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

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In 1991 the most unexpected record of the Arctic moss species Barbula johansenii Williams was made in the Belianske Tatry Mts. in Slovakia. This year, during early autumn, I made together with Rudolf Šoltáš a field excursia to the range of the Belianske Tatry Mts. Just below the top of Bajca vch 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 Monochaena tenuifolia Link, Steganiella isifolia (Schw.) Broth., Orthothecium rufescens (Brid.) B.S.G. and Schistidium tenerinum (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 Mari Polet on the Wollaston Peninsula of the Victoria Island. The sample was determined and described on the honour of discoverer. The specimen is relatively small and stamatis, the plants are striking with excroutant ase, easily broken in the apical part, creating vegetative reproductive bodies. This way of reproduction in the Barbula (Didymocladus) genus is noteworthy and exceptional.

Later, in 1962, far away from the classical locality, this species was collected by W.C. Steere, in Arctic Alaska, but stamatis 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, acute, margin plane, slightly recurved. The nerve is stout, longly excurrent, at the end thickened, in section accompanied by 2-3 cells without soredia; 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 6-8 μm wide, getting longer and pale towards the leaf base. According to Crum (1965) the plants are dioecious, 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 fruiting individuals in Drummond's exsiccat and his description is as follow: "Seta 7-8 mm long, dark-red, annulus differentiated, epoculum not seen, peristome teeth short and slender, but well developed, about 100 μm high, erect imperfectly divided into 2 terete foci, pale finely papillose roughened. Spore sphaerical, finely papillose, 11-13 μm in diameter. Calyptrae cucullate, smooth, naked."

Fig. 1 Barbula johansenii Williams: 1: Habit; 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 (Alba Savich - Lysivčíkova and Simňov 1970)
Fig. 2 Barbula joansenii Williams. distribution map

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

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

With respect to the former knowledge of the distribution of Barbula joansenii, Steere (1932) treated it as a genuine arctic species, growing inside the polar circle. Steere considers such species as evolutionary very old and probably widespread 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 widespread territory 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 be revaluated.

The present distribution of Barbula joansenii 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; Holmes and Martensson unpub). Walker Lake (Jordal unpub); Yukon River-Prudhoe Bay Haul Road, Miles 170 and 215 (Murray and Aila unpub).

Published reports: Chandler Lake (Crum 1966, Steere 1963, 1965), 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 1966, 1965) to the southeastermost Northwest Territories at Nahanni National Park (Steere 1977, Steere and Scotter 1975) and Alberta - Eilismere Island (Bassard 1975). Packer and Vitt (1974) mapped the North American distribution of the species and indicated its occurrence in Arctic Alaska, Axel Haaberg Island (Kuc 1973), Sawich - Lyubutskaya (1964), elaborating the family Tschudnierscose studied the find of Nicholson-Ehle (unpub), collected on July 23, 1856 in the Valley of the Lena river on the north facing slope of Kurach-Suta Hill (Yakutsk Region), determined and published by Arnell (1913) as Barbula rubella var. ruberrima Ferg., today known as Barbula formosanaecens Stir. 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 aculeate 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 Savczuk corrected the mistake. In my collection I have the sample of Didymodon joansenii (Will.) Crum, collected.
Barbula johanseni

by Ignatov in the Altai Mts., Karakon River Valley (Herbarium botanico botanico principalis No. 19), but this record is, however, based on misidentification of Barbula isadiophila Schimp.

In 1974 Barbula johanseni was collected twice on the Spitsebergen Islands in Kongefjorden, the bird cliff below Hauvimbjellet. Liefdefjorden; the bird cliff on the SE side of Wulfberget. Rockfjorden; on a boulder at the hot springs Jotunkjelden; on a boulder at the hot springs Trollkjelden, leg. Frisvold. In the last years specimens determined as Barbula johanseni were collected in the mountains of central Asia: the north slope of Zaalinsky Range in the east Pamir-Altay in the surroundings of Xiehlagu Nur, in the narrow Khatka-Baik at 3,200 - 3,700 m a.s.l., leg. Mamatkulov (Abramova and Mamatkulov 1967) and westward of the Nara Mountain on the west slope of the Barchan-Tau Range in the Central Tyen-Shan at 2,100 - 2,300 m, leg. Konnov, Katchkareva and Shabukova (Savich-Lyubitskaya 1964). Totally unexpected is the last find in Central Europe in Belianske Tatry Mountains, the Bujačí vrch-II at 1,800 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 Orthodinium lineare Schwein.

Morphological and physiological characteristics of Barbula johanseni 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 johanseni. Their paper is accompanied by beautiful pictures they could draw thanks to the possibility to work in the central Asia. Steeno (1938) stressed the presence of the thickened, fragile nerve excriment from the lamina and its ability to grow from the spot of break from accompanying cells which is a unique phenomenon in the genus Barbula. Savich-Lyubitskaya and Smirnova (1961) pointed at surprising similarity of Barbula johanseni to Sarcomerum glaciale (Hock, fil. et Wilk.) Card. et Bryhn. collected several times in Antarctica (Cardot 1908), the thickened and excriment breaking nerve being the feature common. This feature was the reason for an attempt to separate the both species to the Trichostomataceae family. 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 Sarcomerum is homogenous without cortex and central cylinder, whereas the stem of Barbula johanseni consists of 1-2 layers of cortex cells surrounding a central cylinder. Only the find of fertile plants may reliably solve the questions of taxonomical relationship.

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References


Fig. 3 Sarcomerum glaciale (Hock, fil. et Wilk.) 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 excriment leaf (Author of drawing: Brotherson 1924).
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