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Seven lichen species new to Poland

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Abstract — *Biatora pontica*, *Buellia violaceofusca*, *Catillaria croatica*, *Parmelia ernstiae*, *Placopsis lambii*, *Protoparmelia oleagina* and *Scoliciosporum curvatum* are recorded as new to Poland. Most reported species represent a group of crustose, often sterile lichens where secondary chemistry plays an important role in the taxonomy. Characteristics of each species, notes on similar taxa, distribution, and habitat are provided.

Key words — lichenized fungi, chemotaxonomy, lichen metabolites

Introduction

Since the publication of the list of lichens and lichenicolous fungi of Poland (Fałtynowicz 2003), numerous species have been added to the lichen biota of the country, including some new to science (e.g. Flakus 2007, Kukwa & Kubiak 2007, Motiejūnaitė & Czyżewska 2008, Krzewicka 2009, Kukwa & Flakus 2009, Łubek 2009, Zhurbenko et al. 2009, Śliwa & Flakus 2011). Most of these taxa are either lichenicolous fungi or lichens belonging to critical groups requiring analyses of secondary lichen metabolites.

In this paper, we report seven lichen species not previously reported from Poland.

Material & methods

The material studied is deposited in BILAS, KTC, OLS, PRA, UGDA, UPS, and herb. Printzen. Lichen substances were studied by thin-layer chromatography (TLC) using the methods of Culberson & Kristinsson (1970) and Orange et al. (2001). The examined localities are presented according to the modified ATPOL grid square system (Cieśliński & Fałtynowicz 1993, Kukwa et al. 2002).

The species

Biatora pontica Printzen & Tønsberg, Biblioth. Lichenol. 86: 140. 2003.

Characteristics — The species is characterized by its thin, crustose and areolate thallus with punctiform to confluent, yellowish or light green soralia; areoles in non-sorediate parts reaching ≤ 1.2 mm in diam. Apothecia are flat to moderately convex, dark greyish-ochre to brownish-grey and 0.5–0.7 mm in diam.; sometimes they are immersed between soralia. Anatomically apothecia are characterized by the presence of a blue pigment (Pontica-blue) in the hypothecium, subhymenium, and (rarely) hymenium and epihymenium; sometimes an additional red pigment (Pontica-red) is produced in the hypothecium and hymenium. Ascospores are ellipsoid to bacilliform, 11.9–14.8 × 3.4–3.7 µm. *Biatora pontica* produces thiophanic acid (major), asemone, and an unidentified diagnostic substance called 'pontica unknown,' sometimes with minor or trace amounts of other xanthones; soralia react C+ orange (Printzen & Tønsberg 2003). In all Polish specimens thiophanic acid, asemone, and 'pontica unknown' were detected. In only one specimen were apothecia developed, but the fertile material is only the second such record in Europe (Printzen & Tønsberg 2003).

Ecology & distribution — Previously *B. pontica* has been known from scattered localities in Europe (Austria, Italy, Norway, Russia, Slovenia), Asia (Turkey), and North America (USA) (Printzen & Tønsberg 2003, Santesson et al. 2004, Urbanavichus 2010). It is an epiphytic lichen growing in forests on deciduous trees in Europe and in Turkey, but in eastern North America it is more commonly found on *Picea orientalis* (Printzen & Tønsberg 2003).

In Poland *B. pontica* has been recorded in three localities in northern Poland, being always found on the bark of *Carpinus betulus* and *Fagus sylvatica* in the bottom of shady river or streams valleys.

Specimens examined — **POLAND. Drawskie Lakeland.** Drawieński National Park, Stara Węgornia range in valley of the Płociczna river, c. 2 km NNE Ostrowite village, 53°04′42–46″N 15°59′31–41″E, ATPOL grid square Cb–22, on *Carpinus betulus*, 08.05.2010, M. Kukwa 7948 (UGDA); **Elbląska Upland.** Valley of Srebrny Potok stream, forest section No. 342, 54°10′28″N 19°27′55″E, ATPOL grid square Bd–06, beech forest in the bottom of the valley, on *Fagus sylvatica*, 05.08.2007, R. Szymczyk 641 (OLS L-691, dupl. in herb. Printzen); valley of Grabianka river, forest section No. 183b, 54°16′42″N 19°31′27″E, ATPOL grid square Ad–96, beech forest, bottom of the river valley, on *Fagus sylvatica*, 27.06.2009, R. Szymczyk 657 (OLS L-762, dupl. in herb. Printzen).

Comments — When fertile, *B. pontica* can be confused with *B. britannica* Printzen et al. (sorediate), *B. hypophaea* Printzen & Tønsberg (esorediate), and *B. ocelliformis* (Nyl.) Arnold (esorediate) —three other members of the genus with grey apothecia. They can be easily separated chemically as they produce argopsin (thalli react P+ orange-red) (Printzen et al. 2001, Printzen

& Tønsberg 2003); in Poland only *B. ocelliformis* has been recorded so far (Fałtynowicz 2003). Sterile specimens of *B. pontica* are morphologically very similar to *B. efflorescens* (Hedl.) Räsänen, which, however, contains argopsin (Printzen et al. 2001). *Biatora chrysantha* (Zahlbr.) Printzen and *Mycobilimbia epixanthoides* (Nyl.) Vitik. et al. can also be confused with *B. pontica*, but they contain gyrophoric acid (*B. chrysantha*) or no lichen metabolites are produced (*M. epixanthoides*) (Tønsberg 1992, Printzen & Tønsberg 2003, Printzen & Otte 2005).

Biatora pontica can also be confused with *Pyrrhospora quernea* (Dicks.) Körb. which is morphologically very similar when sterile (greenish sorediate thallus). Both taxa contain thiophanic acid as the major secondary metabolite, but *P. quernea* lacks the characteristic substance 'pontica unknown' (Tønsberg 1992, Printzen & Tønsberg 2003).

Buellia violaceofusca G. Thor & Muhr, Lichenologist 23: 11. 1991.

Characteristics — The species is characterized by its thin, usually endophloeodal, pale grey or almost white thallus producing dark brownish soralia with a violet tinge (but greenish when abraded). Soralia are maculiform, scattered, slightly elevated and usually confluent; no apothecia have been discovered so far. This lichen does not produce secondary metabolites (Thor & Muhr 1991), but traces of terpenoids from tree bark can be detected by TLC.

Ecology & distribution — *Buellia violaceofusca* is widespread but with a scattered distribution (Coppins et al. 2009); so far it has been found only in Europe in Austria (Poelt 1994), Belgium (Sérusiaux et al. 1999), Estonia (Thor & Nordin 1998), Great Britain (Coppins et al. 2009), Norway (Gaarder & Tønsberg 2010), Slovakia (Palice et al. 2006), and Sweden (Thor & Muhr 1991). The species usually grows on bark of *Quercus* spp. in different types of forest, but in Great Britain it has been reported also on *Fraxinus excelsior* (Coppins et al. 2009).

In Poland it has been found only at one locality in bark crevices of old *Quercus* sp. in a deciduous forest. Most probably the species is much more common in the country but has been overlooked due to the inconspicuous thalli and the habit of growing in deep crevices.

Specimen examined — **POLAND. Kaszubskie Lakeland.** Trójmiejski Landscape Park, Dolina Ewy valley, 54°24′35″N 18°30′20″E, ATPOL grid square Ac–89, oak-hornbeam forest, on *Quercus* sp., 04.04.2004, M. Kukwa 3006 (UGDA L-10664).

Reference material examined — **SWEDEN. Värmland.** Visnum Kil par., Nötön nature reserve, Arskagen, near Lake Väner, 59°04′N 14°01′E, 50 m, on the northern side of old *Quercus robur* in deciduous wood, 27.05.1985, L.-E. Muhr 7911 (UPS L-17315 – holotype).

Comments — *Buellia violaceofusca* is a very characteristic epiphytic species due to its thin thallus, violet tinged soredia, and the absence of lichen metabolites.

In Poland it can be confused with the morphologically similar *B. griseovirens* (Turner & Borrer ex Sm.) Almb. Both species have dark outermost soredia, but *B. griseovirens* has a thicker thallus and produces atranorin and norstictic acid, with trace of connorstictic acid and sometimes unidentified pigments (in some specimens only atranorin or only norstictic acid are present) (Thor & Muhr 1991, Tønsberg 1992, Coppins et al. 2009).

Buellia arborea Coppins & Tønsberg also develops pigmented soredia, but it can be readily separated by the presence of atranorin and placodiolic acid (Tønsberg 1992, Coppins et al. 2009); so far the species has not been reported from Poland, but its discovery there is probable.

Catillaria croatica Zahlbr., Ann. Mycol. 4: 487. 1906.

≡ *Lecania croatica* (Zahlbr.). Kotlov, Novosti Sist. Nizsh. Rast. 37: 251. 2004.

Characteristics — As the only modern description of *C. croatica* (by Harris & Lendemer 2010) is based mainly on North American specimens, a more detailed description is provided below. The thallus of this corticolous lichen is light green-grey, superficial, well or poorly developed to immersed, consisting of scattered or almost contiguous areoles. Soralia are numerous, rounded, flat, convex or weakly capitate, discrete or patchily coalescing to form a leprose crust. Soredia are in shades of green, but sometimes externally pale brown pigmented. Apothecia are sessile, flat or weakly convex, with pale orange-cream or medium brown discs and paler margins. Anatomically, all structures are colourless except the pale brownish hypothecium. Asci are 8-spored with narrowly fusiform, 0–1-septate ascospores measuring 12–17 × 4.5 µm. Pycnidia were not found in Polish material. The species does not produce lichen substances detectable by TLC.

Ecology & distribution — Rarely reported from Europe: Austria, Belgium, Croatia, France, Luxembourg, Romania, Slovakia, Slovenia and Ukraine (Printzen 1995, Mrak et al. 2004, Hafellner et al. 2005, Eichler et al. 2010, Vondrák et al. 2010), and also known from North America (Harris & Lendemer 2010). The species grows in forests, usually on bark of broad-leaved trees, rarely also shrubs (e.g. *Sambucus* sp.).

In Poland, *C. croatica* has been found in only one locality, a well-preserved, humid deciduous forest not seriously influenced by forest management, growing in association with *Anisomeridium polypori* (Ellis & Everh.) M.E. Barr, *Biatora ocelliformis*, *Lepraria lobificans* Nyl., *L. vouauxii* (Hue) R.C. Harris, *Opegrapha rufescens* Pers., *Pertusaria pertusa* (L.) Tuck., and *Bacidia* sp.

Specimen examined — **POLAND. Bielsk Plain.** Białowieski National Park, forest section No. 273, 52°43'32"N, 23°53'27"E, ATPOL grid square Cg–46, on *Acer* sp., 27.06.2009, A. Łubek s.n. (KTC).

Comments — *Catillaria croatica* is an inconspicuous, easily overlooked, corticolous lichen with a sorediate thallus lacking lichen metabolites, with small

pale apothecia and 0–1-septate ascospores. The species is morphologically very similar to *Mycobilimbia epixanthoides:* both are sorediate, lack lichen substances, and produce pale biatorine apothecia. When fertile, the material is much easier to determine as both species differ in the type of spores: *C. croatica* produces 0–1-septate ascospores, whereas *M. epixanthoides* has 3-septate ascospores. In the sterile state they may be separated based on substrate preference: *Catillaria croatica* grows exclusively on the bark of trees, and *M. epixanthoides* prefers bryophytes and is rarely corticolous (Hafellner et al. 2005, Harris & Lendemer 2010). The corticolous material of the latter, according to the cited sources, could be distinguished by irregular young soralia forming larger irregular patches, while soralia of *C. croatica* remain discrete and round, even when they become crowded with age. From our experience, this might not be true in all cases and some sterile samples may remain undetermined.

Several other sorediate species, which are morphologically similar to *C. croatica* (e.g. *Biatora efflorescens* or *B. chrysantha*), can be confused with this lichen, but they are all readily distinguished by their secondary metabolites (e.g., Printzen 1995).

Catillaria croatica has been recently transferred to *Lecania* A. Massal. by Kotlov (2004), but molecular studies have shown that it nests in *Bilimbia* De Not. s.l. and is not phylogenetically related to *Lecania* s. str. (Reese Næsborg et al. 2007). Therefore we prefer to keep the species in the admittedly heterogeneous genus *Catillaria* A. Massal.

Parmelia ernstiae Feuerer & A. Thell, Mitt. Inst. Allg. Bot. Hamburg 30–32: 52. 2002.

Characteristics — This foliose lichen is characterized by its heavily pruinose thalli and isidia, small and non-overlapping lobes, commonly present lobulae, and the production of atranorin (minor amount, together with chloratranorin), salazinic acid (major amount, with minor amount of consalazinic acid), lobaric, lichesterinic, protolichesterinic, nephrosteranic, isonephrosterinic (all minor amounts) and protocetraric (trace amount) acids (Feuerer & Thell 2002, Thell et al. 2008). Although not distinctly lobulate, Polish material agrees well with the description, except nephrosteranic, isonephrosterinic and protocetraric acids were not detected, most probably due to their low quantity or overlapping with other metabolites in a similar position on the TLC plates.

Ecology & distribution — *Parmelia ernstiae* is widely distributed in Europe, with a few records known from Africa. It has been reported from Austria, Belgium, Bosnia and Herzegovina, Britain, Bulgaria, Czech Republic, Denmark, Estonia, France, Germany, Greece, Ireland, Lithuania, Luxembourg, the Netherlands, Slovenia and Spain (Feuerer & Thell 2002, Sérusiaux et al. 2003, Thell 2003, Molina et al. 2004, Otte 2005, Santesson et al. 2004, Thell

et al. 2007, Suija et a. 2007, Motiejūnaitė et al. 2008, Thell et al. 2008, Berger et al. 2009, Seaward 2010, Diederich et al. 2011) and in Africa from Algeria and the Canary Islands (Sérusiaux et al. 2003). It is a typically corticolous species growing on deciduous or rarely coniferous trees in open situations (e.g. roadsides, churchyards) and forests (Thell 2003, Santesson et al. 2004, Thell et al. 2007); an exceptional saxicolous record is also known (Thell et al. 2008).

In Poland it has been found only at one locality in northwestern Poland on a roadside elm in a well-lit situation. All available material labelled as *P. saxatilis* in UGDA has been examined, but as no more specimens of *P. ernstiae* have been traced, it probably should be regarded as rare in the country.

Specimen examined — **POLAND. Drawskie Lakeland.** road N of Głusko village, 53°02′59″N 15°56′34″E, ATPOL grid square Cb–22, on roadside *Ulmus* sp., 05.05.2010, M. Kukwa 7793 (UGDA).

Comments — Based on DNA sequences and different morphology (Feuerer & Thell 2002) and more recently on the composition of secondary metabolites (Thell et al. 2008), *P. ernstiae* has been recently segregated from *P. saxatilis* (L.) Ach., from which it can be easily separated morphologically by the epruinose thalli and isidia and chemically by the absence of lobaric and fatty acids (Feuerer & Thell 2002, Thell et al. 2008).

Parmelia ernstiae can also be confused with another isidiate species, *P. serrana* A. Crespo et al. Thalli of both taxa are pruinose, but in *P. serrana* lobes are larger, rounded, and commonly overlapping and lobaric acid is not produced (Molina et al. 2004, Thell et al. 2008). *Parmelia serrana* has not been found in Poland, although its distribution range (see Thell et al. 2008) suggests it probably occurs there.

Placopsis lambii Hertel & V. Wirth, Flecht. Baden-Württ. Verbreit.: 511. 1987.

Characteristics — The species is characterized by its placodioid thallus with deeply incised and radiating marginal lobes, shiny upper surface, usually blackish and more or less rounded soralia, non-lobate cephalodia (absent in some specimens), and the production of 5-O-methylhiascic and gyrophoric acids as major substances (Moberg & Carlin 1996, Gilbert & Purvis 2009, Harrold et al. 2010). The cephalodia were not developed in Polish specimen.

Ecology & distribution — *Placopsis lambii* is widespread but rather scattered. In Europe it has been reported from Austria, Belgium, Britain Finland, France, Germany, Iceland, Ireland, the Netherlands, Norway, Russia, and Sweden (Wirth 1987, Diederich 1994, Moberg & Carlin 1996, Aptroot et al. 1999, Hafellner & Türk 2001, Santesson et al. 2004, Harrold et al. 2010, Seaward 2010, Diederich et al. 2011). In Africa it has been found in Kenya, Lesotho, and Tanzania (Moberg & Carlin 1999) and in the Americas in Bolivia, Chile, Costa Rica, and Ecuador (Galloway 2002, Galloway & Arvidsson 2007). It is also

known from New Zealand (Galloway 2001) and asiatic Russia (eastern Siberia and Russian Far East; Urbanavichus 2010).

In Poland *P. lambii* has been recorded only once in northern Poland where it was found on a pile of stones in a sunny but rather humid habitat near several ponds. This stand is also noteworthy for other rare and endangered lichens in Poland, e.g., *Rhizocarpon lecanorinum* Anders and *Xanthoparmelia mougeotii* (Schaer.) Hale.

Specimen examined — **POLAND. Kaszubskie Lakeland.** Vicinity of Szumleś village, 54°09′33″N 18°13′26″E, ATPOL grid square Bc–07, open area by small ponds, on stone, 08.05.2008, M. Kukwa 5968, M. Buliński, J. Zarembska (UGDA L-16515, dupl. in BILAS and PRA).

Comments — *Placopsis lambii* is very similar and morphologically almost indistinguishable from *P. gelida* (L.) Linds. *Placopsis gelida* tends to be matte or shiny only at the lobe tips of the upper surface and has more elongated soralia that are rarely blackish. However, those are subjective characters, and the chemistry is a most reliable diagnostic feature; both taxa contain gyrophoric acid, but *P. lambii* additionally produces 5-O-methylhiascic acid (Gilbert & Purvis 2009, Harrold et al. 2010). Due to their similarity one could treat both species as one variable entity, but molecular studies supported their distinctiveness (Schmitt et al. 2003).

Some *P. lambii* morphs might be also mistaken for *Trapelia placodioides* Coppins & P. James, which, however, lacks radiating marginal lobes and cephalodia; *T. placodioides* also produces gyrophoric acid, but 5-O-methylhiascic acid is absent (Gilbert & Purvis 2009, Purvis et al. 2009).

Protoparmelia oleagina (Harm.) Coppins, Lichenologist 24: 368. 1992.
≡ *Lecanora oleagina* Harm., Lich. France 5: 1023. 1913.

Characteristics — *Protoparmelia oleagina* is a crustose, often sterile, epiphytic lichen with a more or less continuous, dull olivaceous brown, scurfy granular-isidiate thallus and apothecial margin; the apothecial disc is also olivaceous. Ascospores are fusiform, 9.5–15 × 2–3.5 µm (Coppins & Chambers 2009, Brodo & Aptroot 2005). The species produces lobaric acid, but often in low concentration (Brodo & Aptroot 2005). One Polish specimen was fertile (Kukwa 7837a), but very few apothecia were developed.

Ecology & distribution — *Protoparmelia oleagina* occurs only in Europe, where it has been recorded from Austria, Belgium, Finland, France, Germany, Great Britain, Italy, the Netherlands, Norway and Sweden (Aptroot et al. 1999, Scholz 2000, Hafellner & Türk 2001, Santesson et al. 2004, Brodo & Aptroot 2005, Nimis & Martellos 2008, Coppins & Chambers 2009, Diederich et al. 2011).

In Poland *P. oleagina* has been found on deciduous trees in humid forests at two localities in western Pomerania (NE Poland).

Specimens examined — **POLAND. Drawskie Lakeland.** Drawieński National Park, eastern slopes of Drawa river valley, 2 km NE of Zatom village, Tragankowe Urwisko range, 53°09′12″N 15°51′49–54″E ATPOL grid square Cb–12, deciduous forest, on *Fagus sylvatica*, 06.05.2010, M. Kukwa 7837a (UGDA). **Słowińskie Coast.** Białogóra nature reserve, forest section No. 22, 54°49′27″N, 17°57′52″E, ATPOL grid square Ac–36, wet pine-birch forest, on *Betula pendula*, 22.09.2010, M. Kukwa 8268a, A. Jabłońska, M. Oset (UGDA L-16660).

Comments — *Protoparmelia oleagina* is easily distinguished by its corticolous habitat and more or less continuous, dull olivaceous brown, scurfy granular and isidiate thallus. Morphologically it is most similar to *P. ochrococca* (Nyl.) P.M. Jørg. et al., but the thallus of the latter is not isidiate, consists of subglobose areoles, and lacks lichen substances (Brodo & Aptroot 2005, Coppins & Chambers 2009); so far *P. ochrococca* has not been recorded from Poland.

Chemically and morphologically *P. oleagina* can be confused with *P. hypotremella* Herk et al., which is known from several localities in Poland (see Kubiak et al. 2010). Both taxa contain lobaric acid, but the thallus of *P. hypotremella* consists of dispersed round flat granules or microsquamules; it is also brighter, pale grayish-brown to olive-grey (Brodo & Aptroot 2005, Coppins & Chambers 2009).

Morphologically, *P. oleagina* resembles small forms of *P. badia* (Hoffm.) Hafellner, but the latter is a saxicolous lichen with ellipsoid-fusiform ascospores with distinctly pointed apices (Coppins & Chambers 2009).

Some epiphytic species of the genus *Lecanora* Ach. also have dark apothecial discs (e.g. *L. argentata* (Ach.) Malme or *L. persimilis* (Th. Fr.) Arnold), but they lack brown pigmentation, often produce atranorin or usnic acid in the cortex, and their ascospores are generally wider (Śliwa 2007, Coppins & Chambers 2009).

Scoliciosporum curvatum Sérus., Nord. J. Bot. 13: 458. 1993.

Characteristics — This crustose lichen is characterized by its pale green to dark grey-green granular thallus, chlorococcoid photobiont with rather large cells (12–)14–20(–22) µm, numerous and very small (up to 0.16 mm diam.), pale pink, orange to brown apothecia, 2 µm wide, simple to furcated or rarely anastomosing paraphyses, 8–16-spored asci and 1-septate, curved (lunulate) or slightly sigmoid spores with acute ends, 7–11 × 1.5–3 µm. Paraphyses are abundant only in young apothecia. The species does not produce lichen substances (Sérusiaux 1993, Edwards et al. 2009).

Ecology & distribution — This species occurs only in Europe, being much more common in western countries. It has been reported from Austria, Britain, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Norway, Slovakia, Romania, Spain, Sweden, Switzerland and Ukraine (Sérusiaux 1993, Poelt 1994, Boom et al 1995, Palice 1999, Søchting & Alstrup 2002, Clerc 2004,

Santesson et al. 2004, Lisická 2005, Edwards et al. 2009, Vondrák et al. 2009, Seaward 2010, Dymytrova 2011). Dymytrova (2011), citing Nimis & Martellos (2003), cited *S. curvatum* from Italy, but Nimis & Martellos (2008) have included it not in the Italian checklist but only in the iconographic archive (along with several other species not reported from Italy). The report by Himelbrant (2008) of *S. curvatum* from Poland is a misprint (Himelbrant, pers. comm.), making the specimens cited below the first records for Poland.

Most central European localities of *S. curvatum* lie in the mountains (490–1600 m a.s.l.), but those from Poland are in the lowlands. The species is treated as an endangered species (extremely rare and potentially endangered or vulnerable) in some countries and has been included in the lichen red lists of Austria (Türk & Hafellner 1999), Czech Republic (Liška et al. 2008), and Switzerland (Scheidegger et al. 2002).

Scoliciosporum curvatum is typically a foliicolous lichen growing in sheltered and humid situations on leaves and (sometimes) twigs of evergreen shrubs such as *Buxus*, *Camellia*, and *Rhododendron* (Edwards et al. 2009). The species has also been found on needles (rarely twigs) of spruces, firs and occasionally pines, typical of southwestern Scandinavia (Santesson et al. 2004) and the mountains of central Europe (Poelt 1994, Palice 1999, Guttová & Palice 1999, Lisická 2005).

In Poland *S. curvatum* has been found only in two localities in Romincka Forest in northeast Poland where it was collected from spruce needles inside a wet spruce forest and in a managed pine forest.

Specimens examined — **POLAND. Romincka Forest.** Puszcza Romincka Forest Landscape Park, Żytkiejmska Struga nature reserve, forest section No. 63, c. 3.5 km WSW of Żytkiejmy village, 54°20′51″N 22°37′55″E, ATPOL grid square Af–86, boggy spruce forest, on needles of spruce, 17.09.2003, A. Zalewska, W. Fałtynowicz s.n. (OLS); forest section No. 184, c. 4.5 km of SW Żytkiejmy village, 54°19′49″N 22°37′37″E, ATPOL grid square Af–86, pine forest with spruce, on needles of spruce, 19.09.2003, A. Zalewska, W. Fałtynowicz s.n. (OLS).

Comments — Placement of *S. curvatum* within *Scoliciosporum* A. Massal. is problematic as it is separated from other representatives by its higher number of ascospores per ascus and different organization of paraphyses (Sérusiaux 1989, 1993). The generic concept appears to be unclear, since several other species with deviating characters are included, especially *S. abietinum* T. Sprib., *S. intrusum* (Th. Fr.) Hafellner, and *S. coniectum* Kantvilas & Lumbsch (Sérusiaux 1993, Hafellner 2004, Spribille et al. 2009, Kantvilas & Lumbsch 2010). Molecular analyses would clarify its circumscription and explain its relationship with *S. curvatum*.

Scoliciosporum curvatum is inconspicuous and easily overlooked, as its thallus may resemble a green algal cover over the substrate. In the field it can be confused with other species growing in the same habitat, but it is

easily recognizable after microscopic examination. In Poland, only two other species, *Fellhanera bouteillei* (Desm.) Vězda and *F. subtilis* (Vězda) Diederich & Sérus., have been found on needles of *Abies alba* (*F. bouteillei*) or *Picea abies* (*F. subtilis*) (Fałtynowicz 2003). The thallus of *F. subtilis* is grey to green with smaller photobiont cells (5–15 µm in diam.), apothecia are whitish and larger (0.15–0.4 mm in diam.), ascospores are oblong, fusiform and (1–)3-septate, and it always develops pinkish pycnidia. *Fellhanera bouteillei* has a verruculose-rimose thallus, often entirely covered by dull bluish-green farinose soredia. The apothecia and pycnidia superficially resemble those of *F. subtilis*, but ascospores are only 1-septate (as in *S. curvatum*) but also ovoid to oblong-ovoid (sometimes soleiform) and often constricted at the septa; the *F. bouteillei* thallus also contains usnic acid, zeorin, and ± asemone (Sérusiaux 1996, Aptroot et al. 2009).

Some *S. curvatum* specimens might also be mistaken for *Fellhanera viridisorediata* Aptroot et al., which has not been found in Poland. It has a similar green granular thallus, with firstly punctiform, then coalescing, soralia and (0–)1-septate elongate-ellipsoid ascospores. The species is often sterile, but then it differs in the presence of roccellic acid (Aptroot et al. 2009).

Scoliciosporum gallurae Vězda & Poelt, recently recorded in Poland (Kukwa & Kubiak 2007), which may also superficially resemble *S. curvatum*, produces gyrophoric acid and is known from twigs in open, nutrient-enriched situations.

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