Fragm. Flor. Geobot. 36(1): 57–70, 1991

Notes on Polish mosses: II. Ulota phyllantha (Orthotrichaceae) new to Poland

RYSZARD OCHYRA AND HALINA BEDNAREK-OCHYRA

OCHYRA, R. AND BEDNAREK-OCHYRA, H. 1991. Notes on Polish mosses: II. *Ulota phyllantha* (Orthotrichaceae) new to Poland. *Fragmenta Floristica et Geobotanica* 36(1): 57–70. Kraków. ISSN PL 0015–931x.

ABSTRACT: *Ulota phyllantha* Brid. is recorded from West Pomerania in north-western Poland and this is the easternmost locality of this oceanic species on the European mainland. The species is briefly described and illustrated and a key to all Polish species of *Ulota* is given. General distribution of *U. phyllantha* is reviewed and mapped in the world and Europe.

KEY WORDS: bryophytes, *Ulota*, Orthotrichaceae, oceanic species, distribution, Poland

R. Ochyra and H. Bednarek-Ochyra, Laboratory of Bryology, W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, PL–31–512 Kraków, Poland

INTRODUCTION

The genus *Ulota* Mohr contains in Europe eight species (Corley *et al.* 1981; Düll 1985), although most recent study by Rosman-Hartog and Touw (1987) reinstated *U. bruchii* Hornsch. *ex* Brid. as a species of its own, thus increasing the total number of the species in the genus to nine. They are mostly epiphytes and only a few are associated with saxicolous habitats. Of these, no less than six are known to occur in Poland (Szafran 1961; Ochyra & Szmajda 1983). This, however, is not the final number and one more species is now added to the moss flora of the country. *U. phyllantha* Brid. is a moss that we have long had in mind as one that is likely to occur in Poland since there seem to be no phytogeographical reasons which could preclude its occurrence in the north-western part of the country. Its nearest localities are on the islands of Bornholm (Mönkemeyer 1911) and Rügen (Kühner & Pankow 1967; Kühner *et al.* 1968) on the Baltic approximately 100 km from the Polish boundary.

It proved that this assumption had already been substantiated at the beginning of the present century and F. Hintze found this species in West Pomerania. He was an excellent German collector of plants, who found many rarities in Pomerania, for example *Sphagnum lindbergii* Schimp. (Warnstorf 1903) and *Calliergon richardsonii* (Mitt.) Kindb. (Karczmarz 1967), but except for a few small contributions (Hintze & Kohlhoff 1902, 1904; Hintze 1905) he did not publish his records. That is also the case with *U. phyllan-*

tha which was collected in 1914 but for a half-century this record remained unknown, until Koppe (1964) mentioned it quite incidentally in his paper on the bryophytes of the North German Plain. Unfortunately, this note has been overlooked by Polish bryologists and *U. phyllantha* is missing from the checklist of Polish mosses (Ochyra & Szmajda 1978, 1983). It came to our notice very recently and we subsequently asked Professor W. Schultze-Motel for checking the bryophyte herbarium at Berlin-Dahlem (B) for this specimen, because Hintze's collection of mosses is preserved there. He was successful in locating the gathering of *U. phyllantha* from Pomerania and we obtained it on loan. Details of this collection are as follows: "Nr 1207. Ulota phyllantha Brid. Neu für Ostdeutschland! Pommern: Ubedel, Querweg nach Gust, an einer Eberesche. Luftlinie nach der Ostsee etwas 40 km. 22/12 14 leg. F. Hintze". Ubedel is the German name for the village now called Ubiedrze, which is situated in the ATPOL grid square Bb–26, about 40 km from the Baltic coast.

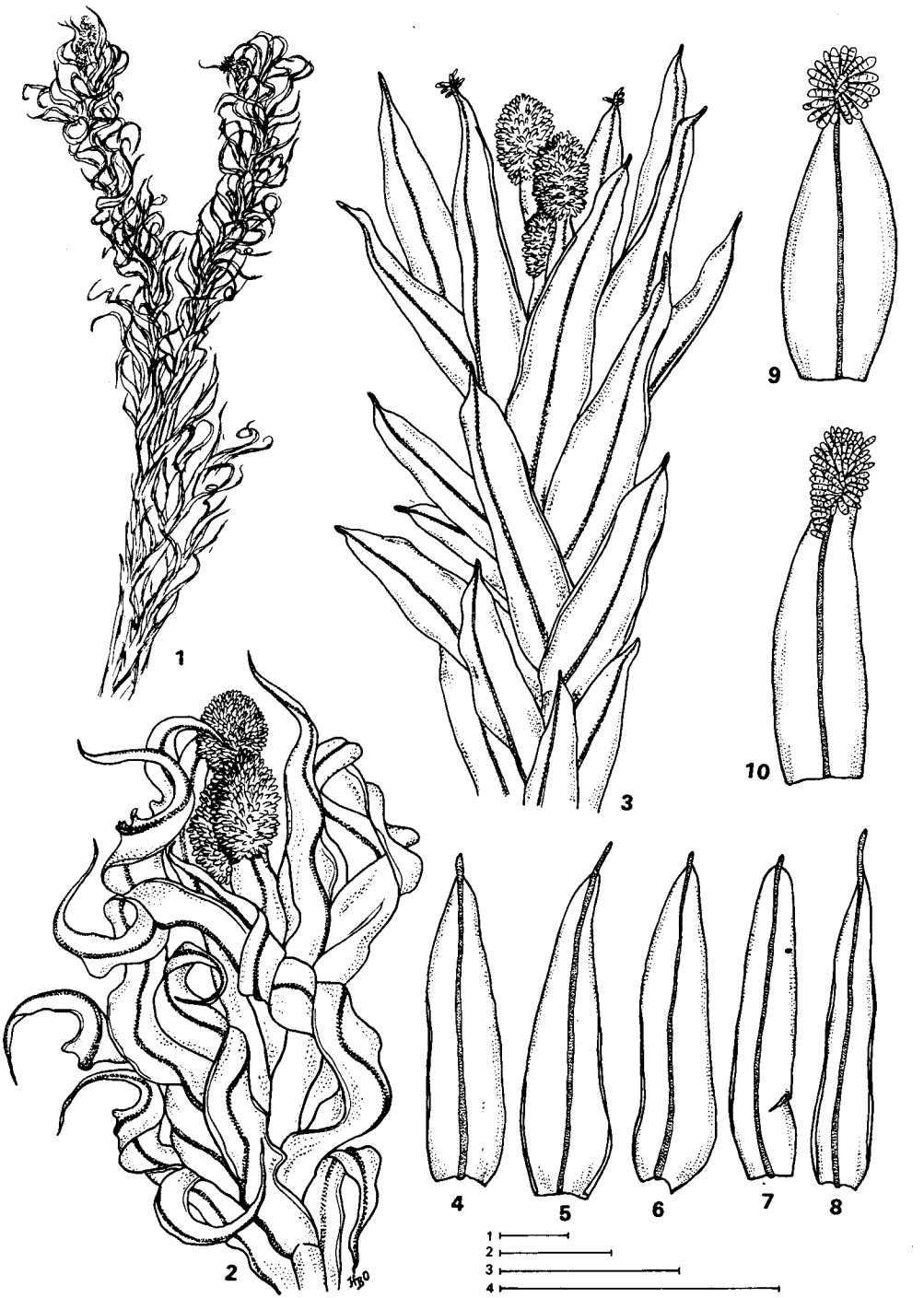
DESCRIPTION

Since *U. pyllantha* has not been described and illustrated in the handbook of Polish mosses (Szafran 1961), we find it worthwhile to fill this gap here in order to facilitate the identification of possible further gatherings of this species from Poland. The following description and illustrations (Figs 1–19) are based on the Pomeranian material. It is entirely sterile but with numerous clusters of brood bodies at the tips of the upper leaves and agrees well with the plants from other European regions which are thoroughly described by Limpricht (1895), Nyholm (1960), and Smith (1978).

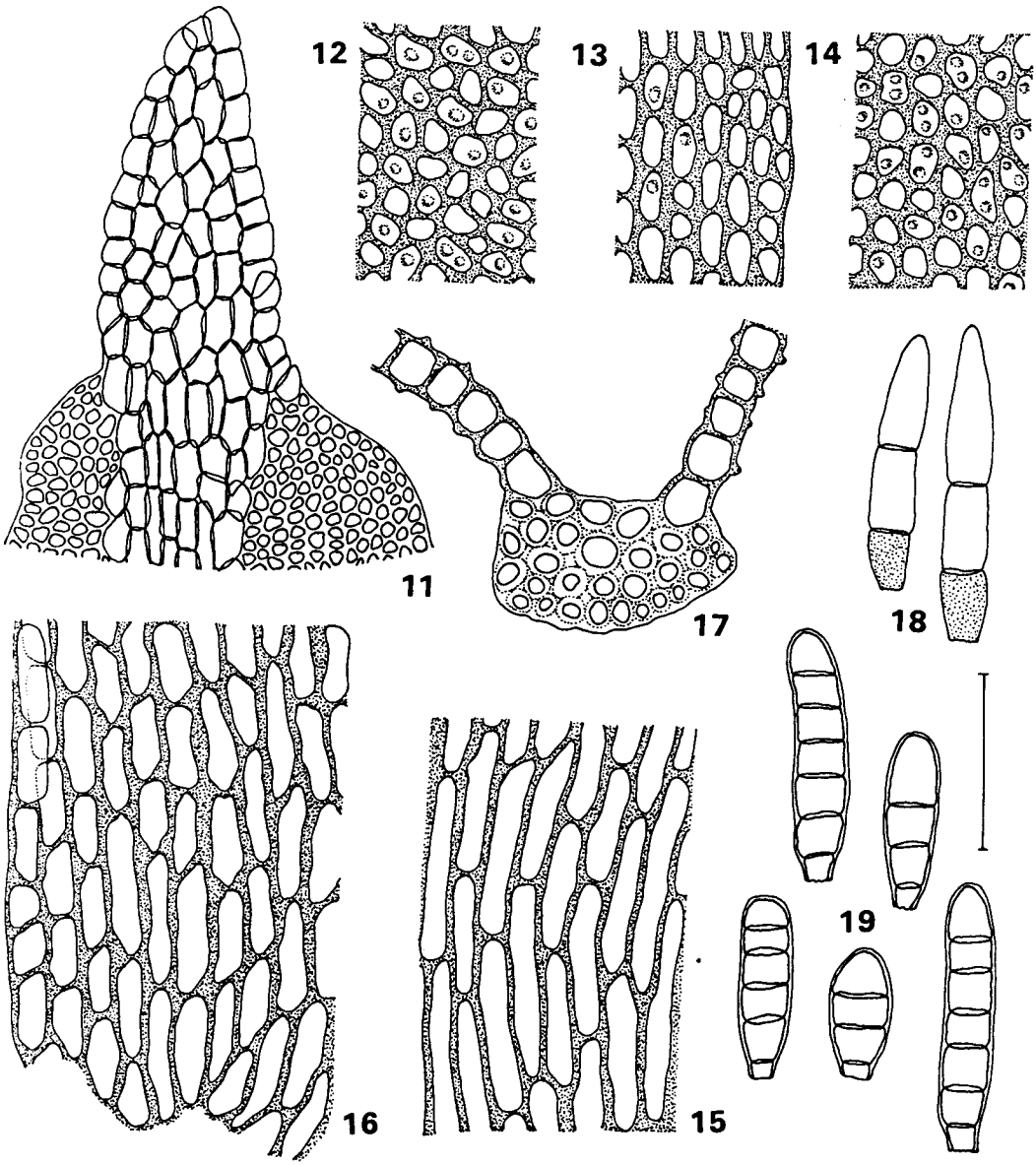
Ulota phyllantha Brid. (Figs 1–19)

Mant. Musc. 113. 1819; – *Orthotrichum phyllanthum* (Brid.) Steud., Nomencl. Bot. **2**: 304. 1824; – *Ulotrichum phyllanthum* (Brid.) Bruch & Schimp. in B. S. G., Bryol. Eur. **3**: 1. 1851 *comb. inval.*; – *Weissia phyllantha* (Brid.) Lindb., Musci Scand. 28. 1879.

Plants relatively coarse and robust, 1.0–1.7 cm high, in dense tufts, yellowish-brown to brownish-green above, dark brown below, slightly lustrous; stems sparingly branched, erect, slightly radiculose at base with reddish-brown, smooth rhizoids, in transverse section ± pentagonal composed of 2(–3) layers of smaller, thick-walled cortical cells surrounding several layers of larger, hyaline, relatively thick-walled medullary cells and without central strand. Axillary hairs few, 3–5-cellular, with short, brown basal cell and elongate upper cells. Leaves strongly crisped and contorted when dry, erecto-patent when moist, 2.5–3.5 mm long, 0.4–0.6 mm wide, keeled above, variable in shape, linear-lanceolate and long acuminate, lingulate to oblong-lanceolate, non-decurrent, sometimes slightly enlarged and somewhat clasping in the basal part, smooth or only weakly plicate in the basal angles, acute to obtuse, sometimes mis-shapen or malformed; margins entire, narrowly recurved below, plane above; costa single, strong, 75–80 µm wide at base, yellow-green to brownish, ending the the apex or in the upper leaves excurrent as a stout, thick, cuspidate point of variable length bearing numerous, brown to dark brown, cylindrical to oblong-cylindrical, uniseriate and 4–8-septate, easily detached propagules, in transverse section composed of 3–4 layers of almost homogeneous cells; upper lamina cells isodiametric to shortly elongate, rounded to elliptical, 8–10 x 8–14 µm, with strongly incrassate walls and 1–2 low, blunt papillae on both surfaces; median lamina cells isodiametric to elongate, 8–10 x 10–20(–25) µm, irregular to more or less rectangular, thick-walled and papillose; basal cells linear-rectangular,



Figs 1–10. *Ulota phyllantha* Brid. 1: habit, dry; 2: portion of plant, dry, enlarged; 3: portion of plant, wet, enlarged; 4–8: leaves; 9–10: uppermost inner leaves with terminal clusters of propagules (all drawn from *Hintze 1207*, B). Scale bars: 1 – 1 mm (1); 2 – 1 mm (4–8); 3 – 1 mm (3, 10); 4 – 1 mm (2, 9).



Figs 11–19. *Ulota phyllantha* Brid. 11: leaf apex; 12: upper lamina cells; 13: median marginal cells; 14: median leaf cells; 15: basal paracostal cells; 16: cells at leaf angle; 17: transverse section of costa and portion of lamina; 18: axillary hairs; 19: propagules (all drawn from *Hintze 1207*, B). Scale bars: 50 µm (12–18) and 100 µm (11, 19).

5–15 times as long as wide, 4–6 x 20–60 µm, smooth, with walls thick and often weakly porose to moderately thin on younger leaves, becoming shorter and broader, 8–10 x 20–30 µm, towards the margin. Sterile.

TAXONOMIC AND ECOLOGICAL NOTES

Ulota phyllantha is a very distinctive species which is unlikely to be mistaken for any other species of the genus. The dark tips of the uppermost leaves bearing clusters of brown, fusiform and uniseriate gemmae are discernible even with the unaided eye or very easily with a hand-lens and are alone sufficient for its immediate recognition from any other moss. Of approximately 60 species of the genus (Wijk *et al.* 1969), which are widespread throughout the temperate regions of the both hemispheres, *U. phyllantha* is the only species known to produce propagules. It was even named for this unique feature, since clusters of gemmae resemble very much paraphyses of an inflorescence or "flowers" situated at the tips of the leaves. Additionally, *U. phyllantha* is unique within the genus in having dioicous inflorescences, all other species being monoicous. As a result of this sexual condition it produces sporophytes very seldom and in fact they were described for the first time by Renauld and Cardot (1888) a half century after original description of the species by Bridel (1819). However, it should be noted that the fruiting plants of *U. phyllantha* had actually been collected in Germany (the first record to the country!) by Müller (1840), but he failed to describe them.

Ulota phyllantha is also unusual by its maritime habitat. It commonly occurs on the seashores or in their close proximity, growing on cliffs, exposed headlands and boulders as well as on bark of tress and bushes in the salt spray zone where the plants are sprayed with sea water. Bryophytes are generally known for their extremely low salinity tolerances. Only a certain number of mosses (Richards 1932; Vitt 1976) and hepatics (Engel & Schuster 1973) are salt-tolerant, growing in places where they are liable to be covered by the tide or by spray. However, the obligate halophytes are extremely few amongst mosses and apart from *U. phyllantha* this group includes only *Schistidium maritimum* (Turn.) B., S. & G. in the Northern Hemisphere (Bremer 1980) and four species of the genus *Muelleriella* Dusén and *Calyptopogon mnioides* (Schwaegr.) Broth. in the Southern Hemisphere (Vitt 1976; Ochyra 1986a).

Ulota phyllantha often grows together with *Schistidium maritimum* on acidic maritime rocks since both species share the same ecological requirements and geographical range in the Northern Hemisphere. These stands have been described as a separate halophilous moss association, *Schistidietum maritimi*, by Häyren (1914) which is the only member of the alliance *Schistidion maritimi* Hadač 1944 within the order *Racomitrietalia heterostichi* Philippi 1956 of the class *Grimmio-Racomitrietea* (Neumayr 1971) Hertel 1974 (Hübschmann 1986). The association is widespread in coastal areas in Europe (Frahm 1974; Hübschmann 1970) and western North America (Hübschmann 1978), and the stands with *U. phyllantha* are recognized as a separate subassociation, *S. maritimi ulotetosum phyllanthae* v. Hübschmann 1986. This community is very poor floristically and, apart from the two halophilous mosses, the occasional associates are, among other things, *Andreaea rupestris* Hedw., *Dicranoweisia crispula* (Hedw.) Milde, *Racomitrium varium* (Mitt.) Jaeg., *Dicranum scoparium* Hedw., and *Bryum argenteum* Hedw. (Hübschmann 1986).

Due to its broader ecological amplitude *U. phyllantha* is also an important constituent

of epiphytic moss-dominated communities. In western Europe it is a characteristic species of *Phyllantho-Tortuletum laevipilae* Barkman 1958, which belongs to the alliance *Tortulion laevipilae* Ochsner 1925 of the order *Leucodontetalia* v. Hübschmann 1986 and the class *Hypnetea cupressiformis* Ježek & Vondráček 1962 (Hübschmann 1986). The most frequent associates of *U. phyllantha* are *Hypnum cupressiforme* Hedw. var. *resupinatum* (Wils.) Schimp. and *Orthotrichum pulchellum* Brunt. *in* Sm., two other characteristic species of the association, as well as *Tortula laevipila* (Brid.) Schwaegr, *T. papillosa* Wils. *in* Spruce, *Orthotrichum affine* Brid., *Zygodon viridissimus* (Dicks.) Brid., *Pylaisiella polyantha* (Hedw.) Grout, *Frullania dilatata* (L.) Dum., and others (Barkman 1958; Koppe 1969; Hübschmann 1970, 1976).

DISTRIBUTION

Ulota phyllantha is a bipolar species that has a discontinuous Euro-American range in the Northern Hemisphere and a few disjunct occurrences in the Southern Hemisphere (Fig. 20). It is a lowland species with very strong affinities for oceanic or hyperoceanic climates, occurring in coastal areas of the boreal and cool temperate zones within salt spray zone of the sea and only very seldom it is found on localities inland. Its elevational range extends from sea-level up to 350 m in Norway (Hägen 1908).

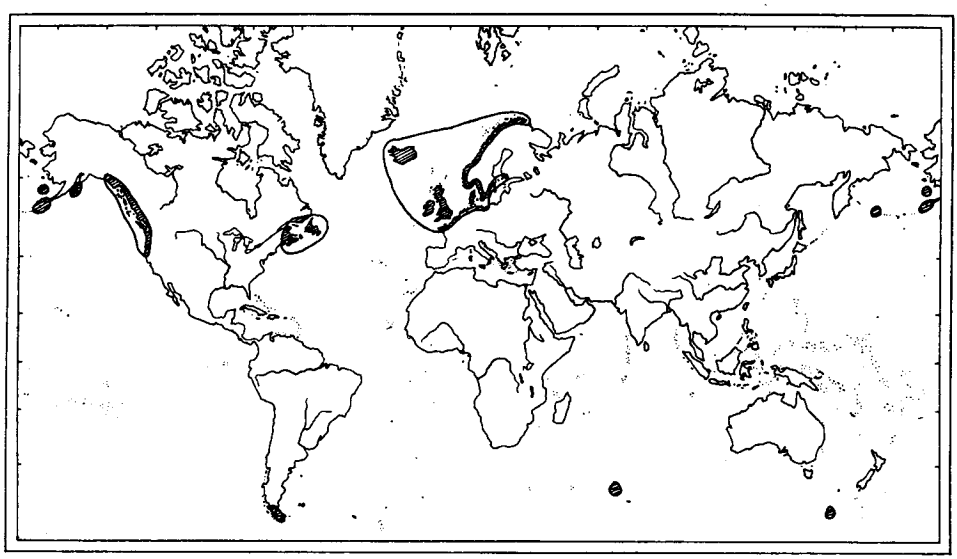


Fig. 20. World distribution of *Ulota phyllantha* Brid.

In Europe the distribution of *U. phyllantha* is restricted to rocky coasts of north-western part of the continent (Fig. 21). It is common in maritime areas on Iceland, with special concentration of the localities along the western and north-western coasts of the

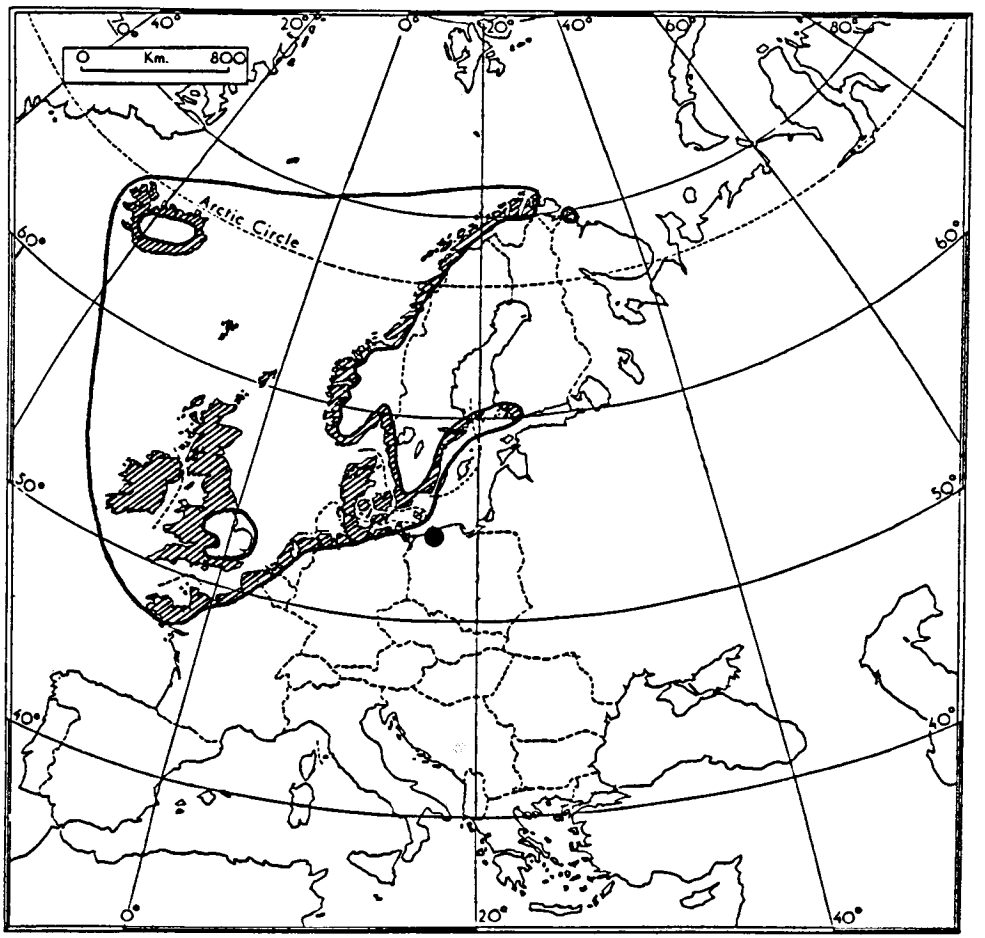


Fig. 21. Distribution map for *Ulota phyllantha* Brid. in Europe.

island (Hesselbo 1918; Jóhannsson 1990), the Faroes (Boesen *et al.* 1975) and throughout the British Isles, except for some small areas in eastern and central England (Corley & Hill 1981). In Scandinavia the species is widespread along the rocky coast of Norway extending as far north as the North Cape at lat. 70°58'N with the easternmost occurrence on the Rybachiy Peninsula in the Soviet Union (Shlyakov & Konstantinova 1982). Furthermore it is widespread in southern Sweden along the coastal area from the Province of Göteborg in the west to the Province of Uppland in the east (Nyholm 1960) and extends to south-western Finland including the Åland archipelago (Bomansson & Brotherus 1894). On the European mainland its range extends along the relatively narrow coastal belt from Bretagne in France (Husnot 1884–1890; Camus 1911), through Belgium (De Zuttere & Schumacker 1984) and Holland (Touw & Rubers 1989) to the North German Plain including the Lower Saxony (Niedersachsen) (Koppe 1964), Schleswig-Holstein (Jensen 1951, 1952; Frahm & Walsemann 1973) and Mecklenburg as far east as

the island of Rügen (Kühner & Pankow 1967; Kühner *et al.* 1968) and West Pomerania as well as throughout Denmark (Jensen 1939) extending as far east as the island of Bornholm on the Baltic (Mönkemeyer 1911). *U. phyllantha* has also been reported from a single locality in Czecho-Slovakia (Matouschek 1899), but this finding is unreliable and in all likelihood it is the result of the misplacement of the labels in the herbarium (Váňa 1986). Likewise, the occurrence of this species on the Canary Islands of Macaronesia (Eggers 1982) seems to be doubtful.

The locality in north-western Poland, which is described herein, is the easternmost occurrence of this species on the European mainland. The discovery of *U. phyllantha* in this region should not be surprising since it is still under the strong influence of an oceanic climate and many atlantic and subatlantic species of vascular plants, e.g. *Carex ligerica* Gay, *Atriplex glabriuscula* Edmondston, *A. calotheca* (Rafn) Fries, *Helosciadium inundatum* (L.) Reichenb. f., *Oenanthe lachenalii* Gmel., and *Lonicera periclymenum* L., penetrate into West Pomerania and have here the eastern limit of their European range (Czubiński 1950; Pawłowska 1972).

In North America *U. phyllantha* is bicentric in distribution. It is more common on the Pacific coast extending from southern Alaska at lat. ca. 60°N to central Oregon at lat. ca. 44°N (Lawton 1971; Schofield 1972, 1976), with some isolated and disjunct stations on the Aleutian Islands (Cardot & Thériot 1902; Persson 1954; Peterson *et al.* 1980) and Saint Paul Island in the Pribilof Islands group (Cardot & Thériot 1902). In eastern North America the species is rare and localized and extends from south-eastern Labrador (Brassard & Weber 1978) through the Gulf of St. Lawrence region of Québec including Gaspé Peninsula and Anticosti and Magdalen Islands (Belland 1987) and Newfoundland (Brassard 1983) southwards to Nova Scotia, New Brunswick and Maine (Crum & Anderson 1981; Ireland 1982). In Asia *U. phyllantha* does not occur, although it has allegedly been reported from the coast of Siberia (Malta 1927) and the Soviet Far East (Abramova *et al.* 1961), but no closer information on these records are available.

Ulota phyllantha is one of several dozens of moss species showing the dramatic bipolar disjunction in distribution (Schofield 1974), without intermediate populations in tropical areas. It has admittedly been mentioned from the high elevation of Chimborazo in the northern Andes of Ecuador (Wilson 1855), but this record proved to be based upon misidentification of an *Orthotrichum* (Dixon 1924; Dixon & Jameson 1924). It was reported for the first time from Cape Horn by Sullivant (1859), but in fact the species was first collected in the southernmost tip of South America on Hermite Island close to Cape Horn by J. D. Hooker during his Antarctic voyage of 1839–1843. However, this material was originally reported as *Orthotrichum crispum* Hedw. (Wilson & Hooker 1847) and this misdetermination has later been corrected by Mitten (1869). Nevertheless the species is exceedingly rare in southern South America and there are only two other collections from the Province of Magallanes of Chile, Seno de Skyring (Cardot & Brotherus 1923) and Tierra del Fuego (Bartram 1952). In addition, *U. phyllantha* has recently been recorded from the sub-Antarctic island of Macquarie (Seppelt 1978). It is also known from another sub-Antarctic island, Kerguelen, whence it was originally described as *U. phyllanthoides* C. Muell. (Müller 1883, 1889), but Malta (1927) has convincingly

shown that this species is inseparable from *U. phyllantha*. It should be mentioned that information on the occurrence of *U. phyllantha* in "southern Africa" (Smith 1978; Seppelt 1978) refers correctly to Kerguelen Island, which is included by the compilers of "Index Muscorum" (Wijk *et al.* 1969) to "Afr. 4".

A KEY FOR DETERMINATION OF *ULOTA* SPECIES IN POLAND

The only key for determination of Polish species of *Ulota* was published by Szafran (1961) in his handbook of mosses of Poland. Because it does not include all species now known to occur in the country as well as presents the out-of-dated concept of taxa, we find it worthwhile to compile a new key for determination of species of this genus. All *Ulota* species are susceptible to the effects of atmospheric pollution and are very endangered with extinction or considerable diminishing the frequency and abundancy in Poland (Ochyra 1986b). Hence their correct identification is of great importance.

1. Dioicous; costa excurrent as a stout cuspidate point; upper leaves with clusters of brown, fusiform, uniseriate, 4-8-septate gemmae ..... *U. phyllantha*
1. Monoicous; costa percurrent or ending below the apex; gemmae lacking 2

2. Capsules inflated and pyriform when dry and empty, whitish, smooth throughout except for a pleated mouth ..... *U. coarctata*
2. Capsules oblong-cylindric to fusiform when dry and empty, brownish, furrowed 3

3. Saxicolous plants; leaves stiff, imbricate, straight or slightly flexuose when dry .... *U. hutchinsiae*
3. Corticolous plants; leaves moderately to strongly crisped or curved when dry 4

4. Leaves ± curved and erect when dry; stomata numerous, 20–30 per capsule; exostome teeth whitish, erect to spreading when dry ..... *U. drummondii*
4. Leaves strongly crisped when dry; stomata few, usually 2–12 per capsule; exostome teeth yellow-brown to pale brownish, reflexed when dry 5

5. Operculum with a yellowish-red rim; calyptra smooth or with few hairs ..... *U. rehmannii*
5. Operculum self-coloured; calyptra densely hairy 6

6. Exothecial rib cells separated by 2–3 rows of small incrassate cells from the orifice; inner surface of the exostome teeth smooth or nearly so at the base and less densely papillose distally ..... *U. crispa*
6. Exothecial rib cells reaching the orifice; inner surface of the exostome teeth strongly papillose throughout ..... *U. bruchii*

Acknowledgments. We are indebted to Professor W. Schultze-Motel, Berlin, for arranging the loan of *Ulota phyllantha* from B.

REFERENCES

ABRAMOVA A. L., SAVICH-LYUBITSKAYA, L. I. & SMIRNOVA Z. N. 1961. Opredelitel' listostebel'nykh mkhov Arktiki SSSR ["Handbook of the Arctic mosses of the USSR"]. 716 pp. Izdatel'stvo Akademii Nauk SSSR, Moskva – Leningrad (in Russian).

BARKMAN J. J. 1958. Phytosociology and ecology of cryptogamic epiphytes. 628 pp. Assen.

BARTRAM E. B. 1952. Mosses of Chile and Argentina mainly collected by R. Santensson. – Svensk Bot. Tidskr. **46**(2): 242–253.

BELLAND R. J. 1987. The disjunct moss element of the Gulf of St. Lawrence region: glacial and postglacial dispersal and migrational histories. – Journ. Hattori Bot. Lab. **63**: 1–76.

BOESEN D. F., LEWINSKY J. & RASMUSSEN L. 1975. A check-list of the bryophytes of the Faroes. – Lindbergia **3**: 69–78.

BOMANSSON J. O. & BROTHERUS V. F. 1894. Herbarium Musei Fennici. II. Musci. 79 pp. + 1 map. J. Simelius, Helsingforsiae.

BRASSARD G. R. 1983. Bryogeography, with special references to mosses. – In: G. R. SOUTH (ed.), Biogeography and ecology of the island of Newfoundland, pp. 361–384. Dr W. Junk Publisher, The Hague.

BRASSARD G. R. & WEBER D. P. 1978. The mosses of Labrador, Canada. – Can. J. Bot. **56**: 441–466.

BREMER B. 1980. A taxonomic revision of *Schistidium* (Grimmiaceae, Bryophyta) 1. – Lindbergia **6**: 1–16.

BRIDEL S.-E. de. 1819. Methodus nova muscorum ad naturae normam melius instituta et Muscologiae recentiorum accommodata. III–XVII + 1–220 pp. A. Ukertum, Gothae.

CAMUS F. 1911. Sur la distribution de l'*Ulota phyllantha*. – Bull. Soc. Bot. France **58**: 65–74.

CARDOT J. & BROTHERUS V. F. 1923. Les mousses. – K. Svensk. Vetensk. Akad. Handl. **63**(10): 1–73.

CARDOT J. & THÉRIOT I. 1902. Papers from the Harriman Alaska Expedition. XXIX. The mosses of Alaska. – Proc. Washington Acad. Sci. **4**: 293–372 + pls. XIII–XXIII.

CORLEY M. F. V. & HILL M. O. 1981. Distribution of bryophytes in the British Isles. A census catalogue of their occurrence in vice-counties. 160 pp. British Bryological Society, Cardiff.

CORLEY M. F. V., CRUNDWELL A. C., DÜLL R., HILL M. O. & SMITH A. J. E. 1981. Mosses of Europe and the Azores; an annotated list of species, with synonyms frpm the recent literature. – J. Bryol. **11**: 609–689.

CRUM H. & ANDERSON L. E. 1981. Mosses of eastern North America. **2**, pp. 665–1328. Columbia University Press, New York.

CZUBIŃSKI Z. 1950. Zagadnienia geobotaniczne Pomorza [Geobotanical problems in Pomerania]. – Bad. Fizjogr. Pol. Zach. **2**(4): 439–658 (in Polish with English summary).

DE ZUTTERE Ph. & SCHUMACKER R. 1984. Bryophytes nouvelles, méconnues, rares, menacées ou disparues de Belgique. – Trav. Serv. Conserv. Nat. **13**: 1–161 + 40 maps.

DIXON H. N. 1924. Miscellanea bryologica. IX. – J. Bot. **62**: 228–236.

DIXON H. N. & JAMESON H. G. 1924. The student's handbook of British mosses. ed. 3. XLVIII + 582 + pls. 63. Sumfield & Day Ltd., Eastbourne.

DÜLL R. 1985. Distribution of the European and Macaronesian mosses (Bryophytina). Part II. – Bryol. Beitr. **5**: 110–232.

EGGERS J. 1982. Artenliste der Moose Makaronesiens. – Cryptogamie, Bryol. Lichénol. **3**(4): 283–335.

ENGEL J. J. & SCHUSTER R. M. 1973. On some tidal zone Hepaticae from South Chile, with comments on maritime dispersal. – Bull. Torrey Bot. Club **100**(1): 29–35.

FRAHM J.-P. 1974. Moosgesellschaften an Küstenfelsen in West-Island. – Act. Bot. Isl. **3**: 89–96.

FRAHM J.-P. & WALSEMANN E. 1973. Nachträge zur Moosflora von Schleswig-Holstein. – Mitt. Arbeitsgem. Geobot. Schleswig-Holstein Hamburg **23**: 1–205.

HAGEN I. 1908. Forarbejder til en Norsk Løvmosflora. I. Orthotrichaceae. – Det Kgl. Norsk. Videnskab. Selsk. Skrift. **1907**(13): 1–100.

HÄYREN E. 1914. Über die Landvegetation und Flora der Meeresfelsen von Tvärminne. – Acta Soc. F. Fl. Fennica **39**(1): 1–193.

HESSELBO Ch. A. 1918. The Bryophyta of Iceland. – In: L. K. ROSENVINGE & E. WARMING (eds), The botany of Iceland **1**(2, 4), pp. 395–677. J. Frimodt, Copenhagen & John Wheldon & Co., London.

HINTZE F. 1905. Beiträge zur Moosflora von Pommern. – Allg. Bot. Zeitschr. **9**: 151–154.

HINTZE F. & KOHLHOFF C. F. 1902. Einige seltene Moose aus Pommern. Sammelbericht bis zum 1. Januar 1902. – Verh. Bot. Ver. Prov. Brandenburg **43**: 144–146.

HINTZE F. & KOHLHOFF C. 1904. Eine Wanderung durch ein interessantes Moosgebiet Hinterpommerns. – Verh. Bot. Ver. Prov. Brandenburg **45**: 38–40.

HÜBSCHMANN A. VON. 1970. Über die Verbreitung einiger seltene Laubmoose in nordwestdeutschen Pflanzengesellschaften. – Herzogia **2**: 63–75.

HÜBSCHMANN A. VON. 1976. Moosgesellschaften des nordwestdeutschen Tieflandes zwischen Ems und Weser. III. Teil: Epiphytische Moosgesellschaften. – Herzogia **4**: 167–198.

HÜBSCHMANN A. VON. 1978. Über Moosvegetation und Moosgesellschaften der Insel Vancouver (Kanada). – Phytocoenologia **5**(1): 80–123.

HÜBSCHMANN A. VON. 1986. Prodromus der Moosgesellschaften Zentraleuropas. – Bryoph. Bibl. **32**: I–VI + 1–413. J. Cramer, Berlin – Stuttgart.

HUSNOT T. 1884–1890. Muscologia gallica. Descriptions & figures des mousses de France et des contrées voisines. Première partie – Acrocarpes. 284 pp. + pls. 1–79. Privately published, Cahan.

IRELAND R. R. 1982. Moss flora of the maritime provinces. – Nat. Mus. Canada Nat. Mus. Nat. Sci. Publ. **13**: 1–738. Ottawa.

JENSEN Ch. E. O. 1939. Skandinaviens bladmossflora. V + 535 pp. Ejnar Munksgaard, København.

JENSEN N. 1951. Die atlantischen Rindenmoose und der atlantische Klimakeil. – Die Heimat **58**(6): 206–212. Neumünster.

JENSEN N. 1952. Die Moosflora von Schleswig-Holstein. – Mitt. Arbeitsgem. Flor. Schleswig-Holstein Hamburg **4**: 1–240.

JÓHANNSSON B. 1990. Islenskir mosar. Slæðsumosaætt, bólmosætt, taðmosaætt of hettumosaætt. – Fjölrit Náttúrufr. **15**: 49–67.

KARCZMARZ K. 1967. Stanowisko *Calliergon Richardsonii* (Mitt.) Kindb. na Pomorzu Zachodnim [The locality of *Calliergon Richardsonii* (Mitt.) Kindb. in West Pomerania]. – Fragm. Flor. Geobot. **13**: 525–527 (in Polish with English summary).

KOPPE F. 1964. Die Moose des Niedersächsenischen Tieflandes. – Abh. Naturw. Ver. Bremen **36**(2): 237–424.

KOPPE F. 1969. Moosvegetation und Moosflora der Insel Borkum. – Natur Heimat **29**(2): 41–84.

KÜHNER E. & PANKOW H. 1967. Die Verbreitung atlantischer Moose in Nordostdeutschland. – Flora Abt. B **157**: 165–178.

KÜHNER E., SCHÄDLICH G. & VERCH L. 1968. Beiträge zur Moosflora Mecklenburgs VII. Die Insel Rügen. – Wiss. Zeitschr. Univ. Rostock Math.-Naturw. R. **17**(4/5): 355–382.

LAWTON E. 1971. Moss flora of the Pacific Northwest. 362 pp. + pls. 1–195. Hattori Botanical Laboratory, Nichinan.

LIMPRICHT K. G. 1895. Die Laubmoose Deutschlands, Oesterreichs und der Schweiz. – In: Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. 2 Aufl. **4**(2) – Bryineae (Stegocarpae [Acrocarpae, Pleurocarpae excl. Hypnaceae]). 853 pp. E. Kummer, Leipzig.

MALTA N. 1927. Die *Ulota*-Arten Süd-Amerikas. – Acta Horti Univ. Latv. **2**: 165–208.

MATOUSCHEK F. 1899. Wilh. Siegmund's Verdienste um die bryologische Floristik Böhmens. – Mitt. Ver. Naturfr. Reichenberg **30**: 1–8.

MITTEN G. 1869. Musci Austro-Americani. Enumeratio muscorum omnium Austro-Americanorum auctori hucusque cognitorum. – J. Linn. Soc. Botany **12**: 1–659.

MÖNKEMEYER W. 1911. Die Moose von Bornholm. – Hedwigia **50**: 333–349.

MÜLLER C. 1883. Die auf der Expedition S. M. S. „Gazelle" von Dr. Naumann gesammelten Laubmoose. – Bot. Jahrb. **5**: 76–88.

MÜLLER C. 1889. Laubmoose (Musci frondosi). – In: Die Forschungsreise S. M. S. „Gazelle" unter Kommando des Kapitän zur See Freiherrn von Schleinitz. **5** – Botanik. 64 pp. Hydrographischen Amt des Reichs-Marine-Amts, Berlin.

MÜLLER K. (of Jever). 1840. Botanische Aphorismen. – Flora **23**: 545–560; 575–576.

NYHOLM E. 1960. Illustrated moss flora of Fennoscandia. II. Musci. **4**, pp. 287–408. The Botanical Society of Lund, CWK Gleerup, Lund.

OCHYRA R. 1986a. On the Antarctic species of the family Orthotrichaceae. – Lindbergia **11**: 141–146.

OCHYRA R. 1986b. Czerwona lista mchów zagrożonych w Polsce [Red list of threatened mosses in Poland]. – In: K. ZARZYCKI & W. WOJEWODA (eds), Lista roślin wymierających i zagrożonych w Polsce [List of threatened plants in Poland], pp. 117–128. Państwowe Wydawnictwo Naukowe, Warszawa.

OCHYRA R. & SZMAJDA P. 1978. An annotated list of Polish mosses. – Fragm. Flor. Geobot. **24**(1): 93–145.

OCHYRA R. & SZMAJDA P. 1983. Mosses (Musci). – In: J. SZWEYKOWSKI & T. WOJTERSKI (eds), Atlas of geographical distribution of spore plants in Poland. Series V. **1**. 31 pp. + 10 maps. Państwowe Wydawnictwo Naukowe, Warszawa – Poznań.

PAWŁOWSKA S. 1972. Charakterystyka statystyczna i elementy flory polskiej ["Statistics and elements of Polish flora"]. – In: W. SZAFER & K. ZARZYCKI (eds), Szata roślinna Polski ["Vegetation of Poland"]. **1**, pp. 129–206. Państwowe Wydawnictwo Naukowe, Warszawa (in Polish).

PERSSON H. 1954. Mosses of Alaska–Yukon. – The Bryologist **57**(3): 189–217.

PETERSON W. L., SMITH D. K. & SHARP A. J. 1980. The mosses of the Kodiak archipelago. – Journ. Hattori Bot. Lab. **47**: 269–285.

RENAULD F. & Cardot J. 1888. La fructification de l'*Ulota phyllantha* Brid. – Rev. Bryol. **15**: 36–37.

RICHARDS P. W. 1932. Ecology. – In: FR. VERDOORN (ed.), Manual of bryology, pp. 367–395. Martinus Nijhoff, The Hague.

ROSMAN-HARTOG N. & TOUW A. 1987. On the taxonomic status of *Ulota bruchii* Hornsch *ex* Brid., *U. crispa* (Hedw.) Brid. and *U. crispula* Bruch *ex* Brid. – Lindbergia **13**: 159–164.

SCHOFIELD W. B. 1972. Bryology in arctic and boreal North America and Greenland. – Can. J. Bot. **50**(5): 1111–1133.

SCHOFIELD W. B. 1974. Bipolar disjunctive mosses in the Southern Hemisphere, with particular reference to New Zealand. – Journ. Hattori Bot. Lab. **38**: 13–32.

SCHOFIELD W. B. 1976. Bryophytes of British Columbia III: habitat and distributional information for selected mosses. – Syesis **9**: 317–354.

SEPPELT R. D. 1978. Studies on the bryoflora of Macquarie Island II. *Ulota phyllantha* Brid. – New Zealand J. Bot. **16**: 21–23.

SHLYAKOV R. N. & KONSTANTINOVA N. A. 1982. Konspekt flory mkhov Murmanskoy Oblasti ["The conspectus of the bryophyte flora of the district of Murmansk"]. 228 pp. Akademia Nauk SSSR, Apatity (in Russian).

SMITH A. J. E. 1978. The moss flora of Britain and Ireland. 706 pp. Cambridge University Press, Cambridge – Melbourne.

SULLIVANT W. S. 1859. Musci. – In: United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, U. S. N. **17** – Botany, pp. 3–32 + pls. 1–26. C. Sherman & Son, Philadelphia.

SZAFRAN B. 1961. Flora polska. Rośliny zarodnikowe Polski i ziem ościennych. Mchy (Musci) ["Polish flora. Spore plants of Poland and adjacent regions. Mosses (Musci)"]. **2**. 408 pp. Państwowe Wydawnictwo Naukowe, Warszawa (in Polish).

TOUW A. & RUBERS W. V. 1989. De Nederlandse bladmossen. 532 pp. Koninklijke Nederlandse Natuurhistorische Vereniging, Utrecht.

VÁŇA J. 1986. Critical notes on the occurrence of some moss species in Czechoslovakia I. – Novit. Bot. Univ. Carol. **2**: 73–85.

VITT D. H. 1976. A monograph of the genus *Muelleriella* Dusén. – Journ. Hattori Bot. Lab. **40**: 91–113.

WARNSTORF C. 1903. Leber- und Torfmoose. – In: Kryptogamenflora der Mark Brandenburg und angrenzender Gebiete. **1**. XV + 481 pp. Gebrüder Borntraeger, Leipzig.

WIJK R. VAN DER, MARGADANT W. D. & FLORSCHÜTZ P. A. 1969. Index Muscorum. Vol. 5 (T–Z, Appendix). – Regn. Veget. **65**: I–XII + 1–922. Utrecht.

WILSON W. 1855. Bryologia Britannica; containing the mosses of Great Britain and Ireland, systematically arranged and described according to the method of Bruch and Schimper, with illustrative plates; being a new (third) edition, with many additions and alterations, of Messrs. Hooker and Taylor. XX + 448 pp. + 61 pls. Longman, Brown, Green, and Longmans, London.

WILSON W. & HOOKER J. D. 1847. Musci. – In: J. D. HOOKER (ed.), The botany of the Antarctic voyage of H. M. discovery ships Erebus and Terror, in the years 1839–43, under the command of Captain Sir James Clark Ross. **1**. Flora Antarctica. Pt. 2. Botany of Fuegia, The Falklands, Kerguelen's Land, etc., pp. 397–423. Reeve Brothers, London.

STRESZCZENIE

Rodzaj *Ulota* Mohr liczy w Europie 8–9 gatunków (Corley i in. 1981; Düll 1985; Rosman-Hartog & Touw 1987), z których 6 rośnie w Polsce (Szafran 1961; Ochyra & Szmajda 1983). Liczba ta nie jest jednak ostateczna i niniejszy artykuł zawiera opis *U. phyllantha* Brid., gatunku nowego dla flory Polski. Jest to typowy oceaniczny gatunek, którego występowania można było się spodziewać na Pomorzu Zachodnim, jako że najbliższe jego stanowiska na Rugii (Kühner & Pankow 1967; Kühner i in. 1968) oraz na Bornholmie (Mönkemeyer 1911) znajdują się około 100 km od granic Polski.

Ulota phyllantha została znaleziona na Pomorzu Zachodnim w miejscowości Ubiedrze jeszcze w 1914 roku przez niemieckiego zbieracza F. Hintzego, lecz zbiór ten nigdy przez niego nie został ogłoszony drukiem. Jedynie Koppe (1964) zupełnie przypadkowo wzmiankował go w swej pracy o mszakach Dolnej Saksonii, ale notatka ta uszła powszechnej uwagi. Materiał zebrany przez Hintzego jest przechowywany w zielniku w Berlinie (B) i został przez nas zbadany i opisany w niniejszym artykule.

Ulota phyllantha (Ryc. 1–19) jest wybitnym gatunkiem, odróżniającym się od wszystkich pozostałych gatunków w rodzaju masowym tworzeniem rozmnóżek, zebranych w grona na szczytach górnych liści. Ponadto jako jedyny gatunek w całym rodzaju jest rośliną dwupienną, niezwykle rzadko tworzącą sporogony, które zostały po raz pierwszy opisane dopiero w pół wieku po odkryciu tego gatunku (Renauld & Cardot 1888). Zupełnie wyjątkowe są również wymagania ekologiczne *U. phyllantha*, bowiem jest jednym z nielicznych gatunków mchów halofilnych. Optimum swego występowania i rozwoju ma na skałach nadmorskich w strefie przypływów i bryzgów fal morskich. Rośnie także na korze drzew i krzewów liściastych, ale w bezpośredniej bliskości wybrzeży morskich i tylko rzadko

rośnie jako epifit na stanowiskach śródlądowych położonych najwyżej kilkadziesiąt kilometrów w głębi lądu.

Ulota phyllantha jest gatunkiem bipolarnym o silnie porozrywanym euro-amerykańskim zasięgu na północnej półkuli z kilkoma oderwanymi stanowiskami na południowej półkuli na południowym krańcu Ameryki Południowej (Sullivant 1859; Mitten 1869; Cardot & Brotherus 1923; Bartram 1952) oraz na subantarktycznych wyspach Macquarie (Seppelt 1978) i Kerguelen (Malta 1927) (Ryc. 20). Jest gatunkiem wybitnie oceanicznym rosnącym w nadmorskich obszarach w całej zachodniej Europie od Islandii po Półwysep Kola oraz na kontynencie od Bretanii wzdłuż wybrzeży Morza Północnego po Rugię, Bornholm i południowo-zachodnią Finlandię (Ryc. 21). W Ameryce Północnej ma rozmieszczenie bicentryczne. Występuje wzdłuż wybrzeży Pacyfiku od południowej Alaski i Oregon z oderwanymi stanowiskami na Aleutach i na wyspie St. Paul na Morzu Beringa. Natomiast we wschodniej Ameryce Północnej jest znacznie rzadszy i występuje na Labradorze, Nowej Fundlandii sięgając na południu po Maine, Nowy Brunszwik i Nową Szkocję.

Obecnie z Polski znanych jest sześć gatunków z rodzaju *Ulota*. Są to w zdecydowanej większości mchy epifityczne, szczególnie wrażliwe na zatrucie powietrza. Stąd też większość gatunków znalazła się na liście gatunków zagrożonych wyginięciem w naszym kraju (Ochyra 1986b). Można je odróżnić według poniższego klucza:

1. Rośliny dwupienne; żebro wybiegające w formie tęgiego, zgrubiałego kończyka; górne liście z gronami bardzo licznych, brązowych, wrzecionowatych, 4-8–komórkowych rozmnóżek ..... *U. phyllantha*
1. Rośliny jednopienne; żebro dochodzi do szczytu lub kończy się poniżej; rozmnóżek brak 2

2. Puszki w stanie suchym gruszkowate, białawe, gładkie i tylko przy ujściu nieco marszczone ... *U. coarctata*
2. Puszki wydłużono-cylindryczne lub wrzecionowate w stanie suchym, brązowe, bruzdowane .. 3

3. Mchy naskalne; liście sztywne, w stanie suchym przylegające do łodygi, proste .... *U. hutchinsiae*
3. Mchy epifityczne; liście w stanie suchym ± silnie kędzierzawe lub zakrzywione 4

4. Liście w stanie suchym ± zakrzywione i wzniesione; aparaty szparkowe bardzo liczne, 20–30 na szyjce puszki; zęby egzostomu białawe, w stanie suchym wzniesione lub odgięte ..... *U. drummondii*
4. Liście w stanie suchym silnie kędzierzawe; aparaty szparkowe mniej liczne, 2–12 na szyjce puszki; zęby egzostomu żółto-brązowe do bladobrązowych, suche bardzo silnie w dół odgięte 5

5. Wieczko z żółto-czerwonym obrzeżeniem; czepek nagi lub z kilkoma włoskami .....*U. rehmannii*
5. Wieczko jednobarwne; czepek gęsto owłosiony 6

6. Wydłużone na żeberkach komórki egzotecjum oddzielone od ujścia puszki przez 2–3 rzędy małych, zgrubiałych komórek; wewnętrzna powierzchnia zębów egzostomu gładka w części nasadowej ..... *U. crispa*
6. Wydłużone na żeberkach komórki egzotecjum dochodzą do ujścia puszki; cała wewnętrzna powierzchnia zębów egzostomu bardzo silnie i gęsto brodawkowana .....*U. bruchii*