

Barbula johansenii Williams, the new European moss species in the Belianske Tatry Mountains, Slovakia

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In 1991 I made the most unexpected record of the Arctic moss species *Barbula johansenii* Williams in the Belianske Tatry Mts. in Slovakia. This year, during early autumn, I made together with Rudolf Šoltés a field excursion to the range of the Belianske Tatry Mts. Just below the top of Bujačí vrch-Hill at 1900 m a.s.l. I collected low, small patch of a moss species, which was unknown for me. Much later, at home, I recognized it as the arctic moss *Barbula johansenii*. The species was growing here at the base of a vertical limestone wall accompanied by *Molendoa tenuinervis* Limpr., *Stegonia latifolia* (Schwaegr.) Broth., *Orthothecium rufescens* (Brid.) B.S.G. and *Schistidium tenerrimum* (Nees. et Hornsch.) Roth. With respect to my age and health I will not be able to see the locality again or to similar habitats in the mountains.

This interesting moss species was collected relatively late on the Victoria Island by the Canadian arctic expedition in 1913-1918. F. Johansen, member of this expedition, found the moss on the dolomite rock Marri Point on the Wolleston Peninsula of the Victoria Island. The sample was determined and described on the honour of discoverer. The specimen is relatively small and sterile, the plants are striking with excurrent nerve, easily broken in the apex part, creating vegetative reproductive bodies. This way of reproduction in the *Barbula* (*Didymodon*) genus is noteworthy and exceptional.

Later, in 1952, far away from the classical locality, this species was collected by W.C. Steere, in Arctic Alaska, but sterile as well. It was growing on north-facing side of calcareous sandstone, not far from the range Brooks, at the altitude of 1,219 m a.s.l., forming dense, hard and small tufts, in some places accompanied by *Schistidium apocarpum*. Descriptions of plants from both localities correspond. Most frequently the species creates small, low, green or yellowish to brownish tufts. The stem is erect, 5 - 6 mm tall, with brown rhizoids below, single or with weak branches, cortex of 1-2 cell layers surrounding a central cylinder with slightly thickened cell walls. Leaves are erect, appressed to imbricate when dry, slightly twisted, mostly 1.5 mm long, 0.4 mm wide in the basal part, ovate-lanceolate, apex acute, margin plane, slightly recurved. The nerve is stout, longly excurrent, at the end thickened, in section accompanied by 2-3 cells without stereids; upper part of 2 layers, rounded, consisting of fascicle of 4 cells.

Lamina cells are smooth, above cross-oval to rounded, thickened, cells in mid-leaf 8-10 μm long and 5-8 μm wide, getting longer and pale towards the leaf base. According to Crum (1965) the plants are dioicous, gametangia contain 2 - 5 archegonia; paraphyses are rare and sometimes absent. Perichaetial leaves lanceolate, wider towards base, the nerve mostly longly excurrent in a thickened point. Interior perichaetial leaves are very small. Crum (1969) found fruited individuals in Drummond's exsiccata and his description is as follow: "Seta 7-8 mm long, dark-red, annulus differentiated, operculum not seen, peristome teeth short and slender, but well developed, about 100 μm high, erect imperfectly divided into 2 terete forks, pale finely papillose roughened. Spores sphaerical, finely papillose, 11-13 μm in diameter. Calyptrae cucullate, smooth, naked."

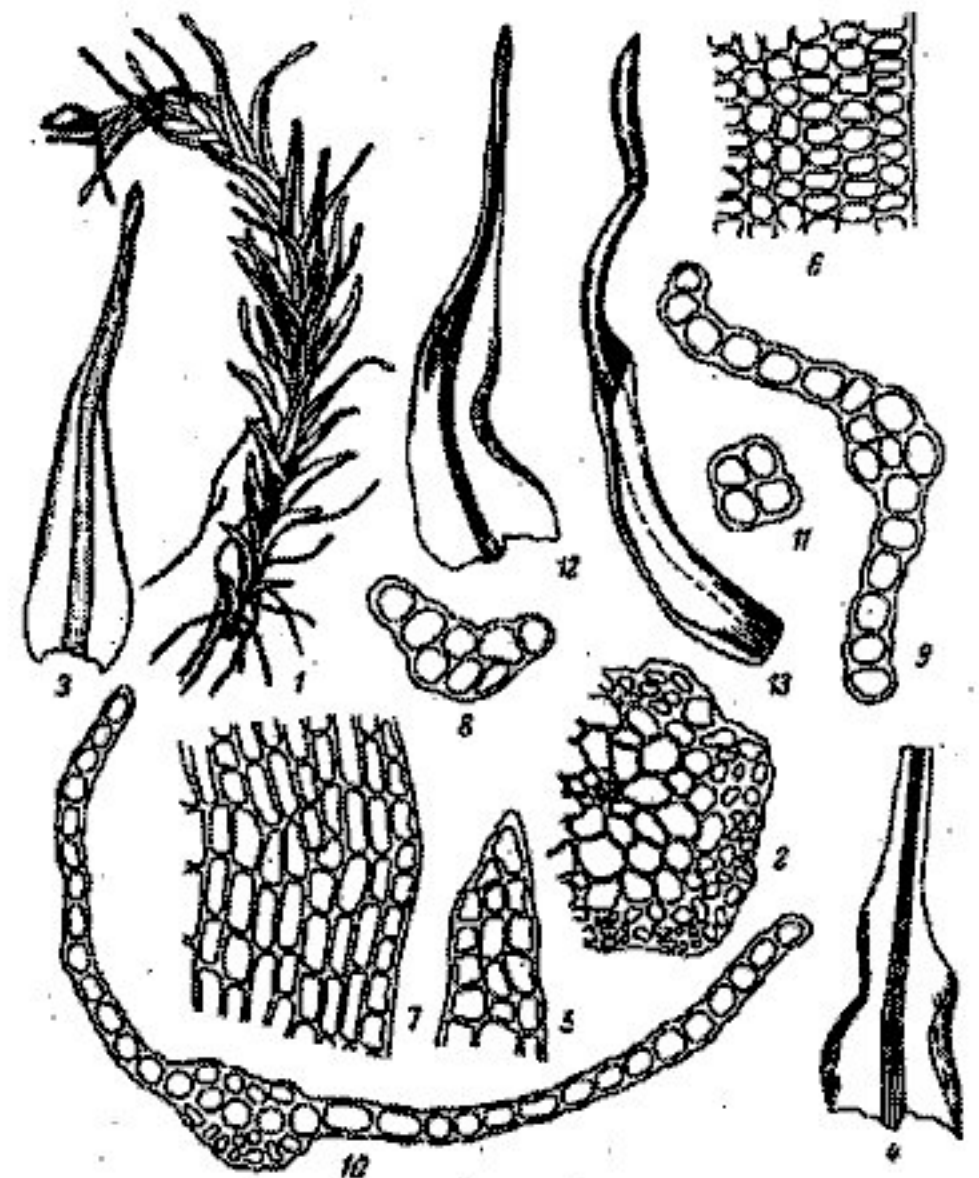


Fig. 1 *Barbula johansenii* Williams 1: Habitus; 2: Transverse section of stem; 3: Ventral surface of stem leaf; 4: Dorsal surface of perichaetial leaf; 5: Leaf apex; 6: Cells at upper part of leaf; 7: Cells at basal part of leaf; 8: Transverse section of the leaf at the place of the nerve ending; 9: Transverse section of upper part of leaf; 10: Transverse section of basal part of leaf; 11: Nerve transverse section (After Sawich - Lyubitskaya and Smirnova 1970)

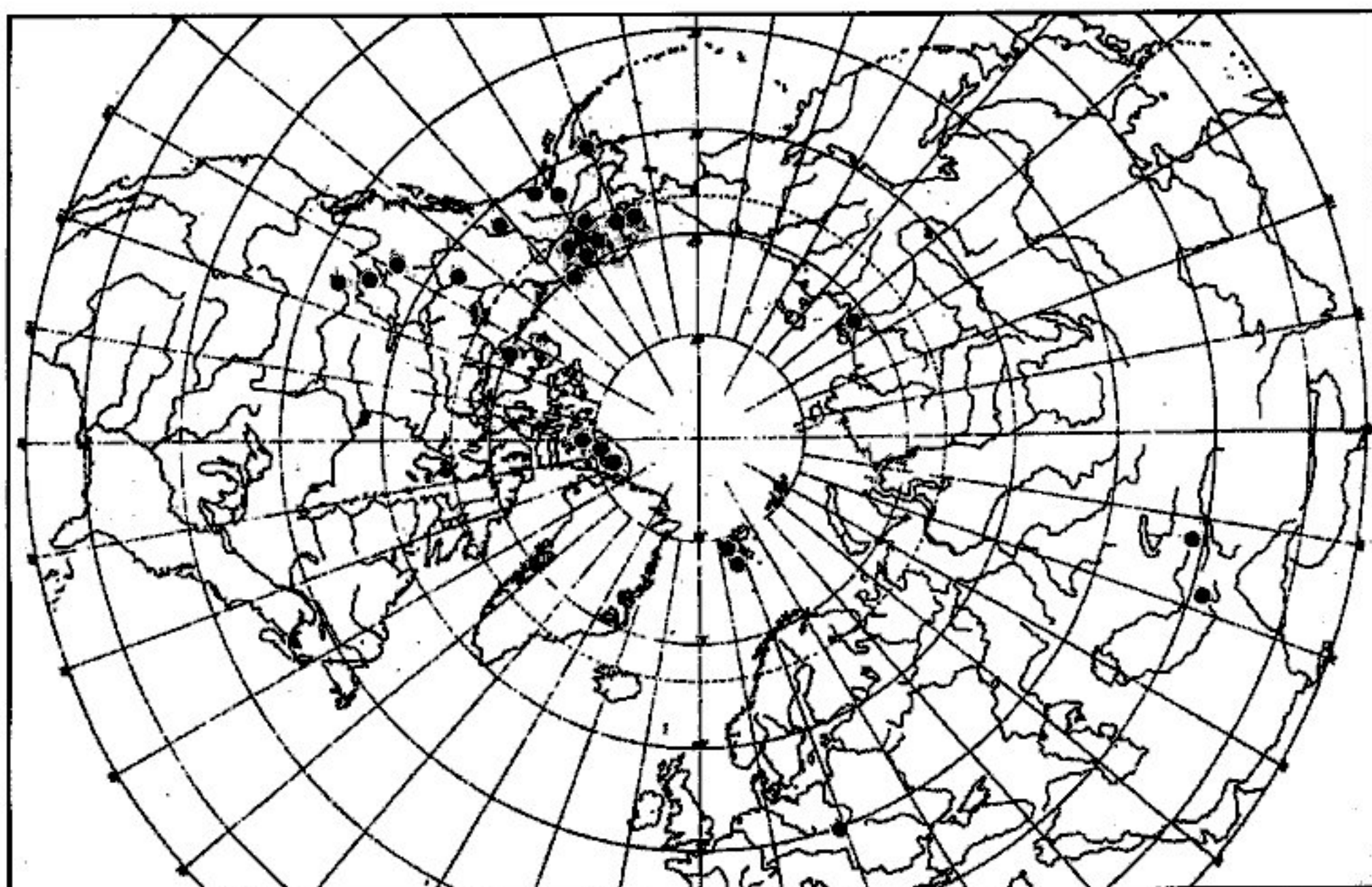


Fig. 2 *Barbula johansenii* Williams, distribution map

With respect to the diagnostic characteristics of the sporophyte the species was transferred from the genus *Barbula* to *Didymodon* - *Didymodon johansenii* (Williams) Crum.

Williams (1921) accepted the idea that *B. johansenii* is closely related to *B. acuta* (Brid.) Brid., usually distinct in its different shape of basal cells and slightly developed stereids in the lower part of the nerve.

With respect to the former knowledge of the distribution of *Barbula johansenii*, Steere (1953) treated it as a genuine arctic species, growing inside the polar circle. Steere considers such species as evolutionary very old and probably wide-spread in the relative warm Pleistocene or interglacial period, now searching refuge in the deglaciated territory of the far North. Such species are considered as the last remnants of a previously wide-spread tertiary or interglacial vegetation, probably of south origin, now different reasons restricted to the arctic area. This conception of bryophyte survival during the Pleistocene or Post-pleistocene period in deglaciated shelters is recently universally accepted. We have to consider that Steere's conclusions at that time were based only on two arctic localities. Occurrences on the Spitsbergen Islands and in Siberia support this conception, but new occurrences in the central European and central Asian mountains suggest that this idea may have to become re-valued.

The present distribution of *Barbula johansenii* is as follows:

Arctic Alaska - Anaktuvuk Pass (Iwatsuki and Steere 1975); Arctic village (Iwatsuki and Steere 1975); Chandler Lake, Driftwood Creek (Smith and Steere, unpub); Peters Lake (Iwatsuki and Steere 1975; Holmen and Martensson unpub); Walker Lake (Jordal unpub); Yukon

River-Prudhou Bay Haul Road, Miles 170 and 215 (Murray and Ala unpub).

Published reports: Chandler Lake (Crum 1965, Steere 1952, 1953), Yukon River-Prudhoe Bay Haul Road (Murray 1977).

Being originally described from Victoria Island in the Canadian Arctic Archipelago of the Northwest Territories, this species is now known from arctic and central Alaska and the Yukon, southward in the Rocky Mountains (Crum 1965, 1969) to the southernmost Northwest Territories at Nahanni National Park (Steere 1977, Steere and Scotter 1978) and Alberta - Ellesmere Island (Bassard 1976). Packer and Vitt (1974) mapped the North American distribution of the species and indicated its occurrence in Arctic Alaska, Axel Heiberg Island (Kuc 1973). Sawich - Lyubitskaya (1964), elaborating the family *Trichostomaceae* studied the find of Nicholson-Ehle (unpub), collected on July 23, 1898 in the Valley of the Lena river on the north facing slope of Kumach-Suta Hill (Yakutsk Region), determined and published by Arnell (1913) as *Barbula rubella* var. *ruberrima* Ferg., today known as *Barbula ferruginascens* Stirt. This is a surprising determination of an experienced bryologist. The description follows Dixon (1904): "Plants taller, with very slender branches, all red or only the tips yellowish; leaves all very short, appressed and slightly twisted when dry, from a widely ovate base shortly acuminate to a stout acute point, mostly formed by the nerve entire; lower cells smaller and stouter." The main feature, the stout, usually broken nerve, was not emphasized. This has been the main reason why the sample was forgotten until the revision by Saviczka corrected the mistake. In my collection I have the sample of *Didymodon johansenii* (Will.) Crum, collected

by Ignatov in the Altai Mts., Karaken River Valley (Herbarium horti botanici principalis No. 19), but this record is, however, based on misidentification of *Barbula icmadophila* Schimp.

In 1974 *Barbula johansenii* was collected twice on the Spitsbergen Islands in Kongsfjorden, the bird cliff below Haawimbjället. Liefdefjorden: the bird cliff on the SE side of Wulffberget. Bockfjorden: on a boulder at the hot springs Jotunkjeldene; on a boulder at the hot springs Trollkjeldene, leg. Frisvold. In the last years specimens determined as *Barbula johansenii* were collected in the mountains of central Asia: the north slope of Zaalaisky Range in the East Pamiro-Altai in the surroundings of Kishlagu Nur, in the narrow Kalte-Bulak at 3,200 - 3,750 m a. s. l., leg. Mamatkulov (Abramova and Mamatkulov 1967) and westward of the Nara Mountain on the west slope of the Baibica-Tau Range in the Central Tyan-Shan at 2,100 - 2,300 m, leg. Konnovy, Kotschkareva and Shibkova (Savich - Lyubitskaya 1964). Totally unexpected is the last find in Central Europe in Belianske Tatry Mountains, the Bujačí vrch-Hill at 1,900 m a. s. l., determined by Pilous (this study).

I am sure, the species will in the future be found also in other unexpected localities. Actual is the question if the species was until now overlooked or if it is spreading as neophyte like *Orthodontium lineare* Schwaegr.

Morphological and physiological characteristics of *Barbula johansenii* seem to adapt to arctic or high-altitude conditions. Abramova and Mamatkulov (1967) dealt with the exceptional vegetative reproduction of this species and other species of the *Barbula* genus and described the way of vegetative reproduction of *Barbula*

johansenii. Their paper is accompanied by beautiful pictures they could draw thanks to the possibility to work in the central Asia. Steere (1938) has stressed the presence of the thickened, fragile nerve excurrent from the lamina and its ability to grow from the spot of break from accompanying cells, which is an unique phenomenon in the the genus *Barbula*. Sawich - Lyubitskaya and Smirnova (1961) pointed at suprising similarity of *Barbula johansenii* to *Sarconeurum glaciale* (Hook. fil. et Wils.) Card. et Bryhn. collected several times in Antarctica (Cardot 1908), the thickened and excurrent breaking nerve being the feature common. This feature was the reason for an attempt to separate the both species to the *Trichostomaceae* familie. The lack of fertile specimens, however, makes the idea of relationship between the two species still uncertain. Similarities as to habitus of the two species may be due to adaptation to extreme climatic conditions. The stem section of *Sarconeurum* is homogenous without cortex and central cylinder, whereas the stem of *Barbula johansenii* consists of 1-2 layers of cortex cells serrouding a central cylinder. Only the find of fertile plants may reliably solve the questions of taxonomical relationship.

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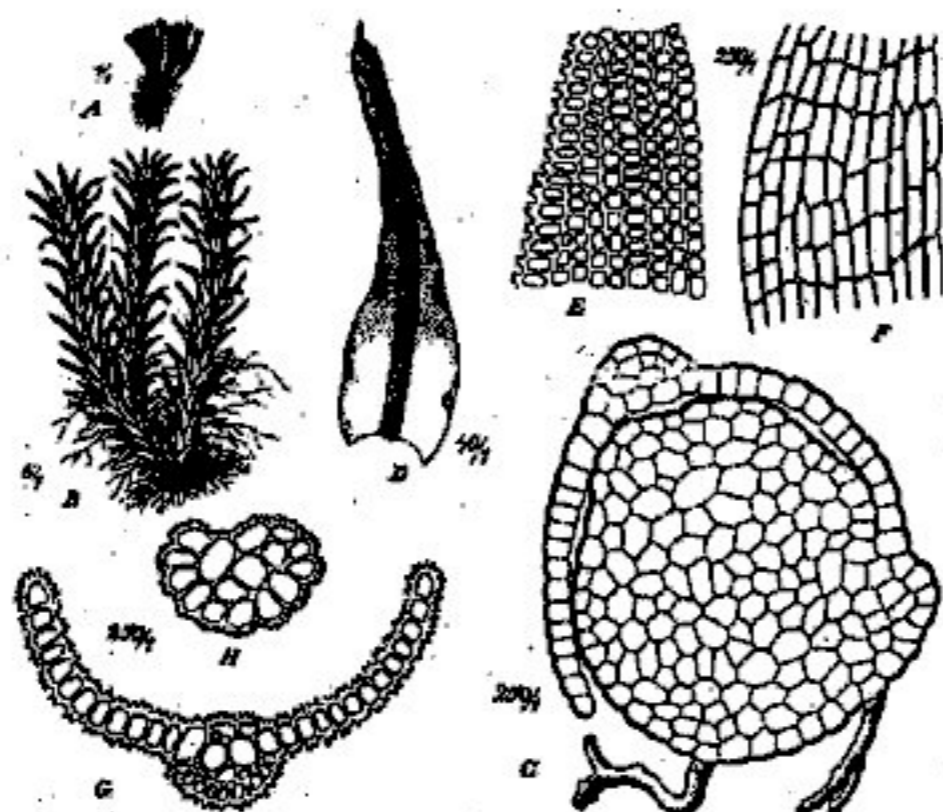


Fig. 3 *Sarconeurum glaciale* (Hook. fil. et Wils.) Card. et Bryhn. A - Plant at 1/2 of natural size; B - Magnified plant; C - Stem transverse section; D - Leaf; E - Leaf cells; F - Basal cells; G - Transverse section of leaf; H - Transverse section of excurrent leaf (Author of drawing: Brotherus 1924).

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