

***Bryoxiphium norvegicum* (Bryopsida: Bryoxiphiaceae),  
newly found in Mauritius**

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*Bryoxiphium norvegicum* (蘚綱：エビゴケ科)，  
モーリシャスで見つかる

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抄録：モーリシャス新産となる*Bryoxiphium norvegicum*を発見した。モーリシャスはこれまでに知られているすべてのエビゴケ属植物の分布域から地理的にかげ離れた場所であり、蘚類における隔離分布の好例となる。本種には分布域の異なる二亜種、subsp. *norvegicum*とエビゴケsubsp. *japonicum*とがある。エビゴケの重要な特徴は、雌苞葉の先端部に著しい鋸歯があり、通常葉の先端が丸みを帯び凹型になり、突出した中肋部に鋸歯をもつことである。一方、基本亜種subsp. *norvegicum*では、雌苞葉の先端は鈍頭で中肋の突出が短い。モーリシャスの植物は通常葉の先端が丸みを帯び凹型になる形態から判断するとエビゴケと似ているが、突出した雌苞葉の先端部には鋸歯がみられない点でエビゴケとは異なる。今回の研究で日本産のエビゴケ標本を多数検討したが、雌苞葉の先端部の鋸歯の程度には変異が認められ、なかには全縁なものも存在する。よって、これまでの両亜種の識別点となっていた形質は不安定であり、分類学的再検討が必要である。

**Abstract:** We found a specimen of the genus *Bryoxiphium* among the small collections from Mauritius. Mauritius is much apart from any previously known distribution areas of the genus, and thus this is a good example of disjunct distributions in mosses. We identified the plant as *B. norvegicum*. This species has been divided into two subspecies; subsp. *norvegicum* and subsp. *japonicum*. Morphology of the Mauritius plant, such as abruptly rotundate or obtuse-cordate apex of ordinary leaves with long, excurrent and serrulate costa, corresponds with that of subsp. *japonicum*. It is, however, different from the subspecies in the entire perichaetial leaf. We examined a number of specimens of *B. norvegicum* subsp. *japonicum* and found that the diagnostic characters of the two subspecies are unstable. Therefore, infraspecific treatment was not concluded here.

**Key Words:** Moss; *Bryoxiphium norvegicum*; Mauritius; Disjunct distribution

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The genus *Bryoxiphium* is a small genus (only five species have been described for the genus), and easily distinguished from other mosses by their unique appearance of distichous foliation. Löve & Löve (1953) revised the genus and classified all the previously described species of the genus into two species: *B. madeirense* A. Löve & D. Löve and *B. norvegicum* (Brid.) Mitt. In the latter species, they recognized two infraspecific taxa, such as subsp. *japonicum* (Berggr.) A. Löve & D. Löve and subsp. *norvegicum*. The latter are again divided into two varieties; var. *norvegicum* and var. *mexicanum* (Besch.) A. J. Sharp, though some taxonomists treated them as independent species (Lee, 1958; Sharp et al., 1994).

The distribution of *Bryoxiphium madeirense* is restricted to Madeira; five islands located north west Africa (Löve & Löve, 1953). On the other hand, *B. norvegicum* has a very wide distribution range: subsp. *norvegicum* reported from Greenland, Iceland and North America (Löve & Löve, 1953), and subsp. *japonicum* from Russia Far East, Japan, Korea (Löve & Löve, 1953), Taiwan (Nakanishi, 1958), China (Lee, 1958; Gao & Crosby, 2000) and Indonesia (Pogs, 1966). *B. norvegicum* var. *mexicanum* has been reported only from Mexico (Löve & Löve, 1953). The distribution pattern suggests that both subspecies are pre-glacial and interglacial relicts (Steere, 1937; Horikawa, 1948).

Examining the moss collections from Mauritius, we found *Bryoxiphium* plants among them. We identified it as *B. norvegicum* based on the leaf morphology.

From the phytogeographical view, it is noteworthy that the genus was newly found in the western Indian Ocean, about 20° S Lat., far from any previously reported areas of the genus. This is one of the typical examples of disjunctive distribution in mosses, such as *Takakia lepidozoides* S. Hatt. & Inoue (Alaska, Japan, Borneo, Nepal; Hattori & al., 1974) and *Solmsiella biseriata* (Austin) Steere (U.S.A., Mexico, Taiwan, Ceylon, Indonesia, India, Thailand; Iwatsuki & Sharp, 1967).

*Bryoxiphium norvegicum* (Brid.) Mitt., Jour. Linn. Soc., Bot. 12:580 (1869) .  
(fig. 1.)

**Description.** Plants yellowish green. Stems simple, up to 18 mm long; the bulb-like base with numerous brown rhizoids. Leaves erect appressed, closely imbricate, oblong-lanceolate, widest at the base, 1.5-3.0×0.3-0.4 mm; vaginant lamina rotund-obtuse or rather emarginated above. Leaf margins bordered in several rows of elongated cells. Marginal cells are considerably longer than the laminal ones; 20-50×2-4 μm. Dorsal wing consisting 2-4 rows of cells, not reaching to the leaf base. Laminal cells of middle part of leaves are irregularly rotund, 7-12 μm; basal cells of the vaginant lamina rectangular, thin-walled, 17-24×6-12 μm. Costa stout, excurrent (long excurrent for the upper and perichaetial leaves). Upper and perichaetial leaves linear-lanceolate, gradually tapering to long acuminate hairy point, much longer than ordinary leaves, 4-8 mm long. Perigonia and fruiting plants not seen.

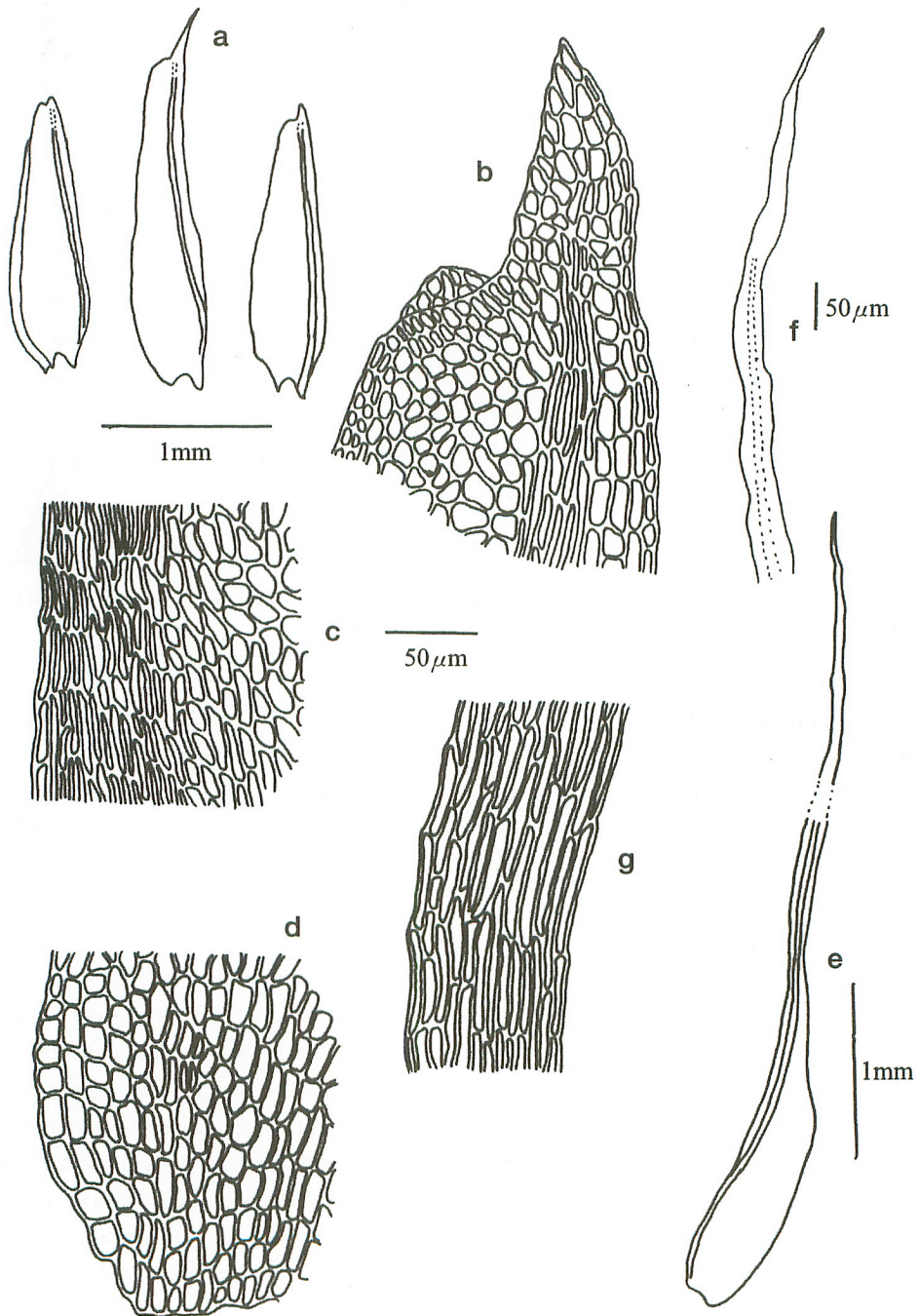


Fig. 1. *Bryoxiphium norvegicum*. a: Ordinary leaves. b: Cells at ordinary leaf apex. c: Leaf margin of middle part of ordinary leaf. d: Cells at leaf base. e: Perichaetial leaves. f and g: Tip of perichaetial leaf. [All drawn from Seto M-57]

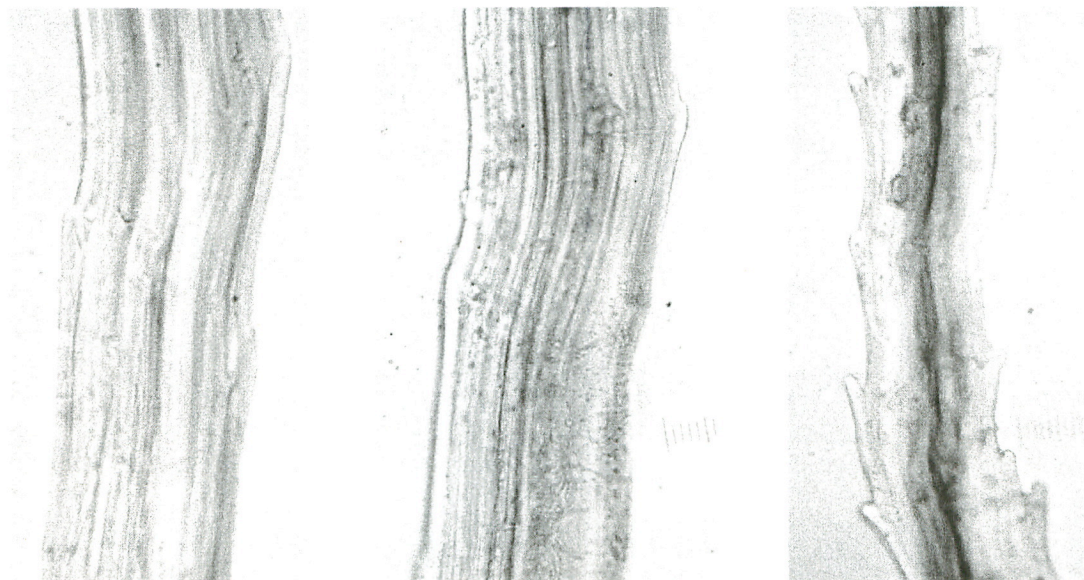


Fig. 2. Photographs showing apical portion of perichaetial leaves. a: Seto M-57. b: Iwatsuki & Chuang s.n., 1969. c: Yamamoto s.n., 1941. All specimens are deposited in OSA.

**Specimens examined.** Mauritius; Plaine Champagne Nature Reserve, on rock cliff by a stream, rather shaded place, Oct. 24, 1980, coll. Seto M-57 (OSA). New to Mauritius.

**Remarks.** According to Löve & Löve (1953), *B. norvegicum* subsp. *japonicum* is different from subsp. *norvegicum* as following characters; 1) tips of perichaetial leaves are distinctly serrulate, 2) ordinary leaves are abruptly rotundate or obtuse-cordate at the tips with long, excurrent and serrulate costa. In subsp. *norvegicum*, var. *mexicanum* differs from the type variety in the more regular and not much differentiated marginal cells.

Subspecies *norvegicum* was once reported from China (Lee, 1958) based on different classification from Löve & Löve (1953). Lee (1958) recognized that subsp. *norvegicum* is characterized by shorter plant size (about 1-3 cm long), ordinary leaves with short awn, gradually narrowed or rotundated at apex, with narrow dosal wing (only 1 cell wide), and perichaetial leaves with short, remotely serrulate awns, while subsp. *japonicum* (as *B. japonicum*) by longer plants size (about 3-5 cm long), ordinary leaves cordate at tips with long awn, with wider dosal wing (composed of 2-3 rows of cells), and perichaetial leaves with longer, densely and sharply serrate awns. Gao & Crosby (2000) followed Lee's taxonomic treatment. Iwatsuki & Sharp (1966) pointed that both leaf shape and width of dosal wing are quite variable even among leaves collected from different portions of the same stem, and that plant size are also highly variable depend on habitat conditions, especially when growing in the places with high humidity, and suspected the identification of subsp. *norvegicum* from China.

Based on Löve & Löve (1953), the material of Mauritius should be identified as *B. norvegicum* subsp. *norvegicum* by the bulb-like basal stem and the entire perichaetial leaves. The

Mauritius plants, however, have rotunded-obtuse or rather emarginate apices of ordinary leaves, and are similar to subsp. *japonicum*. Nakanishi (1964) reported perichaetial leaves of subsp. *japonicum* from Taiwan to be less serrulate at the tip. A number of Japanese materials kept in the herbarium of Osaka Museum of Natural History (OSA) was examined, and the shape of apical part of perichaetial leaves shows variation; one example with entire perichaetial leaves (Exiccate Musci Japonici no. 1156, collected by Z. Iwatsuki & C. C. Chuang from Miyazaki; fig. 2-b). Variation of ordinary leaves also has been reported (Lee, 1958). Therefore, serration or entire margin of perichaetial leaves is unstable and should not be used for the diagnostic character separating two subspecies. Taxonomic study of infraspecific variation is necessary.

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