

FRUITING PLANTS OF *BRYUM* FOUND IN THE VICINITY OF SYOWA STATION, ANTARCTICA

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Abstract: Fruiting plants of *Bryum* are recorded for the first time in the vicinity of Syowa Station, East Antarctica. These were collected at four localities along Sôya Coast, namely, Rundvågshetta, Strandnibba, Einstöingen and Langhovde. Specimens from the Syowa Station area were compared with those from other polar regions, especially with respect to the morphological features of peristome teeth and spores. The fruiting plant was concluded to be *Bryum amblyodon* C. MUELL., which is a new addition to the bryaceous flora of Continental Antarctica.

1. Introduction

STEERE (1961) recorded 15 species in the genus *Bryum* from the Antarctic Continent. OCHI (1979) treated six of these species as synonyms of *Bryum pseudotriquetrum* (HEDW.) GAERTN., MEYER et SCHERB. and one as a synonym of *Bryum argenteum* HEDW. Furthermore, KANDA (1981) excluded *Bryum antarcticum* HOOK. f. et WILS. from Bryaceae and synonymized it with *Pottia heimii* (HEDW.) HAMPE. Recently OCHI and OCHYRA (1985) and OCHYRA and OCHI (1986) added four species of *Bryum* to the moss flora of Antarctica. These were *B. amblyodon* C. MUELL., *B. dichotomum* HEDW., *B. orbiculatifolium* CARD. et BROTH. and *B. urbanskyi* BROTH. all being collected from Maritime Antarctica. Then they reduced *B. imperfectum* CARD. to a synonym of *B. amblyodon*.

The sporophytic characters are basically very important for correct identification of the species in *Bryum*. However, no specimens with good sporophytes have been previously reported from Continental Antarctica, although FILSON and WILLIS (1975) found some immature sporophytic material of *B. algens* in Fold Island, Continental Antarctica. This situation makes the taxonomic workings of *Bryum* in Antarctica very difficult and apparently there has been considerable taxonomic confusion in the past records of *Bryum* species from this region. Several species of *Bryum* have been reported in Antarctica which are closely related to *B. pseudotriquetrum*, but OCHI (1979) only recognized two species from Syowa Station, *B. argenteum* and *B. pseudotriquetrum*. Antarctic *Bryum* plants are almost always sterile, often with poorly developed stems bearing no sexual organs. Vegetative characters are generally not available for taxonomic treatment for the following reasons: 1) the stems are extremely variable in length, thickness, foliation, branching, etc., 2) the leaves vary in size, shape, serrulation and revolution of margin, length and thickness of the costa, differentiation of border, etc. and 3) leaves

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are often damaged mechanically. Recently SEPPELT and KANDA (1986) evaluated the morphological variation in Antarctic species of *Bryum* based on specimens from the Syowa Station area. They confirmed *B. pseudotriquetrum* and *B. argenteum* as distinct taxa in Continental Antarctic flora and supported OCHI's (1979) taxonomic conclusion.

The senior author participated in the 24th Japanese Antarctic Research Expedition (JARE-24) in 1983–84 and he collected fruiting material of *Bryum* from four localities in the vicinity of Syowa Station.

This study aims to clarify the taxonomic position of these fruiting specimens of *Bryum* from the Syowa Station area.

2. Results and Discussion

2.1. Fruiting plants of *Bryum* from Syowa Station area

Fruiting plants of *Bryum* are recorded and illustrated in detail here for the first time from the vicinity of Syowa Station, though the occurrence of sporophyte of *Bryum* sp. was briefly reported in other papers (KANDA, 1986; SEPPELT and KANDA, 1986). These were collected at four localities, namely, Rundvågshetta, Strandnibba, Einstöingen and Langhovde (Fig. 1). The material from Rundvågshetta bore fully mature capsules. The fruiting plants grew there on wet soil at the foot of cliffs or beneath the edges of boulders

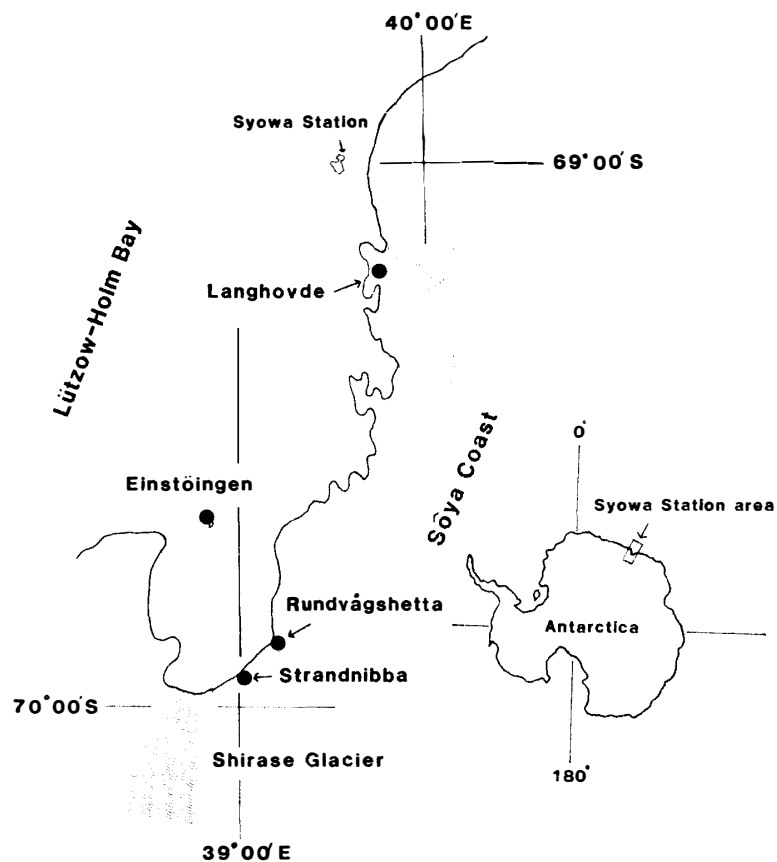


Fig. 1. Distribution of *Bryum amblyodon* C. MUELL. in the Syowa Station area.

on banks of streams. Based on this specimen (NIPR 840906-009), the following description is prepared (Fig. 2).

Plants small to medium-sized, 1–2 cm high, in loose or compact tufts, yellowish-green to golden yellow, brown below. Stems reddish, radiculose below, with papillose rhizoids, much branched. Leaves spreading, ovate-lanceolate to triangular-lanceolate, gradually narrowed to long-acuminate apices or awned-points, 1.2–2.0 mm long, 0.5–0.8 mm wide, yellowish green, reddish at base; cells elongated hexagonal, 50–70 μm long, 9–16 μm wide, with thickened, weakly pitted walls, in upper part a little shorter, narrower, 40 μm long, 7 μm wide, the alar part differentiated by reddish, inflated, thin-walled, subquadrate cells; margins usually bordered with elongated and narrow cells in one or two cell rows but sometimes scarcely differentiated; strongly and broadly (45–55 μm in width) recurved throughout the leaf margin except at the apex, or sometimes plane, entire but clearly serrulate near the apex; costa strong, 80 μm wide in the basal part, usually short- to long-excurrent. Synoicous. Perichaetial leaves not well differentiated, narrower towards the base. Setae short, 1.0–2.0 cm long; calyptra cuculate; operculum small, short-conic; capsule oblong, elongated ovate, dark-brown, 1.5–2.5 mm long, 0.7 mm thick (Fig. 4, 1); cells at the mouth of capsule constricted in 2–3 rows, subquadrate; annulus in 3 cell-rows; exostome teeth 0.25 mm long, yellowish, finely papillose; endostome with a low basal membrane, 90 μm long, thin-walled; cilia 1–3, rudimentary; spores rather coarsely papillose, (15–)20–25(–30) μm in diameter.

OCHI (1979) preliminarily recognized two species of *Bryum*, *B. pseudotriquetrum* and *B. argenteum*, from the Syowa Station area. In the specimens tentatively named *B. pseudotriquetrum*, the vegetative leaves are characterized by peculiar serrulation in the uppermost part of the margin and somewhat decurrent base. Judging from these features, almost all bryaceous specimens except *B. argenteum* growing there are considered to be included in one of the three species, *B. algovicum*, *B. amblyodon* (= *B. stenotrichum*) and a synoicous form of *B. pseudotriquetrum* (*bimum* type).

The fruiting specimens collected from the Syowa Station area are well characterized by the following features: (1) a small operculum, (2) 1–3 rudimentary cilia, and (3) coarsely papillose spores, (15–)20–25(–30) μm in diameter. These features are positively different from those of *Bryum pseudotriquetrum* (Figs. 4 and 5).

The present authors examined sufficient Antarctic specimens of *Bryum* spp., comparing with those from Maritime Antarctica, southern South America and arctic regions, and we concluded that the fruiting plant from Syowa Station area should be assigned to *B. amblyodon*. *Bryum amblyodon* is distinguishable from the synoicous form of *B. pseudotriquetrum* by smaller opercula, less developed endostome and more coarsely papillosed spores. It is also separated specifically from *B. algovicum*, which has been considered to be very closely related to *B. amblyodon*, in having a less pointed operculum, exostome teeth free from each other (not aggregated conic), and endostome free from the outer teeth (endostome connected to the outer in the basal part).

FILSON and WILLIS (1975) reported fruiting plants of *Bryum algens* from Fold Island, Kemp Land. As far as their description and illustration are concerned, the plants are very similar to those from the Syowa Station area, especially in features of the capsule and the endostome segments free from the outer teeth. SEPPELT and KANDA (1986)

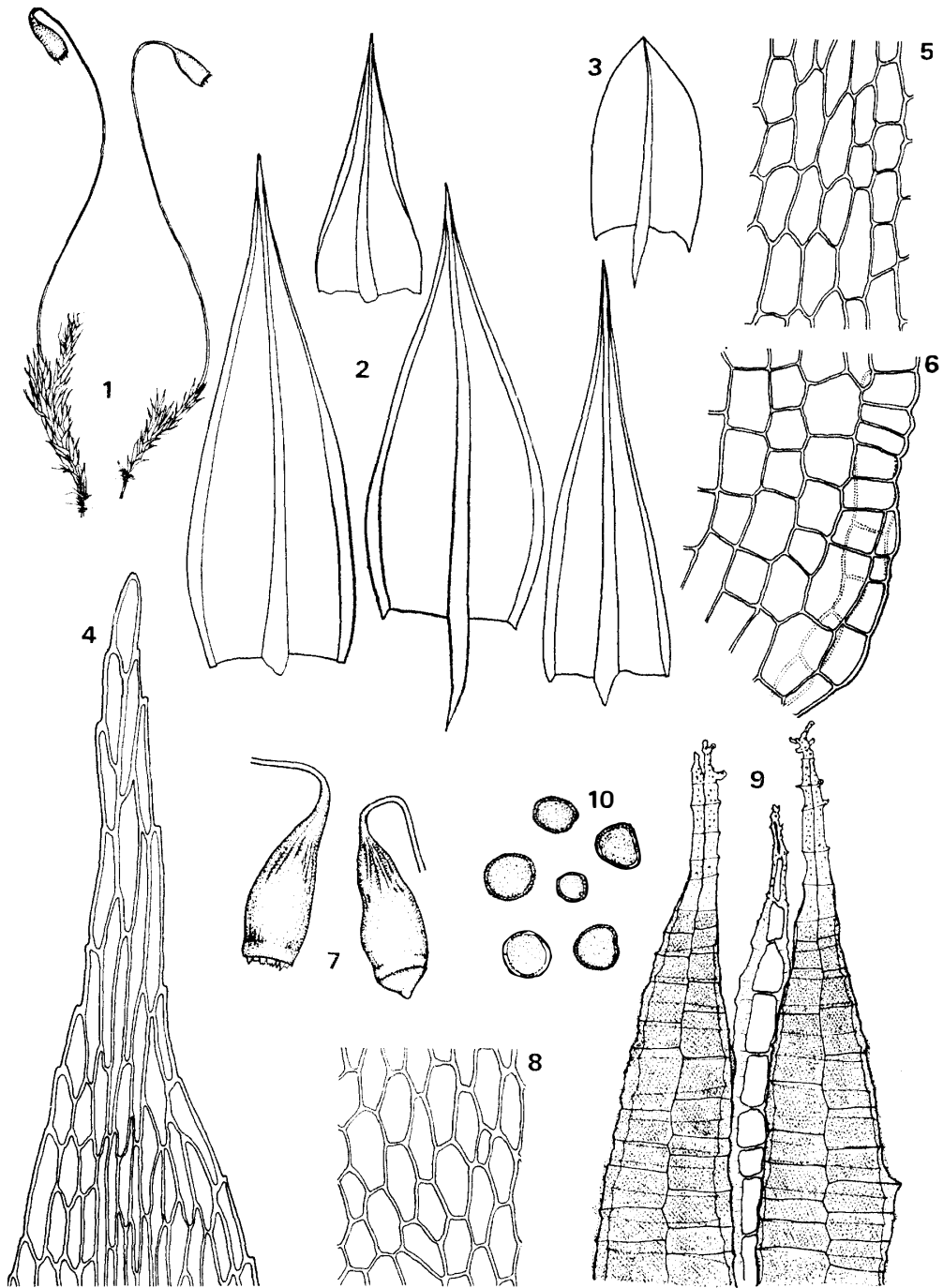


Fig. 2. *Bryum amblyodon* C. MUELL. 1: Fruiting plants. 2: Stem leaves. 3: Leaf at the basal part of stem. 4: Leaf apex. 5: Median laminal cells. 6: Basal cells of leaf. 7: Capsules. 8: Exothecial cells. 9: Peristome teeth. 10: Spores. 1: $\times 3$. 2, 3: $\times 30$. 4-6, 8-10: $\times 200$. 7: $\times 10$. Drawn from 840906-009 (Syowa Station area).

reported preliminarily the second locality of fruiting plants of *Bryum* sp. in Kemp Land, Kemp Peak in the Stillwell Hills. The stem leaves and the median laminal cells of the plants from Kemp Land are somewhat shorter than those of the Syowa Station area, measuring $0.8-1.8 \times 0.45-0.7$ mm in stem leaves and $25-65 \mu\text{m}$ in length in median

laminal cells, respectively. The marginal laminal cells of those from the Syowa specimens are distinctly bordered by more elongated cells, and occasionally towards the leaf apex there is a very slight serrulation. Furthermore, the margins are more distinctly recurved than in those having been studied elsewhere. RASTORFER (1971) succeeded in getting mature sporophytes of *B. antarcticum* in culture. Their features also look like those of *Bryum amblyodon*, judging from the description and photograph.

On the other hand, the authors observed the distinction between leaves of *Bryum amblyodon* and those of the synoicous form of *B. pseudotriquetrum*. The former is distinguishable from the latter by the following characters: (1) stem leaves tending to be more lanceolate, (2) leaf apex more longly acuminate into awned-point, (3) cells at leaf apex longer, (4) less decurrent at leaf base, and (5) costa usually more longly excurrent even in lower leaves. However, it is almost impossible to distinguish *B. amblyodon* and *B. pseudotriquetrum* from each other when plants are insufficiently developed, just as discussed previously (OCHI, 1979).

2.2. *Comparison of the fruiting specimens from the Syowa Station area with those of B. amblyodon from other regions (Fig. 3)*

(a) Maritime Antarctica (*South Shetland Islands, King George Island, Ochyra 967/80, Fig. 3: 9–11*): This specimen has some innovated shoots with synoicous inflorescences (but sometimes only antheridia formed). The stems are much radiculose even in the upper part. The leaves are similar to those from the Syowa specimens in size, but they are usually long acuminate with long awned-points but sometimes less acuminate. The median laminal cells are rather variable in comparison with those of the Syowa specimens, measuring $40\text{--}90 \times 15\text{--}20 \mu\text{m}$. The alar part of the leaf is well differentiated, with inflated subquadrate cells, but it is not colored reddish like in the Syowa specimens. The leaf margins are recurved in a relatively narrow zone of $20\text{--}34 \mu\text{m}$ in width. In contrast, those of the Syowa specimens are wider, measuring $45\text{--}55 \mu\text{m}$ in width. The sporophytes are very similar to those of the Syowa specimens, although they have larger exostome (about $300 \mu\text{m}$ long) and endostome (about $120 \mu\text{m}$ long) teeth.

(b) Chile (*Santiago, Mahu 20424, Fig. 3: 5–8*): The median laminal cells are more similar to those of the Syowa specimens than those from the King George Island described above, measuring $50\text{--}70 \times 12 \mu\text{m}$, and the alar part is also similar to that in the Syowa specimens. The leaf margins have a weak serrulation throughout the leaf and a serration at the apex. The costa is usually long-excurrent but sometimes ceases below the leaf apex. The peristome teeth are relatively larger than those of the Syowa specimens, measuring $300\text{--}350 \mu\text{m}$ long in exostome and $100\text{--}125 \mu\text{m}$ in endostome teeth. The spores are larger, $25\text{--}28 \mu\text{m}$ in diameter.

(c) Alaska (*Philip Smith Mountains, Ochi 82–145, Fig. 3: 1–4*): The leaves are shortly to very longly acuminate with an awn of about 0.9 mm long. The median laminal cells are shorter than those in the Syowa specimens, measuring $35\text{--}45 \mu\text{m}$ long, $9\text{--}12 \mu\text{m}$ wide. The alar part is a little differentiated and occasionally reddish. The leaf margins are considerably differentiated, with narrow, elongated cells in 2–4 rows. The peristome teeth are similar to those of the Syowa specimens. The spores are larger, measuring $22\text{--}30 \mu\text{m}$ in diameter.

When compared with the specimens from other regions, the capsules of the Syowa

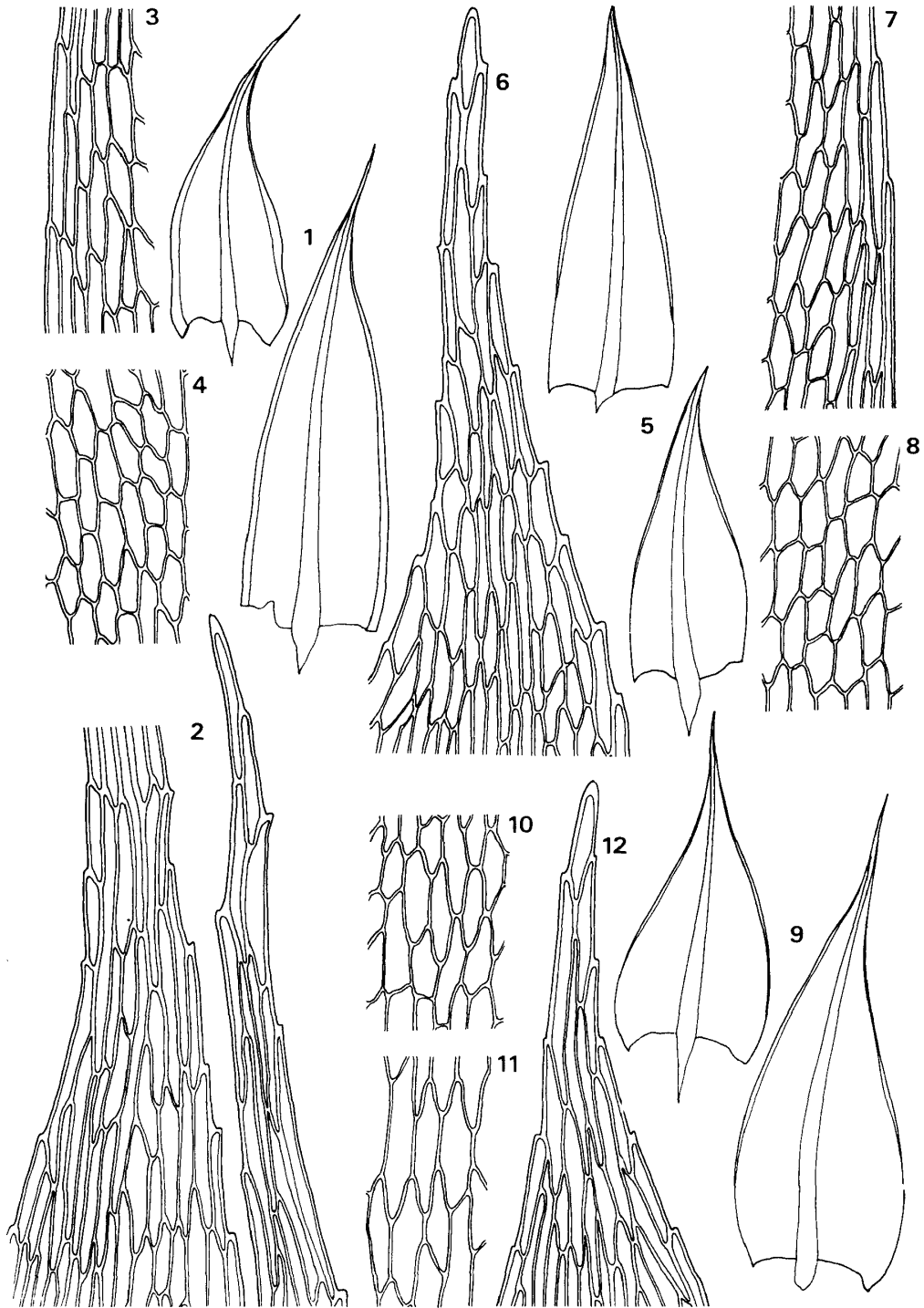


Fig. 3. *Bryum amblyodon* C. MUELL. 1, 5, 9: Stem leaves. 2, 6, 10: Leaf apex. 3, 7: Median leaf margin. 4, 8, 11: Medianlaminal cells. 1, 5, 9: $\times 30$. 2-4, 6-8, 10, 11: $\times 200$. 1-4 drawn from Ochi 82-145 (Alaska), 5-8 Mahu 20424 (Chile) and 9-11 Ochyra 967/80 (King George Island).

specimens appear superficially less developed, but they are morphologically well matured in the features of peristome teeth and spores (Fig. 4). Figure 5 shows the frequency distribution of spore-size in the Syowa specimens and in selected specimens of *B. am-*

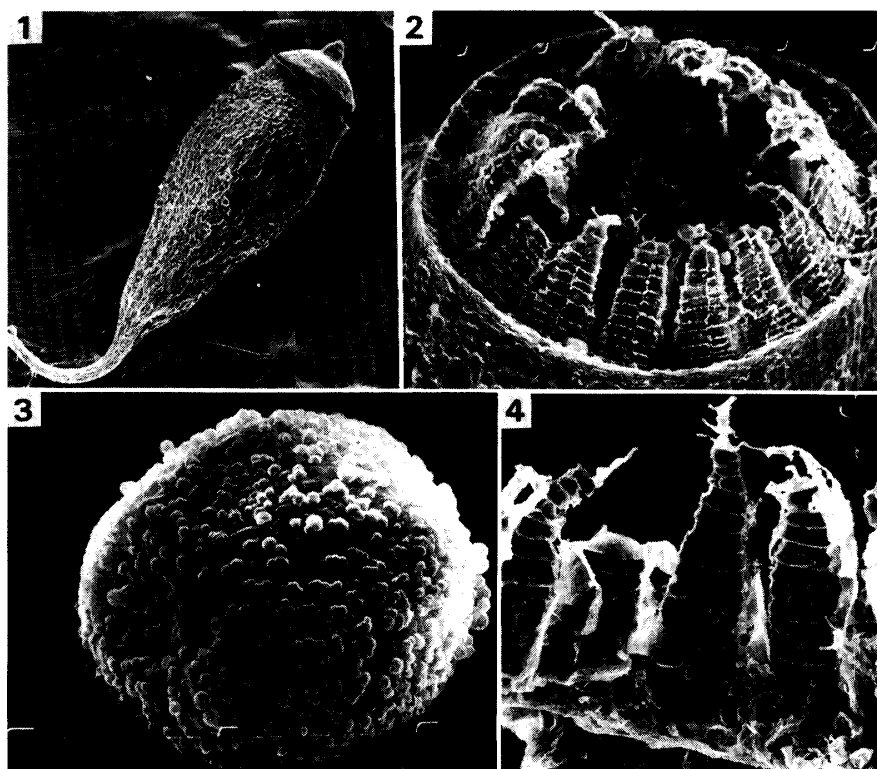


Fig. 4. Details of sporophytic characters of *Bryum amblyodon* C. MUELL. taken by scanning electric microscopy. 1: Capsule with a short-conic operculum. 2: Peristome teeth near the mouth of capsule. 3: Coarsely papillose spores. 4: Inner peristome teeth with rudimentary cilia. 1: $\times 23$. 2: $\times 100$. 3: $\times 2400$. 4: $\times 150$. Drawn from 840906-009 (Syowa Station area).

blyodon and *B. pseudotriquetrum* from some other regions for comparison. Though various ranges in spore-size were often observed in the Syowa specimens, the pattern of the spore size distribution is distinctly separated from those in *B. pseudotriquetrum*. This fact may prove that it is reasonable for the Syowa specimens (c. fr.) in question to be included in the variation range of *B. amblyodon*.

2.3. Taxonomic conclusion and a list of used specimens

As stated above, the fruiting plants should be included in the specific concept of *B. amblyodon*. This means that three species of *Bryum* are now recognized in Continental Antarctica (Syowa Station area), whereas OCHI (1979) recognized only two.

He also retained many indeterminable specimens there. OCHI and OCHYRA (1985) and OCHYRA and OCHI (1986) reported four species of *Bryum* which were new additions to Maritime Antarctica. Considering these facts, a few more additional species could be added to the bryaceous flora of Continental Antarctica including the Syowa Station area, when good fruiting plants are available.

Bryum amblyodon C. MUELL., Linnaea 42: 293, 1879.

B. inclinatum (BRID.) BLAND., Uebers Mecklemb. Moos 6, 1809, hom. illeg.

B. stenotrichum C. MUELL., Flora 70: 219, 1887.

B. inclinatum (BRID.) BLAND. var. *magellanicum* Card., Rev. Bryol. 27: 41, 1900.

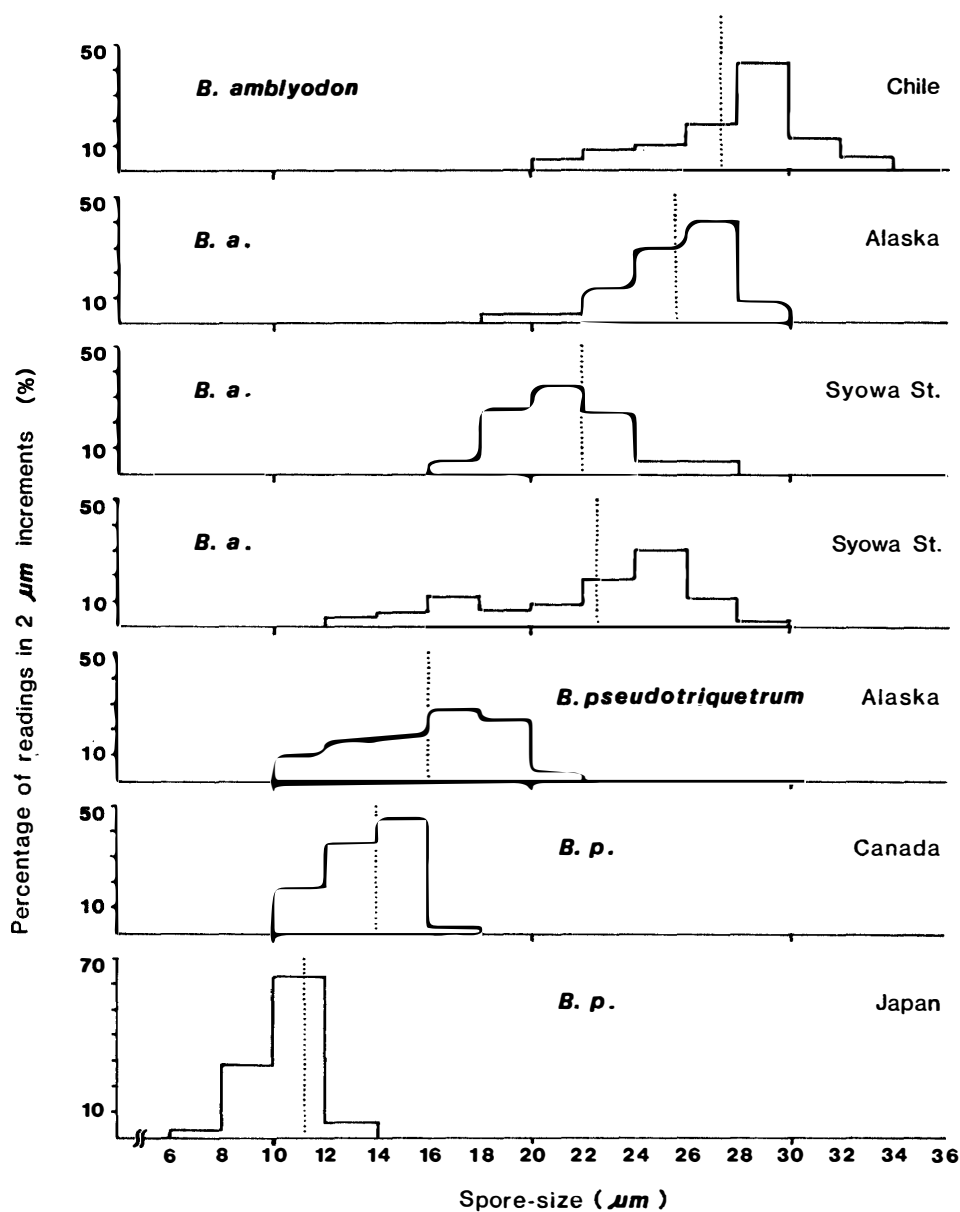


Fig. 5. Frequency distribution of the spore-size in the fruiting plants from the Syowa Station area and selected specimens from some other regions of *B. amblyodon* C. MUELL. and *B. pseudotriquetrum* GAERTN., MEYER et SCHERB.

B. imperfectum CARD., Rev. Bryol. 27: 44, 1900.

Specimens examined: CONTINENTAL ANTARCTICA. **Syowa Station area.** Langhovde. Yukidori Valley, 840905-001, -002, -003 (Kanda 1149, 1150, 1151, 120 m alt.), 840914-030 (Kanda 267, 125 m alt.). Einstöingen. 840912-017 (Kanda 22, 38 m alt.), 840912-032 (Kanda 40, 50 m alt.). Rundvågshetta. 840906-009 (Kanda 630, 10 m alt.), 840907-020, -021, -022, -023, -024 (Kanda 695, 696, 697, 698, 699, 10 m alt.), 840911-017, -029 (Kanda 732, 744, 40 m alt.), 840907-038, -039 (Kanda 714, 715, 50 m alt.), 840911-015 (Kanda 731, 70 m alt.). Strandnibba. 840913-020, -021, -022 (Kanda 864, 868, 870, 25 m alt.). MARITIME ANTARCTICA. **South Shetland Islands.** King

George Island. Admiralty Bay, Ezcurra Inlet (*Ochyra* 967/80, 50m alt. in KRAM-B). **Canal de Gerlache**. XXeme debarquement (*Racovitza, Voyage de la Belgica* 268 in PC as *B. imperfectum* Card.). CHILE. Santiago (*Mahu* 20424, 3500m alt.), Punta Arenas (*Racovitza, Voyage de la Belgica* 59 in PC as *B. inclinatum* var. *magellanicum* Card.). CANADA. Yukon (*Sharp* MC-5825g). ALASKA. Philip Smith Mountains (*Ochi* 82-145, 1200m alt.), Prudhoe Bay (*Ochi* 82-147, sea level).

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