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GEOGRAPHIC DISTRIBUTION OF *HAPLOMITRIUM HOOKERI* (HEPATICAE, CALOBRYALES) IN POLAND

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Abstract: All Polish stations (many of them new) of *Haplomitrium hookeri* (Sm.) Nees are mapped. The ecology and variability of the species in Central Europe are discussed.

Key words: *Hepaticae*, *Haplomitrium hookeri*, morphological variation, ecology, geographic distribution, Poland

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INTRODUCTION

Haplomitrium hookeri (Sm.) Nees is a very rare and interesting hepatic. In Poland, according to the literature, it is known to exist at several stations in the central part of the northern Polish lowland (Klinggraeff 1883; Koppe 1931, 1932) and more rarely in mountains: the Sudetes, Góry Kaczawskie Mts. (Nees 1833), and Karkonosze Mts. (Turzańska unpublished; it has been observed, however, in the Czech part of these mountains – very close to the present Polish state border – for over 150 years: Nees 1833; Schiffner 1905), and Tatra Mts. (Lilienfeld 1914; Szweykowski 1960). During field work over the last 20 years we were able to discover several new station of this plant in northern Poland and particularly in the Tatra Mts., where it is now known from more than 10 stations, some of them with copious growth of the plant. As this species is rarely collected and its geographic distribution, especially in Central Europe, is rather poorly known, here we publish new stations and map the geographic distribution of the species, incorporating all known occurrences.

VARIATION

Lilienfeld (1911, 1914) noticed differences between the habitats of plants growing in peaty places (Czarnohora Mt., Eastern Carpathians, Ukraine; Tatra Mts., Poland) and those growing on mineral substrates. We also noticed that plants of the first kind are usually larger than the latter: those from peaty places are relatively high (up to 2 cm and even more), whereas the others are small, only a few millimeters high.

No studies on the nature of these two phenotypes are available, we do not know whether they differ genetically, and there is no taxonomic treatment of them. Schiffner (1941) observed morphological differences between plants of *Haplomitrium* from lowland and mountainous localities, and differentiated the mountainous plants as *H. hookeri* subsp. *montanum* Schiffn. He found the differences between *H. hookeri* subsp. *hookeri* and his newly described subsp. *montanum* to be so important that he even suggested it could be treated as a separate species. The taxon was not accepted by bryologists (mainly, it seems, because it was not validly published; the description lacked a Latin diagnosis) and has since been entirely forgotten. For example, Paton (1999) published drawings of these two forms without mentioning Schiffner's work. Having relatively rich material of this rare plant from the northern Polish lowlands and the Tatra Mts., we compared plants from the two regions. At first glance they are different: the lowland plants are short, with the leafless, underground parts of the stem freely

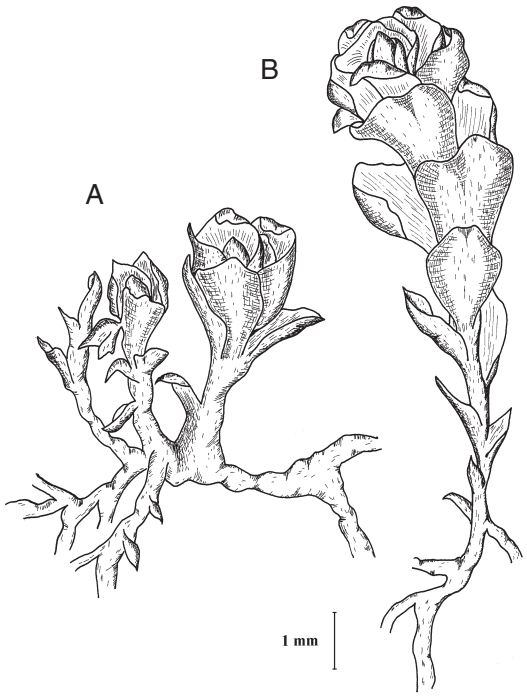

Fig. 1. Habit of *Haplomitrium hookeri*: (A) plant from the shore of a eutrophic lake corresponding to Schiffner's subsp. *hookeri* (B) plant from the Tatra Mts. corresponding to Schiffner's subsp. *montanum*.

branched (Fig. 1a); the plants from the mountains are relatively tall, with their leafless parts rather sparsely branched (Fig. 1b). Thus we confirm Schiffner's observations (1941). However, to identify these two plants taxonomically, the genetic basis of these differences remains to be shown. It is plausible that the reported differences are only modifications for the very different kinds of substrates they grow in; lowland plants growing on loose sand suffer frequent changes in the level of the substrate: they are easily buried in sand, or their lower parts are exposed when the sand is blown away. The strong ramification of the lower parts of the plants may be an adaptation to the shifting substrate. The mountain substrates are more stable, and changes of the substrate level are slight if any. In this situation one sparsely ramified stem creeping in the soil is the best solution for the plant to spread throughout the substrate.

Bartholomew-Began (1991) described in detail the variation in our species without mentioning Schiffner's varieties. This author is of the opinion that a species from New Zealand, named *Steereomitrium minutum,* described by Campbell (1987), is only a small variety of *Haplomitrium hookeri*. Thus the geographical range of the species has became bipolar.

We are skeptical about lumping the New Zealand plants with the Holarctic species. Our arguments against it are as follows: (i) there are, according to Bartholomew-Began (1999), distinct differences between the Holarctic and the New Zealand plants in spore and elater morphology, and in the anatomy of the antheridial stalk. As is well known, the characters of the sporophyte and sexual organs are not easily modified by environmental factors; thus, most probably they have a genetic basis and therefore are taxonomically important; (ii) having seen only limited material of *Steereomitrium minutum*, the author's statement that the two plants in question "are virtually indistinguishable" (Bartholomew-Began 1999: 231) is not very convincing; (iii) the plants of *Steereomitrium minutum* were found only at an artificial site growing on "turfs of the bowling green" (Bartholomew-Began 1999: 233) as a "weed," and all attempts to find the plant in the wild failed.

Thus, the treatment of *Steereomitrium minutum* as a mere variety of the Holarctic *Haplomitrium hookeri* is premature at least. Engel and Schuster (1994) do not accept the genus *Steereomitrium*; they do, however, recognize *Haplomitrium minutum* (E. Campb.) Engel & Schust. as a species different from the Holarctic *Haplomitrium hookeri*.

ECOLOGICAL REMARKS

Occurrences in the Polish lowlands and in the mountains vary dramatically. In the northern Polish lowland the species is restricted to the shores of oligotrophic lakes, constituting a nearly stable

element of a characteristic plant association on moist sand (Koppe 1932).

We meet a wholly different situation in the mountains. *Haplomitrium hookeri* can be found there on four different substrates which seem ecologically diverse. The plant occurs (i) on limestone slopes covered with low and relatively loose plant cover; the plant grows here as single stems between other plants and is widely spaced as a rule. It is the most difficult place to locate the plant because of its small size and scattered occurrence; this type of occurrence is common on the grassy slopes of waste dumps of old mines (abandoned about 100 years ago) in the Żleb Pod Czerwienicą gully or in the upper part of the Dolina Strążyska valley. Both stations are situated in the Tatra Mts. Probably the same type of occurrence was that discovered by Flotow in 1832 (Nees 1833: 111) on Maślak Mt. in the Góry Kaczawskie Mts. (Sudetes); this station was unsuccessfully sought by Koppe (1932), and by the senior author in the 1970s. The second (ii) category of substrates comprises mossy stones protruding from mountain springs; they sometimes harbor single stems of *Haplomitrium*; in this category there are sites in the Dolina Jarząbcza valley (Tatra Mts., Szweykowski 1960) and on the southeast margin of Morskie Oko lake (also in the Tatra Mts., Lilienfeld 1914). Sometimes the plant grows in rather extended patches on the banks of rivulets (Babia Góra Mt., Wojterski 1956; Szweykowski, Klama, Buczkowska & Bączkiewicz, in preparation). The next (iii) substrate category includes moist and usually north-facing bases of large rocks or rock crevices; this is the case only in mylonitic areas (either mylonitic rocks or other rock types exposed to water coming from mylonitic regions). The hepatic grows here either singly or, more often, in small patches; as an example we can cite occurrences in the gully called Żleb Pod Banie on the northeast slope of Ornak Mt. (Tatra Mts.). The last category (iv) comprises peat bogs, where the plant grows sometimes en masse, producing antheridia, perianths and sporophytes. We found such a flourishing population of the plant on the northeast shore of Wielki Staw Polski lake (Tatra Mts.). The substrate of the first category is strongly basic, about neutral in the second and third category, and strongly acid in the last one.

In his detailed description of ecological conditions found in places where *Haplomitrium hookeri* grows in western North America, Worley (1969) stressed the differences between the European and American occurrences of the plant. However, according to our observations the ecology of the plant in North America is very similar to that in European mountains. In addition there are two types of European sites apparently lacking in America: acid peat bogs in the mountains, and sandy shores of oligotrophic lakes of Central European lowlands. Thus, *Haplomitrium hookeri* seems to be ecologically more versatile in Europe.

Observing the western American stations of our plant, Worley concluded that *Haplomitrium hookeri* can colonize freshly deglaciated sites easily: "it is likely that the species has the ability to disperse locally and become established in recently deglaciated areas as soon as a satisfactory substrate becomes available" (Worley 1969). We observed a similar phenomenon in Poland, and no doubt it is the case elsewhere; our observations refer to both lowland and mountainous occurrences. In northern Poland we found frequent discrepancies between the actual places of occurrence and those reported in the literature. We looked in vain for *Haplomitrium hookeri* on the shore of Jezioro Dobrogoskie lake, where Koppe (1932) found it growing profusely. Koppe could not find *Haplomitrium hokeri* on the shore of a lake near the village of Osowa Góra, where it reportedly grew earlier (Klinggraeff 1883). Oligotrophic lakes change over time because they slowly become eutrophic. Also, as the water level falls the sandy shores become dry and covered with a different type of vegetation. As the water level rises the sandy shores are flooded. Such drastic changes cause the plant association and, of course, *Haplomitrium hookeri*, to become extinct in some places and to undergo ecesis in others. A similar situation exists, it seems, in the Tatra Mts.: at the beginning of the 20th century Lilienfeld found the plant on the peaty shore of Kurtkowiec lake in the Dolina Gąsienicowa valley, where the plant grew in abundance (Lilienfeld 1911). The senior author

looked for the plant in this place several times between 1955 and 1990 but without success. Recently we found a large population of *Haplomitrium hookeri* on the peaty shore of another lake (Wielki Staw Polski), close to the other lake but separated by a ridge over 2000 m high. The new site is easily accessible, only a few meters from a tourist path, but nobody noticed it before the 1990s. Thus we may assume that the plant is able to migrate. Its frequent production of spores makes this assumption very plausible. Meinunger and Schröder's (1999) observation that the plant grows in timber storage lots supports this suggestion.

WORLD DISTRIBUTION

Haplomitrium hookeri is a plant with a very incomplete Holarctic distribution (see maps published by Szweykowski 1962; Schuster 1983; Bartholomew-Began 1991; to the last map a recently discovered station on the Iberian Peninsula – Geissler 1990 – should be added). In Europe it is known from nearly all countries north of the Alps and Carpathians to Iceland, the Faroes and Spitsbergen; in North America it is locally abundant in the western part of the continent (from Alaska to the north of Washington state, Worley 1969), but it is very rare in the eastern part of the continent and is known to exist at one location in Greenland. The Asiatic part of the area comprises eastern Siberia (Konstantinova *et al.* 1992), Japan and the Himalayas (Schuster 1983). However, as the plant is difficult to find, especially the Asiatic part of its area could be undercollected. We do not accept the joining of the Holarctic *Haplomitrium hookeri* with the antipodal *Steereomitrium minutum* from New Zealand (Bartholomew-Began 1991; see also Engel & Schuster 1994 and the discussion of variation above) and thus its geographic area is restricted to the Holarctic. This area is highly disjunct: the plant grows first of all in the parts of Holarctic under the influence of oceanic climate. The general type of the geographical area of *Haplomitrium hookeri* can be described formally as circumpolar arctic-boreal montane (see also Düll & Meinunger 1989; Szweykowski 1962).

DISTRIBUTION IN POLAND

VERTICAL DISTRIBUTION

As evident from Fig. 2, the two parts of the *Haplomitrium hookeri* geographical area are sharply distinct in terms of elevation: there is a break between the lowland and mountainous occurrences.

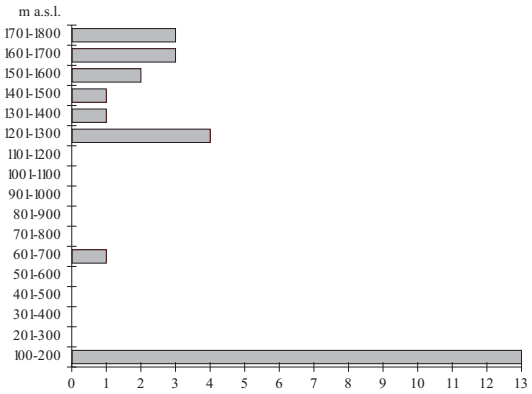

Fig. 2. Vertical distribution of *Haplomitrium hookeri* in Poland.

It is also clear that the occurrence of the plant in the mountains is restricted to higher elevations, that is, to subalpine and alpine zones, which means that it grows only above the tree line (1210–1785 m in the Tatra Mts.). The only exception (*ca* 650 m) is an old station on Maślak Mt. as reported by Nees (1833).

HORIZONTAL DISTRIBUTION

As with many other plants considered to be glacial relicts, the Polish part of the geographical area of *Haplomitrium hookeri* is divided into two different parts (Fig. 3) separated by a distance of over 500 km.

LIST OF STATIONS

The stations are ordered according to the new (1999) government administration units. As some provinces (Woj.) and several counties (pow.) bore the same names before 1999 as now but differ (sometimes dramatically) in their area, all the sta-

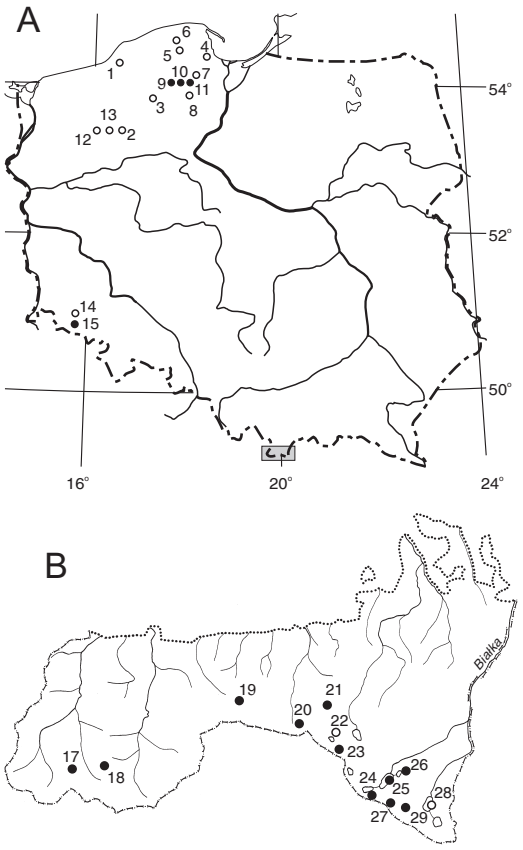

Fig. 3. Geographical distribution of *Haplomitrium hookeri* in Poland as a whole (A) and in the Polish part of the Tatra Mts. (B); ● – stations or respective herbarium specimens seen by the senior author (JS); ○ – stations known only from the literature.

tions, including old ones, are located in terms of the present administration units.

Collectors: AB – Alina Bączkiewicz, HB – Hanna Barczak, HK – Henryk Klama, JS – Jerzy Szweykowski, KB – Katarzyna Buczkowska, MM – Marta Mierzeńska, MT – Magdalena Turzańska

Woj. ZACHODNIOPOMORSKIE, pow. BIAŁOGARD: 1 – Peat bog near Pękanino village [54°16'N, 16°26'E] near city of Białogard, margin of a ditch (Koppe 1932); pow. SZCZECINEK (1999): 2 – Heath called Czarcie Pola N of city of Sypniewo [53°28'N, 16°36'E], on bare sand (Koppe 1932).

Woj. POMORSKIE, pow. CZŁUCHÓW: 3 – oligotrophic Jezioro Zalane lake [53°52'N, 11°12'E] N of Nowa Brda village, moist sand on E shore (Koppe 1932); pow. GDAŃSK: 4 – shore of lake near Osowa Góra village [54°26'N, 18°26'E], single stems (Klinggraeff 1883); Koppe (1933) could not locate the plant here; pow. WEJHEROWO: 5 – oligotrophic Dąbrowo lake [54°26'N, 17°53'E] NW of Niepoczołowice village, moist sand on NW shore (Koppe 1932); pow. STAROGARD: 6 – oligotrophic lake near Wysokie village [54°38'N, 17°53'E] (close to Huta Jeleńska village), sandy shore (Koppe 1932); pow. KARTUZY: 7 – oligotrophic Sitno lake [54°20'N, 18°18'E] (N of Jezioro Karlikowskie lake, E of city of Kartuzy) few plants on moist sand (Koppe 1932a); pow. KOŚCIERZYNA: 8 – oligotrophic Jezioro Dobrogoskie lake [54°09'N, 18°02'E] NE of city of Kościerzyna, sand on SW shore (Koppe 1932a) – we could not locate the plant here; 9 – Gołuń village [54°01'N, 17°59'E], moist sand on S shore of Stryjek lake, 03.06.1993, *leg. K.B., J.S. H.B.* (POZW 35332); 10 – vicinity of Dziemiany and Lipusz villages, moist sand on E shore of Kulkówko lake [54°04'N, 17°51'E], 03.05.1993, *leg KB., H.B., J,S.* (POZW 35333); 11 – vicinity of Dziemiany and Lipusz villages, moist sand on E shore of Małe Płocice lake [54°05'N, 17°50'E], 30.05.1993, *leg J.S., K.B. & H.B.* (POZW 35300)

Woj. WIELKOPOLSKIE, pow, ZŁOTÓW: 12 – Jezioro Pawie lake [53°27'N, 16°20'E] W of Nadarzyce village (near city of Wałcz), sandy E shore (Koppe 1932); 13 – Jezioro Businowskie Duże lake [53°27'N, 16°26'E] by Nadarzyce village (near city of Wałcz), sandy SE shore (Koppe 1931, 1932).

Woj. DOLNOŚLĄSKIE, pow. ZŁOTORYJA: 14 – Forest margin on Maślak Mt. [50°57'N, 15°52'E] near Podgórki village, few stems on calcareous soil, fert, 1832, *leg. v. Flotow*, (Nees 1833). Neither F. Koppe (1932) nor the senior author could find this plant here; pow. JELENIA GÓRA (1999): 15 – Karkonosze Mts. (Sudetes), S scarp of glacial cirque called Kocioł Wielkiego Stawu [50°50'N, 16°30'E], 1260 m, ?.?.1996, *leg. MT.*

Woj. MAŁOPOLSKIE, pow. SUCHA BESKIDZKA, 16 – Beskid Wysoki Mts., Babia Góra Mt. [49°30'N, 19°30'E]: glacial cirque called Kościółki, around a spring, 1490 m (Wojterski 1956; Szweykowski, Klama, Buczkowska & Bączkiewicz, in preparation); pow. TATRZAŃSKI: A – TATRY ZACHODNIE (W part of Polish Tatra Mts.): 17 – Dolina Jarząbcza, W slope of Czubik Mt. [49°15'N, 19°47'E], 30.07.1957, *leg. J.S.* (POZW 6565); 18 – Gully called Żleb pod Banie, NE slope of Ornak Mt. [49°14'N, 19°50'E] growing on humus on rock near stream, 1375 m, 15.09.1990, *leg. J.S. K.B. & A.B.* (POZW 29651, 30010); 19 – Mała Dolinka valley [49°15'N, 19°56'E], growing on humus on rock; 1300 m, 20.09.1990, *leg J.S. K.B. & A.B.* (POZW 30583); 20 – Dolina Goryczkowa pod Zakosy valley [49°14'N,

19°58'E], growing among mosses near stream, 1625 m, 13.09.1986, *leg. J.S.* (POZW 38747); 21 – Dolina Jaworzynka valley, Żleb pod Czerwienicą gully [49°15'N, 19°59'E], single stems growing between flowering plants; 1510 m, 13.07.1996, *leg. K.B.& J.S.* (POZW 37900); B – TATRY WYSOKIE (E part of Polish Tatra Mts.): 22 – Kurtkowiec lake [49°14'N, 20°00'E] in Dolina Gąsienicowa valley, abundant on SW shore, 1686 m (Lilienfeld 1914). 23 – SW shore of Długi Staw Gąsienicowy lake [49°13'N, 20°00'E] among mosses in snow-bed, 1785 m, 22.09.1992, *leg. J.S. & A.B.* (POZW 33285); 24 – Moist and peaty NW shore of Wielki Staw Polski lake [49°12'N, 20°02'E] in Dolina Pięciu Stawów Polskich valley, 1670 m cum spor., 04.09.1991, *leg. J.S. H.K. & M.M.* (POZW 31588, 31919, 31985); 25 – Outflow of Szpiglasowe Stawki lakes [49°12'N, 20°02'E] in Dolina Pięciu Stawów Polskich valley, 1715 m, 11.09.1991, *leg. J.S. & A.B.*(POZW 33860); 26 – N base of the Świstowa Czuba Mt. [49°13'N, 20°03'E] in Dolina Roztoki valley, growing on rocks 1460 m, 02.09.1992, *leg. J.S. & A.B.* (POZW 33386); 27 – Dolina Za Mnichem valley [49°11'N, 20°03'E], humus between plants near Stawek Staszica lake, 1775 m, 08.07.1996, *leg. K.B. & J.S.* (POZW 37886); 28 – Morskie Oko lake [49°12'N, 20°04'E], on E shore, 1393 m (Lilienfeld 1914); 29. SW shore of Morskie Oko lake [49°11'N, 20°03'E], rock crevices at base of Mięguszowiecki Szczyt Mt. 1570 m, 28.08.1990, *leg. J.S., K.B. & A.B.* (POZW 30641).

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REFERENCES

BARTHOLOMEW-BEGAN S. A. 1991. A morphogenetic re-evaluation of *Haplomitrium* Nees (Hepatophyta), *Bryoph. Bibliotheca* **41**: 1–297 & 508 figs.

CAMPBELL E. O. 1987. *Steereomitrium minutum* gen. et sp. nov. (Calobryales). *Mem. New York Bot. Gard.* **45**: 569–574.

DÜLL R. & MEINUNGER L. 1989. Deutschlands Moose, 1. Teil. IDH-Verlag, Bad Münstereifel-Olerath.

ENGEL J. J. & SCHUSTER R. M. 1994. Studies of New Zealand Hepaticae. 7. The status of *Steereomitrium*. *Bryologist* **97**(1): 63–66.

GEISSLER P. 1990. *Haplomitrium hookeri* (Sm.) Nees (Calobryales, Hepaticae) – Nuevo para la Peninsula Iberica. *Saussurea* **21**: 147–150.

KLINGGRAEFF H. 1883. Bericht über die botanischen Reisen im Neustädter Kreise im Sommer 1882. 6. *Jahresber. westpr. bot.-zool. Ver.* (1883): 18.

KONSTANTINOVA N. A, POTEMKIN A. D. & SCHLJAKOV R. N. 1992. Check-list of the Hepaticae and Anthocerotae of the former USSR. *Arctoa* **1**: 87–127.

KOPPE F. 1931. Dritter Beitrag zur Moosflora der Grenzmark Posen – Westpreussen. *Abh. Ber. Naturwiss. Abt. Grenzm. Ges.* **6**: 1.

KOPPE F. 1932. Eine Moosgesellschaft des feuchten Sandes. *Ber. Dtsch. Bot. Ges.* **50**(10): 503.

LILIENFELD F. 1911. Beiträge zur Kenntnis der Art *Haplomitrium Hookeri* Nees. Bull. *Acad. Sci. Cracovie, Sci. Math. Nat., sér. B Sciences Naturelles* (1911): 315–339.

LILIENFELD F. 1914. Przyczynek do znajomości krajowych wątrobowców. *Spr. Kom. Fizj. P. A.U.* **48**: 59.

MEINUNGER L. & SCHRÖDER W. 1999. Beiträge zur Moosflora Deutschlands. *Haussknechtia* **9**(Riclef-Grolle-Festschrift): 243–250.

NEES VON ESENBECK C. G. 1833. Naturgeschichte der Europäischen Lebermoose 1. August Rücker, Berlin.

PATON J.A. 1999. The Liverwort Flora of the British Isles. Harley Books, Colchester**.**

SCHIFFNER V. 1905. Bryologische Fragmente, XXI. Über das Vorkommen von *Haplomitrium hookeri* N. ab E. im Riesengebirge. *Österr. Bot. Z.* **55**(1): 10–11.

SCHIFFNER V. 1941. Kritische Bemerkungen über die europäischen Lebermoose, Serie XXVII, Wien (1941): 1–24. F. Berger, Horn, N. Österreich; privately published.

SCHUSTER R. M. 1983. Phytogeography of the Bryophyta, In: R. M. SCHUSTER (ed.), *New Manual of Bryology*, **1**: 463–626, The Hattori Botanical Laboratory, Nichinan.

STOTLER R. E. & CRANDALL-STOTLER B. 1993. Recent Literature on Hepatics and Anthocerotes – 131. *Bryologist* **96**(1): 149–156.

SZWEYKOWSKI J. 1960. Liverworts of the Tatry Mountains. *Pozn. Tow. Przyj. Nauk. Prace Kom. Biol.* **21**(3): 1–92 (in Polish with English summary).

SZWEYKOWSKI J. 1962. Liverworts (Hepaticae), I. In: Z. CZUBIŃSKI & J. SZWEYKOWSKI (eds), *Atlas of Geographical Distribution of Spore-Plants in Poland*, Serie IV. Poznańskie Towarzystwo Przyjaciół Nauk, Poznań.

WOJTERSKI T. 1956. Babia Góra Mt. is a National Park. *Chrońmy Przyr. Ojcz.* **12**(4): 12–28 (in Polish).

WORLEY I. A. 1969. *Haplomitrium hookeri* from Western North America. *Bryologist* **72**(2): 225–232.

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