は大部分の種が着生種であるが、今回研究した標本には木の樹幹や生葉から採集

されたと思われる標本がほとんど含まれていないので、多くの着生種はまだ採集されていない可能性が示唆された。従って、全体的なフロラを他の地域のそれと比較するのは今後の課題とした。