

ANDREAEA NIVALIS (ANDREAEACEAE, MUSCI) NEW TO THE KARKONOSZE MTS (SW POLAND)

EWA FUDALI & JAN KUČERA

Abstract: *Andreaea nivalis* Hook., known in Poland only from the Tatra Mts previously, is reported from the Karkonosze Mts; this is the first record for the whole range of the Sudety Mts. The distribution of the moss in Poland is reviewed and a brief description of the site in the Karkonosze Mts is provided.

Key words: *Andreaea*, glacial relicts, Karkonosze, Sudety Mts, Carpathians, Tatra Mts, Poland

Ewa Fudali, Department of Botany and Plant Physiology, Agricultural University, ul. Cybulskiego 32, PL-50-205 Wrocław, Poland; e-mail: efudali@ozi.ar.wroc.pl

Jan Kučera, Faculty of Biological Sciences, University of South Bohemia, Branišovská 31, CZ-370 05 České Budějovice, Czech Republic; e-mail: jan.kucera@tix.bf.jcu.cz

The first author has been carrying out a bryofloristic survey of the Śnieżne Kotły glacier cirques (Polish side of the Karkonosze/Krkonoše Mts) since 2000 within the framework of a three-year research project supported by the State Committee for Scientific Research. Among other results (Fudali 2001; Fudali & Kučera, in prep.), the survey recently yielded the discovery of the moss species *Andreaea nivalis* Hook. not previously reported from the Karkonosze Mts – neither the Polish nor the Czech side of the range. Details for the site are as follows:

POLAND. WESTERN KARKONOSZE MTS, Mały Śnieżny Kocioł glacier cirque (UTM square 33UWS 393 256; ATMOS grid square Ea-78), E part of the cirque, NNW slope, 160 m N of TV transmitter, 850 m WNW of top of Wielki Szyszak Mt. 1380 m; inclined (<45°) naked granite block with trickling water beneath patches of persistent snow, associated with *Racomitrium aciculare*, *R. aquaticum*, *R. fasciculare* and *Philonotis seriata*. 15 Aug. 2001, leg. E. Fudali 1/2001 EF, det. J. Kučera (herb. Fudali, KRAM-B).

The species is widespread in the northern part of the Holarctic region (Schultze-Motel 1970) – Scotland, Fennoscandia, northern Russia (records for Murmansk area, Novaya Zemlya and Kamchatka), Japan, NW North America (Alaska, British Columbia, Oregon) and Greenland, and also

forms isolated islands in the European high mountains (Alps, Pyrenees, Carpathians). Schultze-Motel (1970) describes *Andreaea nivalis* as an arctic-alpine moss with an oceanic distribution range that avoids continental areas of Eurasia and North America. Scattered sites of *Andreaea nivalis* in the high mountains of Central and Southern Europe indicate the relict character of this species outside its circumpolar range (Szweykowski 1956; Jeník 1997).

The ecology of *Andreaea nivalis* is rather distinctive. It grows on wet acidic rocks but commonly also on raw sandy soil, typically in snowbeds or close to streams flushed by water from melting snow or ice, sometimes completely inundated, in the subalpine to upper alpine belt (Schultze-Motel 1970; Murray 1988). The new locality is one of the lowest in Central Europe (the recorded altitudinal minimum is 1300 m in the Western Tatra Mts of the Western Carpathians, but the altitude reading is questionable; all other data from the area are over 1700 m).

From the floristic point of view, the new find is quite remarkable. Bryofloristically, the massif of the Karkonosze/Krkonoše Mts is considered to be one of the best-explored mountain ranges in Europe if not the best-explored mountain range in the world, thanks to surveys done nearly continuously

since the end of the 18th century. The most records were given in the second half of the 19th century and the first decades of the 20th century (Milde 1869; Limpricht 1876; Limpricht 1930) but recently increased bryological activity has been initiated on both sides of the range (Kučera & Buryová 2001; Fudali 2001), to assess the present state and historical changes in the flora. Mały Śnieżny Kocioł cirque is one of the best-surveyed places in the Karkonosze Mts and *Andreaea nivalis* is a well-known and distinctive species, easy to recognize by the presence of costa and a denticulate margin (Nyholm 1969; Schultze-Motel 1970).

The Karkonosze Mts are a refuge for several subarctic-(sub)alpine mosses such as *Arctoa fulvella* (Dicks.) Bruch & Schimp., *Bryum muehlenbeckii* Bruch & Schimp., *Dicranum elongatum* Schleich. ex Schwägr., *Kiaeria glacialis* (Berggr.) I. Hagen, *Pohlia ludwigii* (Spreng. ex Schwägr.) Broth., *Polytrichastrum sexangulare* (Brid.) G. L. Sm. and *Tortula euryphylla* R. H. Zander which have survived from the Ice Age to this day at isolated sites (Limpricht 1930; Jeník 1997). *Andreaea nivalis* adds to this list of glacial relicts and also to the list of such representatives found only in cirques on the Polish side of the range [e.g., *Dichelyma falcatum* (Hedw.) Myrin, *Dicranodontium uncinatum* (Harv.) A. Jaeger, *Schistidium flexipile* (Lindb. ex Broth.) G. Roth].

To date in Poland, *Andreaea nivalis* was reported only from the Tatra Mts and almost the all stations were situated in the High Tatras (Krupa 1882; Chałubiński 1886; Żmuda 1912; Lisowski 1959; Balcerkiewicz 1984; Ochyra & Cisło 1999). The map of the current distribution of the species in Poland, according to the ATMOS grid square system (Ochyra & Szmajda 1981), is shown in Fig. 1. It refers to the published data and to the herbarium specimens reported below.

ADDITIONAL SPECIMENS EXAMINED: POLAND. Grid square Ge-50 – HIGH TATRAS: Staw Gąsienicowy lake, granite rocks below long-cover snow, 13 August 1957, leg. S. Lisowski (KRAM B-42745); below the last lake of the Dolina Gąsienicowa valley, 13 August 1957, leg. S. Lisowski 64712 (POZG-1746); Dolina Gąsienicowa valley, alt. 1700 m, hiking trail between the Czarny Staw Gąsienicowy and Zmarzły Staw lakes, 29 August

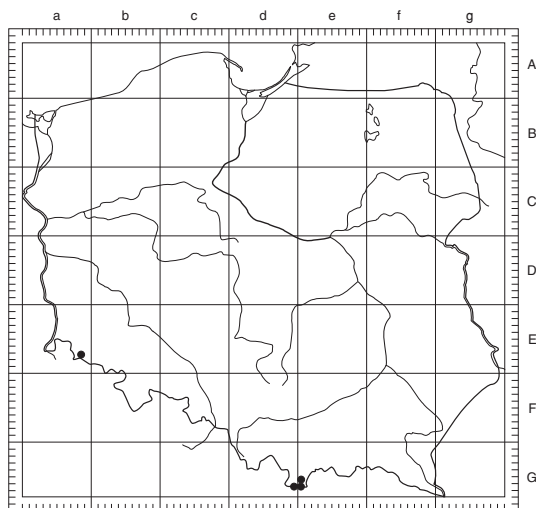


Fig. 1. Distribution of *Andreaea nivalis* Hook. in Poland.

1990, leg. H. Bednarek-Ochyra & R. Ochyra (KRAM B-90384), *Musci Poloniae exsiccati* no. 814; Zmarzły Staw lake, rock below persistent snow, 12 August 1957, leg. S. Lisowski, det. R. Ochyra (KRAM B-79606, 84223, *Musci Poloniae exsiccati* no. 1017); below Zmarzły Staw lake, 20 July 1957, leg. S. Lisowski 63908, (POZG-1744), 12 August 1957, leg. S. Lisowski 65441, (POZG-1743); above Zmarzły Staw lake at Kościelec Mt., 12 July 1957, leg. S. Lisowski (POZG-1738, *Bryotheca Polonica* fasc. XXV no. 653b); Zawrat Mt., July 1908, leg. A. Żmuda (KRAM B-1013); N slope of Zawrat Mt., 26 July 1955, leg. S. Lisowski (POZG-1742, 1739); below Zawrat Mt., 29 August 1912, leg. A. Żmuda (KRAM B-9491); Świnica Mt., alt. 2290 m, 7 August 1986, leg. J. J. Wójcicki, det. R. Ochyra (KRAM B-89855), *Musci Poloniae exsiccati* no. 915; Kozia Dolinka valley below Kozi Wierch Mt., alt. 1950 m, on flushed rocks, 29 August 1912, leg. A. Żmuda (KRAM B-124); Dolina Pańszczyca valley, granite rocks in persistent snow, 18 July 1966, leg. S. Lisowski (KRAM B-127472); slope of Mała Koszysta Mt. on the Dolina Pańszczyca valley side, alt. 1780 m, 18 July 1966, leg. S. Lisowski (KRAM B-127466); Dubrawiska Mt. alt. 1550 m, 17 July 1966, leg. S. Lisowski (POZG-1753). – Grid square Ge-60 – HIGH TATRAS: Dolina Pięciu Stawów Polskich valley below Miedziane Mt., 18 July 1957, leg. S. Lisowski, det. R. Ochyra (KRAM B-86271); Dolina Pięciu Stawów Polskich valley above Zadni Staw Polski lake, 26 August 1956, leg. S. Lisowski (KRAM B-35181), *Bryotheca Polonica* fasc. XV no.

402; Liptowskie Mury ridge in Dolina Pięciu Stawów Polskich valley, 18 July 1957, leg. S. Lisowski (KRAM B-127468, POZG-1755); Błękitna Przełęcz pass towards Dolina Pięciu Stawów Polskich valley, alt. 2130 m, 7 August 1986, leg. J. J. Wójcicki, det. R. Ochyra (KRAM B-89940); Dolina Mięszowiecka valley at Morskie Oko lake, alt. 1750 m, 5 September 1912, leg. A. Żmuda (KRAM B-127465); Czarny Staw lake, granite rocks, 1918, leg. A. Rehmann (KRAM B-126490); Dolina za Mnichem valley, alt. 1790 m, 2 August 1957, leg. S. Lisowski (KRAM B-35428), *Bryotheca Polonica* fasc. XXV, no. 653a); S slope of Cubryna Mt. alt. 2050 m, 2 August 1957, leg. S. Lisowski (KRAM B-35430, *Bryotheca Polonica* fasc. XXV no. 653c).

ACKNOWLEDGEMENTS. We thank the curators of KRAM-B (Dr. Halina Bednarek-Ochyra) and POZG (Dr. Anna Rusińska) for allowing us to study the *Andreaea nivalis* collections, Professor Ryszard Ochyra (Kraków) for valuable remarks, and the two anonymous reviewers for helpful remarks on the manuscript. This work was supported by the State Committee for Scientific Research (KBN grant 6 P04C 03419).

REFERENCES

- BALCERKIEWICZ S. 1984. High-mountain vegetation of the Five Polish Lakes Valley in the Tatra Mountains and its anthropogenic changes. *Wyd. Nauk. UAM, Poznań, Ser. Biologia* **25**: 3–225, (in Polish with English summary).
- CHAŁUBIŃSKI T. 1886. Enumeratio muscorum frondosum taternium hucusque cognitorum. *Pam. Fizyogr.* **6**: 170–171.
- FUDALI E. 2001. Mosses of the żyła bazaltowa (basalt outcrop) of Mały Śnieżny Cirque (Karkonosze Mts). *Ann. Sil.* **31**: 81–88 (in Polish with English summary).
- JENÍK J. 1997. Anemo-orographic systems in the Hercynian Mts and their effects on biodiversity. *Acta Univ. Wratisl.* 1950, *Prace Instytutu Geograficznego, Ser. C. Meteorologia i Klimatologia* **4**: 9–21.
- KRUPA J. 1882. Bryological notes. *Sprawozd. Kom. Fizyogr.* **16**: 170–204 (in Polish).
- KUČERA J. & BURYOVÁ B. 2001. Bryofloristic survey of the summit region of the Eastern Krkonoše Mts. (Czech Republic). *Opera Corcontica* **36**(1999): 105–132.
- LIMPRICHT K. G. 1876. Laubmoose. In: F. COHN (ed.), *Kryptogamen-Flora von Schlesien*, pp. 27–224. J. U. Kern's Verlag, Breslau.
- LIMPRICHT W. 1930. Die Pflanzenwelt der Schneeegruben im Riesengebirge. *Bot. Jahrb.* **63**(3): 1–74.
- LISOWSKI S. 1959. Materials to the bryoflora of the Tatra Mountains. *Pozn. Tow. Przyj. Nauk Wyzd. Mat.-Przyr., Pr. Kom. Biol.* **21**(2): 21–149 (in Polish with English summary).
- MILDE J. 1869. Bryologia Silesiaca. Laubmoos-Flora von Nord- und Mittel-Deutschland. A. Felix, Leipzig.
- MURRAY B. 1988. The genus *Andreaea* in Britain and Ireland. *J. Bryol.* **15**: 17–82.
- NYHOLM E. 1969. Illustrated moss flora of Fennoscandia. II. Musci. Fasc. **6**: 689–765. The Botanical Society of Lund. Stockholm.
- OCHYRA R. & CISŁO G. 1999. The moss herbarium of Tytus Chałubiński in the Tatra Museum in Zakopane. *Polish Bot. Stud. Guidebook Series* **22**: 1–178 (in Polish with English summary).
- OCHYRA R. & SZMAJDA P. 1981. La cartographie bryologique en Pologne. In: J. SZWEYKOWSKI (ed.), *New perspectives in bryotaxonomy and bryogeography*. A. Mickiewicz University, *Ser. Biologia* **20**: 105–110.
- SCHULTZE-MOTEL W. 1970. Monographie der Laubmoosgattung *Andreaea*. I. Die costaten Arten. *Willdenowia* **6**: 25–110.
- SZWEYKOWSKI J. 1956. Materials to the geography of Polish liverworts. II. *Chandonanthus setiformis* (Ehrh.) Howe in Polish Tatras. *Acta Soc. Bot. Poloniae* **25**(4): 603–613 (in Polish with English summary).
- ŻMUDA A. J. 1912. *Bryotheca Polonica*. 3. Nr. 101–150. Musci Tatrenses. *Kosmos* **37**: 662–670 (in Polish).

Received 18 March 2002