

The lichen family Parmeliaceae in Poland. III. *Parmelia serrana*, new to Poland

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Abstract

Parmelia serrana A. Crespo, M.C. Molina & D. Hawksw. is reported here for the first time from Poland. The species has been recorded from more than 20 localities and exclusively on the bark of trees. Its general distribution, habitat requirements, morphology, secondary chemistry are provided and the differences between this species and similar taxa, especially *P. saxatilis* and *P. ernstiae*, are discussed.

Keywords: parmelioid lichens; chemotaxonomy; *Parmelia serrana*; distribution

Introduction

The genus *Parmelia* Ach. occurs in the boreal-temperate Northern Hemisphere [1,2]. It is characterized by foliose thalli, which are loosely to closely adnate to the substrate. Upper surface is smooth to foveolate, grey to brown-grey or grey-green, occasionally pruinose, with protoplectenychmatous and non-pored epicortex and always with usually elongated pseudocypbellae. The lower surface is black and uniformly rhizinate up to the margins, with simple, branched or squarrose rhizines. Some species develop soredia, pustules or isidia as the vegetative propagules. Apothecia are rare, especially in the species, which reproduce by soredia or isidia, with brown or rarely blackish discs; ascospores are colorless, ellipsoidal to oval in shape [1–5]. All *Parmelia* species contain atranorin and chloroatranorin in the cortex, but a variety of secondary metabolites are present in the medulla, including lobaric, salazinic and protocetraric acids [3,5].

Although *Parmelia* species are easily observed in the field and occur in a variety of habitats, up to the end of the last decade its taxonomy was based mainly on morphological characters and rarely on chemical characters for species identification. However, as it was proved recently, this approach masked the presence of species representing distinct phylogenetic clades with similar or identical morphology and chemistry (so-called cryptic or semi-cryptic species) [6–12]. The taxonomy of the genus *Parmelia* appears to be still far

from resolved as material from only a few regions has been investigated and the discovery of additional undescribed taxa is expected.

Previously in Poland, only six taxa have been reported: *Parmelia discordans* Nyl., *P. ernstiae* Feurer & A. Thell, *P. omphalodes* (L.) Ach., *P. saxatilis* (L.) Ach., *P. submontana* Nád. ex Hale and *P. sulcata* Taylor [13–18]. Two of these, the isidiate *P. saxatilis* and the sorediate *P. sulcata*, commonly reported from Poland, were recently shown to represent a group of cryptic or semi-cryptic species [8–11,19]. Therefore, their previously known distribution and frequency in Poland should be treated rather as potential and are in need of re-evaluation.

During the revision of the material previously referred to *P. saxatilis*, *P. serrana*, a recently recognized species previously not reported from Poland, was discovered. The aim of this article is to present the first records of this species in the country. The morphology, chemistry and general distribution of the species and discussion on allied taxa are provided. This paper is the third in the series dealing with lichens of the Parmeliaceae in Poland [20,21], and one of numerous designed to aid recognition of the country's lichen biota (e.g. [22–29]).

Material and methods

Herbarium material loaned from the following Polish herbaria: GPN, KRAM, KRAB, OLS, WA, WRSL, UGDA and herbarium of the Society Workshop for All Beings from Białystok (in the locality section as herb. SWAB) has been revised.

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Handling Editor: Krzysztof Spalik

Morphology was studied with a stereomicroscope and following characters were examined: color and structure of the upper surface (pruinose, not pruinose or dull), shape and development of lobes (elongated, broad, short, oval, imbricate or not), type of rhizines and their shape (simple, squarrose or branched), the abundance, shape (narrow or oval) and distribution (marginal, laminal) of pseudocyphellae, the abundance, shape and distribution on thallus of isidia. The secondary lichen compounds were studied with thin layer chromatography (TLC) in solvent A and C, according to Orange et al. [30]. The localities in Poland were mapped according to the ATPOL grid square system [31].

Results and discussion

Parmelia serrana A. Crespo, M.C. Molina & D. Hawksw. in Molina et al., *Lichenologist* 36(1): 48 (2004).

ICONOGRAPHY. Molina et al. [9], Thell et al. [5].

MORPHOLOGICAL CHARACTERS. Thalli adnate to loosely adnate, 3–7 cm in diameter; lobes sometimes overlapping, rounded to sublinear, up to 2–4 mm wide; upper surface pale greenish-grey to whitish-grey, shiny mainly towards the margins, sometimes dull and reticulately cracked, epruinose (sometimes, few lobe tips have faint pruina); pseudocyphellae linear or irregular in shape; isidia simple, cylindrical or branched, up to 0.2–0.8 mm tall and 0.05–0.1 mm wide, laminal and marginal, in well developed specimens densely covering central parts of the thalli; lower surface black, with long, simple or branched (but not squarrose) rhizines, up to 0.2–1 mm long; apothecia rare in Polish material; disc brown and concave; ascospores broadly ellipsoidal, 16–18 × 11.5–13 µm.

SECONDARY CHEMISTRY. The species produces atranorin (moderate amounts), salazinic acid (major), consalazinic acid (minor), often protocetraric acid (trace amounts only) and fatty acids: lichesterinic and protolichesterinic acids. The chemistry agrees with that reported by Molina et al. [9] and Thell et al. [5,11].

NOTES. *Parmelia serrana* is morphologically and chemically very similar to *P. saxatilis* and apparently for many years considered as a chemical variant of the latter species [1]. However, recent molecular data supported the recognition of *P. serrana* as a distinct taxon [9]. Both taxa are very similar, but they can be easily separated by their chemistry since *P. serrana* produces fatty acids instead of lobaric acid, which is present in *P. saxatilis*. There are also some morphological differences [5,9,11], which are summarized in Tab. 1.

Parmelia serrana can also be confused with *P. ernstiae*, but the thallus of the latter is strongly pruinose and, in addition to all substances produced by *P. serrana*, *P. ernstiae* contains lobaric acid [5,9,11,32]. All differences are presented in Tab. 1.

Recently, another species similar to *P. serrana*, *P. mayi* Divakar, A. Crespo, M.C. Molina, has been described from North America. The differences between both species refer mainly to their chemistry. *Parmelia mayi* produces almost the same set of secondary metabolites as *P. serrana*, but protocetraric acid is absent while alectorialic acid is present instead. Until now *P. mayi* is known only from high montane areas of northern Appalachian Mountains, North America [8].

Parmelia serrana can be confused with *P. submontana*, which produces granular to nearly isidioid soredia. However, the thallus lobes of *P. submontana* are elongated and little branched with down-rolled margins and the species lacks fatty acids (only atranorin and salazinic acid are present) [3,5,15].

Other *Parmelia* species reported from Poland cannot be mistaken for *P. serrana* because *P. discordans* and *P. omphalodes* lack vegetative diaspores, while *P. sulcata* propagates through soredia [3,5].

HABITAT REQUIREMENTS. *Parmelia serrana* grows on coniferous and deciduous trees and rarely on mossy rocks [3,5]. The Polish specimens are mostly epiphytic and have been collected predominantly from bark of deciduous trees (*Betula* spp., *Alnus* spp., *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Populus* spp., *Quercus* spp., *Salix* spp., *Tilia cordata*) in forests or roadside alleys and only rarely (one specimen) on bark of *Pinus sylvestris*. One sample was also found on sand dunes.

DISTRIBUTION IN POLAND. The currently known distribution of *Parmelia serrana* in Poland is presented in Fig. 1. The species is distributed in both the northern and southern parts of the country, and is probably much more common, since *P. saxatilis* s.l., under which name the species was previously recorded, was not always documented with herbarium vouchers and therefore some published records cannot be verified.

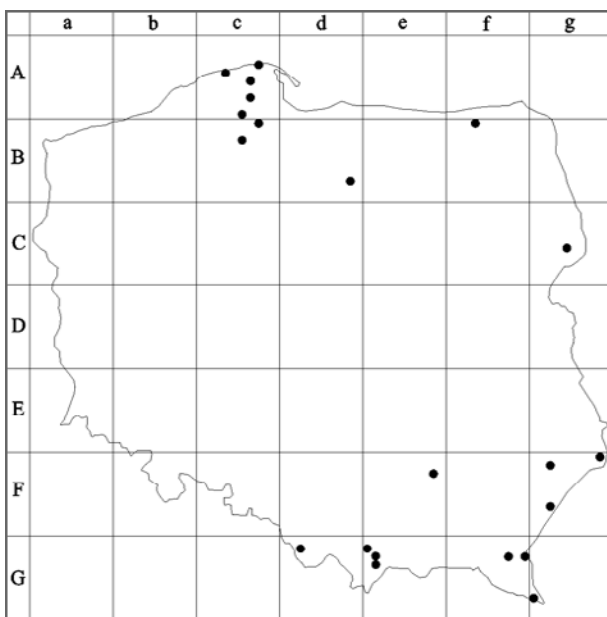
GENERAL DISTRIBUTION. *Parmelia serrana* appears to be rather widely distributed. So far, it has been found in Europe (Austria, Germany, Finland, Russia, Spain, Sweden and Ukraine) [5,8,9,11,16,33] and Africa (Canary Islands). It probably occurs in North America, since Hale [1] reported specimens of *P. saxatilis* s.l. without lobaric acid; however, this hypothesis needs to be confirmed and specimens studied by Hale must be re-examined.

NUMBER OF SPECIMENS EXAMINED – 28.

SELECTED SPECIMENS EXAMINED. Ac-37 – Mierzeja Helska Sandbar, 1 km from Władysławowo town, on *Pinus sylvestris*, 1986.07.10, B. Wojtyła (UGDA L-2899). Ac-43 – Wybrzeże Słowińskie Coast, Słowiński National Park, Mierzeja Łebska Split, forest section No. 8, on sand, 1996.09.08, W. Fałtynowicz (UGDA L-5061). Ac-56 – Pradolina Redy i Łeby Glacial Valley, Świetlino village, forest section No. 31, on bark of tree, 1972.07.27, T. Sulma (UGDA L-5851). Ac-76 – Pojezierze Kaszubskie Lakeland, Szczelina Lechicka Nature Reserve, on *Alnus glutinosa*, 2012.05.05, A. Kowalewska (UGDA). Ac-95 – Pojezierze Kaszubskie Lakeland, 1 km E of Klukowa Huta village, on *Tilia cordata*, 1994.06.16, W. Fałtynowicz (UGDA L-4375). Bc-08 – Pojezierze Kaszubskie Lakeland, Przywidz village, by Przywidz Lake, on *Fagus sylvatica*, 1985.10.25, W. Fałtynowicz (UGDA L-2581). Bc-25 – Pojezierze Kaszubskie Lakeland, by Sasnowicz Lake near Dziemiany village, on *Betula pendula*, 1986.07.25, J. Miądlkowska (UGDA L-3543). Bd-79 – Garb Lubawski, Wzgórza Dylewskie Landscape Park, near Wygoda village, roadside trees, on *Betula pendula*, 2003.08.23, R. Szymczyk (OLS L-339). Bf-03 – Pojezierze Ełckie Lakeland, Borki Nature Reserve, forest section No. 22, on *Carpinus betulus*, 2012.09.19, R. Szymczyk (OLS L-1284); *ibid.*, forest section No. 15, on bark of tree, 2012.08.22, R. Szymczyk (OLS

Tab. 1 Diagnostic characters of isidiate *Parmelia* species occurring in Poland.

Characters	<i>P. serrana</i>	<i>P. ernstiae</i>	<i>P. saxatilis</i>
type of thallus	epruinose, rarely faint pruina at lobe tips	strongly pruinose	epruinose or partially pruinose
shape of lobes	broad and round, often overlapping	broad and round, not overlapping	sublinear, not overlapping
type of isidia	epruinose	pruinose	epruinose
atranorin	present	present	present
salazinic acid	present	present	present
lobaric acid	absent	present	present
lichesterinic and protolichesterinic acids	present	present	absent

**Fig. 1** Distribution of *Parmelia serrana* in Poland.

L-1243); Borki Nature Reserve, on *Quercus* sp., 1987.08.27, J. Zielińska (WA 28982). Cg-54 – Równina Bielska Plain, Białowieża Forest, Białowieża forest division, Zwierzyniec forest district, Natural Woodlands of Białowieża Forest Reserve, forest section No. 392A, wet alder forest, on *Fraxinus*

excelsior, 2013.07.12, A. Bohdan (herb. SWAB); *ibid.*, on branch of *Carpinus betulus*, 2013.07.12, A. Bohdan (herb. SWAB). Fe-28 – Niecka Połaniecka Basin, Przeczów Stara Wieś village, on *Betula* sp., 1990.09.04, J. Kiszka (KRAM L-60083). Fg-08 – Pogórze Przemyskie Foothills, Cisowa, forest section No. 30b, roadside, on *Quercus* sp., 1997.08.24, J. Kiszka (KRAM L-60081); road between Sanok to Przemyśl towns, on *Salix* sp., 1984.07.23, J. Kiszka & J. Piórecki (KRAM L-60091). Fg-12 – Roztocze Środkowe, Hamernia, on old *Quercus*, 1986.06.08, J. Kiszka & J. Piórecki (KRAM L-60092). Fg-62 – Płaskowyż Tarnogrodzki Plateau, S of Lubaczów town, Wielkie Oczy village, on *Betula* sp., 1984.07.24, J. Kiszka & J. Piórecki (KRAM L-60094). Gd-12 – Beskid Śląski Mts, Dolina Białej Wisłęki valley, Fojtula village, on *Alnus* sp., T. Sulma (UGDA L-5330). Ge-10 – Gorce Mts, Poręba Wielka village, alt. 550 m, on bark of tree, 1993.11.23, P. Czarnota (GPN/1/94). Ge-21 – Gorce Mts, Gorce National Park, Turbacz Nature Reserve, below Czołogłade in Olszowy Potok valley, alt. 960 m, on *Abies alba*, 1994.06.23, P. Czarnota (GPN/653/94). Ge-31 – Pieniny Mts, Kramnica village, on *Salix* sp., 1998.08.15, J. Kiszka & J. Piórecki (KRAM L-64841). Gf-27 – Góry Słonne Mts, Rudenka village, on *Salix* sp., 1988.07.08, J. Kiszka & J. Piórecki (KRAM L-60085). Gf-29 – Pogórze Przemyskie Foothills, Liskowate, on *Populus tremula*, 1987.09.30, J. Kiszka & J. Piórecki (KRAM L-60080); *ibid.*, on *Salix* sp., 1981.08.31, J. Kiszka & J. Piórecki (KRAM L-60077). Gg-70 – Bieszczady Zachodnie Mts, Połonica Bukowska, near the road to Bukowska Przełęcz pass, on *Alnus* sp., 1998.08.05, J. Kiszka & J. Piórecki (KRAM L-60097).

Acknowledgments

We are grateful to the Curators of herbaria for the loan of specimens and the reviewers for the constructive remarks. We thank also Professor Mark R.D. Seaward (Bradford) for checking the English. The research was supported by the Ministry of Science and Higher Education, project No. 2012/07/N/NZ8/00061 granted to EO.

Authors' contributions

The following declarations about authors' contributions to the research have been made: field and herbarium research: EO, RS, AB, MK; determination of specimens: EO, RS, MK, chromatographic analyses: EO, RS; writing of the manuscript: EO, MK, RS, AB; preparation of the distribution map: EO, MK.

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