

## New or Interesting Species of *Marsupella* in Japan

By

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(Received June 15, 1960)

In the last two decades, hepaticology in Japan has made a rapid progress and several elaborate taxonomic works have been published on various groups of Hepaticae, which had been unfortunately left aside for a long time. Some groups, however, are still in need of revision. As an example we may take the family Marsupellaceae, which has been left neglected by most Japanese hepaticologists, probably because of the dirty unattractive appearance and the difficulty of classification. The writer has investigated the Japanese species of Marsupellaceae and the work is now completed in manuscript. On *Gymnomitrium* the writer has already issued a brief report<sup>1)</sup>. In the present paper, an attempt has been made to afford some noteworthy results achieved in the course of his study of *Marsupella*.

Hepaticologists who touched upon the Japanese Marsupellaceae are four in all. In 1897<sup>2)</sup> and 1901<sup>3)</sup>, STEPHANI reported several species based chiefly on a collection made by U. FAURIE, a famous collector who travelled throughout Japan. Almost complete set of his collection is now available in our herbarium, and the writer has the good fortune to examine the duplicates of STEPHANI's original materials. After STEPHANI's presentation, we had no account of Japanese *Marsupella* up to 1934<sup>4)</sup>, when Prof. HORIKAWA described *Sphenolobus yakushimensis*, now known as *M. yakushimensis*. In 1950<sup>5)</sup>, Dr. S. HATTORI described *M. pseudofunckii*, thenceforth he has occasionally offered suggestive criticism on many species of *Marsupella* previously reported from Japan. Lastly in 1953<sup>6)</sup>, BONNER published STEPHANI's manuscript, in which four new species of *Marsupella* were described.

Since STEPHANI described *M. tubulosa* in 1897, about twenty 'species' of this genus have been reported for the hepatic flora of Japan. According to the

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- 1) Acta Phytotax. Geobot., 18: 33-38 (1959).
  - 2) Bull. Herb. Boiss., 5: 76-108 (1897).
  - 3) Ibid., Ser. 2, 1: 151-171 (1901).
  - 4) Journ. Sci. Hiroshima Univ., Ser. B., Div. 2, 2: 156 (1934).
  - 5) Journ. Hattori Bot. Lab., 4: 63 (1950).
  - 6) Candollea, 14: 253-256 (1953).

writer's investigation, many of them are to be referred to the species already known, and only the following seven species appear to deserve the specific status:—*M. tubulosa*, *M. pseudofunckii*, *M. yakushimensis*, *M. disticha*, *M. sphacelata*, *M. commutata* and *M. revoluta*. In the present paper, *M. tubulosa* is reduced to a subspecies of *M. emarginata*, and two new species and a variety are proposed. Thus, in Japan, the genus *Marsupella* is represented by nine species.

The writer here wishes to acknowledge the kind guidance rendered by Prof. S. KITAMURA and Dr. M. TAGAWA. Special thanks are also due to Dr. S. HATTORI for his kind criticism and support in various ways.

***Marsupella emarginata*** (EHRH.) DUM., *Comm. Bot.*, 114 (1882); STEPH., *Spec. Hepat.*, 2: 22 (1901); FRYE et CLARK, *Hepat. N. Amer.*, 6: 229 (1943); S. ARNELL, *Moss Fl. Fennosc.*, 1: 238 (1956); K. MÜLLER, in RABENHORST's *Krypt.-Fl.*, 3 Aufl., 6: 772 (1956).—*Jungermannia emarginata* EHRH., *Beitr.*, 3: 80 (1788), type from Europe.

Subsp. ***emarginata***.

Distribution: Europe, N. America, Canary Islands.

Carefully comparing rich materials of *M. tubulosa* from various quarters of Japan with some specimens of *M. emarginata* from Europe and N. America, the writer has arrived at a conclusion that *M. tubulosa* is closely allied to or even conspecific with *M. emarginata*. *M. tubulosa*, however, is not quite identical with *M. emarginata*. In the commonest and typical form of *M. tubulosa*, which includes the type specimen of that species, the apex of leaf lobe is broadly round and not pointed as in *M. emarginata*. Moreover, its leaves show a tendency to have unequal lobes. This fact is a noticeable feature which is also seen in the case of some other species of Japanese *Marsupella*, such as *M. pseudofunckii*, *M. yakushimensis* and *M. disticha*, all of which are so far endemic to Japan. So far as known to the writer, none of the European members of this genus is known to have leaf lobes unequal so strongly. Judging from the facts mentioned above and from the chorological point of view, it may be appropriate to reduce *M. tubulosa* into a subspecies of *M. emarginata*.

Subsp. ***tubulosa*** (STEPH.) N. KITAGAWA, *st. nov.*—*Marsupella tubulosa* STEPH., *Bull. Herb. Boiss.*, 5: 99 (1897), type from Unzen, Kyushu in Japan.

*Marsupella apertifolia* STEPH., *Spec. Hepat.*, 2: 23 (1901), type from Mt. Myoko, central Honshu in Japan.—*Marsupella tubulosa* var. *apertifolia* (STEPH.) S. HATT., *Bull. Tokyo Sci. Mus.*, 11: 78 (1944).

*Marsupella japonica* STEPH. ex BONNER, *Candollea*, 14: 255 (1953), type from Mt. Daisen, western Honshu in Japan.

*Marsupella emarginata* (EHRH.) DUM. *sensu* STEPH., *Bull. Herb. Boiss.*, 5: 80 (1897).

Distribution: Japan throughout, at lower to higher elevations, on rather dry to wet rocks or soil.

Representative specimens in KYO: HOKKAIDO. Mt. Taisetsu, N. KITAGAWA 1217; Mt. Meakan, N. KITAGAWA 1471. HONSHU. Pref. Iwate: Mt. Iwate-san, N. KITAGAWA 3886; Pref. Toyama: Mt. Tateyama, N. KITAGAWA 3663; Pref. Kyoto: Shizuhara, north of Kyoto, M. TAGAWA 2285; Pref. Nara: Mt. Oodaigahara, N. KITAGAWA 3260; Pref. Wakayama: Nachi, N. KITAGAWA 2662; Pref. Tottori: Mt. Daisen, U. FAURIE 411 (isotype of *Marsupella japonica* STEPH. ex BONNER); Pref. Hiroshima: Isl. Miyajima, U. FAURIE 1306. SHIKOKU. Pref. Tokushima: Mt. Tsurugi, T. KODAMA 7236; Pref. Ehime: Uwajima, T. SEKI 7667. KYUSHU. Pref. Nagasaki: Unzen, U. FAURIE 15380 (isotype of *Marsupella tubulosa* STEPH.); Pref. Kagoshima: Isl. Yakushima, M. TAGAWA & N. KITAGAWA 736.

This subspecies seems to be one of the commonest and variable hepatics in Japan. Plants named *M. tubulosa* are growing in dry or moist places and correspond with *M. emarginata* of Europe and N. America, and those named *M. apertifolia* occur in wet or submerged situation and correspond with *M. aquatica*. *M. apertifolia* is stouter than *M. tubulosa*, having leaves more or less reflexed on margin. These differences may, however, be caused from the effects of environmental factors, chiefly of humidity. Various intergrading forms are found between these two extremes. It is hardly possible to group these intermediates into the two named taxa, if they would be accepted. The type specimen of *M. apertifolia* (U. FAURIE s.n., Mt. Myoko-san) is unavailable in our herbarium. Judging from all the specimens labelled as *M. apertifolia* which were determined by its author, STEPHANI, and consulting his original description, the writer would prefer to unite *M. apertifolia* with the present subspecies.

*M. japonica*, of which the writer has examined the isotype (U. FAURIE 411), is somewhat different from the typical form of subsp. *tubulosa* in that the leaves are fairly distant from one another and have subacute lobes. So far as the leaf features are concerned, therefore, *M. japonica* looks like *M. pseudofunckii*, but other features indicate its closest affinity to subsp. *tubulosa*. Under consideration of exceeding variability of subsp. *tubulosa*, the writer is unable to maintain any distinction between *M. japonica* and the present subspecies.

*M. emarginata* was already reported by STEPHANI from Japan without citing any detail of specimens. Examining all the specimens of '*M. emarginata*' in FAURIE's collection, which are supposed to be named by STEPHANI, the writer prefers to regard all of them as the present subspecies.

Var. **patens** N. KITAGAWA, var. nov.

Dioica, mediocris, olivaceo-brunnea vel dilute brunnea, dense pulvinata. Caulis brunneus, ad 1.5 cm longus, 0.1 mm in diametro, cum foliis 1.1-2.3 mm latus, procumbens, subflore innovatus; radicellis parvis, pallidis. Folia caulina superiora majora, fere transverse inserta, approximata vel parum imbricata, succuba, subrecte vel arcuato patula, arcte conduplicata, inaequaliter incisobilobata, in plano 0.6-1.1 mm longa, 0.5-1.0 mm lata; lobis valde inaequalibus, triangulato-ovatis, obtusatis; sinu gibboso. Cellulae apicales  $8 \times 8 \mu$ , medianae  $10-11 \times 8-9 \mu$ , basales  $13-16 \times 8-10 \mu$ , parietibus validis; trigonis magnis acutis;

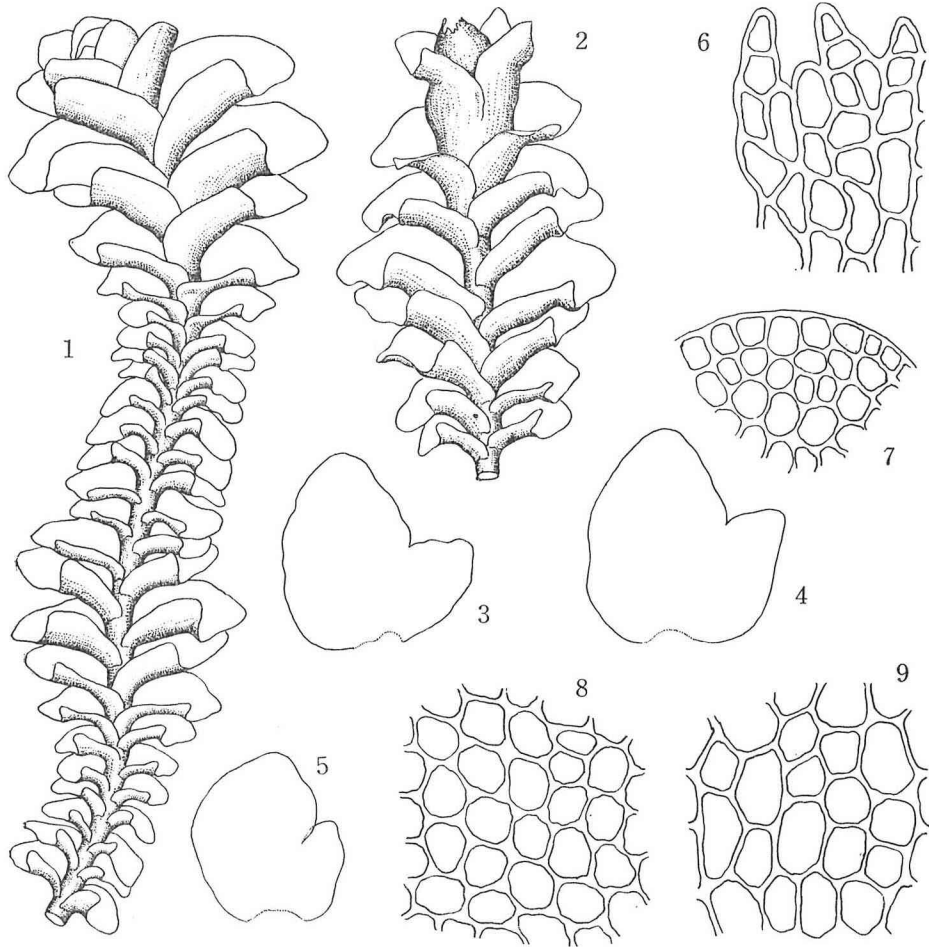


Fig. 1. *Marsupella emarginata* var. *patens* N. KITAG.

1. sterile shoot,  $\times 16$ .—2. female inflorescence,  $\times 16$ .—3-5. leaves,  $\times 42$ .—6. cells of perianth mouth,  $\times 435$ .—7. cells of leaf apex,  $\times 650$ .—8. cells of leaf middle,  $\times 650$ .—9. cells of leaf base,  $\times 650$ .

cuticula fere levis. Perichaetia obovata; bracteis bijugis, majoribus quam foliis caulinis, supremis erectis, ad medium connatis. Perianthia perichaetio aequilonga, ad 2/3 coalita; ore contracto, crenulato vel mamillatim dentato. Capsula fusco-brunnea; strato interno semi-annulatim incrassato, eo externo nodulatim. Seta ad 4 mm longa.

Holotype: K. IWATSUKI & N. KITAGAWA 37 from Mt. Gozaisho, on wet rock at an altitude of ca. 800 m, Pref. Mie, Honshu in Japan, KYO.

Other specimens examined: SHIKOKU. Pref. Ehime: between Nateba and

Tonaru, Nii-gun, M. TOKUI 938, NICH. KYUSHU. Pref. Kumamoto: Mt. Ichifusa, 1,100 m alt., on moist rock, K. MAYEBARA 1580, NICH.

This variety may be rather clearly distinguished by having distinctly conduplicate and straight or arcuately spreading leaves with highly unequal lobes. The leaf lobes are so extremely unequal that they look superficially like those of *Diplophyllum*. If only the leaves were taken into consideration, this plant would be regarded as a separate species. It is, however, quite similar to *M. emarginata* subsp. *tubulosa* in its leaf cells, female inflorescence and capsule walls. Considering these similarities and the extraordinary variability of subsp. *tubulosa*, the writer prefers to recognize the present plant as a variety of this subspecies.

***Marsupella alata* S. HATTORI et N. KITAGAWA, sp. nov.**

Dioica, mediocris, olivaceo-brunnea, dense pulvinata. Caulis brunneus, ad 1.5 cm longus, 0.17 mm in diametro, cum foliis 0.8–1.2 mm latus, procumbens, subflore innovatus; radicellis parvis, pallidis. Folia caulina fere transverse inserta, contigua sed superiora conferta, carinato-conduplicata, oblique patula, 1/7–1/6 viae deorsum bilobata, in plano rotundato-quadrata, 0.55–0.65 mm longa, 0.55–0.60 mm lata; lobis inaequalibus, obtusis vel rotundatis; sinu gibberoso; carina conspicue alata. Cellulae apicales  $10 \times 10 \mu$ , medianae  $10-13 \times 10-13 \mu$ , basales  $13-17 \times 13-15 \mu$ ; parietibus tenuibus; trigonis magnis, acutis; cuticula levis. Perichaetia obovata; bracteis 2–3 jugis, multoties majoribus quam foliis caulinis, erectis, alte connatis, tenuiter inaequali-bilobata, margine undulatis; carinis distincte alatis. Perianthia perichaetiis aequilonga, ad 2/3 coalita; ore crenulato, aliquantum contracto. Androecia intercalaria; bracteis 3–4 jugis, valde ventricosis, ceterum foliis caulinis similibus. Antheridia ad 3, ovalia, longe stipitata.

Holotype: H. INOUE 6344 from Mt. Shirouma, on serpentine rocks in shade at an elevation over 1,600 m, Pref. Nagano, Honshu in Japan, NICH.

Other specimens examined: HONSHU. Pref. Nagano: Mt. Shirouma, on moist granite, 1,900–2,000 m alt., H. INOUE 6218, NICH; Pref. Yamagata: Mt. Chokai-zan, Y. IKEGAMI 1427, NICH.

This species is best characterized by the acutely conduplicate leaf with a keel bearing conspicuous wing. The conduplicate leaves with unequal lobes of this species exhibit some similarity to those of *M. pseudofunckii*, but in the latter species, the keels are free from wings and usually arcuate, and the lobes are not so round but subacute. The present species may be most closely related to *M. disticha*, from which it is distinguished by the larger size of plants, the leaf-keel with wing and the thin walled leaf cells with distinct trigones.

Acute conduplication of the leaves seems to be a tendency peculiar to a series of species of Japanese *Marsupella*, viz. *M. pseudofunckii*, *M. yakushimensis*, *M. disticha* and *M. emarginata* var. *patens*; they are mostly found in warm temperate regions and are all endemic to Japan at present. In the present

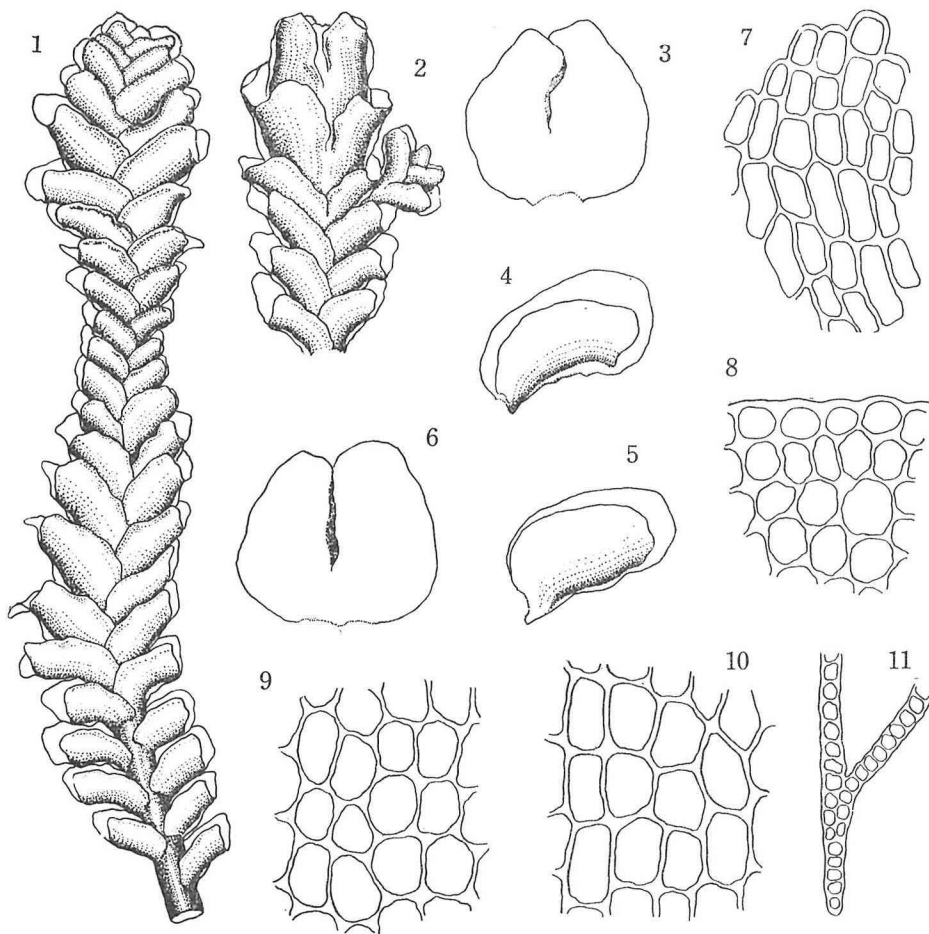


Fig. 2. *Marsupella alata* S. HATT. et N. KITAG.

1. sterile shoot,  $\times 16$ .—2. female inflorescence,  $\times 16$ .—3-6. leaves,  $\times 42$ .—7. mouth of perianth,  $\times 435$ .—8. cells of leaf apex,  $\times 650$ .—9. cells of leaf middle,  $\times 650$ .—10. cells of leaf base,  $\times 650$ .—11. cross section of leaf keel,  $\times 210$ .

new species the conduplication of leaves reaches its culmination, a conspicuous wing growing out of the keels. In the species of *Marsupella* widely distributed in the north temperate zone, their leaves are not so sharply keeled so far as the writer knows. The writer may call special attention to the fact that, in spite of having strongly conduplicate leaves, *M. alata* is found not in warm temperate regions but in the alpine or the subalpine regions of the central and the northern districts of Honshu.

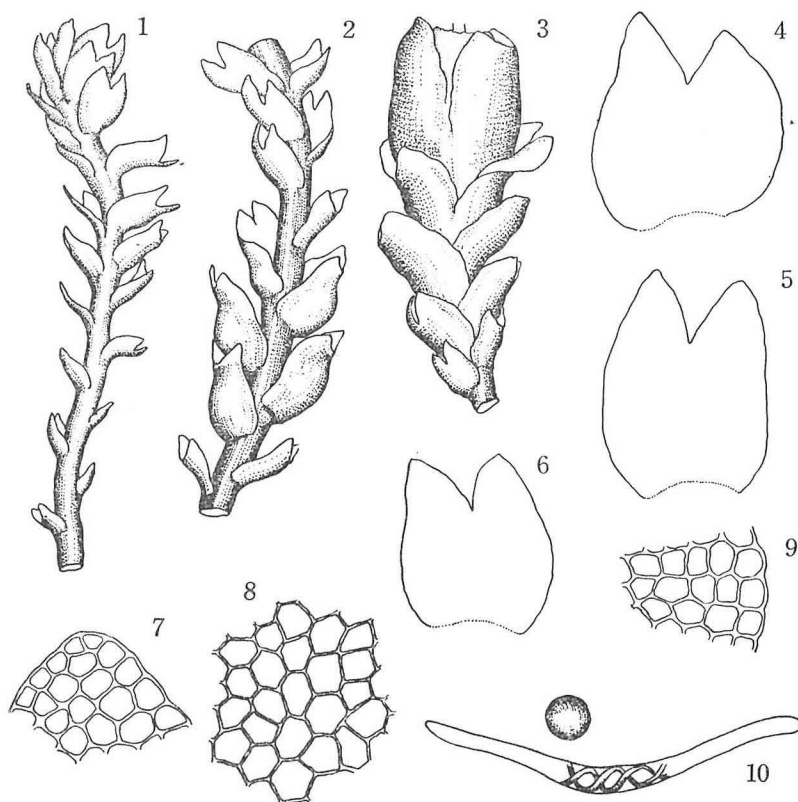


Fig. 3. *Marsupella minutissima* N. KITAG.

1. sterile shoot,  $\times 42$ .—2. male inflorescence,  $\times 42$ .—3. female inflorescence,  $\times 42$ .—4-6. leaves,  $\times 100$ .—7. cells of leaf apex,  $\times 435$ .—8. cells of leaf middle,  $\times 435$ .—9. a part of cross section of stem,  $\times 435$ .—10. elater with a spore,  $\times 650$ .

***Marsupella minutissima* N. KITAGAWA, sp. nov.**

Dioica, minutissima, tenera flaccidaque, fusco-brunnea, dense depresso-caespitosa. Caulis ad solum 2 mm longus, 0.07–0.09 mm in diametro, ascendens vel erectus, superne simplex; radicellis parvis. Folia caulina fere transverse inserta, remota, oblique patula, late ovata, 0.25–0.32 mm longa, 0.2–0.28 mm lata, ad 1/3 viae deorsum bilobata; sinu obtuso vel acuto; lobis ovato-triangularis, subacutis vel acutis. Cellulae apicales  $11 \times 11 \mu$ , medianae  $11-14 \times 13-15 \mu$ , basales  $13-15 \times 14-16 \mu$ ; parietibus tenuibus; trigonis parvis; cuticula levis. Perichaetia terminalia, capitata; bracteis 3–4 jugis, confertis, majoribus quam foliis caulinis, breviter acuteque bilobatis, superioribus e base coalitis erectis. Perianthia perichaetio breviora, ad 2/3 coalita; ore minute crenulato. Androecia intercalaria, bracteis 2–3 jugis, valde ventricosis, majoribus quam foliis caulinis, subrectis,

apice angustatis, tenuiter bilobatis. Antheridia solitaria (?), ovalia, longe stipitata. Capsula globosa, 0.17 mm in diametro, parietibus nodulosis; sporis  $10\mu$  in diametro, fere levibus; elateris  $110\mu$  longis,  $8\mu$  latis, bispiralibus.

Holotype: K. OCHI 1927 from Mt. Nishiakaishi, Pref. Ehime, Shikoku in Japan, NICH.

Only known from the type-collection.

By its extremely small size and slender habit this species is easily distinguished from all the other Japanese members of this genus. It is hardly possible that the type collection represents a dwarf form of some species else, because it bears many full-grown sporophytes. The plants remind us of one of small forms of exceedingly variable *M. emarginata* subsp. *tubulosa*, but they differ from the latter in having more deeply lobed, narrower leaves composed of cells with less distinct trigones. There is also a clear difference in the capsule wall: in *M. minutissima* numerous nodular thickenings are found in the inner layer of capsule, while in *M. emarginata* subsp. *tubulosa* thickenings of inner layer are semi-annular.

It may be *M. bolanderi* known from the western coastal regions of N. America, which allies most closely to the present species, but the writer can not state this positively, for he has not examined any material of *M. bolanderi*. Judging from literature, the present species is very similar to *M. bolanderi* in colour and size of plant, form of leaves, male and female inflorescences and in capsule walls, but differs distinctly in size of leaf cells. In his original description of *M. bolanderi*, C. F. AUSTIN<sup>7)</sup> does not give definitely the size of leaf cells and notes that the species is remarkable chiefly for its leaf cells being the largest of the genus<sup>8)</sup>. According to M. A. HOWE<sup>9)</sup> and FRYE & CLARK<sup>10)</sup>, size of leaf-median cells of *M. bolanderi* is said to be  $16-36\mu$ , while in the present species it is only  $11-15\mu$ .

It may be characteristic of the alpine hepatic flora of Japan that minute species such as those of Cephaloziaceae and Cephaloziellaceae are rather scanty. Likewise in Marsupellaceae, minute species like *M. ustulata*, *M. sprucei*, *M. adusta*, *M. varians* and *M. pygmaea* can not be found there. *M. minutissima* resembles these species in its small size, but is distinguishable from the latter in several respects. *M. ustulata* is paroecious and its trigones larger; *M. sprucei* and *M. adusta* are also paroecious, the cells of the former much larger, and the elater of the latter bearing 4 spirals; in *M. pygmaea* and *M. varians*, leaves are more closely imbricate, leaf base of the former narrower, and the elater of the latter with 4 spirals.

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7) Bull. Torr. Bot. Club, 3: 9 (1872).

8) The 'genus' means *Sarcoscyphus*, under which *Marsupella bolanderi* was first described.

9) Mem. Torr. Bot. Club, 3: 86-88 (1899).

10) Hepaticae of North America, 222-223 (1943).