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

Emilia Ossowska¹, Rafał Szymczyk², Adam Bohdan³, Martin Kukwa¹*

¹ Department of Plant Taxonomy and Nature Conservation, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland
² EKO PROJEKT Environmental Survey Laboratory, Nowica 24, 14-405 Wilcza, Poland
³ Society Workshop for All Beings, Świętojańska 22/1, 15-082 Białystok, Poland

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 protoplectenchymatous and non-pored epicortex and always with usually elongated pseudocyphellae. 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 discords Nyl., P. ernstiae Feurer & A.Thell, P. omphalodes (L.) Ach., P. saxatilis (L.) Ach., P. submontana Nádv. 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, KRAP, 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.
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, square-rose 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


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 craked, pruinose (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 square-rose) 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: lichesteronic and protolichesteronic 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 electeralic 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 allies 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. This 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.

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

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

Fig. 1 Distribution of Parmelia serrana in Poland.

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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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