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VERRUCARIA ELAEOMELAENA AND *V. FUNCKII* (VERRUCARIACEAE) IN POLAND

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Abstract. *Verrucaria elaeomelaena* (A. Massal.) Arnold is confirmed as occurring in Poland, and its relation to *V. funckii* (Spreng.) Zahlbr. is discussed. The species are briefly described and their distribution in Poland given.

Key words: freshwater lichens, taxonomy, distribution, Poland

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INTRODUCTION

During a study of pyrenocarpous aquatic lichens in the Polish Tatra Mts, two closely related species – *Verrucaria elaeomelaena* (A. Massal.) Arnold and *V. funckii* (Spreng.) Zahlbr. – were identified. Both species occur on inundated or submerged rocks and pebbles in streams. They are recognized by the shape and size of ascospores, and they are characterized by substratum preferences: *V. elaeomelaena* inhabits exclusively basic substrata such as limestone, gneiss and other kinds of calcareous rocks, whereas *V. funckii* occurs on acidic substrata such as siliceous rocks. Nevertheless, these closely related species have often been confused. One source of confusion was misapplication of the name *V. elaeomelaena* by Swinscow (1968), who mistakenly attributed it to the freshwater species, which was widespread on siliceous rocks. According to him, 'The type specimens of *V. elaeomelaena*, from Massalongo's herbarium at Verona, is unfortunately on limestone, so that it is not entirely characteristic of this species so widespread on acidic rocks', and this statement likely influenced further understanding of the species by other lichenologists. In a monograph of Polish lichens, for example, Nowak and Tobolewski (1975) included *V. silicea* Servít (a later synonym of *V. funckii*) under the name *V. elaeomelaena*. In consequence of these and other nomenclatural problems, the two species *V. elaeomelaena* and *V. funckii* were incorrectly determined in several European countries, including Poland. In 1972 Wirth noted that the specimens on acidic and basic rocks referred to *V. elaeomelaena* represent two different species, and that the specimens growing on acidic rocks belong to *V. silicea* (Servít 1954), now *V. funckii* due to nomenclatural priority (Wirth 1980). Unfortunately, Wirth's observations were not taken into account by other authors, nor were reconsiderations of the taxonomic status of these species by Hawksworth (1989). For instance, in recent checklists of lichens in Poland (Fałtynowicz 1993, 2003; Bielczyk 2003) *V. elaeomelaena* is not listed as a separate species, and *V. elaeomelaena* auct. is considered a synonym of *V. funckii*.

The present research has confirmed *V. elaeomelaena* in Poland and treated it as a separate, well-defined species, clearly distinguished from *V. funckii*. Both species are described here, together with selected synonyms and the known distribution in Poland. The study is based on revision of material from KRAM, KRAP, LBL, UGDA and GPN, as well as the authors' own field survey in the Polish Carpathians.

Results and discussion

Verrucaria elaeomelaena (A. Massal.) Arnold

Verh. Zool.-Bot. Ges. Wien **18**: 958. 1868. – *Lithoicea elaeomelaena* A. Massal., Att. Ist. Veneto, Ser. 3, **2**: 380. 1856. Type: Arnold, Rabenhorst, Lichenes europaei: 333d (KRAM-L), isolectotype – *V. elaeomelaena* f. *calcicola* Zschacke, Hedwigia **67**: 70. 1927.

Prothallus not distinct, whitish or pinkish, non-fimbriate. Thallus superficial, light brownish green to olive-brown or mid brown, subgelatinous, usually not cracked (rarely with fine splits forming in the herbarium), thallus surface dull, smooth or uneven. Cells of thallus weakly arranged in columns. Cortex weakly developed, pigmented brown; lower part of thallus continuous with areas of brown pigment, or rarely discontinuous. Perithecia forming very low to moderate projections 0.3–0.4 mm in diameter, at first completely covered by thallus layer but later becoming erumpent in thalline warts; apex often somewhat exposed and blackish. Involucrellum black, variable, conical and in upper half of exciple or reaching to base of thallus, or more or less appressed to exciple. Exciple 200–400 μm wide, colorless at side and base. Asci clavate, 8-spored. Ascospores colorless, non-septate, broadly ellipsoid, rounded at both ends, without a perispore, 22–30 × 12–16 μm. Conidiomata not detected.

Taxonomic note. This species was often confused with the more common *V. funckii*. *Verrucaria elaeomelaena* is distinguished from *V. funckii* by the thicker and paler thallus, and larger, broadly ellipsoid ascospores. It can usually also be recognized in the field by its substratum preference, as it occurs on calcareous rocks in basic streams. The taxonomic and nomenclatural problems associated with the two species were discussed by Hawksworth (1989) and Thüs (2002).

Ecology and distribution. *Verrucaria elaeomelaena* occurs on calcareous rocks, or rocks under calcareous influence on inundated or submerged rocks and pebbles in springs, streams and rivers mainly in lowlands and uplands, less frequently on mountains at lower altitudes. This species is known from scattered sites in Europe, where it is reported from the British Isles (Hawksworth *et al.* 1992) and from lowlands and uplands of Central Europe (Fałtynowicz 1992; Wirth 1995; Diederich & Sérusiaux 2000). It is also known from lower altitudes in mountains, such as the Carpathians (Bielczyk *et al.* 2004), Alps (Hafellner & Türk 2001; Clerc 2004), Apennines (Nimis & Martellos 2003) and Pyrenees (Llimona & Hladun 2001). Outside Europe it occurs in North America (Esslinger & Egan 1995), but the precise distribution of the species is still relatively poorly known, and probably this species is more frequent.

In Poland *V. elaeomelaena* is limited to larger limestone areas (Fig. 1). In the Carpathians it occurs in the West Tatras (Krzewicka 2006) and Pieniny Mts (Kiszka 2000), where it is found on calcareous rocks in clear streams. Outside the Carpathians it occurs in basic streams of the Wyżyna Krakowsko-Wieluńska upland at a few scattered sites (Nowak 1961, 1967, 1995; Kiszka 1979). It is also known from lower altitudes in northwest Poland, for example at one locality in the Bory Tucholskie forest (Lipnicki 1993a), one locality on the Równina Drawska plateau (Lipnicki 1993b), and a few localities in the Pojezierze Kaszubskie lake district (Krawiec 1933, 1938; Fałtynowicz 1992). This species was also reported from the Sudety Mts (Eitner 1911), but there are no recent records. It seems that in Poland *V. elaeomelaena* is a rare species growing predominantly in clear streams at lower altitudes.

Comments. Specimens from Mstów village reported by Nowak (1967) as *V. funckii* in fact belong to *V. elaeomelaena* although the lichens grow on noncalcareous substratum. However, they can grow in this locality because of the large area of calcareous outcrops, for example the Wyżyna Wieluńska upland, where the pH of the water in streams is basic. In that situation the surface of stones inhabited by this species gives a positive reaction with acid (HCl+). It was previously observed by Krzewicka and Galas (2006) that some aquatic lichens that tend to grow on a particular acid or basic substratum may sometimes occur on a substratum type other than the preferred one. This usually happens when the occupied sub-

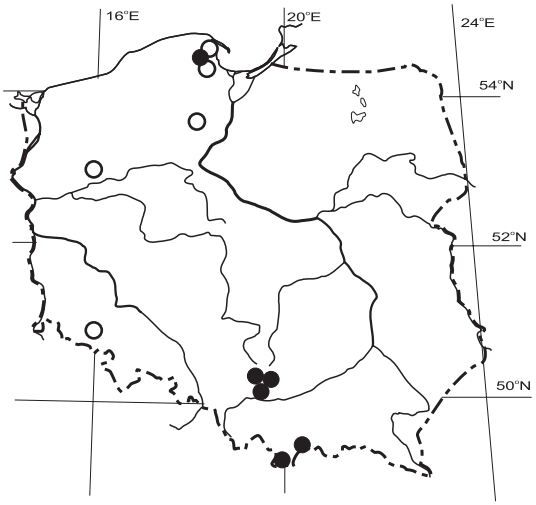

Fig. 1. Distribution of *Verrucaria elaeomelaena* in Poland. ● – confirmed (based on herbarium material); O – uncertain (herbarium material unavailable or missing).

stratum is permanently submerged in water with a pH agreeing with the species' requirements. For example, species usually growing on a calcareous substratum may occur on siliceous rock if the rock is continually submerged in strongly basic water.

Probably all the specimens hitherto cited from western Pomerania as *V. funckii* by Fałtynowicz (1992) represent *V. elaeomelaena*. Revision of the available herbarium material from this area confirmed that the specimens previously named *V. funckii* in fact belong to *V. elaeomelaena*. Other historical materials from western Pomerania cited by Fałtynowicz (1992) as *V. funckii* were previously reported by Krawiec (1933, 1938) as *V. elaeomelaena*. The historical specimens were not located in any herbaria and cannot be reexamined, but the ecological note by Krawiec (1933, 1938) suggests that his determination was correct.

SPECIMENS EXAMINED. POLAND. WESTERN POMERANIA, Pojezierze Kaszubskie lake district, Tłuczewo, 4 April 1986, *W. Fałtynowicz & Z. Tobolewski* (UGDA). – WYŻYNA KRAKOWSKO-WIELUŃSKA UPLAND, Mstów 4 July 1963, *J. Nowak* (KRAM-L 12738); Siemiaszyce, on pebbles in stream, 6 Feb. 1957, *J. Nowak* (KRAM-L 19543); Ojców, Dolina Sąspowska valley, in water on limestone, 9 Aug. 1957, *J. Nowak* (KRAM-L 19542); Dolina Będkowska valley, on submerged limestone rocks in a spring, 7 Sept. 1956, *J. Nowak* (KRAM-L 19541); Dolina Będkowska valley, near Rudawa, on submerged limestone boulders in stream, 19 May 1976, *J. Nowak* (KRAM-L 49539; LBL); near Będkowice, on limestone pebbles in stream, 400 m, 26 July 1986, *J. Nowak* (KRAM-L 30349); Jeziorki near Kroczyc, 5 May 1958, *J. Nowak* (KRAM-L 19544, 19539). – WESTERN CARPATHIANS, Pieniny Mts, in Potok Limbargowy stream on calcareous rocks, 650 m, 16 July 1997, *J. Kiszka* (KRAP); West Tatra Mts, Dolina Chochołowska valley, Polana Huciska glade, in stream on calcareous rocks, 975 m, 16 July 2004, *B. Krzewicka 2755a* (KRAM-L 49589); near Koryciska, 960 m, 16 July 2004, *B. Krzewicka 2709a* (KRAM-L 50162).

Verrucaria funckii (Spreng.) Zahlbr.

Cat. Lich. Univ. **1**: 41. 1921. – *Pyrenula funckii* Spreng., in Funck, Krypt. Gewächse **32**: 5. 1826. TYPE: Sprengel in Funck: Krypt. Gewächse 32: no. 658, *Pyrenula funckii*, Auf Steinen in klaren Gebirgs-Bächen' (FR SYNTYPE). – *V. silicea* Servít, Československé Lišejníky čeledi Verrucariaceae. Lichenes familiae Verrucariacearum. Nakladatelstvi Ceskoslovenske Akademié Ved, Praha: 156. 1954. – *V. elaeomelaena* auct. non (A. Massal.) Arnold. – *V. denudata* var. *mougeotii* Zschacke, Hedwigia, **67**: 74. 1927. TYPE: Siegmund, Rabenhorst, Lichenes europaei: 344b (KRAM-L SYNTYPE). – *V. mougeotii* (Zschacke) Servít, Československé Lišejníky čeledi Verrucariaceae. Lichenes familiae Verrucariacearum. Nakladatelstvi Ceskoslovenske Akademié Ved, Praha: 156. 1954. – *V. nuda* Zschacke, Rabenh. Kryp. Fl. 9. 1/1. 240. 1934.

Prothallus indistinct, creamy or black, non-fimbriate. Thallus superficial, grey-green, greenish brown to dark brown, subgelatinous, usually well developed, not cracked, rarely with a few cracks, surface smooth, glossy. Cells of thallus arranged in columns. Cortex weakly developed, pigmented brown, lower part of thallus continuous, black. Perithecia 0.2–0.3 mm in diameter, remaining immersed, only the ostioles visible as small black dots from above. Involucrellum dark brown to black, well developed, thick. Exciple wide, colorless at sides and base. Asci clavate, 8-spored. Ascospores colorless, non-septate, narrowly ellipsoid, rounded at apices, without a perispore, 18–25 × 6–8 µm. Conidiomata not detected.

TAXONOMIC NOTE. The species originally described as *Pyrenula funckii* Spreng. was considered by Zahlbruckner (1921) as a member of *Verrucaria* and transferred to this genus. Unfortunately this name has long been neglected by taxonomists. Instead the species *V. silicea* (Servít 1954) was described for this aquatic lichen growing on acidic substrata. In 1980, Wirth noted that the specimens named as *V. silicea* are conspecific with *V. funckii*, which has nomenclatural priority.

ECOLOGY AND DISTRIBUTION. *Verrucaria funckii* occurs on inundated or submerged siliceous rocks and pebbles in mountain and upland streams, rivers and lakeshores. This species is known from Europe and widely distributed in the northern part, where it is reported in Scandinavia (Santesson *et al.* 2004), Iceland (Kristinsson 2002), Ireland and Great Britain (Hawksworth *et al.* 1992), through the uplands and mountains of Central Europe, such as the Carpathians and Alps (Wirth 1995; Hafellner & Türk 2001; Thüs 2002; Bielczyk 2003; Bielczyk *et al.* 2004; Clerc 2004), to southern Europe, where it is known from a few scattered localities on the Iberian, Apennine and Balkan Peninsulas (Llimona & Hladun 2001; Nimis & Martellos 2003; Krzewicka *et al.* 2007).

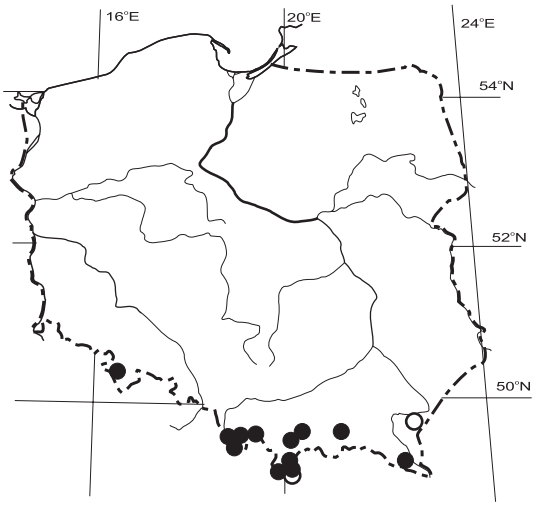

Fig. 2. Distribution of *Verrucaria funckii* in Poland. ● – confirmed (based on herbarium material); O – uncertain (herbarium material missing).

Outside Europe it is known from North America and Asia (Esslinger & Egan 1995).

In Poland *V. funckii* occurs mainly in mountainous regions. It is known from the Sudety Mts where it was found in one locality in the Góry Stołowe Mts, and from the Carpathians where it was recorded at scattered localities (Fig. 2). Hitherto in the Polish Eastern Carpathians this species was reported from only one locality (Kiszka & Kościelniak 2001), but it is probably more frequent in this area. In the Polish Western Carpathians it occurs both in the Tatras (Motyka 1926, 1927; Nowak 1995; Krzewicka 2006) and the Beskidy Mts where it was noted from many places in the Beskid Śląski Mts (Kiszka 1967), Beskid Żywiecki Mts (Nowak 1971, 1998), Beskid Wyspowy Mts (Nowak 1998), Beskid Mały Mts (Nowak 1965), and Gorce Mts (Czarnota 2000). The species is also known from localities at lower altitudes in the Pogórze Rożnowsko-Ciężkowickie foothills, where it was found at 400 m altitude (Kozik 1977), and in the Pogórze Przemyskie foothills at 350 m (Kiszka 2002). *Verrucaria funckii* seems to be relatively common within its distribution range.

COMMENTS. The specimens reported by Motyka (1926, 1927) from the Tatra Mts under the name *V. elaeomelaena* probably belong to *V. funckii.* However, these are historical records and no specimens are preserved in any Polish herbaria. Motyka mentions that the species was associated with *V. hydrela* Ach. growing on granite rocks. Both species (*V. funckii* and *V. hydrela*) occur exclusively in acidic streams and prefer siliceous substrata, whereas *V. elaeomelaena*, as we currently know it inhabits exclusively basic substrata.

SPECIMENS EXAMINED. POLAND. SUDETY MTS, Góry Stołowe Mts, Sokołówka near Polanica, Kamienna Góra Mt. on inundated siliceous pebbles in stream, 650 m, 4 March 1959, *J. Nowak* (KRAM-L 19484). – WESTERN CARPATHIANS, Beskid Śląski Mts, Podmagurka, on pebbles in stream near the road to Szczyrk, 600 m, 28 June 1964, *J. Kiszka* (KRAP); Szczyrk, in stream by a forest, 560 m, 28 June 1964, *J. Kiszka* (KRAP); S slope of Małe Skrzyczne Mt., in stream, 860 m, 1 Sept. 1964, *J. Kiszka* (KRAP); Potok Leśna stream, 570 m, 11 Sept. 1962, *J. Kiszka*

(KRAP); Malinowska Skała, on pebbles in stream in the Dolina Malinowka valley, 800 m, 8 Sept. 1962, *J. Kiszka* (KRAP); Potok Malinowski stream, on pebbles in water, 650 m, 6 Sept. 1962, *J. Kiszka* (KRAP); Cieślar Mt., E slope, on siliceous rocks in stream, 820 m, 9 July 1963, *J. Kiszka* (KRAP); N slope of Mt. Kościelec, in Potok Kościelec stream, 820, 865 m, 10 and 11 Sept. 1962, *J. Kiszka* (KRAP); valley of Potok Dziechcin stream, in water on pebble, 530 and 660 m, 13 June 1963, *J. Kiszka* (KRAP); Malinów Mt., SW slope, on pebbles in stream, 890 m, 8 Sept. 1964, *J. Kiszka* (KRAP); Czarna Wisełka stream, on pebbles, 790 m, 6 Aug. 1962, *J. Kiszka* (KRAP); on E slope of Tyniok Mt, in stream, 760 m, 5 Aug. 1962, *J. Kiszka* (KRAP); Beskid Żywiecki, Mts, Rysianka Forest Reserve near Spotnica Wielka, on submerged sandstone boulders in little streamlet on N-facing forested slope, *ca* 1080 m, 10 Sept. 1970, *J. Nowak* (KRAM-L 23423); on pebbles in Potok Radecki stream, *ca* 700 m, 5 Aug. 1964, *J. Nowak* (KRAM-L 11924, 14473); Lipowska Mt., in stream, *ca* 1250 m, 27 Sept. 1964, *J. Nowak* (KRAM-L 16588); Szeroki Kamieniec, on pebbles in stream, *ca* 1100 m, 6 Sept. 1964, *J. Nowak* (KRAM-L 16517); Beskid Wyspowy Mts, Polana Skalne glade below Hala Jasień meadow, on sandstone pebbles in stream, *ca* 1000 m, 18 Aug. 1966, *J. Nowak* (KRAM-L 29913); Ćwilin Mt., on pebbles in stream, *ca* 1000 and 1020 m, Aug. 1966, *J. Nowak* (KRAM-L 4801, 4623); Beskid Mały, Targoszów near Krzeczów, on sandstone pebbles in stream, *ca* 500 m, 26 Aug. 1961, *J. Nowak* (KRAM-L 40145); in valley on E slope of Leskowiec Mt., on sandstone pebbles in stream, *ca* 500 m, 27 Aug. 1961, *J. Nowak* (KRAM-L 40144, 19346); Rów Podtatrzański trench, Las Capowski forest near Murzasichle, on submerged granite boulders in little streamlet on N-facing forested slope, *ca* 1000 m, 2 Aug. 1971, *J. Nowak* (KRAM-L 49540; LBL); Tatra Mts, Dol. Chochołowska, Chochołowski Potok near Niżna Jarząbcza Polana, 1130 m, 15 July 2004, *B. Krzewicka 2742a* (KRAM-L 50163); Dolina Chochołowska valley, in Potok Chochołowski stream on granite boulders, *ca* 1010 m 16 July 2004, *B. Krzewicka 2766c* (KRAM-L 50170); Polana Huciska glade, in stream, 975 m, 16 July 2004, *B. Krzewicka 2731c* (KRAM-L 50169); Wielkich Koryciskach, 960 m, 16 July 2004, *B. Krzewicka 2705d* (KRAM-L 50167); Dolina Kościeliska valley, in stream below Ornak hut, *ca* 1085 m, 15 July 2004, *B. Krzewicka 2784a* (KRAM-L 50159); in stream above Ornak hut, *ca* 1100 m, 15 July 2004, *B. Krzewicka 2621a* (KRAM-L); Dolina Rybiego Potoku valley, in Rybi Potok stream on granite rock, near Zakręt, *ca* 1210 m, (KRAM-L 50160); 26 July 2004, *B. Krzewicka 2962* (KRAM-L 50160); Gorce, Turbacz Nature Reserve, in Potok Turbacz stream on sandstone pebbles, 920 m, 1996, *P. Czarnota* (GPN 1347); Pogórze Rożnowskie foothills, N slope of Majdan Mt., on pebbles in stream, *ca* 400 m, 21 June 1971, *R. Kozik* (KRAP). – EASTERN CARPATHIANS, Bieszczady Mts, Moczarne Reserve near Rawka, in stream, 840 m, 1999, *J. Kiszka* & *R. Kościelniak* (KRAP).

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