

## The lichen family Parmeliaceae in Poland. IV. The genus *Punctelia*

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**Abstract:** SZYMCZYK, R., ZALEWSKA, A., SZYDŁOWSKA, J. & KUKWA, M. 2015. The lichen family Parmeliaceae in Poland. IV. The genus *Punctelia*. – *Herzogia* 28: 556–566.

A study of the genus *Punctelia* in Poland revealed that only two species, *P. jeckeri* and *P. subrudecta*, occur there. Both species have been more commonly found in the southern Poland than in other parts of the country, and are almost absent in the west. Most records of both taxa originate from the 1980s and 1990s. This is most likely the result of intensification of lichenological inventories in this period, but the impact of climate changes on the species frequency cannot be excluded. *P. subrudecta* is threatened in the country and treated as vulnerable in the red list of lichens in Poland and the same status is proposed for *P. jeckeri* for the next edition of the red list. The distribution of both species, their morphology, secondary chemistry and habitat requirements, are discussed. Notes on similar taxa are presented.

**Zusammenfassung:** SZYMCZYK, R., ZALEWSKA, A., SZYDŁOWSKA, J. & KUKWA, M. 2015. Die Flechtenfamilie Parmeliaceae in Polen. IV. Die Gattung *Punctelia*. – *Herzogia* 28: 556–566.

Eine Untersuchung zur Gattung *Punctelia* in Polen offenbarte das Vorkommen von lediglich zwei Arten, *P. jeckeri* und *P. subrudecta* im gesamten Staatsgebiet. Beide Arten wurden bisher häufiger in südlichen Gebieten Polens gefunden als in anderen Gegenden des Landes, Fundstellen im Westen sind nicht bekannt. Die meisten Nachweise beider Arten stammen aus den 80er und 90er Jahren des letzten Jahrhunderts. Dies ist wahrscheinlich nur auf in dieser Zeit intensivierte Flechtenerhebungen zurückzuführen, obwohl eine Wirkung des Klimawandels auf die Häufigkeit der beiden Arten nicht auszuschließen ist. *P. subrudecta* ist eine bedrohte Art in Polen und ihr künftiger Rote-Liste-Status als „gefährdet“ (vulnerable) vorgesehen. Für die nächste Ausgabe der Roten Liste ist der gleiche Status auch für *P. jeckeri* vorgesehen. Die Verbreitung der beiden Arten in Polen, ihre Morphologie, Sekundärstoffchemie werden ebenso diskutiert wie ihre Habitatanforderungen. Anmerkungen zu ähnlichen Taxa werden gemacht.

**Key words:** Parmelioid lichens, Lecanoromycetes, Ascomycota, chemotaxonomy.

### Introduction

The genus *Punctelia* Krog belongs to the *Parmotrema* clade within the parmelioid lichenized fungi (CRESPO et al. 2010, MIĄDLIKOWSKA et al. 2014) and is characterized by a foliose thallus, non-pored epicortex and the presence of pseudocyphellae, which are more or less punctiform. These features have been thought to represent the main ancestral phenotypic traits within the group of parmelioid lichens (DIVAKAR et al. 2013). Other diagnostic characters of *Punctelia* are unciform (curved or hooked at one tip) or cylindrical conidia. Ascospores are apothecial, concave, with brown discs and often pseudocyphellate thalline margins, but many species are known only in a sterile state (KROG 1982, CRESPO et al. 2010). Chemically the genus is characterized by the presence of isolichenan as a constituent of the hyphal cell walls, the production

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of atranorin in the thalline cortex and the lack of usnic acid (KROG 1982, CRESPO et al. 2010). *Punctelia* species produce orcinol depsides, lecanoric and/or gyrophoric acids or various aliphatic acids in the medulla (EGAN & APTROOT 2004); in addition, lichexanthone was reported recently (HODKINSON & LENDEMER 2011).

The genus shares some of the morphological characters with few other parmelioid genera. *Flavopunctelia* (Krog) Hale is the most similar one as it also develops punctiform pseudocyphellae, but it has bifusiform conidia (KROG 1982) and contains usnic acid in the cortex (CRESPO et al. 2010). A similar pseudocyphellate foliose thallus is also a key character of *Cetrelia* W.L.Culb. & C.F.Culb. and *Parmelia* Ach. s. str. (CRESPO et al. 2011). *Cetrelia* differs from *Punctelia* in its larger thallus and an almost non-rhizinate underside, whereas in *Parmelia* the pseudocyphellae are elongated (CULBERSON & CULBERSON 1968, VAN HERK & APTROOT 2000, LOUWHOFF 2009, CRESPO et al. 2010, KUKWA et al. 2012).

The intrageneric segregation within *Punctelia* is based on a the combination of chemical and morphological features, e. g. the colour of the lower side of the thallus, the presence/absence of pruina at the lobes tips, the type of the vegetative propagules and their placement on the thallus (laminal or submarginal), as well as the type of conidia (uncinate or filiform) (CRESPO et al. 2004, THELL et al. 2005, 2008, LENDEMER & HODKINSON 2010). Recently, molecular data have been incorporated to establish the taxonomy of species within the groups of similar taxa (CRESPO et al. 2004, THELL et al. 2005, 2008, LENDEMER & HODKINSON 2010).

In terms of geographical range, *Punctelia* is a cosmopolitan genus consisting of c. 45 species, with its highest species diversity in South America and Africa (CRESPO et al. 2010, CANÊZ & MARCELLI 2010, THELL et al. 2012). Most of taxa occur in subtropical and temperate regions, mainly as epiphytes. Few species extend into the boreal zone and cold montane areas, e. g. the saxicolous *P. stictica* (Delise ex Duby) Krog (EGAN & APTROOT 2004, THELL 2011).

In Europe seven *Punctelia* species have been recorded to date; these are *P. borreri* (Sm.) Krog, *P. jeckeri* (Roum.) Kalb, *P. perreticulata* (Räsänen) G.Wilh. & Ladd, *P. reddenda* (Stirt.) Krog, *P. rudecta* (Ach.) Krog, *P. stictica* and *P. subrudecta* (Nyl.) Krog (HAWKSWORTH et al. 2008, 2011). Until now, only two species have been recorded in Poland, *P. jeckeri* and *P. subrudecta* (FAŁTYNOWICZ 2003). The former species has been rather uncommonly recorded in the country as it has been only recently segregated from the latter one. On the other hand, *P. subrudecta* has been reported for more than 150 years (e. g., VAN HERK & APTROOT 2000, FAŁTYNOWICZ 2003, KUKWA 2010, KOŚCIELNIAK 2013). As numerous records have not been revised recently and determinations have not been confirmed by thin layer chromatography, we suspected that many old herbarium specimens are incorrectly named. As both species are included in the red list of lichens in Poland (CIEŚLIŃSKI et al. 2006), a more accurate picture of their abundance and distribution is necessary.

We hypothesized that some Polish herbarium material of *P. subrudecta* s. l. may belong to *P. jeckeri* or other similar sorediate species reported from neighbouring countries (HAWKSWORTH et al. 2008). The aim of this paper is to present the result of a revision of *Punctelia* in Poland together with notes on the distribution of each species and habitat requirements, as well as morphology and secondary chemistry. This is the fourth paper dealing with the revision of selected genera of the family Parmeliaceae in Poland (see JABŁOŃSKA et al. 2009, KUKWA et al. 2012, OSSOWSKA et al. 2014).

## Material and Methods

The present study is based on 494 specimens deposited in the following Polish herbaria: KRA, KRAM, KRAP, KTC, OLS, OLTC, POZ and UGDA; material from private herbarium of Szczepańska has been also studied. The morphology of the specimens was examined under the stereo microscope. The colour of upper and lower side of thallus, shape and position of soralia and the presence of pruina on the tips of lobes were studied. Hand sections of pycnidia in squash preparation in water were used to study the dimensions and shape of conidia. The lichen substances were investigated by thin layer chromatography (TLC) in solvent B following the standardized methods (CULBERSON & KRISTINSSON 1970, ORANGE et al. 2001). Chemical reactions of the thallus with C, K and Pd were also tested (ORANGE et al. 2001). Localities are mapped according the ATPOL grid square system (for details see KUKWA et al. 2010, 2013); for each ATPOL grid square only one record is presented.

## Results and discussion

Only two species, *Punctelia jeckeri* and *P. subrudecta* are recognized in Poland, according to the revision. The occurrences of other similar sorediate *Punctelia* species known from Europe, i. e. *P. borrieri*, *P. perreticulata* and *P. reddenda* (CRESPO et al. 2004, HAWKSWORTH et al. 2008, LOUWHOFF 2009, WIRTH et al. 2011), have not been confirmed. Specimens of *P. jeckeri* were previously misidentified as *P. subrudecta* (c. 20% of revised specimens) or *Parmelia dubia* (Wulfen) Schaer. var. *ulophylla* (Ach.) Harm. and its synonyms. Several specimens were erroneously determined as *Cetrelia cetrarioides* (Delise) W.L.Culb. & C.F.Culb. or *C. olivetorum* (Nyl.) W.L.Culb. & C.F.Culb., and *Punctelia subrudecta* was placed in herbaria as *Parmelia dubia*, rarely as *P. borrieri* auct. or *Cetrelia cetrarioides*.

*Punctelia jeckeri* was slightly more frequent in the studied material and represented of c. 60% of revised specimens. In several collections the species was mixed with *P. subrudecta*. Both species have very similar distribution patterns in Poland and both are more common in the southern part of the country (Figs 1 & 2), but *P. subrudecta* has been less frequently found in northern Poland (Fig. 2). Records of both species are almost completely lacking in western and north-western parts of the country; this is perhaps due to the lack of available material from those regions.

The oldest studied Polish specimen of *P. jeckeri* was collected in 1951. The largest numbers of specimens (c. 54%) were collected in two periods, 1984–1993 and 2004–2013. In case of *P. subrudecta*, the oldest available collection from Poland is from 1889. The highest number of examined specimens was collected in two periods, 1954–1963 and 1984–1993 (c. 50% of 216 records). The collections made after 2000 represent only 17% of the revised material.

It is difficult to determine a clear trend in the changes of frequency of *P. jeckeri* and *P. subrudecta* in Poland. Most records of both taxa in the south and south-eastern part of the country originate from the 1980s and 1990s; this is most likely the result of intensification of lichenological inventories in these periods. The number of records of both species in the northern Poland increased considerably in recent years (KUKWA 2010) as lichenologists, aware of the occurrence of these species, most probably paid more attention in their recognition when making field lichen inventories. However, it is also possible that these species may have started to spread northwards. Recently such a phenomenon has been shown for *P. subrudecta* and several other lichens with a temperate-Mediterranean distribution in Europe, which are clearly expanding in Western Europe, especially in eutrophicated urban and suburban areas, where the

concentration of sulphur dioxide has decreased significantly (CRESPO et al. 2004, VAN HERK et al. 2002, CHRISTIANSEN & SØCHTING 2007). Several new or rediscovered localities of these species were also noted in northern Europe (GAUSLAA 2000, 2012, THELL 2011). The distinct increase in the frequency of *P. jeckeri* and *P. subrudecta* in western Germany is thought to be related, at least partly, to climate warming (STAPPER et al. 2011). The results of our studies, however, do not allow us to state explicitly whether these species have started to expand in Poland as there have been insufficient lichenological studies in many regions to confirm the previous presence or the absence of the species.

*P. jeckeri* and *P. subrudecta* are included on the red list of lichens in Poland, the former in the category DD (data deficient) and the latter as vulnerable (category VU) (CIEŚLIŃSKI et al. 2006); both species are strictly protected in Poland (REGULATION OF THE MINISTER OF THE ENVIRONMENT 2014). Probably they no longer exist in the majority of their older localities in southern Poland due to air pollution and are uncommon there at present. As *P. jeckeri* and *P. subrudecta* occur in Poland as epiphytes in open areas, mainly on the bark of old roadside trees, the loss of such habitats due to the road modernization, especially in the northern part of the country (R. Szymczyk, unpubl. materials), is the strongest threat for both species. For this reason both species still have a status of protected taxa. Perhaps in the next list of threatened lichens *P. jeckeri* should be treated as vulnerable.

#### *Punctelia jeckeri* (Roum.) Kalb

Biblioth. Lichenol. **95**: 312 (2007). – *Sticta jeckeri* Roum., Revue Mycol. **3**: 33 (1881). – *Punctelia ulophylla* (Ach.) van Herk & Aptroot, Lichenologist **32**: 239 (2000).

**Description:** Thallus foliose, up to 5 cm in diam., closely adnate, rosette-like or irregular. Lobes up to 3 mm wide, rounded, occasionally concave with margin bent upwards; upper surface pale greenish-grey and slightly shiny in the centre, often brownish, mat and pruinose at the lobe tips. Pseudocyphellae mostly punctiform, occasionally elongated, often developing into soralia, which may become confluent. Soralia primarily marginal, laminal soralia also sometimes present. Soredia farinose or granular. Lower side of thallus whitish to pale brown, not rhizinate at the margins. Rhizines dense, simple or clumped, often with paler tips.

Apothecia and pycnidia not found in Polish material, but according to VAN HERK & APTROOT (2000), pycnidia are rare and produce unciform or short-filiform ( $3\text{--}5 \times 1\ \mu\text{m}$ ) conidia.

**Chemistry:** Atranorin in the cortex (K+ yellow) and lecanoric acid in medulla (C+ red, K–, KC+ red, P–). In c. 30% of Polish specimens atranorin was detected in trace amounts.

**Habitat:** This lichen grows on bark of deciduous trees in open situations, usually roadsides, rarely in forests. Its localities observed in forests during the last decade were usually situated in rather well-lit situations, in tree crowns, near clearings, edge of forests, etc. The species was most often collected on *Fraxinus excelsior* (22% of all host trees), *Salix* spp. (16%), *Tilia cordata* (15%), *Quercus* spp. (10%), *Alnus* spp. (8%), *Acer* spp. (7%), *Malus domestica* (6%), *Pyrus communis* (5%) and *Populus* spp. (5%). It was very rarely found on other trees, e. g. *Ulmus* spp., *Fagus sylvatica*, *Prunus* sp., *Aesculus hippocastanum*, *Larix* sp., and *Picea abies*.

**Distribution:** In Poland *P. jeckeri* was recorded mostly in southern and south-eastern parts, especially in the Western Carpathians and their forelands (Podkarpacie region). Several records are known from the Sudety Mts and central part of the country. Recently the species has also been found at c. 20 localities in northern Poland (Fig. 1). To date, the species has only been reported from Europe and North America (HAWKSWORTH et al. 2008, 2011, LENDEMER & HODKINSON 2010). In Europe it is known from Belgium, Czech Republic, Denmark, Estonia, France, Germany, Great Britain, Ireland, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Romania, Russia, Slovakia, Spain (Canary Islands), Switzerland, Sweden and Ukraine (VAN HERK & APTROOT 2000, KALB 2007, HAWKSWORTH et al. 2008, 2011, KUKWA & MOTIEJŪNAITĖ 2012).

**Notes:** *P. jeckeri* is characterized by its greenish-grey thallus (greenish when wet), mainly marginal soralia, always pruinose, brown lobe margins and the presence of lecanoric acid (VAN HERK & APTROOT 2000). It can easily be confused with the morphologically and chemically very similar *P. subrudecta*, with which it may grow in association. Both species produce lecanoric acid as the only medullary metabolite, but *P. subrudecta* is distinguished by its thinner thallus, mostly laminal, orbicular soralia and shiny, epruinose lobe margins (VAN HERK & APTROOT 2000).

The presence of soralia, pale underside and lecanoric acid in the medulla are also the characters of two other *Punctelia* species which can occur in temperate regions, namely *P. caseana* Lendemmer & B.P.Hodk. and *P. perreticulata*. The latter species is a rare lichen with a southern distribution in Europe (CRESPO et al 2004, LOUWHOFF 2009, HAWKSWORTH et al. 2008, 2011); it has marginal soralia, like *P. jeckeri*, but the thallus is rugulose to occasionally scrobiculate and its conidia are much longer (6.5–8 µm) (VAN HERK & APTROOT 2000, LENDEMER & HODKINSON 2010). *P. caseana*, a species so far known from USA and Canada, has mainly marginal soralia developing on secondary lobes, shiny and epruinose main lobe margins (as in *P. subrudecta*) and longer conidia (8–12 µm) (LENDEMER & HODKINSON 2010). *P. borrieri* and *P. reddenda*, two other sorediate species recorded in Europe mainly in western and southern countries (HAWKSWORTH et al. 2008, 2011), can hardly be confused with *P. jeckeri* due to the black lower surface of their thallus and the medullary chemistry. *P. borrieri*, which is more similar to *P. jeckeri* due to a C+ red reaction of the medulla, contains gyrophoric acid and sometimes also fatty acids; for *P. reddenda*, the medulla contains only fatty acids (LOUWHOFF 2009).

**Number of specimens examined:** 278.

**Selected specimens examined:** **Ac-64** – Chocielewko village, 54°31'46"N/17°37'49"E, roadside trees, on *Acer platanoides*, 2007, M. Kukwa 5752 (UGDA); **Ac-66** – 1 km W of Chmieleniec village, the edge of forest, on *Acer platanoides*, 2001, M. Kukwa 561 (UGDA); **Ad-96** – Kadyński Las nature reserve, forest section no. 130f, on *Acer platanoides*, 2012, R. Szymczyk 1074 (OLS); **Af-92** – Popioły village, 54°13'58"N/21°57'06"E, roadside, on *Tilia cordata*, 2011, R. Szymczyk 1038 (OLS); **Bb-06** – Ratajki village, 54°12'37"N/16°27'44"E, park, on *Tilia cordata*, 2013, R. Szymczyk (OLS); **Bd-05** – Elbląg town, Marymoncka street, 54°10'25"N/19°26'42"E, park, 2013, R. Szymczyk 1293a (OLS); **Bd-17** – vicinity of Kopina village, 54°05'02"N/19°45'47"E, roadside, on *Tilia cordata*, 2012, R. Szymczyk 1296 (OLS); **Bd-18** – vicinity of Burdajny village, 54°5'15"N/19°51'46"E, roadside, on *Tilia cordata*, 2012, R. Szymczyk 1298 (OLS); **Bd-19** – vicinity of Padągi village, 54°5'10.55"N/20°1'28.89"E, roadside, on *Quercus robur*, 2012, R. Szymczyk 1297 (OLS); **Bd-35** – W of Sójki village, 53°56'08"N/19°23'46"E, roadside trees, on *Quercus* sp., 2010, M. Kukwa 8351 (UGDA); **Bd-43** – 0.5 km N of Nowa Wieś village, by stream, on *Salix* sp., 2001, M. Kukwa 613 (UGDA); **Bd-63** – vicinity of Trumieje, 53°38'29"N/19°08'32"E, roadside, on *Tilia cordata*, 2014, R. Szymczyk (OLS); **Be-08** – vicinity of Kaczory village, 54°12'46"N/21°35'04"E, roadside, on *Fraxinus excelsior*, 2011, R. Szymczyk 1035 (OLS); **Be-09** – vicinity of Srokowo town, 54°10'45"N/21°31'10"E, roadside, on *Tilia cordata*, 2011, R. Szymczyk 1025 (OLS); **Be-10** – vicinity of Orneta town, 54°07'25"N/20°12'03"E, roadside, on *Acer platanoides*, 2011, R. Szymczyk 1007 (OLS); **Be-18** – Stara Różanka village, 54°06'44"N/21°24'46"E, roadside, on *Tilia cordata*, 2011, R. Szymczyk 1027 (OLS); **Be-50** – Grazymy village, 53°44'49"N/20°08'15"E, palace park, on *Acer platanoides*, 2014, R. Szymczyk (OLS); **Bf-01** – vicinity of Harsz village, 54°08'39"N/21°49'14"E, roadside, 2011, R. Szymczyk (OLS); **Bf-13** – Targowiska village near Iwonicz town, on *Alnus* sp., 1956, T. Sulma (UGDA L-13451); **Bf-57** – Wojdy village, 53°43'10"N/22°41'29"E, roadside-trees, on *Quercus* sp., 2008, M. Kukwa 7219, K. Czyżewska (UGDA); **Ca-53** – Dębno village, by Jezierzycza river valley, roadside, on *Quercus robur*, 2010, A. Szczepański (herb. Szczepańska 842); **Db-97** – Dębno nature reserve, by Masłówka river, ash-alder stream-side forest, on *Quercus* sp., 1998, D. Kubiak (OLTC-L 11); **Dc-65** – Gołuchów town, near castle arboretum, on *Quercus* sp., 1960, K. Glanc (KRAM L-36153); **Df-90** – between Brzoza and Koziencice villages, on *Quercus* sp., 2009, S. Cieśliński (KTC); **Eb-08** – Książęca Wieś village, roadside, on *Tilia cordata*, 1969, K. Glanc (KRAM L-36374); **Ed-30** – Wieluń town, on *Salix* sp., 1963, J. Nowak (KRAM L-12361); **Ee-09** – between Leniwa nature reserve and Stoki village, boggy pine forest, on *Alnus* sp., 2007, S. Cieśliński (KTC); **Ee-19** – Jedlnia nature reserve, on *Quercus* sp., 2003, S. Cieśliński (KTC); **Ee-48** – Osiny village, 8 forest km NW of Hża town, pine forest, on *Alnus* sp., 1987, A. Głąb (KTC); **Ee-60** – Oleszno nature reserve, forest section 72, on *Fraxinus excelsior*, 2008, A. Łubek (KTC); **Ee-69** – Krzemionki Opatowskie nature reserve, near Ostrowiec Świętokrzyski town, mixed forest, on *Quercus* sp. and *Pyrus communis*, 2005, S. Cieśliński (KTC); **Ee-76** – Świętokrzyski National Park, Chełmowa Mt., by Słupianka river, on *Salix* sp. and *Populus tremula*, 1965, 1985, S. Cieśliński (KTC); **Ee-77** – Świętokrzyski National Park, Chełmowa Góra Mt., Servis-Dąbrowa range, on *Salix fragilis*, 2000, A. Donica; **Ee-86** – 250 m SE of Oleszno village, on *Salix* sp., 1977, U. Kruk (KTC); **Ef-33** – Kazimierzów village, 51°11'06"N/21°58'58"E, on bark, 1971, T. Popiołek; **Eg-91** – Guciów village,

50°35'14"N/23°04'04"E, roadside trees, on *Fraxinus excelsior*, 2006, M. Kukwa 5065 (UGDA); **Fb-26** – between Czeremna and Pstrązna villages, near Kudowa village, roadside, on *Acer platanoides*, 1952, Z. Tobolewski (POZ); **Fb-47** – Góry Białskie Mts, Stary Gieraltów village, 600 m, on *Acer platanoides* and *Fraxinus excelsior*, 2003, K. Szczepańska (herb. Szczepańska 301, 467); **Fd-93** – Bielsko-Biała town, Karbowa street, on *Fraxinus excelsior*, D. Bielec (KRAP); **Fd-94** – Zawadka village, 300 m, roadside, on *Salix* sp., 1961, J. Nowak (KRAM L-7062); **Fd-95** – Targanice village, 500 m, roadside, on *Ulmus* sp., 1960, J. Nowak (KRAM L-7734); **Fe-08** – Niewolnik village, near Staszów town, by stream, on *Salix* sp., 1978, S. Nowak (KTC); **Fe-66** – Szujec village, edge of forest, on *Quercus robur*, 1962, J. Kiszka (KRAP); **Fe-74** – Damianice village, edge of forest in nature reserve, on *Quercus* sp., 1960, J. Kiszka (KRAM L-6689); **Fe-67** – Kańska Górna village, 301 m, roadside, on *Tilia* sp., 2005, P. Gubernat, P. Lis (KRA); **Fe-73** – Kopaliny village, 325 m, on *Salix* sp., 1999, P. Stolarczyk (KRA); **Fe-85** – Stróże village, 262 m, near the school, on *Fraxinus excelsior*, 2005, P. Gubernat, P. Lis (KRA); **Fe-88** – Tursko village, 240 m, roadside, on *Fraxinus excelsior*, 2005, P. Gubernat, P. Lis (KRA); **Ff-48** – Głogowiec village, by San River, on *Salix* sp., 1992, J. Kiszka (KRAM L-61829); **Ff-68** – Łapajówka village, on *Quercus* sp., 1984, J. Kiszka (KRAM L-61854); **Ff-86** – Dynów town, on *Malus domestica*, 1992, J. Kiszka, J. Piórecki (KRAM L-61766); **Ff-90** – Jasło town, on *Fraxinus excelsior*, 1989, L. Pacocha (KRAP); **Ff-95** – Dubnik village, on *Malus domestica*, 1993, J. Nowak (KRAM L-34242); **Ff-98** – Bolestraszyce village, arboretum, on *Salix* sp., 2001, J. Kiszka (KRAM L-61762); **Ff-99** – Huwnik village, Strwiążyk village, on *Fraxinus excelsior*, 1989, J. Kiszka, J. Piórecki (KRAM L-61756 & 61827); **Fg-10** – Radymno town, by Rada stream, on *Populus tremula*, 1987, J. Kiszka, J. Piórecki (KRAM L-61842); **Fg-12** – Susiec village by Tanwia river, Rebizanty nature reserve, on *Alnus glutinosa*, 1963, J. Krygel; **Fg-23** – Narol forest division, on *Abies alba*, 1960, J. Rydzak (LBL); **Fg-40** – Wola Mołodycka village, pine forest, on *Quercus robur*, 1984, J. Kiszka, J. Piórecki (KRAM L-61845 & 61845); **Fg-70** – Nowosielce Kozickie village, on *Tilia cordata*, 1987, J. Kiszka, J. Piórecki (KRAM L-61802); **Fg-80** – Hołuczaków village, near the forest, on *Malus domestica*, 1990, J. Kiszka (KRAM L-61837); **Fg-90** – Jaksmanice village, old orchard, on *Malus domestica*, 1986, J. Kiszka, J. Piórecki (KRAM L-61838); **Gd-01** – Serednica village, on *Populus tremula*, 1987, J. Kiszka, J. Piórecki (KRAM L-61748); **Gd-03** – Lipowa village, on *Tilia cordata*, 1966, S. Kuziel (KRAP); **Gd-04** – Zabłocie village, 358 m, on *Alnus glutinosa*, 1966, S. Kuziel (KRAP); **Gd-09** – Pcim village, 390 m, roadside, on *Fraxinus excelsior*, 1996, J. Nowak (KRAM L-43056); **Gd-12** – Lipowiec village, 440 m, on *Alnus* sp., 1964, J. Kiszka (KRAP); **Gd-13** – Bystra village, 495 m, on *Fraxinus excelsior*, 1964, J. Kiszka (KRAP); **Gd-18** – Polica Range, by Sidzina stream, on *Alnus glutinosa*, 1965, J. Nowak (KRAM L-16165 & 16167); **Gd-48** – Witów village, 810 m, on *Alnus* sp., 1964, J. Kiszka (KRAP); **Ge-00** – Kasinka Mała village, 400 m, roadside, on *Fraxinus excelsior*, 1995, J. Nowak (KRAM L-42514); **Ge-10** – Poręba Wielka village, old park by Gorczański National Park building, on *Populus nigra*, 1995, M. Kukwa (UGDA L-13497); **Ge-20** – Poręba Wielka village, near the park, on *Populus tremula*, 1994, J. Nowak (KRAM L-32112); **Ge-22** – Ochotnica Dolna village, Twarogi Mt., 503 m, 49°31'43"N/20°21'09"E, on *Prunus* sp., 2014, R. Szymczyk (OLS); **Ge-24** – Radziejowa Range, Przysietnica village, 450 m, on *Fraxinus excelsior*, 1991, L. Śliwa (KRA); **Ge-25** – Radziejowa Range, between Rytro and Obłozły Ryterskie villages, 450 m, on *Juglans* sp., 1990, L. Śliwa (KRA); **Ge-26** – Jaworzyna Krynicka range, Uhryń village, 620 m, on *Fraxinus excelsior*, 1989, L. Śliwa (KRA); **Ge-27** – Jaworzyna Krynicka range, by Uhryński stream valley, 590 m, on *Salix* sp., 1989, L. Śliwa (KRA); **Ge-28** – Klimkówka village, by Kościłkowa stream valley, 360 m, on *Alnus* sp., 1974, M. Olech (KRA); **Ge-29** – Zdynia village, 530 m, on *Pyrus communis*, M. Olech (KRA); **Ge-32** – by Limbargowy stream, on *Salix* sp., 1998, J. Kiszka (KRAM L-61833); **Ge-34** – Jaworki village, 580 m, on *Fraxinus excelsior*, 1990, L. Śliwa (KRA); **Ge-38** – Stary Sącz town, by Dunajec river, on *Populus tremula*, 1987, (KRAP); **Ge-40** – Pasma Gubałowski range, Dzianisz village, by stream, 850 m, on *Alnus* sp., 1964, J. Kiszka (KRAP); **Ge-41** – Stasikówka village, 800 m, on *Acer pseudoplatanus*, 1967, J. Kiszka (KRAP); **Gf-16** – Wujskie village, on *Malus domestica*, 1990, J. Kiszka (KRAM L-61817); **Gf-21** – Huta Krempska settlement, 49°39'49"N/21°30'29"E, on *Salix* sp., 2009, M. Kukwa 7681 (UGDA); **Gf-27** – Słonne Mts, by San river, Sobień Castel, on *Salix* sp., 1990, J. Kiszka (KRAM L-61811); **Gf-29** – Cisowa dolna village, by Cisowa stream, on *Fraxinus excelsior*, 1983, J. Kiszka, J. Piórecki (KRAM L-61823); **Gf-37** – Żuków range, Michałowiec Mt, on *Malus* sp., 1990, R. Kościelniak (KRAP); **Gf-38** – Żuków range, Bazyle village, on *Malus* sp., 1990, R. Kościelniak (KRAP R-00825); **Gf-39** – Hoszowczyk village, orchard, on *Pyrus* sp., 1991, R. Kościelniak (KRAP); **Gf-47** – Łopienka village, 604 m, on *Malus* sp., 2011, G. Woszewicz (KRAP); **Gf-48** – Studenne, remains of old orchard, 508 m, on *Pyrus* sp., 2011, N. Kapek (KRAP); **Gf-49** – Czarna village, on *Salix* sp., 1992, R. Kościelniak (KRAP); **Gf-57** – Łopienka village, old orchard, on *Pyrus* sp., 2011, G. Woszewicz (KRAP); **Gf-58** – by Tworylczyk stream, 790 m, on *Populus tremula*, 2011, R. Kościelniak (KRAP); **Gf-68** – Wetlina village, N slope of Dział Mt., 710 m, on *Fraxinus excelsior*, 2001, J. Kiszka, R. Kościelniak (KRAP); **Gf-69** – former Górne village, 840 m, on *Fraxinus excelsior*, 2010, R. Kościelniak (KRAP); **Gg-40** – Michniowiec village, roadside, on *Tilia* sp. and *Fraxinus excelsior*, 1992, R. Kościelniak (KRAP R- 00486 & 00353); **Gg-60** – Tarnawa village, 670 m, on *Salix* sp. and *Tilia* sp., 2005, R. Kościelniak (KRAP); **Gg-71** – Sianki village, 830 m, on *Fraxinus excelsior*, 2009, R. Kościelniak (KRAP).

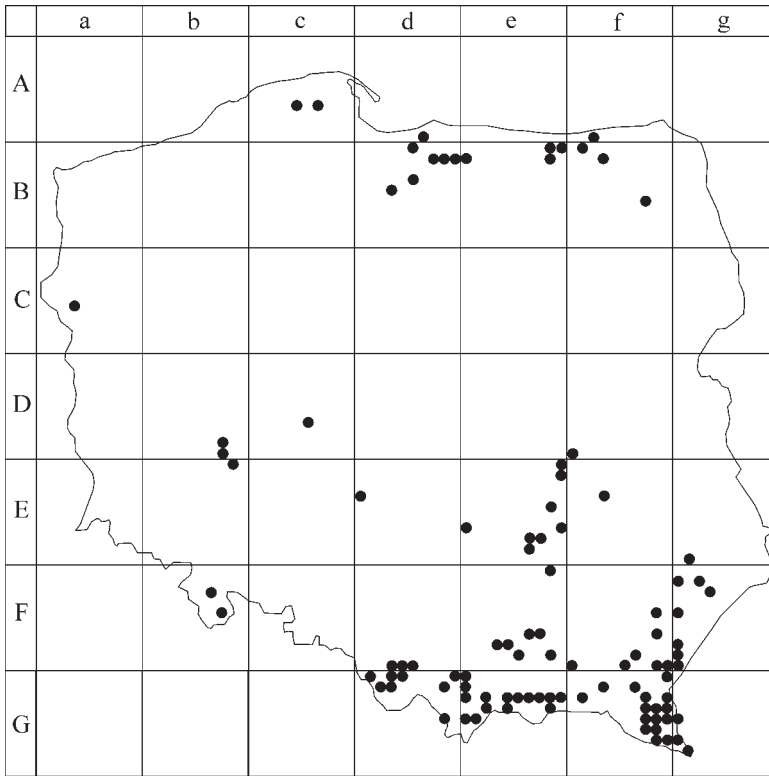


Fig. 1: Distribution of *Punctelia jeckeri* in Poland (in ATPOL grid square system).

***Punctelia subrudecta*** (Nyl.) Krog

Nordic J. Bot. 2: 291 (1982). – *Parmelia subrudecta* Nyl., Flora 69: 320 (1886).

**Description:** Morphology very similar to *Punctelia jeckeri*, but with mainly punctiform, not marginal soralia and epruinose lobe tips. Apothecia absent in Polish material. Pycnidia observed in only 7 specimens. Conidia unciform,  $4-6(-8) \times 1(-1.2) \mu\text{m}$ .

**Chemistry:** All revised specimens contained lecanoric acid as a major medullary substance and atranorin in the cortex. Atranorin was detected only in trace amounts in c. 30% of specimens.

**Habitat:** The habitat requirements of the species are very similar to *P. jeckeri*, but a few specimens were found also on wood and concrete. Studied Polish material was collected on the bark of following trees: *Quercus* spp. (26% of all host trees), *Alnus* spp. (13%), *Fraxinus excelsior* (11%), *Tilia cordata* (11%), *Salix* spp. (10%), *Acer* spp. (8%), *Fagus sylvatica* (5%), *Malus* spp. (4%) *Carpinus betulus* (2%), and rarely from other phoropytes (*Ulmus* sp., *Populus* spp., *Pyrus* sp., *Prunus* sp., *Picea abies* and *Pinus sylvestris*).

**Distribution:** *Punctelia subrudecta* is a subcosmopolitan species confirmed from Europe, Asia, Africa and Australasia. It was incorrectly reported from South America and North America (LOUWHOFF 2009, LENDEMER & HODKINSON 2010). In Europe this species is known from Albania, Austria, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Spain, Switzerland, Turkey and Ukraine (VAN HERK & APTROOT 2000, HAWKSWORTH et al. 2008, 2011). It was erroneously reported from Lithuania; the record belongs to *P. jeckeri* (KUKWA & MOTIEJŪNAITĖ 2012).

In Poland, *P. subrudecta* shows very similar distribution pattern as *P. jeckeri*, but with less localities in the northern part of the country (Fig. 2).

**Notes:** Diagnostic features of this species are the laminal, punctiform soralia, lack of pruina at the lobe margins, pale lower surface and the presence of lecanoric acid. In Europe the species can be mistaken for *P. jeckeri* with mainly marginal soralia, *P. borrieri*, which differ in the presence of gyrophoric acid and black lower surface, *P. reddenda*, which contains fatty acids, and *P. perreticulata*, which has a rugulose to scrobiculate thallus and longer conidia; for more details see notes under *P. jeckeri*.

**Number of specimens examined:** 216.

**Selected specimens examined:** **Ac-97** – Kartuzy town, Wzgórze Wolności hill, on *Tilia cordata*, 1982, E. Pałka (UGDAL-4143); **Bb-06** – Ratajki village, 54°12'37"N/16°27'44"E, park, on *Fraxinus excelsior*, 2013, R. Szymczyk (OLS); **Bd-04** – Elbląg town, Bażantarnia, Saperów street, beech forest, on *Fraxinus excelsior*, 1959, T. Sulma; **Bd-05** – Elbląg town, Marymoncka street, 54°10'25"N/19°26'42"E, park, on *Tilia cordata*, *Quercus robur*, 2013, R. Szymczyk 1292, 1293 (OLS); **Bd-19** – vicinity of Dobry village, 54°6'39"N/19°57'13"E, roadside, on *Quercus robur*, 2012, R. Szymczyk (OLS); **Bd-26** – Dymniki village, 53°58'40"N/19°28'56"E, roadside, on *Tilia cordata*, 2012, R. Szymczyk 1036 (OLS) & on *Quercus* sp., 2011, M. Kukwa 8363, M. Oset (UGDA); **Bd-42** – Lisewo forest district, forest section No. 185, W of Nowa Wieś, edge of forest, on *Robinia pseudoacacia*, 2000, M. Kukwa (UGDAL-9345); **Be-09** – vicinity of Srokowo town, 54°10'45"N/21°31'10"E, on *Tilia cordata*, 2011, R. Szymczyk (OLS); **Be-18** – vicinity of Stara Różanka village, 54°06'51"N/21°25'25"E, on *Tilia cordata*, 2011, R. Szymczyk 1028 (OLS); **Db-97** – Dębno nature reserve, by Masłowska River, on *Quercus* sp., 1998, D. Kubiak (OLTC-L 11); **Dd-49** – Arkadia village, park, on *Tilia cordata*, 2011, M. Kukwa 8369 (UGDA); **De-99** – Brzeźniczka nature reserve, oak-linden-hornbeam forest, on *Carpinus betulus*, 2007, S. Cieśliński (KTC); **Df-90** – between Brzoza and Kozienice villages, on *Quercus* sp., 2009, S. Cieśliński (KTC); **Eb-08** – near Żmigród village, mixed forest, on *Fagus sylvatica*, 1970, R. Kapuściński (KRAM L-36379); **Ec-00** – Postolin village, by lake, on *Quercus* sp., 2004, D. Kubiak (OLTC-L 2033); **Ee-09** – Załamanek nature reserve, forest section No. 119, on *Alnus* sp., 2007, S. Cieśliński (KTC); **Ee-60** – Oleszno nature reserve, forest section 73, ash-alder stream-side forest, on *Fraxinus excelsior*, 2008, A. Łubek (KTC 8085); **Ee-69** – Krzemionki Opatowskie nature reserve, near Ostrowiec Świętokrzyski, mixed forest, on *Quercus* sp., 2005, S. Cieśliński (KTC); **Ee-72** – Wesola village, on *Quercus* sp., 1960, J. Nowak (KRAM L-17766); **Ee-76** – Świętokrzyski National Park, Chelmowa Mt., by Słupianka river, on *Alnus* sp., 1964, S. Cieśliński (KTC); **Ee-86** – Grzywy Korczewskie village, on *Quercus* sp., 1977, Z. Tobolewski (KTC); **Ef-33** – Chodlik village, on bark, 1971, T. Popiołek (LBL); **Ef-90** – Uroczysko Żyznów range, near Klimontowo village, by stream, forest section 72, *Carpinus betulus*, 1999, S. Cieśliński (KTC 8005); **Eg-91** – Zwierzyniec village, Browarna street, 50°36'29"N/22°58'12"E, c. 230 m, free standing trees, on *Robinia pseudoacacia*, 2006, M. Kukwa 5071 (UGDA); **Fd-93** – Bielsko-Biała town, Kopytko street, edge of forest, on *Acer platanoides*, D. Bielec (KRAP); **Fe-37** – Szczucin town, on *Salix* sp., J. Nowak (KRAM L-31709); **Fe-52** – Ispina village, bark of *Quercus robur*, 1960, J. Kiszka (KRAP); **Fe-64** – Załętownia village, on *Quercus robur*, 1961, J. Kiszka (KRAP); **Fe-66** – Szujec village, edge of forest, on *Quercus robur*, 1962, J. Kiszka (KRAP); **Fe-67** – Kaśna Górna village, 253 m, on *Quercus* sp., 2005, P. Gubernat, P. Lis (KRA-L); **Fe-74** – Kamionka village, on *Quercus robur*, 1961, J. Kiszka (KRAP); **Fe-78** – Pławna village, 259 m, roadside, on *Quercus* sp., 2005, P. Gubernat, P. Lis (KRA-L); **Ff-12** – Wola Tarnowska village, on *Alnus glutinosa*, 1962, J. Kiszka (KRAP); **Ff-17** – Harasiuki village, roadside, on *Populus tremula*, 1991, J. Kiszka & J. Piórecki (KRAM L-61765); **Ff-23** – Bojanów village, on *Fraxinus excelsior*, 1988, J. Kiszka, J. Piórecki (KRAM L-61794); **Ff-36** – Biedaczów village, *Alnus incana*, 1989, M. Miś (KRAP); **Ff-56** – Łapajówka village, on *Quercus* sp., 1987, J. Kiszka & J. Piórecki (KRAM L-61769); **Ff-90** – Jasło town, Floriańska street, on *Salix* sp., 1988, L. Pacocha (KRAP); **Ff-98** – by Krupna village, by stream, on *Tilia cordata*, 1985, J. Kiszka, J. Piórecki (KRAM L-61778); **Ff-99** – Zawadka stream, near the church, on *Fraxinus excelsior*, 1987, J. Kiszka (KRAM L-61806); **Fg-50** – Ścieżki village, Stara Zuchowa village, on *Alnus glutinosa*, 1987, J. Kiszka, J. Piórecki (KRAM L-61803); **Fg-53** – Wólka Małkowa village, on *Quercus* sp., 1992, J. Kiszka (KRAM L-61839); **Fg-62** – Wólka Ogryzkowa village, on *Quercus* sp., 1992, J. Kiszka & J. Piórecki (KRAM L-61763); **Fg-70** – Nowosielce Kozićkie village, *Tilia cordata* and *Fraxinus excelsior*, 1987, J. Kiszka & J. Piórecki (KRAM L-61851 & 61846); **Fg-80** – Wyszatyce village, on *Fraxinus excelsior*, 1994, U. Bielczyk (KRAM L-39891); **Fg-90** – Rożubowice village, old orchard, on *Prunus domestica*, 1986 J. Kiszka & J. Piórecki (KRAM L-61749); **Gd-03** – Żywiec town, alt 348 m, roadside, on *Quercus robur* and *Acer platanoides*, 1966, S. Kuziel (KRAP); **Gd-04** – Zabłocie village, 358 m, on *Alnus glutinosa*, 1966, S. Kuziel (KRAP); **Gd-09** – Łękawica village, 380 m, on *Quercus* sp., 1995, U. Bielczyk (KRAM L-42250); **Gd-12** – Bystra village, 495 m, on *Fraxinus excelsior*, 1964, J. Kiszka (KRAP); **Gd-18** – Ciecina village, 445 m, on *Tilia cordata*, 1964, J. Nowak (KRAM L-16660); **Ge-08** – Kościelisko village, on *Alnus glutinosa*, 1889, Boberski (KRAM L-20122); **Ge-17** – Kałcowa village, on *Acer pseudoplatanus*, 1927, J. Motyka (KRAM L-10149); **Ge-18** – Krempna village, 355 m, on *Fraxinus excelsior*, 1979, J. Nowak (KRAM L-32820); **Ge-20** – Poręba Wielka village, 500 m, on *Acer*



*pseudoplatanus* and *Ulmus* sp., 1965, K. Glanc (KRAM L-36149); **Ge-22** – Ochotnica Dolna village, Twarogi Mt., 503 m, 49°31'43"N/20°21'09"E, on *Prunus* sp., 2014, R. Szymczyk (OLS); **Ge-23** – Pracza village, 490 m, on *Pyrus communis*, 1991, L. Śliwa (KRA); **Ge-24** – Barcice village, Przysietnica stream valley, on *Salix* sp., 1965, M. Olech (KRA); **Ge-32** – Facimiech Mt., by river, on *Alnus* sp., 1981, K. Toborowicz (KTC); **Ge-36** – Złockie village, 500 m, on *Tilia* sp., 1967, M. Olech (KRA-L); **Ge-41** – Bukowina Tatrzańska range, by Białka stream, 700 m, on *Alnus* sp., J. Kiszka (KRAP 10165); **Gf-08** – Kreców village, on *Malus domestica*, 1987, J. Kiszka, J. Piórecki (KRAM L-61840); **Gf-09** – Huwniki village, Wiar stream valley, roadside, on wood, *Fraxinus excelsior* and *Tilia platyphyllos*, 1978, U. Bielczyk (KRAM L-22017, 22654 & 22605); **Gf-10** – by Folusz stream, Diabli Kamień Mt., on *Abies alba*, 1954, T. Sulma (UGDA L-6247); **Gf-13** – Targowiska village near Iwonicz town, on *Alnus* sp., 1956, T. Sulma (UGDA L-2526); **Gf-16** – Olszanica village, on *Quercus robur*, 1988, J. Kiszka & J. Piórecki (KRAM L-61780); **Gf-27** – Cisowa village, in the arboretum, on *Quercus* sp., 1999, J. Kiszka (KRAM L-61808); **Gf-28** – Wańkowa village, on *Salix* sp. and *Tilia cordata*, 1990, J. Kiszka (KRAM L-61757 & 61809); **Gf-38** – Kościelisko village, road over stream, 890 m, on *Alnus* sp., J. Kiszka (KRAP); **Gf-49** – Czarna Dolna village, by road to Żuków village, on *Tilia cordata*, 1991, R. Kościelniak (KRAP R-00209); **Gf-57** – Przystup village, roadside, 800 m, on *Fagus sylvatica*, 1958, K. Glanc (KRAM L-36143); **Gf-58** – Suche Rzeki village, Krywe village, 500 m, on *Fraxinus excelsior*, *Pyrus* sp., 2011, N. Kapek (KRAP); **Gf-59** – Smolnik village, 500 m, roadside, on *Fraxinus excelsior*, 1958, K. Glanc (KRAM L-36155); **Gf-68** – Nasiczne village, roadside, on *Fraxinus excelsior*, 1959, K. Glanc (KRAM L-36376); **Gf-69** – remains of Górne village, 960 m, on *Acer pseudoplatanus*, 2009, R. Kościelniak (KRAP); **Gg-40** – Bystre village, near the church, on *Fraxinus excelsior*, 1992, R. Kościelniak (KRAP); **Gg-60** – Tarnawa Niżna village, on *Tilia* sp., 2002, R. Kościelniak (KRAP-L); **Gg-61** – Bieszczadzki National Park, by San river, on *Tilia* sp., 2001, J. Kiszka (KRAP).

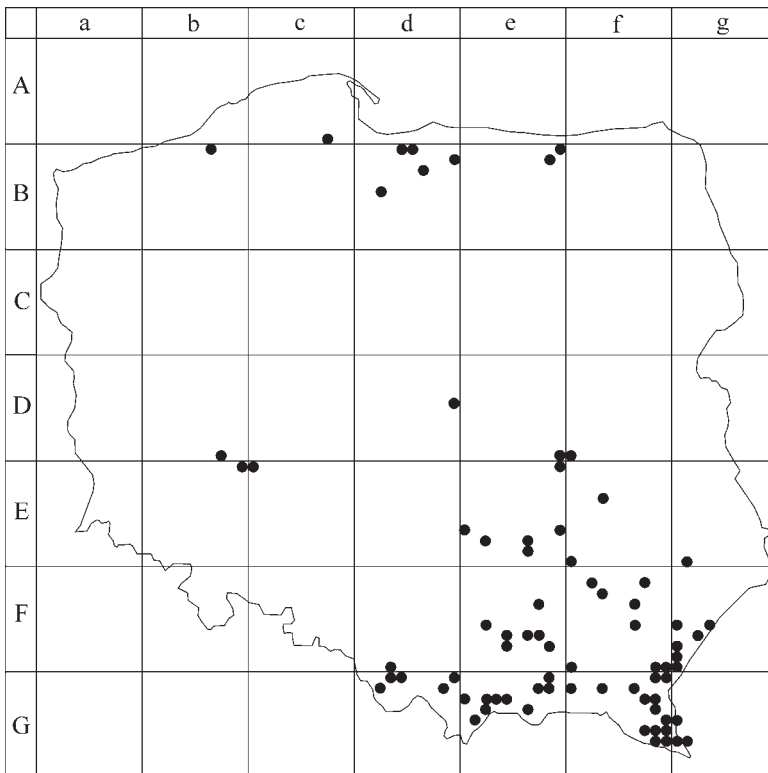


Fig. 2: Distribution of *Punctelia subrudecta* in Poland (in ATPOL grid square system).

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