

## The lichen genus *Ochrolechia* in Poland I. *O. androgyna* s. lat. and *O. arborea*

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**Abstract:** JABŁOŃSKA, A. & KUKWA, M. 2007. The lichen genus *Ochrolechia* in Poland I. *O. androgyna* s. lat. and *O. arborea*. – *Herzogia* 20: 13–27.

The taxonomy, chemistry, morphology, habitat requirements and distribution of *Ochrolechia androgyna* s. lat. and *O. arborea* in Poland are detailed; there are two chemotypes (B and C) of *O. androgyna*. *Ochrolechia androgyna* B is a mountain taxon with few scattered lowland localities, whereas *O. androgyna* C is typically a lowland lichen with very few mountain records. The possible type collection of *O. androgyna* s. str. and holotype of *O. pulvinata* var. *ecorticata* proved to be *O. androgyna* B. *Ochrolechia androgyna* B is reported for the first time from Austria, Finland, France, Great Britain, Slovenia, Spain, Ukraine and North America (U.S.A.). *O. androgyna* C is recorded for the first time from Austria, Germany and Slovakia. *Ochrolechia arborea* appears to be continental in its distribution in Poland. Morphological variation of *O. arborea* is briefly discussed. *Pertusaria sordidogrisea* (= *O. sordidogrisea*) proved to be a synonym of *O. arborea*.

**Zusammenfassung:** JABŁOŃSKA, A. & KUKWA, M. 2007. Die Flechtengattung *Ochrolechia* in Polen I. *O. androgyna* s. lat. und *O. arborea*. – *Herzogia* 20: 13–27.

Die Taxonomie, Chemie, Morphologie, Standortsansprüche und Verbreitung von *Ochrolechia androgyna* s. lat. und *O. arborea* in Polen werden dargestellt. Zwei Chemotypen von *O. androgyna* (B und C) werden nachgewiesen. *Ochrolechia androgyna* B ist ein Taxon der montanen Höhenstufe mit zerstreuten Fundorten in den Tieflagen. *Ochrolechia androgyna* C ist eine typische Tieflagensippe mit einigen Funden in den Bergen. Die mögliche Typusaufsammlung von *O. androgyna* s. str. und der Holotypus von *O. pulvinata* var. *ecorticata* gehören zur Chemosippe B. Diese wird erstmals für Österreich, Finnland, Frankreich, Großbritannien, Slowenien, Spanien, Ukraine und Nordamerika (U.S.A.) nachgewiesen. *Ochrolechia arborea* ist anscheinend eine kontinental verbreitete Art in Polen. Die morphologische Variabilität von *O. arborea* wird kurz diskutiert. *Pertusaria sordidogrisea* (= *O. sordidogrisea*) stellte sich als ein Synonym von *O. arborea* heraus.

**Key words:** Taxonomy, chemistry, distribution, new synonyms, Ochrolechiaceae, Pertusariales, lichenized Ascomycota.

### Introduction

*Ochrolechia* A.Massal. (Ochrolechiaceae, Pertusariales, Ascomycota; see SCHMITT et al. 2006) is characterized by a crustose, continuous to areolate-cracked thin to thick, whitish to grey, or in some species yellowish, thallus. Soredia are produced in a few species [e.g. *O. alboflavescens* (Wulfen) Zahlbr. and *O. arborea* (Kreyer) Almb.]; isidia are also known, but appear to be rarer and in Europe are produced only by *O. subviridis* (Høeg) Erichsen (BRODO 1991, TØNSBERG 1992). Apothecia are rather large, sometimes reaching 1 cm in diam., with pruinose or epruinose discs. Anatomically characterized by a strongly amyloid hymenium including asci, a hyaline hypothecium, a hamathecium of paraphysoids, and simple thin-walled ascospores (BRODO 1991, SCHMITT & LUMBSCH 2004).

As many taxa are superficially similar in morphology (see BRODO 1991, TØNSBERG 1992), lichen substances are taxonomically very important in *Ochrolechia*; these include orcinol depsides, with gyrophoric acid as the most common substance found in the genus, orcinol depsidones,  $\beta$ -orcinol depsides, fatty acid and non-chlorinated xanthenes (HANKO et al. 1986, BRODO 1991, TØNSBERG 1992, SCHMITZ et al. 1994, SCHMITT & LUMBSCH 2004). The chemistry is also thought to be a good character for the delimitation of *Ochrolechia* from other similar genera (SCHMITZ et al. 1994, SCHMITT & LUMBSCH 2004).

Actually there is no comprehensive modern revision of the genus. VERSEGHY (1962) revised the genus worldwide, but overestimated morphological characters and made numerous errors in the identification of lichen substances (see BRODO 1991). Many of Verseghy's taxa are not currently accepted (e.g. BRODO 1991, MESSUTTI & LUMBSCH 2000, HANKO et al. 1986, Kukwa unpubl.), and some taxa still remain unclear. The excellent revision of North American corticolous taxa by BRODO (1991) provides new discriminating characters useful for defining the taxa, but is of limited use elsewhere. Another interesting work, by MESSUTTI & LUMBSCH (2000), deals with South American taxa, and there are other works, dealing with single species or groups of species (e.g. BRODO 1988, LUMBSCH et al. 2003). TØNSBERG (1992) is the first to present very valuable data on the chemistry and its correlation to morphology of some sorediate taxa, particularly in respect of *O. androgyna* s. lat., a very common, but rather complex aggregation of taxa.

The distribution of *Ochrolechia* is reasonably well investigated, the taxa occurring in both hemispheres from the Arctic and Antarctic to the tropics (e.g. KALB 1984, BRODO 1991, TØNSBERG 1992, MESSUTTI & LUMBSCH 2000, ØVSTEDAL & LEWIS SMITH 2001). However, there are still considerable gaps in our knowledge of the distribution of many taxa in many regions of the world, including Europe. In many cases the data are not reliable, as their determination was based mainly on morphological characters, which overlap in many respects, especially in sorediate members of the genus. Chemistry was often studied only by spot test reagents and lacked thin-layer-chromatography (TLC). In the case for Poland, 11 taxa reported (FALTYNOWICZ 2003), and almost all of which have not been confirmed by TLC. Some species were considered to be rather common (e.g. *O. arborea*, *O. androgyna*, *O. subviridis*), but some were very rarely reported from few stands only (e.g. *O. alboflavescens*, *O. parella* [L.] A.Massal., *O. upsaliensis* [L.] A.Massal.). Our preliminary results show that the frequency is different to that previously reported. In this paper we would like to present results of the studies on two most common *Ochrolechia* species in Poland, *O. androgyna* and *O. arborea*.

Although *Ochrolechia androgyna* is known mainly from boreal to arctic regions of the Northern Hemisphere (e.g. BRODO 1991), it is also reported from Australia (MCCARTHY 2006) and South America (MESSUTTI & LUMBSCH 2000). It is a sorediate lichen with a thick, usually shiny thallus and large, granulose, often yellowish soralia, and produces gyrophoric (major substance) and lecanoric acid (minor to trace) (BRODO 1991). During the intensive studies on sorediate and isidiate epiphytic lichens in Norway, TØNSBERG (1992) found *O. androgyna* to be more diverse chemically and morphologically than previously reported. Based on the presence of some diagnostic substances, he distinguished four chemotypes: *O. androgyna* A containing only gyrophoric acid (with lecanoric acid), *O. androgyna* B with additional unknown substances named 'androgyna B unknown 1, 2 & 3', *O. androgyna* C with murolic acid complex, and *O. androgyna* D producing variolaric acid (TØNSBERG 1992). Since the chemistry is correlated with some morphological characters (thickness and colour of thallus, size of apothecia, type and colour of soralia), TØNSBERG (1992) considered that they merited specific

rank, but there are still no names available for these 'chemical' taxa. The main problem seems to be caused by the lack of typification of *O. androgyna* (see BRODO 1991, see also HANKO et al. 1986); until this is done, the taxa should be treated as proposed by TØNSBERG (1992).

Although *O. arborea* has been reported from several localities in Poland, it has been considered to be rather uncommon (FALTYNOWICZ 2003) and vulnerable lichen (CIEŚLIŃSKI et al. 2006). The great similarity with *O. androgyna* s. lat. has most probably led to many mistakes; apparently TLC and UV-lamp fluorescence have not been applied in the determination of the specimens.

The main aim of this paper is to present the results of studies on the taxonomy, chemistry, morphology, habitat requirements and distribution of *Ochrolechia androgyna* s. lat. and *O. arborea* in Poland, together with records from elsewhere. Type collections of several names were studied, with those related to *O. androgyna* s. lat. and *O. arborea* are presented here and discussed. This paper is the first part of a series dealing with a revision of *Ochrolechia* in Poland.

## Material and methods

Material studied, including types, are housed in the following herbaria: B, BM, BSG, GZU, H, KRA, KRAM, LOD, OLTC, OLS, POZ, SLTC, UGDA, herb. Kolanko and herb. Schiefelbein; for comparison, a part of T. Tønsberg's collection in BG was studied. Specimens were studied for morphological and chemical characters. First, thalli were checked under UV-light to trace all specimens of *O. arborea*. Then, chemical analyses were performed by TLC (in solvents A, B and C) according to the methods of ORANGE et al. (2001). For the determining the distribution of gyrophoric acid in the thalli, a spot-test-reaction with C was applied to different parts of the thallus. Following morphological characters were examined under the stereoscopic microscope: thickness, morphology and colour of thallus, colour, shape and size of soralia and apothecia.

All localities of examined material are mapped according to the ATPOL grid square system (ZAJĄC 1978, modified by CIEŚLIŃSKI & FALTYNOWICZ 1993), the area of Poland being divided on the basis of geographical coordinates into  $100 \times 100$  km squares (symbols from Ag to Gg), each in turn divided into  $10 \times 10$  km subunits with numbers from 00 to 99 (numbered from left to right); see also KUKWA et al. (2002) and KUKWA (2004, 2005).

## Results

Only two chemotypes of *Ochrolechia androgyna*, B and C, have been found, the former represented by 208 specimens, and the latter by 184. All terricolous records from the Tatra Mts appeared to belong to another taxon. For *O. arborea*, only 70 specimens have been found in Polish material.

The morphology of 48 samples of *O. androgyna* B and 88 specimens of *O. androgyna* C were compared. Our results agreed perfectly with those reported by TØNSBERG (1992) for Norwegian material, as confirmed by comparative studies in BG. *Ochrolechia androgyna* B has a thick, distinctly tuberculate thallus, rather coarse soredia and consoredia in regular to irregular soralia, and large apothecia. *O. androgyna* C usually develops a thin thallus with small, rarely enlarged, separated from each other, tubercles and small apothecia; soredia and consoredia are smaller, and usually in regular and convex soralia. The differences are so distinct,

that with some experience it is even possible to distinguish *O. androgyna* B and C in the field using only a hand lens. However, TLC is recommended for confirmation, particularly in the case of small and young thalli or individuals in poor condition.

During the revision of *Ochrolechia* specimens in H, the second author studied syntype specimen of *Lecanora subtartarea* Nyl. nom. nudum, which was considered to be a synonym of *O. androgyna* (HANKO et al. 1986, BRODO 1991). This is a terricolous lichen with areoles (sometimes bullate) and irregularly produced granular soredia; gyrophoric and lecanoric acids together with pigments were detected by TLC. It is dissimilar to any of the *O. androgyna* chemotypes, but comes close to some morphs of *O. frigida* (Sw.) Lyngé and specimens referred to as *O. inaequatula* (Nyl.) Zahlbr. The whole complex of terricolous and muscicolous sorediate *Ochrolechia* needs further investigation (Kukwa, unpubl.).

### ***Ochrolechia androgyna* B**

?*Ochrolechia androgyna* (Hoffm.) Arnold s. str., Flora 68: 236 (1885). – *Lichen androgynus* Hoffm., Enum. Lich. 56 (1794).

?Type: Germany, no exact locality, sub *Lecanora tartarea* with a note in pencil '*L. androgyn.* Hoffm.' (H-ACH 1251D – syntype?; see HANKO et al. 1986).

*Ochrolechia pulvinata* var. *ecorticata* Verseghy, Beih. Nova Hedwigia 1: 84 (1962).

Type: Finland, Helsingfors (= Helsinki), Degerö, Hästnässund-Stansvik, 01.06.1947, L. Fagerström (H – holotype).

**Exs.:** Nowak, Lich. Polon. Merid. Exs. 17 (BM, H). Poelt, Pl. Graec. Lich. 322 (BM, H). Schade, Stolle & Riehmer, Lich. Saxon. Exs. 491 (BM). Tobolewski, Lichenoth. Polon. 30 (sub *O. tartarea* (L.) A.Massal., LOD-L-117). Tobolewski, Lichenoth. Polon. 245 (B, BM). Tobolewski, Glanc, Lichenoth. Polon. 341 and 416 (BM).

**Description:** Thallus episubstratal, thick, poorly to well delimited, usually bullate-tuberculate, tuberculae usually not separated from one another; cortex shiny to matt, white-grey to dark grey; prothallus usually developed, shiny, thick, pinkish in colour; soralia usually well delimited, rounded, later may become more confluent, concolorous with thallus or beige grey to yellowish-grey, sometimes pinkish; soredia fine or more frequently coarse, in consoredia, sometimes resembling isidia in quasi-isidiate specimens; apothecia rare, large, margin usually with at least narrow smooth, salmon-pink discoid tissues around the disc (see BRODO 1991), non-sorediate to completely sorediate. For a detailed description and iconography see TØNSBERG (1992).

**Chemistry:** *O. androgyna* B produces gyrophoric acid, with lecanoric acids in minor to trace amounts and three diagnostic substances '*androgyna* B unknowns 1, 2 & 3' (TØNSBERG 1992).

In Polish material, the diagnostic '*androgyna* B unknowns' were found in different quantities. Most specimens (160) contained '*androgyna* B unknowns 2 & 3'; 26 specimens contained all three '*androgyna* B unknowns', 20 specimens contained only '*androgyna* B unknown 3', and one specimen contained '*androgyna* B unknowns 1 & 3'. The substance '*androgyna* B unknown 1' was probably produced in all examined specimens, but the concentrations were probably too low to be detected; in many cases, we rechecked the specimens, and sometimes it was found to occur. As all specimens had a typical morphology of *O. androgyna* B, we treat them under that name with no hesitation.

In many specimens we also found 1–2 pigments in low Rf classes; they were not always detectable and seem not to be diagnostic as we also found them in other *Ochrolechia* species and in unrelated lichens that also contained gyrophoric acid. Interestingly, these pigments were not detected in lichens containing lecanoric acid only (e.g. *Pertusaria hemisphaerica* [Flörke] Erichsen or *Varicellaria rhodocarpa* [Körb.] Th.Fr.), so perhaps they are somehow biochemically related to gyrophoric acid.

In a few specimens atranorin was also detected in trace to minor amounts. In our opinion it is probably a natural product, since it was detected in samples taken from large thalli. Moreover, it was also detected in other taxa (e.g. *O. microstictoides* Räsänen; see also HANKO et al. 1986).

The thallial cortex, apothecial margin cortex and soredia always react C+ red, whereas the medulla in all parts is C-, very rarely faintly pinkish. The same reactions were also reported by BRODO (1991) and by TØNSBERG (1992).

In many specimens the cortex was covered by a necrotic layer, and thus did not react to C or the colour was very faint. However, when the reaction was checked in section, the cortex layer always reacted C+ red.

**Notes:** TØNSBERG (1992) revised types of three names: *O. roseosorediosa* Gyeln., *O. albo-sorediosa* Gyeln. and *O. tatrlica* Gyeln., tentatively placing them under *O. androgyna* B. All samples contained ‘*androgyna* unknown 1–3’ with ‘*androgyna* unknown 1’ in large amounts, a metabolite rarely found in large concentrations in Norwegian material, and there were also some minor morphological differences, e.g. colour of soredia and appearance of cortex (TØNSBERG 1992). Specimens with characteristics similar to those given for the type collections in the present study which can be classified, at least temporarily, as *O. androgyna* B as some intermediates exist. In our opinion, its diverse morphology is probably due to different environmental factors, such as type of substrate, air humidity and insolation. In general, it seems that saxicolous specimens have more densely packed soredia and firmer thalli, whereas epiphytic entities are looser, and soredia are easily separable from each other. It is difficult, however, to explain why soredia in some specimens become pinkish. More comprehensive studies, including molecular work, are necessary on the morphological variability of *O. androgyna* B.

The probable syntype of *O. androgyna* (see HANKO et al. 1986) also represents *O. androgyna* B with ‘*androgyna* B unknowns 2 & 3’ and typical thallus morphology and large apothecia. That agrees with TØNSBERG’s (1992) view that *O. androgyna* Hoffm. s. str. is represented by *O. androgyna* B. Whether the specimen in H-ACH represents the original material is, however, questionable. Interestingly, the other specimen (BM-ACH-434; sub *Lecanora tartarea*) also belongs to that chemotype. Furthermore, some additional 19<sup>th</sup> century specimens are represented by *O. androgyna* B, the other chemotypes being virtually absent in herbaria. The reason why it was so frequently collected is probably because the thallus is particularly conspicuous and also often fertile with large apothecia; other chemotypes have a thinner thallus and apothecia are rare and smaller.

The holotype of *O. pulvinata* var. *ecorticata* in H (see VERSEGHY 1962) has been located. TLC revealed a typical chemistry with all three ‘*androgyna* unknowns’, but the morphology was strange for *O. androgyna* B (no typical soredia, areoles with many granular papillae-like outgrowths). Although it is reminiscent of the quasi-isidiate form noted by TØNSBERG (1992: 233), it would still have been difficult to refer it to *O. androgyna* B. The additional specimen in H found under *O. pulvinata* var. *ecorticata* (see additional specimens examined) proved helpful: the thallus was similar to typical *O. androgyna* B, but only like the holotype of *O. pulvi-*

*nata* var. *ecorticata* in some characteristics. *O. pulvinata* var. *ecorticata* is an earlier name for *O. androgyna* B and would therefore be a synonym of some later names even if *O. androgyna* proved not to be the same as *O. androgyna* B.

**Habitat requirements:** In Poland *O. androgyna* B prefers deciduous trees, mostly *Fagus sylvatica*, but quite often it is found on *Picea abies*. Very rarely it is found on rocks. The species seems to prefer forest conditions and places with a rather high air humidity. The frequency on different substrata is as follows: *Fagus sylvatica* (76), *Picea abies* (48), bark of unidentified trees (30 deciduous ones, 1 conifer), *Abies alba* (12), *Alnus glutinosa* (11), *Quercus* spp. (5), *Sorbus aucuparia* and *S. sp.* (3), *Fraxinus excelsior* (2), *Betula* sp. (2), *Acer pseudoplatanus* (1), wood (2), mosses (2), sandstone (6), rocks (4), mossy rocks (2), and granite (1).

According to TØNSBERG (1992), *Ochrolechia androgyna* B preferred the bark of *Betula pendula/pubescens*, *Quercus* spp. and *Picea abies*, more rarely occurring on *Alnus* spp., *Sorbus aucuparia*, *Fagus sylvatica*, etc., and frequently grew over mosses and on rough bark surfaces; it was also found on rocks.

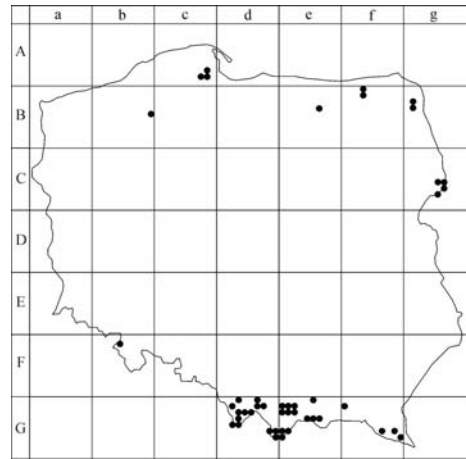
**Distribution:** In Poland *O. androgyna* B is a mountain taxon (Fig. 1), but in lowlands it is very rare with scattered localities in areas of the last glaciations. Its distribution is similar to that of some mountain vascular plants (ZAJĄC 1996) and lichens, e.g. *Lepraria neglecta* (Nyl.) Erichsen (KUKWA 2006). However, in Norway TØNSBERG (1992) found it to be coastal, with no inland records. As far as we know, *O. androgyna* B has been reported from Norway (TØNSBERG 1992), with single records from Germany (type of *O. roseosorediosa*), Bosnia and Herzegovina (type of *O. albosorediosa*) and Slovakia (type of *O. tatrica*). In this paper it is also reported from Austria, Finland, France, Great Britain, Slovenia, Spain, Ukraine and North America (United States), with additional records from Germany and Slovakia. It appears to be widely distributed in the Northern Hemisphere and absent in the Southern Hemisphere.

Number of specimens examined – 208

**Selected specimens examined:** [Ac-78] – By Tuchom lake, 54°25'21"N/18°22'06"E, on bark, 08.10.1955, T. Sulma (UGDA-L-3258). [Ac-87] – By lake Osuszyno, near Kartuzy town, on *Fagus sylvatica* and *Quercus* sp., 21.06.1958, Z. Tobolewski (POZ). [Ac-86] – Kurze Grzędy nature reserve, forest section No. 133b, on *Sorbus aucuparia*, 05.05.2005, M. Kukwa 4020 (UGDA-L-11451). [Bb-49] – Cisy w Czarnem nature reserve, 53°44'15"N/16°58'45"E, on *Quercus* sp., 13.11.2004, M. Kukwa 3728 (UGDA-L-12661). [Be-36] – 3 km N of Bredynki village, on *Alnus glutinosa*, 08.05.1990, S. Cieśliński (KTC). [Bf-03] – Near Diabla Góra hill, forest section No. 117, on *Alnus glutinosa*, 15.05.1992, A. Zalewska (OLS-L). [Bf-13] – Borki nature reserve, forest section 18, 54°07'N/22°06'E, on *Fraxinus excelsior*, 05.08.2004, A. Zalewska (OLS-L). [Bg-21] – Augustowska Forest, forest inspectorate Płaska, forest section No. 23, on wood, 01.11.1958, K. Glanc (KRAM-L-35825). [Bg-31] – Augustowska Forest, Starożyn nature reserve, forest section No. 211/191, on *Alnus glutinosa*, 17.09.1986, S. Cieśliński (KTC). [Cg-55] – Białowieża National Park, forest section No. 256, on *Alnus glutinosa*, 13 & 14.10.1988, S. Cieśliński, K. Czyżewska (KTC). [Cg-56] – Białowieża National Park, forest section No. 262, on *Alnus glutinosa*, 14.10.1988, S. Cieśliński, K. Czyżewska (KTC). [Cg-66] – Białowieża Large Forest, forest section No. 672A, on *Alnus glutinosa*, 1982, S. Cieśliński, Z. Tobolewski (KTC). [Cg-75] – Białowieża Forest, forest section 672A, on *Picea abies*, after 1980, S. Cieśliński, Z. Tobolewski (BSG). [Fb-14] – Góry Stołowe Mts, by the highway between Karlów and Radków towns, alt. 630 m, c. 5 km of Karlów village, on sandstone, 17.07.1951 & 07.09.1952, Z. Tobolewski (POZ). Ibidem., Tobolewski, Lichenoth. Polon. 30 (sub *O. tartarea* (L.) A.Massal., LOD-L-117). [Gd-03] – Skrzyczne Mt., alt. 700 m, on *Fagus sylvatica*, 20.07.1976, U. Bielczyk (KRAM-L-36241). [Gd-06] – Kiczora Mt., 15.06.1965, J. Nowak (KRAM-L-15863). [Gd-12] – Przysłop Mt., alt. 900 m, on *Sorbus* sp., 18.07.1976, U. Bielczyk (KRAM-L-36171). [Gd-16] – Babia Góra Mt., Markowe Równienki village, on *Picea abies*, 23.06.1961, J. Nowak (KRAM-L-8771). [Gd-17] – Hala Krupowa alp, alt. 1100–1200 m, on *Fagus sylvatica*, 05.06.1976, U. Bielczyk (KRAM-L-42054, 42055). [Gd-24] – Rysianka Mt., on *Picea abies*, 08 & 07.09.1964, J. Nowak (KRAM-L-16799 & 16921). Rysianka forest reserve near Lipowska Mt., c. 1150 m, on *Fagus sylvatica*, 10.09.1970, J. Nowak, Lich. Polon. Merid. Exs. 17 (BM, H). [Gd-25] – Piłsko nature reserve, alt. 1250 m, 09.07.1974, on *Picea abies*, U. Bielczyk (KRAM-L-41950 & 41951). [Gd-26] – Babia Góra Mt., alt. 1200 m, on *Picea abies*, 24.09.1975, U. Bielczyk (KRAM-L-43994). [Gd-33] – Będoszka Wielka Mt., c. alt. 1120 m, on *Fagus sylvatica*, 12.08.1964, J. Nowak (KRAM-L-14214 & 14213). [Gd-42] – Orzeł Mt.,

c. alt. 1050 m, on *Fagus sylvatica*, 09.08.1964, J. Nowak (KRAM-L-14262 & 14263 & 14115 & 14121 & 14546 & 14440 & 14385 & 14129). [Gd-43] – Bugaj Mt., under Hala Śrubita alp, c. alt. 1050 m, on *Fagus sylvatica*, 12.08.1964, J. Nowak (KRAM-L-13856). [Gd-58] – Dolina Jarzabcza valley, by Jarzabczy stream, alt. 1280 m, on *Picea abies*, 31.07.1957, J. Szejkowski (POZ). [Gd-59] – Tatry Mts, Dolina Kościeliska valley, by Kościeliski stream, on *Picea abies*, 06.07.1955, J. Nowak (KRAM-L-2359). S slope of Kominy Tylkowe Mt., alt. 1420 m, on *Picea abies*, 05.09.1959, Z. Tobolewski, Lichenoth. Polon. 245 (B, BM). [Gd-69] – Tatry Mts, Dolina Starorobociańska valley, c. alt. 1290 m, on *Picea abies*, 15.08.1960, Z. Tobolewski (POZ). [Ge-05] – Beskid Mały Mts, Zamczysko range near Łysina village, c. alt. 650 m, on mossy rocks, 10.08.1960, J. Nowak (KRAM-L-7636 & 7635). [Ge-10] – Gorce Mts, Turbacz Mt., on *Fagus sylvatica*, 06.09.1964, K. Glanc (KRAM-L-35811). [Ge-11] – Gorce, Figurki Dolne glade, alt. 1140 m, on sandstone, 03.09.1996 & 04.11.1999, P. Czarnota (GPN 1481/94, 2254). [Ge-12] – Gorce Mts, Dolina Kamienicy valley, c. alt. 600 m, on *Picea abies*, 20.08.1966, K. Glanc (KRAM-L-35834). [Ge-20] – Gorce Mts, S slope of Obidowiec Mt., by Lepietnica stream, c. 710 m n.p.m., on *Picea abies*, 07.09.1964, K. Glanc (KRAM-L-35835). [Ge-21] – Gorce Mts., Dolina Forędówki valley, on *Abies* sp., 02.04.1959, K. Glanc (KRAM-L-35819). N slope of Turbacz Mt., alt. 1260 m, spruce forest, on *Picea abies*, 20.08.1965, Z. Tobolewski, K. Glanc, Lichenoth. Polon. 416 (BM). [Ge-22] – Gorce Mts, Kamienica stream valley, alt. 1150 m, on *Picea abies*, 11.09.1959, K. Glanc (KRAM-L-35841). [Ge-34] – Nad Kotelnicyz Potokiem nature reserve, alt. 1000 m, on *Abies alba*, 31.08.1990, L. Śliwa (KRA). [Ge-35] – Jaworzynka Mt. near Pusta Wielka Mt., alt. 1000 m, on mosses, 22.10.1966, M. Olech (KRA). [Ge-36] – Between Jaworzynka Mt. and Runek Mt., alt. 1020 m, on *Fagus sylvatica*, 26.05.1989, L. Śliwa (KRA). [Ge-50] – Tatry Mts, Dolina Białej Wody valley, c. alt. 1300 m, on *Picea abies*, 04.07.1993, U. Bielczyk (KRAM-L-23955). [Ge-51] – Bieszczady Mts, Widelki forest division, between Berezki village and Bukowe Berdo Mt., c. alt. 950 m, on *Fagus sylvatica*, 11.08.1958, Z. Tobolewski (POZ). [Ge-60] – Tatry Mts, between Przyporniak stream and Zazadnia glade, alt. 900 m, on *Abies alba*, 21.09.1966, Z. Tobolewski (POZ). [Gf-10] – Diabli Kamień rock near Folsz village, on rock, 1954, T. Sulma (UGDA-L-12153). [Gf-56] – Bieszczady Mts, by Solinka river, Rawka Mt., c. alt. 800 m, on bark and on *Fagus sylvatica*, 07.08.1956, K. Glanc (KRAM-L-35842 & 35844 & 35843). [Gf-58] – Bieszczady Mts, E slope of Smerek Mt., c. alt. 900 m, on *Fagus sylvatica*, 21.08.1957, Z. Tobolewski (POZ). [Gf-68] – Bieszczady Mts, Bukowa Forest, near Wetlina village, by Wielki Lutowy stream, c. alt. 750 m, on *Fagus sylvatica*, 18.08.1956 & 18.08.1958, S. Cieśliński (KTC) & K. Glanc (KRAM-L-35828). [Gf-69] – Bieszczady Mts, Rawka Mt., alt. 800 m, on bark, 07.08.1956, K. Glanc (KRAM-L-35846). By the tourist path to Widelki Mt., alt. 900 m, on *Fagus sylvatica*, 05.09.1958, Z. Tobolewski, K. Glanc, Lichenoth. Polon. 341 (BM).

**Additional specimens examined:** (selected; a total of 185 specimens examined). **Austria.** Vorarlberg, Rätikon, SSW von Nenzing, Gamperdona-Tal, Bachschlucht SSE Kühbruck, S der Schmalzbergalpe, zwischen der Forststraße und dem Talboden, alt. 940–1180 m, ad arbores, 28.07.1986, A. Vězda (UGDA-L-10717). Steiermark, Schladminger Tauern, Hänge N der Riesachfälle, kurz W unter der Oberen Gfölleralm, c. 1300 m, Fichtenreicher Forst mit einzelnen Laubbäumen, 28.08.2001, U. Schiefelbein 814 (herb. Schiefelbein). Ibidem, Ennstaler Alpen, 3.5 km östl. St. Gallen, c. 500–590 m, Grundfeld, 8354/1, *Acer pseudoplatanus*, 03.05.1995, H. Mayrhofer, G. Böttger (GZU). Ibidem, Pözlalmbachgraben S Oberlaussa, c. 760–840 m, Grundfeld 8353/1, *Fraxinus excelsior*, 18.10.1994, G. Böttger, J. Prügger, G. Kantvilas, H. Mayrhofer (GZU). **Finland.** Helsinki, Lauttasaari (=Drumsö), on cliff, 13.06.1913, V. Räsänen (H, sub *O. pulvinata* var. *ecorticata*, det. K. Verseghy). **France.** ad saxa loco dicto 'dicto Chaos du gouët' prope Plaine-Haute (C.-du-N.), on rock, no date, H. de Abbayes, Lich. Armor. Exs. 39 (POZ). Dept. Orne, Parc Naturel Regional Normandie Maine, Forêt d'Ecouvres N von Alençon, 350 m, Fagetum N vom Rochers du Vignage, *Quercus robur*, 09.07.1980, J. Hafellner, Poelt, Pl. Graec. Lich. 322 (BM, H). **Germany.** Niedersachsen, Landkreis Lychow-Dannenb., Naturschutzgebiet „Breeseer Grund“, ca. 4 km SSE Gohrde, ca. 1.5 km S Gr. Stern, alte freistehende Eiche in einem ehemaligen Hudewald, an *Quercus* sp., 26.10.2003, U. Schiefelbein 1375 (herb. Schiefelbein). Schwarzwald, Baden, feuchtkühler Fichtenmischwald nördlich unterhalb des Notschrei, Kreis Freiburg, 1020–1050 m, Borke, 18.05.1967, J. Poelt, V. Wirth 4510 (GZU). An alten Tannen im Walde Bärenbad am Laber bei Oberammergau, *Abies*, 08.1893, Schnabl, Arnold, Lich. Monac. Exs. 1582 (BM). Erzgebirge: an *Fagus*, *Acer pseudopl.* und *Sorbus aucup.* bei Olbernhau, 09.1931, W. Flößner, Schade, Stolle & Riehmer, Lich. Saxon. Exs. 491 (BM). **Slovakia.** Tatra



**Fig. 1:** Known distribution of *Ochrolechia androgyna* B in Poland given in ATPOL grid square system.

Mts, Bielowodská dolina valley, alt. 1300 m, on *Picea abies*, 04.07.1993, U. Bielczyk (KRAM-L-23955). **Slovenia.** Pohorje, Šumik, along the creek Lobnica north of car parking area, c. 1020–1030 m, 46°28'53–55"N/15°27'07–11"E, on *Picea abies*, 29.05.2006, M. Kukwa 5143, C. Scheuer, H. Mayrhofer (UGDA-L-13380). Track above creek Lobnica to Veliki Šumik, c. 1000–1020 m, 46°28'55–57"N/15°27'18–27"E, on *Picea abies*, 29.05.2006, M. Kukwa 5155, C. Scheuer, H. Mayrhofer (UGDA-L-13392). **Spain.** Asturias, Prov. Oviedo, Parque Nacional de Muniellos N von Cangas de Narcea, Las Chabolas, 1150 m, Silikatblockwerk in lockerem Mischwald, 05.08.1980, J. Hafellner 9787 (GZU). **Ukraine.** Czywczyn Mts, Rotundul Mt., alt. 1205 m, on *Abies alba*, 28.08.1935, T. Sulma (UGDA-L-5053). Top of Albin Mt., alt. 1200 m, on *Picea abies*, 15.07.1935, T. Sulma (UGDA-L-4746). Slope of Preluki Mt., c. alt. 1520 m, on bark, 21.07.1934, T. Sulma (UGDA-L-4983). Mokryn Mt., on *Picea abies*, 04.08.1934, T. Sulma (UGDA-L-5201). Top of NW slope of Albin Mt, alt. 1200 m, on *Picea abies*, 15.07.1935, T. Sulma (UGDA-L-5224). **Great Britain.** Scotland, Argyll, Isle of Skye, East of road from Isleronsay to Broadford, Grid Ref. NG 59593 11866, meadow/moor, on *Quercus* sp., 12.10.2004, R. S. Larsen, 255, S. LaGreca (BM). Wales, Merioneth, Dolgelly, on *Alnus glutinosa*, 1961, K. A. Kershaw (BM). Snowdonia National Park, slope of mountain N of Llanfachreth, on *Quercus* sp., 28.08.2005, M. Kukwa 4588 (UGDA-L-12951). **U.S.A.** Maine, Hacock County, Acadia National Park, Schoodic Peninsula, NE of West Pond Cove (W of Schoodic Head), in spruce woods, on mossy rock, 21.07.1983, T. J. Sullivan 2302 (GZU).

### *Ochrolechia androgyna* C

**Description:** Thallus episubstratal, thin to thick (always thinner than in *O. androgyna* B), usually well delimited, with small regular tuberculae, usually well separated from one another; cortex shiny to matt, white-grey to dark grey, occasionally greenish-grey; soralia well delimited, but later some may become more confluent, convex in most case, rounded, beige-grey to yellowish-grey, or concolorous with thallus; soredia fine or more frequently coarse, in consoredia, sometimes densely packed in soralia and than resembling isidia; apothecia very rare, small up c. 2 mm in diameter, margin smooth, salmon-pink discoid tissues not observed (see BRODO 1991), non-sorediate to partly sorediate. For a detailed description see TØNSBERG (1992).

**Exs.:** Magnusson, Lich. Sel. Scand. 4 (isotypes of *O. bahusiensis*: GZU, B-92402).

**Chemistry:** This chemotype produces gyrophoric acid, trace of lecanoric acids and 3 substances of murolic acid complex (TØNSBERG 1992). Specimens from Poland were identical in their chemistry. When the specimens were rather small and/or a small part of the thallus was removed for TLC, only two substances of murolic acid complex were found. Additionally the same pigments as in *O. androgyna* B as well as traces of atranorin were detected in some specimens.

The thallial cortex, apothecial margin cortex and soredia always react C+ red, whereas the medulla in all parts is C-, which agrees with TØNSBERG (1992). As in *O. androgyna* B, the cortex was covered by a thin necrotic layer, and the reaction was best visible on a thallial section.

**Notes:** No available names have been found for *O. androgyna* C (see also TØNSBERG 1992), but the isotype specimens of *O. bahusiensis* H.Magn. in B and GZU contain *O. androgyna* C (see additional specimens studied). The sample in GZU consists mostly of fertile *O. androgyna* C with a small fragment of *O. subviridis*, whereas in B only *O. androgyna* C is present. *O. bahusiensis* is considered to be a synonym of *O. subviridis* by ALMBORN (1952), but he labelled it as 'at least pro p.'. Therefore, the holotype needs to be checked again if indeed it represents that taxon.

**Habitat requirements:** In Poland it is found mainly on *Fagus sylvatica*, *Alnus* spp. and *Quercus* spp., and very rarely on wood. Its frequency on different substrata is as follows: *Fagus sylvatica* (44), *Alnus glutinosa* and *A. sp.* (33), *Quercus* spp. (26 – incl. *Q. rubra*), *Betula* spp. (18), *Carpinus betulus* (16), *Fraxinus excelsior* (10), bark with tree species not noted (8), *Abies alba* (6), *Tilia cordata* (5), *Acer pseudoplatanus* (4), *A. platanoides* (3), *Populus tremula* (3),

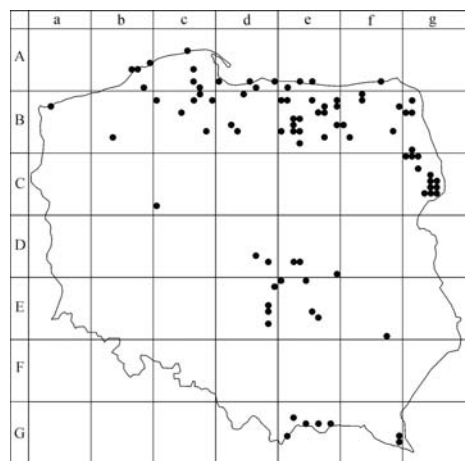


*Picea abies* (2), *Sorbus aucuparia* (2), *Salix* sp. (1), *Ulmus* sp. (1) and wood (2). In Norway, *O. androgyna* C prefers *Alnus incana*, *Quercus*, *Fagus sylvatica* and *Alnus glutinosa*, and more rarely *Betula*, *Salix*, *Tilia* etc. (TØNSBERG 1992).

**Distribution:** *O. androgyna* C is unevenly distributed in Poland, but mainly in the north (Fig. 2). It is known from only a few localities in central Poland, but in the mountain to the south it appears to be truly rare. *O. androgyna* C can be considered to be a lowland species, with a distribution similar to that of the lowland moss *Rhodobryum roseum* (Hedw.) Limpr. (FLAKUS & CYKOWSKA 2004). *O. androgyna* C has only been reported from Norway, Sweden and Finland (TØNSBERG 1992). In this paper it is also reported from Austria, Germany and Slovakia, with an additional record from Sweden.

Number of specimens examined – 184

**Selected specimens examined:** [Ab-59] – Orzechowo village near Ustka town, on *Fagus sylvatica*, 17.07.1986, W. Fałtynowicz (UGDA-L-2812). [Ab-66] – Lake Kopań sandbar, 54°29'N/16°26'E, on *Alnus glutinosa*, 14.07.1986, W. Fałtynowicz (UGDA-L-3273). [Ab-67] – Between Wicie and Jarosławiec villages, on *Betula pubescens*, 12.07.1986, W. Fałtynowicz (UGDA-L-3275). [Ab-98] – Janiewice village, Chomicz hill, on *Acer pseudoplatanus*, 26.08.1987, W. Fałtynowicz (UGDA-L-3557, KRAM-L-21832). [Ac-35] – Choczewo forest division, Szklana Huta forest inspectorate, on *Fagus sylvatica*, 13.09.1957, T. Sulma (UGDA). [Ac-66] – 1.5 km S of Porzecze village, on *Betula pendula*, 15.07.1985, W. Fałtynowicz (UGDA-L-3001). [Ac-86] – Bącka Huta village, on *Fagus sylvatica*, no date, T. Sulma (UGDA-L-12754). [Ac-97] – Gołubie village, near Gołubie lake, on *Fagus sylvatica*, 07.09.1963, T. Sulma (UGDA-L-12126). [Ad-80] – Gdańsk Oliwa town, Dolina Radości valley, on *Fraxinus excelsior*, 25.02.1962, T. Sulma (UGDA). [Ad-85] – Krynica Morska town, forest section No. 26m, on *Populus tremula*, 07.08.1981, E. Budzbon (UGDA-L-2183). [Ad-89] – Wola Lipowska village, c. 1 km SE of Piotrowice village, on *Acer platanoides*, 27.08.1993, S. Cieśliński (KTC). [Ad-96] – Grabianka stream valley, forest section No. 214, 54°16'N/19°31'E, on *Fagus sylvatica*, 07.08.2002, R. Szymczyk (OLS-L-16). [Ae-83] – 1.5 km NNE of Nowa Wieś Iławiecka village, on *Tilia cordata*, 05.05.1989, S. Cieśliński (KTC). [Ae-85] – C. 3.5 km SW of Bezledy village, on *Betula* sp., 05.05.1989, S. Cieśliński (KTC). [Ae-91] – C. 1.5 km NW of Skarbiec village, on *Alnus glutinosa*, 09.05.1989, S. Cieśliński (KTC). [Af-86] – Romincka Forest, Żytkiejmska Struga nature reserve, on *Quercus* sp., 15.05.1985, S. Cieśliński (KTC). [Ba-23] – Wolin island, Międzyzdroje forest division, on *Fagus sylvatica*, 18.06.1958, Z. Tobolewski (POZ). [Bb-73] – Złotniki village near Złotkowo village, on *Quercus* sp., 14.08.1985, W. Fałtynowicz (UGDA-L-3768). [Bc-08] – Przywidz village, on bark and on *Fagus sylvatica*, 26.09.1959, T. Sulma (UGDA-L-12162 & 12160). [Bc-10] – Stara Karczma Wojanowo village, on bark and on *Fagus sylvatica*, 12.10.1961, T. Sulma (UGDA-L-12129 an unnumbered specimen). [Bc-16] – Kościerzyna town, near Czaplinciec nature reserve, on *Fagus sylvatica*, 08.04.1960, T. Sulma (UGDA-L-12121). [Bc-19] – By Piekielko lake, NW of Miastko town, on *Fagus sylvatica*, 31.05.1983, W. Fałtynowicz (UGDA-L-3394). [Bc-34] – Leśno village near Brusy town, on *Quercus* sp., 10.05.1979, W. Fałtynowicz (UGDA-L-3720). [Bc-68] – C. 2.5 km W of Stara Rzeka village, 53°39'20"N/18°17'00"E, on *Quercus* sp., 14.06.2004, M. Kukwa 3315a (UGDA-L-11792). [Bd-04] – E of Elbląg city, Bażantarnia park, on *Fagus sylvatica*, 02.04.1959, T. Sulma (UGDA-L-12163). [Bd-52] – Dolina Miłosny valley, on *Fagus sylvatica*, 1965, T. Sulma (UGDA-L-12127). [Bd-63] – Polno village, on *Fagus sylvatica*, 11.09.1957, T. Sulma (UGDA-L-12161). [Be-10] – C. 2 km S of Orneta town, on *Alnus glutinosa*, 10.05.1989, S. Cieśliński (KTC). [Be-11] – C. 3 km SW of Mingajny village, on *Alnus glutinosa*, 10.05.1989, S. Cieśliński (KTC). [Be-15] – C. 2.5 km SEE of Bisztynek town, on *Fraxinus excelsior*, 07.05.1989, S. Cieśliński (KTC). [Be-19] – Gierłoż village, on *Betula* sp., 03.09.1988, S. Cieśliński (KTC). [Be-27] – Grzybowo forest division, forest section No. 107, 53°57'15"N/21°13'01"E, oak forest, on *Carpinus betulus* and *Fraxinus excelsior*, 05.07.2006, M. Kukwa 5259 & 5266 (UGDA). [Be-29] – Salik village, on *Quercus*



**Fig. 2:** Known distribution of *Ochrolechia androgyna* C in Poland given in ATPOL grid square system.

sp., 02.05.1989, S. Cieśliński (KTC). [Be-36] – 0.5 km NEE of Dębowo village, Dębowo nature reserve, on *Fagus sylvatica*, 28.08.1983, S. Cieśliński (KTC). [Be-37] – 2.5 km of Bagienice Nowe village, on *Carpinus betulus*, 19.09.1994, S. Cieśliński (KTC). [Be-42] – Olsztyn city, Las Miejski forest, 53°47.467'N/20°28.168'E, on *Quercus rubra* and *Fraxinus excelsior*, 2000 & 02.05.2005, D. Kubiak (OLTC). [Be-43] – C. 3 km SW of Gady village, on *Fraxinus excelsior*, 11.05.1989, S. Cieśliński (KTC). [Be-52] – Olsztyn city, by Ukiel lake, on *Alnus glutinosa* and wood, 2000, D. Kubiak (OLTC). [Be-59] – Piska Forest, c. 1.5 km E of Krutyń village, on *Acer* sp., 02.09.1987, S. Cieśliński (KTC). By Beldany lake, on *Carpinus betulus*, 09.11.1999, D. Kubiak (OLTC). [Be-60] – By the road Pawolki–Jadwiny, on *Quercus* sp., 20.07.1988, S. Cieśliński (KTC). [Be-62] – Between Ustrzych and Galik lakes, on *Fraxinus excelsior*, 29.08.1993, S. Cieśliński (KTC). [Be-63] – Olsztyn city, Las Warmiński nature reserve, by Oczko lake, on *Alnus glutinosa*, 2003, D. Kubiak (OLTC). [Be-77] – C. 1 km N of Czajki Nowe, on *Alnus glutinosa*, 04.05.1990, S. Cieśliński (KTC). [Be-83] – Dęby Napiwodzie nature reserve, 2005, D. Kubiak (OLTC). [Bf-00] – Mokre nature reserve by Mamry lake, on *Alnus glutinosa*, 04.09.1988, S. Cieśliński (KTC). [Bf-03] – Borecka Forest, forest section No.172/173, on *Betula* sp., 20.05.1987, S. Cieśliński, Z. Tobolewski (KTC). [Bf-13] – Borki nature reserve, forest section No. 22, on *Fraxinus excelsior*, 19.05.1987, S. Cieśliński, Z. Tobolewski (KTC). [Bf-29] – Augustowska Forest, forest section No. 14, c. 5 km N of Przewież village, on *Alnus glutinosa*, 15.09.1986, S. Cieśliński, Z. Tobolewski (KTC). [Bf-50] – Piska Forest, c. 1.5 km NW of Onufryjewo village, on *Carpinus betulus*, 07.09.1988, S. Cieśliński (KTC). [Bf-68] – Biebrzański National Park, Grzędy range, neighbouring area of forest sections Nos 144, 145 and 161, on *Carpinus betulus*, 15.09.2005, E. Bylińska, M. Kukwa, M. Seaward (UGDA). [Bf-71] – 2 km SW of Pogubie Tylne village, on *Sorbus aucuparia*, 24.08.1990, S. Cieśliński (KTC). [Bg-11] – Augustowska Forest, forest section No. 465, 1 km SE of Giby village, on *Alnus glutinosa*, 13.09.1986, S. Cieśliński, Z. Tobolewski (KTC). [Bg-30] – Augustowska Forest, forest sections Nos 201–226, 6 km E of Sajniki village, on *Alnus glutinosa*, 21.09.1986, S. Cieśliński (KTC). [Bg-31] – Perkuć nature reserve, on *Alnus glutinosa*, 18.09.1986, S. Cieśliński (KTC). [Bg-91] – 1 km SE of Karczmiśko village, by Czarna Rzeka river, on *Alnus glutinosa*, 01.07.1991, S. Cieśliński (KTC). [Cc-80] – Zielonka village near Poznań town, forest section No. 56c, on *Betula* sp., 21.08.1969, K. Glanc (KRAM-L-35833). [Cg-00] – 1.5 km SW of Rybniki village, on *Betula* sp., 01.07.1991, S. Cieśliński (KTC). [Cg-01] – Podsupraśl village, on *Tilia cordata*, 1985, S. Cieśliński (KTC). [Cg-02] – Knyszyńska Forest, Budzisk nature reserve, on *Fraxinus excelsior*, 05.08.1994, S. Cieśliński (KTC). [Cg-22] – C. 5 km NE of Folwarki Małe village, on *Betula* sp., 28.06.1991, S. Cieśliński (KTC). [Cg-34] – Ładzka Forest, Browek forest inspectorate, forest sections Nos 747b & 748a, on *Alnus glutinosa*, 1983, S. Cieśliński, Z. Tobolewski (KTC). [Cg-44] – Białowieża Forest, forest sections Nos 119D & 120D, on *Fraxinus excelsior*, after 1980, S. Cieśliński, Z. Tobolewski (BSG). [Cg-45] – Białowieża Forest, forest sections Nos 125B & 126A, on *Carpinus betulus*, after 1980, S. Cieśliński, Z. Tobolewski (BSG). [Cg-54] – Białowieża Forest, Hajnówka forest inspectorate, forest section No. 391D, on *Betula* sp., 1982, S. Cieśliński, Z. Tobolewski (KTC). [Cg-55] – Białowiecki National Park, by Orłówka river, on *Fraxinus excelsior*, 23.06.1997, S. Cieśliński (KTC). [Cg-63] – Białowieża Forest, 1 km SW of railway station in Witowo village, on *Betula* sp., after 1980, S. Cieśliński, Z. Tobolewski (BSG). [Cg-64] – Białowieża Forest, forest section No. 598B, on *Populus tremula*, after 1980, S. Cieśliński, Z. Tobolewski (BSG). [Cg-65] – Białowieża Forest, forest section No. 449D, on *Betula pendula*, after 1980, S. Cieśliński, Z. Tobolewski (BSG). [Dd-66] – Łódź town, Las Łagiewnicki forest, forest section No. 19a, on *Quercus petraea*, 07.08.1997, B. Kośmider (LOD-L-9962). [Dd-78] – Vicinity of Nowosolna village, Wiączyn nature reserve, on *Quercus* sp., 06.07.1969, K. Czyżewska (LOD-L-2950). [De-72] – Ryłsk Mały range, on *Carpinus betulus*, 18.06.1974, K. Czyżewska (LOD-L-2951). [De-73] – Trębaczew nature reserve, Rawa Mazowiecka forest division, forest section No. 92, on *Quercus* sp., 27.08.1969, K. Czyżewska (LOD-L-733). [De-99] – Kozińska Forest, Zagożdżon nature reserve, on *Carpinus betulus* and *Betula* sp. and on *Abies alba*, 12.08.1998 & 2001 & 1969, A. Gnat, S. Cieśliński (KTC). [Ed-19] – Lubiaszów nature reserve, on *Betula pendula*, 27.09.1971, K. Czyżewska (LOD-L-2949). [Ed-48] – Vicinity of Kobile Wielkie village, Masłowiec range, forest section No. 68, on *Fagus sylvatica*, 02.11.1970, K. Czyżewska (LOD-L-2095). [Ed-58] – Góra Chelmno nature reserve, Kobile Wielkie forest inspectorate, forest section No. 140, on *Carpinus betulus*, 21.06.1969, K. Czyżewska (LOD-L-2088). [Ed-78] – Dębowiec range, Silniczka forest division, forest section No. 165, on *Ulmus* sp., 21.09.1971, K. Czyżewska (LOD-L-1007). [Ee-00] – Spała nature reserve, on *Carpinus betulus*, 02.09.1969, K. Czyżewska (LOD-L-550). [Ee-04] – Rawicz forest district, forest section No. 231m, on *Acer pseudoplatanus*, 22.05.1974, K. Czyżewska (LOD-L-2948). [Ee-55] – Świnia Góra nature reserve, on *Quercus petraea*, 06.06.1974, K. Czyżewska (LOD-L-2947). [Ee-66] – Świętokrzyskie Mts, Świętokrzyski National Park, Dolina Wilkowska valley, forest section No. 103 and forest section No. 104, on *Alnus glutinosa*, 01.04.1998 & 04.07.1998, S. Cieśliński, A. Donica (KTC). [Ee-76] – Świętokrzyski National Park, Łysa Góra Mt., forest section No. 117 near 116, on *Sorbus aucuparia*, 26.07.1983, S. Cieśliński (KTC). [Ef-97] – Janowskie Forests, Porytowe Wzgórze hill, by Brania river, on *Alnus glutinosa*, 09.1999, D. Kubiak (OLTC). [Ge-22] – Gorce Mts, Twarogi Mt., above Ochotnica village, alt. 550 m, on *Betula* sp., 09.09.1960, K. Glanc (KRAM-L-35810). [Ge-34] – Wietrzne Dziury range, alt. 960 m, on *Acer platanoides*, 21.07.1990, L. Śliwa (KRA). [Ge-36] – Jaworzyna Mt., 1020 m n.p.m., on *Fagus sylvatica*, 11.07.1989 & 26.05.1989, L. Śliwa (KRA). [Ge-38] – Kozie Żebro Mt., 850 m n.p.m., on *Fagus sylvatica*, 22.07.1970, M. Olech (KRA). [Ge-51] – Bieszczady Mts, between Bereżki village and Bukowe Berdo Mt., c. 950 m n.p.m., on *Fagus syl-*

*vatica*, 11.08.1958, Z. Tobolewski (POZ). [Gf-59] – Bieszczady Mts, Pszczeliny village, on *Alnus glutinosa*, 25.09.1958, K. Glanc (KRAM-L-35830). [Gf-69] – Przysłup village, near Bereżki village, on *Fagus sylvatica*, 23.09.1958, K. Glanc (KRAM-L-35829).

**Additional specimens examined:** (selected; a total of 40 specimens examined). **Austria.** Steiermark, Steirisches Randgebirge, N Bachufer des Packer Baches, W von Modriach, ca. 0.5 km SW der Stampf, ca. 820 m, MTB 9056/1, *Acer* sp., 16.08.1994, E. Unger, H. Unger (GZU). Steiermark, Windische Bühel, Graben kurz W Großklein, Eschenauwald, Borke, 03.1974, J. Poelt (GZU). **Germany.** Mecklenburg-Vorpommern, Landkreis Uecker-Randow, ca. 3 km SSW Mönkebude, MTB 2249/2, ehemalige Hofstelle im Wald, *Carpinus betulus*, 08.04.1999, U. Schiefelbein 234 (herb. Schiefelbein). **Slovakia.** Belanske Tatry Mts, vicinity of Tatranská Kotlina town, on wood, 06.09.1957, T. Sulma (UGDA-L-12778). **Sweden.** Svennevad, Gropen, 26.06.1948, G. Kjellmert (POZ). Bohuslän, par. Långelandia, Röd, alt. 15 m, open situation facing the south-west and the sea, on *Quercus* sp., 26.07.1926, A. H. Magnusson, Magnusson, Lich. Sel. Scand. 4 (isotypes of *O. bahusiensis*: GZU – mixture of *O. subviridis* and fertile *O. androgyna* C; B-92402 – only *O. androgyna* C).

### *Ochrolechia arborea* (Kreyer) Almb.

Bot. Not. **3**: 254 (1952). – *Variolaria lactea* var. *arborea* Kreyer, Trudy Imp. S.-Peterburgsk. Bot. Sada **31**: 322 (1913). – *Pertusaria arborea* (Kreyer) Zahlbr., Catal. Lich. Univ. **8**: 520 (1932).

Type: Russia, Prov. Novgorod, Reg. Boprovici, near Rovnoe village, 1910, Savicz (LE – holotype, not seen).

*Lecanora perleprosa* Räsänen, Lich. Fenn. Exs. 897 (1946).

Type: Finland, Tavastia australis, Jämsä, Säyrylä, Pussila. Ad caudicem basali pruni padi, 25.09.1943, A. Koskinen, (H – holotype; BM – isotype, Räsänen, Lich. Fenn. Exs. 897).

*Pertusaria myriosora* Erichsen, Rev. Mycol., (Paris) Nov. Ser. **3**: 113 (1938).

Type: Bohemoslovakia, Sudeti orient., regio montis Králický Sněžník, prope pagum Králiky, c. 570 m s. m., ad corticem *Aceris pseudoplatani*, 1936, V. Kut'ák, (B, H, as Vězda, Lich. Sel. Exs. 912, UGDA-L-13454 – isotypes).

*Pertusaria sordidogrisea* Erichsen, Ann. Mycol. **38**: 32 (1940). – *Ochrolechia sordidogrisea* (Erichsen) E. Schreiner & Hafellner, Biblioth. Lichenol. **45**: 189 (1992).

Type: Germany, Niedersachsen, Stade, bei Höftgrube, 21.09.1931, C. F. E. Erichsen 98 (B-39763 – holotype; see HANKO 1983, SCHMITZ et al. 1994).

**Exs.:** Nowak, Lich. Polon. Merid. Exs. 125 (B-94344, H).

**Description:** Thallus endo- to episubstratal, thin and ± even to thick, folded and tuberculate, usually well delimited, tuberculae crowded or separated from one another; cortex shiny to matt, especially in tuberculate specimens, white-grey to dark grey, occasionally with beige tinge; soralia rounded or irregular, ± flat to slightly convex, well delimited, but sometimes becoming ± confluent in some parts of the thalli, white-grey to grey and beige-grey, usually brighter than the thallus; soredia fine to coarse, usually densely packed in soralia, and sometimes resembling isidia; apothecia very rare, being found only in one specimen in H (Finland, Vitikainen 7643; see additional specimens examined), up to 1.8 mm in diam., margin without salmon-pink discoid tissues, partly sorediate. For a detailed description see also BRODO (1991), NOWAK & TOBOLEWSKI (1975) and TØNSBERG (1992).

**Chemistry:** The species always contains gyrophoric and lecanoric (minor to trace amounts) acids and lichexanthone (HANKO et al. 1986, BRODO 1991, TØNSBERG 1992). Chemistry of Polish specimens agrees well with those reported earlier. Additionally the same pigments as in *O. androgyna* B and C were found. Cortex and soredia always react C+ red, whereas medulla

of thallus is C-. It was only possible to check the reaction of the medulla in specimens with a relatively thick thallus. As in *O. androgyna* s. lat., the cortex is covered by a necrotic layer, and the reaction was best seen in a thallial section. Soredia are yellow-orange to orange in UV due to the presence of lichexanthone, and the thallus is faintly orange.

**Notes:** *O. arborea* is uniform in its chemistry, but it is diverse in morphology. Usually specimens have thin to moderately thick, even to folded thallus, but rarely it develops a thick, areolate and verruculose to verrucose thallus (see also BRODO 1991). It seems from our observations that such morphology is caused by dusty and polluted open habitats, such as roadside trees; the type of *O. sordidogrisea* represents such a specimen, with a thallus unevenly covered by ashy-grey dust.

Apart from *Lecanora perleprosa* and *Pertusaria myriosora*, which were previously considered to be synonyms of *O. arborea* (see ALMBORN 1952, SANTESSON et al. 2004), *O. sordidogrisea* has never been connected with that name. HANKO (1983) and HANKO et al. (1986) considered it as probably belonging to *O. subviridis* (Høeg) Erichsen. SCHREINER & HAFELLNER (1992) transferred it to *Ochrolechia* and considered it be a separate taxon, fairly similar to *O. androgyna*. SCHMITZ et al. (1994) included *P. sordidogrisea* as a possible member of the genus *Ochrolechia*. In terms of chemistry, HANKO (1983) reported only gyrophoric with lecanoric acids, and noted in all his following further papers, but according to an annotation slip he considered that atranorin also probably occurred in the type collection. Annotations on the material by K. E. Schmitz indicate lichexanthone, but that information was not mentioned in SCHMITZ et al. (1994). The type specimen was re-checked by the second author, and gyrophoric and lecanoric acids along with lichexanthone were found in the thallus. The chemistry matches *O. arborea*, and the appearance of the thallus falls within the morphological variability of the species; we therefore consider *P. sordidogrisea* as a new synonym of the former.

In Polish material c. 70 % of specimens were correctly attributed to *O. arborea*, but 30 specimens were filed under other names, mostly as *O. androgyna* or *O. subviridis*. Both species can look similar, as the former produces soralia, and soredia of *O. arborea* might resemble isidia, but only *O. arborea* is UV+ orange and produces lichexanthone (BRODO 1991, TØNSBERG 1992).

**Habitat requirements:** In Poland it has been found mostly in light deciduous forests, rarely in open habitats. It has only been recorded on tree bark, mainly of *Alnus glutinosa*. The frequency on different substrata is as follows: *Alnus glutinosa* (26), *Sorbus aucuparia* (7), *Fraxinus excelsior* (5), unidentified deciduous tree (5), *Abies alba* (3), *Betula* spp. (3), *Populus* spp. (3), *Salix* spp. (3), *Tilia cordata* (3), *Acer platanoides* (2), *A. pseudoplatanus* (2), *Quercus* sp. (2), bark of log (1), *Cerasus avium* (1), *Fagus sylvatica* (1), *Malus* sp. (1), *Picea abies* (1) and *Prunus* sp. (1).

According to BRODO (1991) *O. arborea* is a species of bark and wood of different species of coniferous and deciduous trees in light forests and open habitats in North America. Similar observations are provided by TØNSBERG (1992).

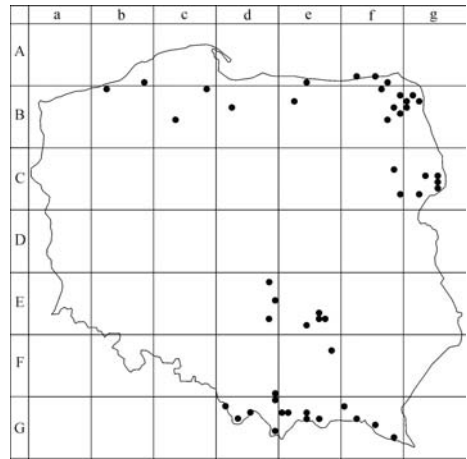
**Distribution:** Although the number of specimens examined is almost double those previously known, *O. arborea* is still rather rare in Poland, with an uneven distribution (Fig. 3). It appears to be rare in western Poland, but more frequent in north-eastern, central and southern parts of the country. It seems to have continental preferences, but this may reflect the uneven coverage in Poland. *O. arborea* is rather widely distributed, but so far it has only been reported from the northern hemisphere. It is known in Europe from, for example, Austria (HAFELLNER &

TÜRK 2001), Czech Republic (VĚZDA & LIŠKA 1999), Estonia (RANDLANE & SAAG 1999), Fennoscandia (TØNSBERG 1992, SANTESSON et al. 2004), Germany (SCHOLZ 2000), Iceland (FEUERER 2006), Lithuania (MOTIEJŪNAITĖ 1999), Spain (LLIMONA & HLADUN 2001) and Great Britain (COPPINS 2002). It has also been recorded from Mongolia (FEUERER 2006) and North America (BRODO 1991).

Number of specimens examined – 70

**Selected specimens examined:** [Ab–98] – Janiewice village, on *Sorbus aucuparia*, 26.08.1951, Z. Tobolewski (POZ). [Ae–94] – S the edge of Żydowo village, N of Bartoszyce village, on *Acer platanoides*, 05.05.1989, S. Cieśliński (KTC). [Af–82] – Zabrost Wielki village, by Węgorapa river, on *Betula* sp., 02.09.1988, S. Cieśliński (KTC). [Af–85] – Romincka Forest, forest section No. 290/209, on *Alnus glutinosa*, 16.05.1985, S. Cieśliński (KTC). [Af–97] – By Głazowisko Bachanowo nad Czarną Hańczą nature reserve, on *Alnus glutinosa*, 03.07.1999, W.

Faltnowicz, M. Kukwa (UGDA-L-9576). [Bb–02] – By lake Hołny, on *Alnus glutinosa*, 30.08.1985, S. Cieśliński (KTC). [Bc–08] – Przywidz village, 26.09.1959, T. Sulma (UGDA). [Bc–53] – By S part of Niedzwiedzie lake, 53°45'07"N/17°32'30"E, on *Betula pendula*, 11.02.2006, M. Kukwa 4835 (UGDA-L-12325). [Bd–32] – Biała Góra village, on *Tilia cordata*, 23.05.1959, T. Sulma (UGDA-L-3755). Between Benowo and Biała Góra villages, on *Tilia cordata*, 08.1966, T. Sulma (UGDA-L-6096). [Be–22] – C. 3 km NE of Dobre Miasto town, on *Populus* sp., 14.09.1989, S. Cieśliński (KTC). [Be–27] – 0.5 km E of Szpigłówka village, 53°57'19"N/21°11'15"E, on *Fraxinus excelsior*, 02.07.2006, M. Kukwa 5240 (UGDA). [Bf–06] – 1.5 km N of Matlak village, on *Alnus glutinosa*, 16.05.1987, S. Cieśliński, Z. Tobolewski (KTC). [Bf–19] – Jezioro Białe Wigierskie nature reserve, forest section No. 237, on *Alnus glutinosa*, 12.07.1995, M. Kukwa (UGDA-L-10149). [Bf–38] – Jeziorki village, on *Alnus glutinosa*, 23.05.1985, S. Cieśliński, Z. Tobolewski (KTC). [Bf–49] – W of Osowy Grąd village, on *Alnus glutinosa*, 31.08.1995, S. Cieśliński (KTC). By Kolno lake, Czapliniec nature reserve, on *Alnus glutinosa*, 23.09.1986, S. Cieśliński (KTC). [Bf–57] – By lake Dreństwo, on *Alnus glutinosa*, 17.05.1977, J. Nowak (KRAM-L-24298, specimen of *Buellia griseovirens*). [Bf–68] – Grzędy nature reserve, forest sections Nos 144 and 145, on *Betula* sp., 15.09.2005, E. Bylińska, M. Kukwa, M. Seaward (herb. Kolanko). [Bg–11] – By lake Wilkokuk, on *Alnus glutinosa*, 18.05.1977 J. Nowak (KRAM-L-24163). [Bg–30] – Augustowska Forest, forest section No. 285, Sucha Rzeczka village, on *Sorbus aucuparia*, 11.09.1986, S. Cieśliński (KTC). [Bg–32] – Augustowska Forest, Kudryniki village near Rudawka village, on *Alnus glutinosa*, 16.09.1986, S. Cieśliński, Z. Tobolewski (KTC). [Bg–40] – Augustowska Forest, forest section No. 72, near Glinka nature reserve, on *Alnus glutinosa*, 21.09.1986, S. Cieśliński (KTC). [Cf–38] – C. 4 km E of Sokoły village, on *Alnus glutinosa*, 27.08.1991, S. Cieśliński (KTC). [Cf–79] – 0.5 km S of Andryjanki village, on *Alnus glutinosa*, 30.08.1991, S. Cieśliński (KTC). [Cg–43] – Ładzka Forest, N edge of Waški village, on roadside tree, 1983, S. Cieśliński, Z. Tobolewski (BSG, KTC). [Cg–45] – Białowiecki National Park, forest section No. 224, by Hwoźna river, on *Alnus glutinosa*, 1982, S. Cieśliński (KTC). [Cg–55] – Białowiecka Forest, forest sections Nos 251A & 251B, on *Quercus* sp., 1983, S. Cieśliński, Z. Tobolewski (KTC). [Cg–65] – Białowiecki National Park, forest sections Nos 609A & B, on *Alnus glutinosa*, 1983, S. Cieśliński (KTC). [Cg–72] – Jelonka nature reserve, on *Populus tremula*, 1996, S. Cieśliński (KTC). [Ed–18] – Włodzimierzów village, by Luciąża river, 51°22'08"N/19°48'51"E, on *Alnus glutinosa*, 19.05.2005, M. Kukwa 4105 (UGDA-L-12922). [Ed–49] – Wilkowice range, by Pilica river, on bark of log, 30.06.1971, K. Czyżewska (LOD-L-2094). Zbyłowiec village, on *Alnus glutinosa*, 14.04.1971, K. Czyżewska (LOD-L-2089). [Ed–78] – Dębowiec nature reserve, forest section No. 163, on *Acer platanoides*, 27.08.1970, K. Czyżewska (LOD-L-841). [Ee–66] – Świętokrzyski National Park, Dolina Wilkowska valley, forest section No. 100, on *Alnus glutinosa*, 06.11.1998, S. Cieśliński, A. Donica (KTC). [Ee–76] – Świętokrzyski National Park, Chusty Gawroniec range, forest section No. 53, near Wola Szczygiełkowa village, on *Alnus glutinosa*, 19.07.1982, S. Cieśliński (KTC). [Ee–77] – Świętokrzyskie Mts, Chelmowa Góra forest division, Serwis-Dąbrowa range, on *Salix fragilis*, 05.07.2000, A. Donica (KTC). [Ee–84] – Nida-Łaziska village, on *Alnus glutinosa*, 11.10.1976, K. Toborowicz (KTC). [Fd–99] – Zawadka village, 15.04.1966, J. Nowak (KRAM-L-5641). [Ff–28] – Zagródki village, on *Tilia cordata*, 21.08.1965, J. Nowak (KRAM-L-13655). [Gd–09] – Pcim village, Dolina Kaczanki valley, c. alt. 450 m, on *Fraxinus* sp.,



**Fig. 3:** Known distribution of *Ochrolechia arborea* in Poland given in ATPOL grid square system.

05.07.1996, J. Nowak (KRAM-L-42802). [**Gd-11**] – Beskid Śląski Mts, Soszów Wielki Mt., alt. 750 m, on *Fraxinus excelsior*, 17.07.1976, U. Bielczyk (KRAM-L-42058). [**Gd-25**] – Zywiec village, Pilsko Mt., Glinne pass, c. 750 m n.p.m., on *Sorbus aucuparia*, 19.09.1964, J. Nowak (KRAM-L-16489). [**Gd-33**] – Rycerka stream valley, c. alt. 650 m, on *Sorbus aucuparia*, 07.08.1964, J. Nowak (KRAM-L-14182). [**Gd-59**] – Dolina Białego valley, alt. 960 m, on *Acer pseudoplatanus*, 16.06.1998, U. Bielczyk (KRAM-L-44477 & 44487 – specimen of *Pertusaria albescens*). [**Ge-20**] – Kowaniec stream valley, alt. 700 m, on *Salix* sp., 29.06.1967, K. Glanc (KRAM-L-38581). [**Ge-21**] – N slope of Czoło Turbacza Mt., W. Orkana nature reserve, alt. 1060 m, on *Alnus glutinosa*, 04.08.1994, S. Cieśliński (KTC). [**Ge-24**] – Przysietnica village, alt. 490 m, on *Cerasus avium*, 01.05.1991, L. Śliwa (KRA). [**Ge-34**] – By the road from Prehyba Mt. to Rytro village, 02.09.1954, on tree, T. Sulma (UGDA). [**Ge-36**] – Hala Szczawik alp, alt. 900 m, on *Prunus* sp., 07.09.1989, L. Śliwa (KRA). [**Gf-10**] – Folsz stream valley, Diabli Kamień rock monument, on *Fagus sylvatica* and *Abies alba*, 1954 & 1995, T. Sulma UGDA-L-12563, 6235 & 6232). [**Gf-32**] – Beskid Niski Mts, valley of Obszana Woda stream, near Barwinek, c. 430 m, on *Fraxinus excelsior*, 12.09.1974, J. Nowak, Lich. Polon. Merid. Exs. 125 (B-94344, H). [**Gf-45**] – SW slope of Komańcza Mt., 16.09.1956, T. Sulma (UGDA). [**Gf-68**] – Bukowa Forest, S of Wetlina village, by Wielki Lutowy stream, c. alt. 750 m, on *Abies alba*, 23.08.1957, Z. Tobolewski (POZ).

**Additional specimens examined:** (selected; a total of 39 specimens examined). **Austria.** Steiermark, zwischen Neuberg an der Mürz und Mürzsteg, an der Einmündung des Taleinschnitts SE unter der Falkenstein Alm, ca. 770 m, MTB 8359/1, Mischwald, auf *Fraxinus excelsior*, 20.10.1989, J. Hafellner 22603, E. Schreiner, W. Petutschnig (GZU). **Czech Republic.** Bílé Karpaty Mts, E edge of Vápenky village, by the stream and the edge of the forest, 48°52'30"N/17°38'09"E, alt. c. 450 m, on *Quercus* sp., 21.04.2006, J. Liška (UGDA-L-13213). **Estonia.** Jõgeramaa County, Endla Nature Reserve, Männikjärve bog trail, 58°52'21"N/26°14'56"E, peat bog, on very small *Pinus sylvestris*, 22.08.2004, M. Kukwa 3444 (UGDA-L-10091). **Finland.** South Savo, Mikkeli rural commune, Pajula, W of Piesanlampi, on *Alnus incana*, 02.08.1972, O. Vitikainen 7643 (H, fertile). **Germany.** Hessen, Krs. Erbach-Oderwald, Falkengesäß, 400 m, Wegebäume, auf *Fraxinus excelsior*, 01.10.1956, O. Behr 10195 (B). **Russia.** Karelia onegensis, Pertnavolok, on bark, 1863, A. Kullhem (H). **Sweden.** Värmland, Karlskoga par., Lokadalen, c. 300 m S of Limtjärnen, alt. c. 175 m, 59°31'N/14°30'E, bog, open situation, on *Alnus glutinosa*, 31.01.1981, L.-E. Muhr 3473 (BM).

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## References

- ALMBORN, O. 1952. A key to sterile corticolous crustaceous lichens occurring in South Sweden. – *Bot. Not.* **3**: 239–263.
- BRODO, I. M. 1988. Studies of the lichen genus *Ochrolechia*. 1. A new classification for *Pertusaria subplicans* and *P. rhodoleuca*. – *Canad. J. Bot.* **66**: 1264–1269.
- BRODO, I. M. 1991. Studies in the lichen genus *Ochrolechia*. 2. Corticolous species of North America. – *Canad. J. Bot.* **69**: 733–772.
- CIEŚLIŃSKI, S. & FAŁTYNOWICZ, W. 1993. Note from editors. – In: CIEŚLIŃSKI, S. & FAŁTYNOWICZ, W. (eds.). Atlas of the geographical distribution of lichens in Poland **1**: 7–8. Kraków: W. Szafer Institute of Botany of Polish Academy of Sciences.
- CIEŚLIŃSKI, S., CZYZEWSKA, K. & FABISZEWSKI, J. 2006. Red list of the lichens in Poland. – In: MIREK, Z., ZARZYCKI, K., WOJEWODA, W. & SZELAĞ, Z. (eds.). Red list of plants and fungi in Poland. – Kraków: W. Szafer Institute of Botany of Polish Academy of Sciences.
- COPPINS, B. J. 2002. Checklist of lichens of Great Britain and Ireland. – Huddersfield: British Lichen Society.
- FAŁTYNOWICZ, W. 2003. The lichens, lichenicolous and allied fungi of Poland. An annotated checklist. – In: MIREK, Z. (ed.). Biodiversity of Poland **6**: 1–435. – Kraków: W. Szafer Institute of Botany, Polish Academy of Sciences.
- FEUERER, T. (ed.) 2006. Checklists of lichens and lichenicolous fungi. Version 1 November 2006. – <http://www.checklists.de>.
- FLAKUS, A. & CYKOWSKA, B. 2004. The highest locality of *Rhodobryum roseum* (Bryopsida, Bryaceae) in Poland. – In: STEBEL, A. & OCHYRA, R. (eds.). Bryological studies in the Western Carpathians, pp. 79–82. – Poznań: Sorus.

- HAFELLNER, J. & TÜRK, R. 2001. Die lichenisierten Pilze Österreichs – eine Checkliste der bisher nachgewiesenen Arten mit Verbreitungsangaben. – *Stapfia* **76**: 3–167.
- HANKO, B. 1983. Die Chemotypen der Flechtengattung *Pertusaria* in Europa. – *Biblioth. Lichenol.* **19**: 1–297.
- HANKO, B., LEUCKERT, C. & AHTEI, T. 1986. Beiträge zur Chemotaxonomie der Gattung *Ochrolechia* (Lichenes) in Europa. – *Nova Hedwigia* **42**: 165–199.
- KALB, K. 1984. Lichenes Neotropici. Fasc. VIII (No. 301–350). – Neumarkt/OPF: Eigenverlag.
- KUKWA, M. 2004. New or interesting records of lichenicolous fungi from Poland II. Species mainly from northern Poland. – *Herzogia* **17**: 67–75.
- KUKWA, M. 2005. New or interesting records of lichenicolous fungi from Poland III. – *Herzogia* **18**: 37–46.
- KUKWA, M. 2006. The lichen genus *Lepraria* in Poland. – *Lichenologist* **38**: 293–305.
- KUKWA, M., MOTIEJŪNAITĖ, J., RUTKOWSKI, P. & ZALEWSKA, A. 2002. New or interesting records of lichenicolous fungi from Poland I. – *Herzogia* **15**: 129–139.
- LLIMONA, X. & HLADUN, N. L. 2001. Checklist of the lichens and lichenicolous fungi of the Iberian Peninsula and Balearic Islands. – *Bocconea* **14**: 1–581.
- LUMBSCH, H. T., MESSUTI, M. I. & NASH III, T. H. 2003. *Ochrolechia splendens* (Pertusariaceae), a new species from south-western North America. – *Lichenologist* **35**: 387–391.
- MCCARTHY, P. M. 2006. Checklist of the lichens of Australia and its island territories. Version 6 April 2006. – <http://www.anbg.gov.au/abrs/lichenlist/introduction.html>.
- MESSUTI, M. I. & LUMBSCH, H. T. 2000. A revision of the genus *Ochrolechia* in southern South America. – *Biblioth. Lichenol.* **75**: 33–46.
- MOTIEJŪNAITĖ, J. 1999. Checklist of lichens and allied fungi of Lithuania. – *Bot. Lithuanica* **5**: 251–269.
- NOWAK, J. & TOBOLEWSKI, Z. 1975. *Porosty polskie*. – Warszawa–Kraków: Państwowe Wydawnictwo Naukowe.
- ORANGE, A., JAMES, P. W. & WHITE, F. J. 2001. *Microchemical methods for the identification of lichens*. – London: British Lichen Society.
- ØVSTEDAL, D. O. & LEWIS SMITH, R. I. 2001. *Lichens of Antarctica and South Georgia. A guide to identification and ecology*. – Cambridge: Cambridge University Press.
- RANDLANE, T. & SAAG, A. (eds.) 1999. Second checklist of lichenized, lichenicolous and allied fungi of Estonia. – *Folia Cryptog. Estonica* **35**: 1–132.
- SANTESSON, R., MOBERG, R., NORDIN, A., TØNSBERG, T. & VITIKAINEN, O. 2004. Lichen-forming and lichenicolous fungi of Fennoscandia. – Uppsala: Museum of Evolution, Uppsala University.
- SCHMITT, I. & LUMBSCH, H. T. 2004. Molecular phylogeny of the Pertusariaceae supports secondary chemistry as an important systematic character set in lichen-forming ascomycetes. – *Mol. Phylogenet. Evol.* **33**: 1–82.
- SCHMITT, I., YAMAMOTO, Y. & LUMBSCH, H. T. 2006. Phylogeny of Pertusariales (Ascomycotina): Resurrection of Ochrolechiaceae and new circumscription of Megasporaceae. – *J. Hattori Bot. Lab.* **100**: 753–764.
- SCHMITZ, K., LUMBSCH, H. T. & FEIGE, G. B. 1994. Systematic studies in the Pertusariales II. The generic concept in the Pertusariaceae. – *Acta Bot. Fenn.* **150**: 153–160.
- SCHOLZ, P. 2000. *Katalog der Flechten und flechtenbewohnenden Pilze Deutschlands*. – Schriftenreihe Vegetationsk. **31**: 4–298.
- SCHREINER, E. & HAFELLNER, J. 1992. Sorediöse, corticole Krustenflechten im Ostalpenraum. I. Die Flechtenstoffe und die gesicherte Verbreitung der besser bekannten Arten. – *Biblioth. Lichenol.* **45**: 1–291.
- TØNSBERG, T. 1992. The sorediate and isidiate, corticolous, crustose lichens in Norway. – *Sommerfeltia* **14**: 1–331.
- VERSEGHY, K. 1962. Die Gattung *Ochrolechia*. – *Beih. Nova Hedwigia* **1**: 1–146.
- VĚZDA, A. & LIŠKA, J. 1999. *A catalogue of lichens of the Czech Republic*. – Průhonice: Institute of Botany, Academy of Sciences of the Czech Republic.
- ZAJĄC, A. 1978. Atlas of distribution of vascular plants in Poland (ATPOL). – *Taxon* **27**: 481–484.
- ZAJĄC, M. 1996. Mountain vascular plants in the Polish lowlands. – *Polish Bot. Stud.* **11**: 1–92.

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