

A New Species of *Exormotheca* (*Exormothecaceae*, *Hepaticae*) from China

Tatsuwo FURUKI^a, Masanobu HIGUCHI^{b*}

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

^b *Department of Botany, National Science Museum, 4-1-1 Amakubo,
Tsukuba, Ibaraki 305-0005, Japan*

(Received 30 September 2005, accepted 24 October 2005)

Abstract – *Exormotheca bischleri* Furuki & Higuchi is described as new to science from Sichuan Province, China. This is the first record of *Exormothecaceae* from China and the easternmost locality of the family in Eurasia. This new species is characterized by (1) air chambers twice as tall as the septa, (2) septa of air chambers as tall as the chlorophyllose filaments, (3) ligulate to lunulate ventral scales with oil-cells, (4) 1-2 filiform appendages on the ventral scales, (5) tubers absent, (6) dioicous sexual condition, (7) sessile archegoniophores, (8) large spores, 100-120 µm in diam. and (9) elaters with mostly 1(-2) spiral(s). *Exormotheca bischleri* belongs to sect. *Corbierella*.

Hepaticae / *Exormotheca bischleri* / China / New species

INTRODUCTION

In 1996 the second author joined the field research party organized by the National Science Museum, Tokyo, in southwestern Sichuan Province, China, in cooperation with the Kunming Institute of Botany, Academia Sinica. A strange, pale green marchantioid hepatic was found during the field survey in the area of Mt. Siguniangshan. The thalli have strongly elevated air chambers coupled with simple air pores and the cubical carpocephala of archegoniophores, which are characteristic of the family *Exormothecaceae*. By these characteristics it is easily distinguished from other families of the *Marchantiales*. *Exormothecaceae* include three genera, *Aitchisoniella*, *Exormotheca* and *Stephensoniella* (Bischler, 1998). *Aitchisoniella* and *Stephensoniella* are monotypic genera and endemic to the western Himalaya, and they differ from *Exormotheca* by the absence of chlorophyllose filaments in air chambers (Bischler, 1998). Sichuan plants have chlorophyllose filaments in air chambers, and this suggests that they belong to *Exormotheca*. We carefully examined it and have concluded that it should be described as a new species. We are pleased to name the species as a tribute to Dr. Hélène Bischler-Causse who made great contributions to the taxonomy of the genus as well as to other marchantioid hepatics.

* Correspondence and reprints: higuchi@kahaku.go.jp

***Exormotheca bischleri* Furuki & Higuchi, sp. nov.** (Figs 1-26)

Planta affinis Exormothecae welwitschii Steph. sed differt 1) strato antico humili et 2) squamata ventrali rotundata, integra, appendicula filiformi, cellula oleosa dispersa.

Thalli pale green, purple at middle part of ventral epidermis, 5-10 mm long, 2-3 mm wide, 700-900 μm thick at middle, slightly geotropic at apices. **Branching** dichotomous, mainly apical, rarely ventral. **Dorsal epidermis** with simple pores, with oil-cells scattered along lines of septa. Air pores simple, with a single ring of 7-9 cells. Assimilatory tissues of one layer of air chambers; air chambers elevated above epidermis as conical dorsal projections, 200-400 μm high; septa 150-180 μm high, as long as chlorophyllose filaments; chlorophyllose filaments ciliate, uniseriate, 2-5 cells (50-180 μm) long. **Ventral tissue** massive, semi-immersed in soil, 400-500 μm thick, without mucilage cavities, without sclerotic cells; cells polygonal, irregular in size, mostly $25 \times 25 - 50 \times 50 \mu\text{m}$, thin-walled in cross-sections; oil-bodies scattered, 1-4 per each cross-section, light brown, globose, 25-27.5 μm , filled with indistinct granules; oil-drops filled in cells of ventral-middle part. **Ventral scales** in two rows, pale green, sometimes purple red at base or at margins, slightly emergent from beyond margin of thalli, ligulate to lunulate, with 3-6 scattered oil-cells, with 1 (-2) appendage(s); appendages deciduous, ciliate, uniseriate, rarely 2 cells wide at base, 5-10 cells long. **Rhizoids** translucent, numerous, smooth and pegged, restricted to ventral surface of thallus-midrib. Asexual reproduction and tubers absent.

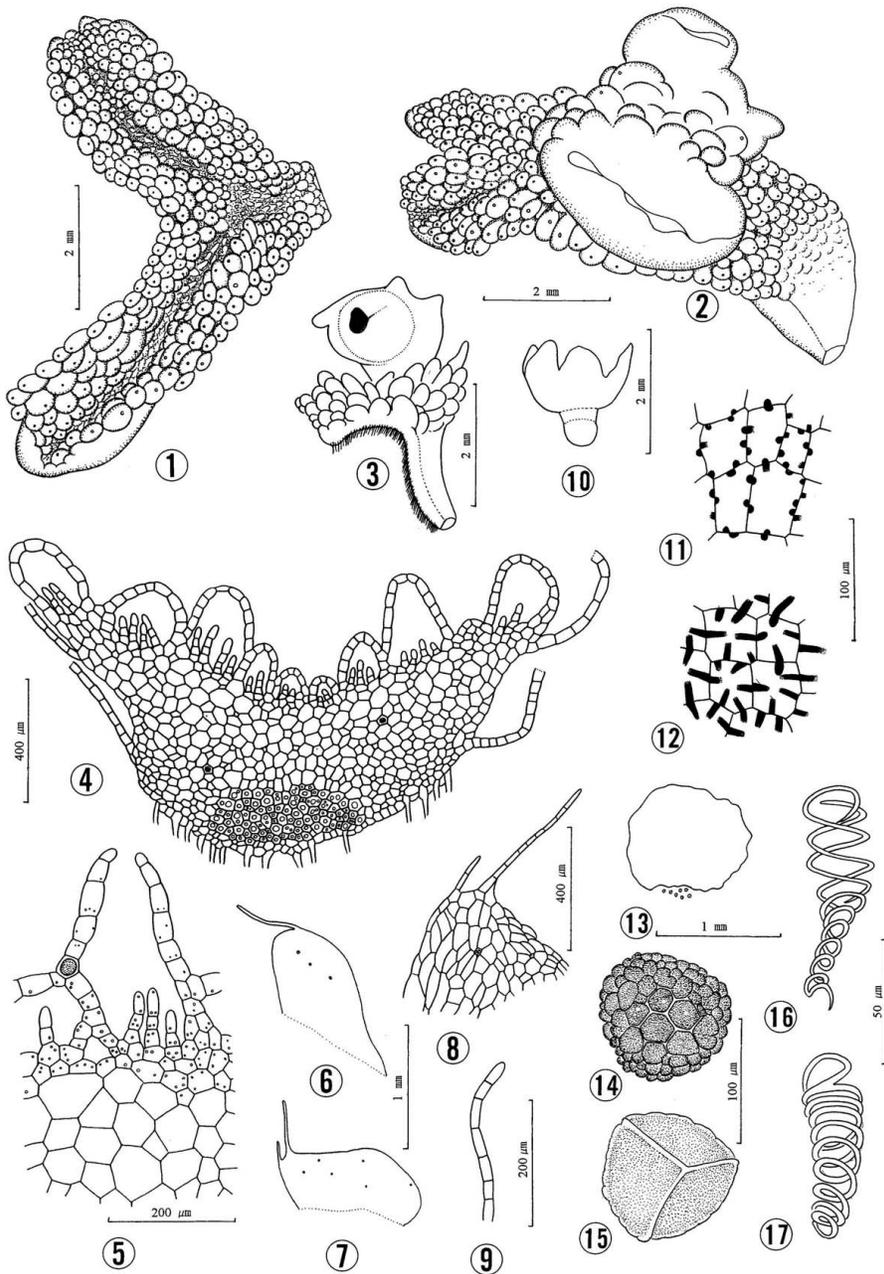
Dioicous. Antheridia embedded in dorsal groove; dorsal grooves aggregated or in 2-3 rows along thallus-midline, not surrounded by scales, not forming antheridiophores; ostioles strongly elevated. **Archegonia** on archegoniophores; archegoniophores located on dorsal surface of thalli, nearly sessile; stalk poorly developed, ca 100 μm long, 700-900 μm in diam., with one indistinct rhizoid furrow, without assimilatory strip, without scales; receptacle cubical, with 2-3 lobes, with strongly elevated air chambers at center; involucre terminal at apices of lobes, tubular, fleshy. **Pseudoperianths** absent.

Sporophytes 1-3 per involucre, not exerted from involucre. **Capsules** globose, ca. 1.5 mm in diam., opening by 5-7 irregular valves; wall unistratose, with semi-annular to L-shaped thickenings on radial and transverse walls, sometimes extending to outer tangential walls, usually extending to inner tangential walls. **Seta** ca 500 μm long including foot, ca 500 μm thick. **Spores** brown, tetrahedral with distinct triradiate marks on proximal surface, 100-120 μm in diam., irregularly sculptured, areolate to hemispherically papillose, covered with fine granules on distal surface, finely granulose on proximal surface. **Elaters** 50-100 μm long, 20-25 μm thick, mostly 1(-2)-spiral, rarely 3-spiral in part.

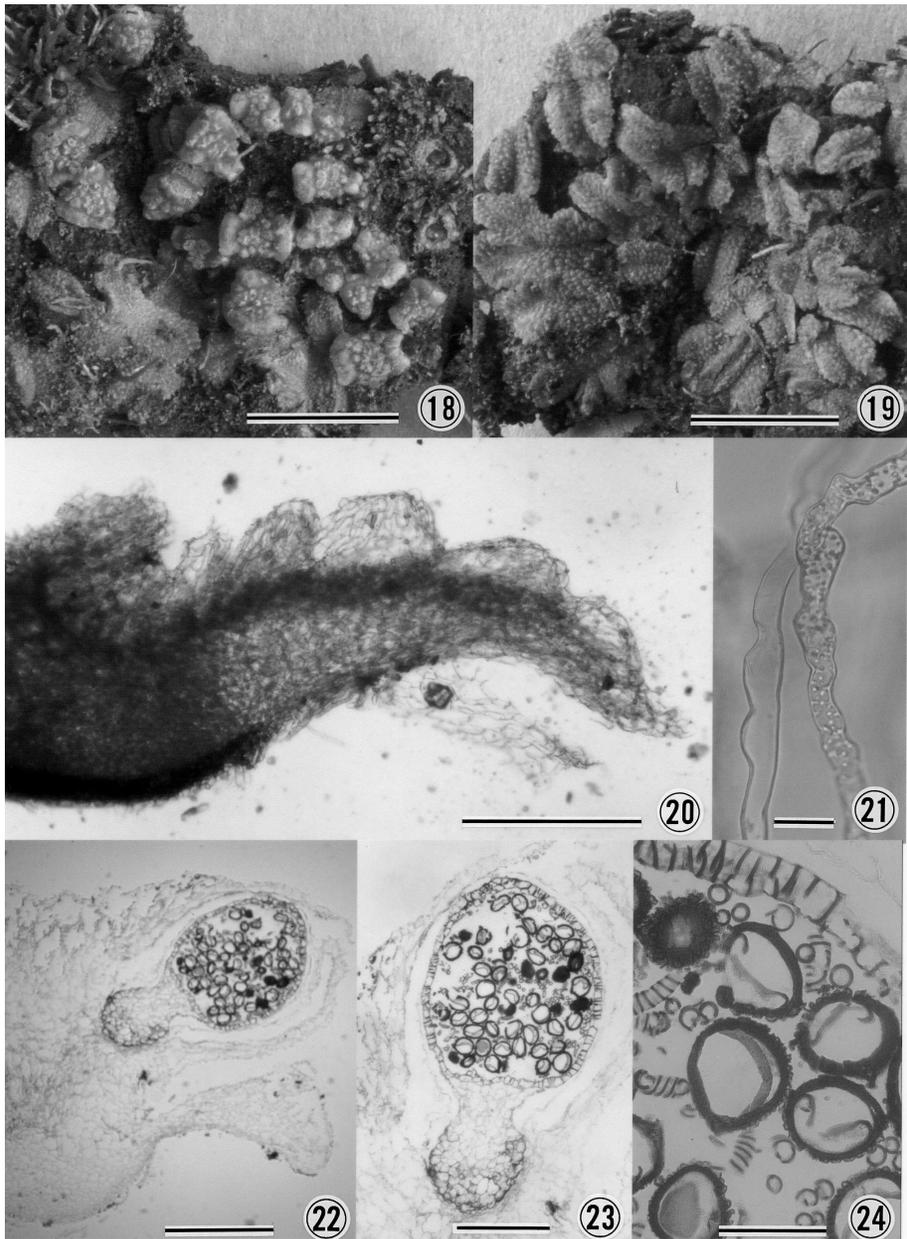
Typus: China. Sichuan Province, Mt. Siguniangshan, Double-bridge Valley, 3450 m alt., 31.00° N, 103.00° E, on soil by stream mixed with *Lophozia* sp. and *Jungermannia* sp., 23 August 1996, *Higuchi 29514* (holotype HKAS; isotypes TNS, NY).

Schiffner (1942) divided the genus *Exormotheca* into three sections, and Perold (1999) followed it: sect. *Exormotheca*, sect. *Corbierella* (Douin & Trabut) Schiffn. and sect. *Myrriorhynchus* Lindb. & Arnell.

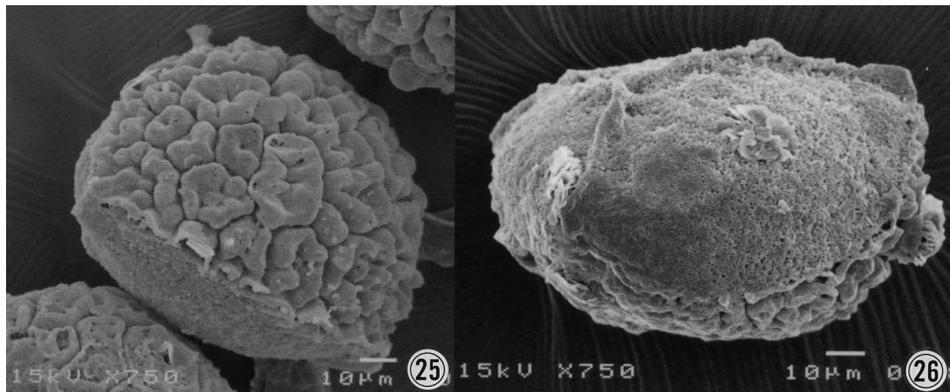
The sect. *Myrriorhynchus* includes one species, *E. fimbriata* (Nees) Lindenb. & H.W.Arnell distributed in South America (Schiffner, 1942; Hässel de Menéndez, 1962; Perold, 1999). This section is distinguished from others by the unique ventral scales with fan-shaped, multi-branched, filamentous appendages.



Figs 1-17. *Exormotheca bischleri* Furuki & Higuchi. **1.** Male plant. **2, 3.** Female plants with archegoniophore (**2:** dorsal view, **3:** ventral view). **4.** A cross section of the thallus. **5.** A cross section of the air chamber of the thallus. **6, 7.** Ventral scales. **8.** Apical part of ventral scale. **9.** Appendage of ventral scale. **10.** Sporophyte. **11, 12.** Cells of capsule walls (**11:** external view, **12:** internal view). **13.** A cross section of the stalk of the archegoniophore. **14, 15.** Spores (**14:** distal surface, **15:** proximal surface). **16, 17.** Elaters. All drawn from holotype.



Figs 18-24. *Exormotheca bischleri* Furuki & Higuchi. **18.** Female plants. Scale = 1 cm. **19.** Male plants. Scale = 1 cm. **20.** A cross section of the thallus. Scale = 0.5 mm. **21.** Rhizoids. Scale = 20 μ m. **22.** A cross section of an archegoniophore with a young sporophyte. Scale = 1 mm. **23.** Young sporophyte. Scale = 0.5 mm. **24.** A portion of the cross section of a young capsule. Scale = 100 μ m. All taken from holotype.



Figs 25, 26. SEM micrographs of spores of *Exormothea bischleri* Furuki & Higuchi. **25.** Distal surface of spore. **26.** Proximal surface of spore. All taken from holotype.

Exormothea bischleri differs from *E. fimbriata* by having ligulate to lunulate ventral scales with uniseriate cilia, rarely 2 cells wide at base, and appendages 5-10 cells long (Figs 6-9).

Section *Exormothea* consists of three species, *E. pustulosa* Mitt. from Europe and southeast Africa (Bischler, 1976; Perold, 1994, 1999), *E. tuberifera* Kashyap from Himalaya (Kashyap, 1914) and *E. ceylonensis* W.Meijer from Sri Lanka (Meijer, 1956). This section is characterized by the lower air chambers, the oblong to rounded ventral scales with 1 or 2 filiform appendages, the long stalks of the archegoniophores, the small spores and the long, trispiral elaters. Although *Exormothea bischleri* shows the similarity to the members of the sect. *Exormothea* in sharing the lower archegoniophores and the rounded ventral scales with 1-2 filiform appendages, it is critically distinguished from them by several aspects, such as the length of stalks of the archegoniophores, the size of the spores and the number of spirals in the elaters (Figs 16, 17).

The sect. *Corbierella* includes four species, *E. welwitschii* Steph. (= *E. bullosa* sensu Müll.Frib.) from Europe (Müller, 1954; Perold, 1991), *E. algeriensis* (Douin & Trabut) Schiffn. from north Africa (Schiffner, 1942), *E. holstii* Steph. from South Africa (Perold, 1994, 1999) and *E. bulbigena* Bornefeld, O.H.Volk & R.Wolf from South Africa (Bornefeld *et al.*, 1996). This section is characterized having strongly elevated air chambers, triangular, hyaline ventral scales with up to 5 filiform appendages, sessile archegoniophores, large spores and short, unispiral or ringed elaters. *Exormothea bischleri* has sessile archegoniophores (Figs 2, 3), large spores (Figs 14, 15, 25, 26) and mostly unispiral, short elaters (Figs 16, 17), which indicates that this species belongs to sect. *Corbierella*. Among the members of sect. *Corbierella*, *Exormothea welwitschii* is closely related to this species, in being dioicous and lacking tubers. *Exormothea algeriensis* is also dioicous, but it has tubers. Other two South African species are monoicous. *Exormothea bischleri* is distinguished from *E. welwitschii* by the short septa of the air chambers (Fig. 5) and rounded ventral scales with entire margins, ciliate appendages and oil-cells (Figs 6, 7). *Exormothea welwitschii* has tall septa of air chambers, which are *ca* 6 times as long as chlorophyllose fimaments, triangular ventral scales with ciliate margins and the lack of oil-cells.

Acknowledgements. We wish to express our sincere thanks to Prof. X.-J. Li, Prof. M. Zang and Mr. L.-S. Wang for their kind help in the field research in 1996. Many thanks are also due to Dr. W. R. Buck for correcting the English text. The material was collected with aid of a Grant-in-Aid for Overseas Scientific Survey (no. 07041151) from the Ministry of Education, Science, Sports and Culture, Japan.

REFERENCES

- BISCHLER H., 1976 — *Exormotheca pustulosa* Mitten. Distribution, écologie, caryotype, spores, parois sporales, germination. *Revue bryologique et lichénologique* 42: 769-783.
- BISCHLER H., 1998 — Systematics and evolution of the genera of the Marchantiales. *Bryophytorum bibliotheca* 51: 1-202.
- BORNEFELD T., VOLK O.H. & WOLF R., 1996 — *Exormotheca bulbigena* sp. nov. (Hepaticae, Marchantiales) and its relation to *E. holstii* in southern Africa. *Bothalia* 26(2): 159-165.
- HÄSSEL DE MENÉNDEZ G. G., 1962 — Estudio de las Anthocerotales y Marchantiales de la Argentina. *Opera Liloana* 7: 1-297.
- KASHYAP S.R., 1914 — Morphological and biological notes on new and little known West Himalaya liverworts. II. *New phytologist* 13: 308-323.
- MEIJER W., 1956 — A new species of *Exormotheca* from Ceylon. *Journal of the Hattori botanical laboratory* 16: 72-74.
- MÜLLER K., 1952 (1951-1958) — *Die Lebermoose Europas*. In: Rabenhorst's *Kryptogamenflora*, 3rd edition, Vol. 6: 397-403.
- PEROLD S.M., 1991 — Studies in the genus *Riccia* (Marchantiales) from southern Africa. 23. *R. bullosa*: typification and a full description. *Bothalia* 21(1): 129-135.
- PEROLD S.M., 1994 — Studies in the Marchantiales (Hepaticae) from southern Africa. 5. The genus *Exormotheca*, *E. pustulosa* and *E. holstii*. *Bothalia* 24(1): 15-23.
- PEROLD S.M., 1999 — Hepatophyta. Part 1: Marchantiopsida. Fascicle 1: Marchantiidae. In: Leistner, O.A. (ed.), *Flora of southern Africa*. Pretoria, National Botanical Institute, 252 p.
- SCHIFFNER V. F., 1942 — Monographie der Gattung *Exormotheca*. *Hedwigia* 81: 40-74.