

# New and noteworthy species of *Verrucaria* from Bulgaria

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**Abstract.** In the Herbarium of the W. Szafer Institute of Botany, Polish Academy of Sciences is housed a significant number of lichen specimens collected in Bulgaria by Janusz Nowak. Among them 22 species of *Verrucaria* are represented. Seven species are reported here for the first time from this country: *V. dolosa*, *V. funckii*, *V. halizoa*, *V. hydrela*, *V. obfuscanus*, *V. parmigerella*, and *V. procopii*. In addition 15 species are reported with new records for Bulgaria.

**Key words:** Bulgaria, lichens, new records, pyrenocarpous species

## Introduction

The first note about the occurrence of *Verrucaria* Schrad. species in Bulgaria date back from the turn of the 19<sup>th</sup> century when Kazandzhiev published the first *Lichen flora of Bulgaria*. The author of the flora reported two *Verrucaria* species from the Black Sea coastal region, *V. caerulea* (as *V. plumbea* Ach.) and *V. marmorea* (Scop.) Arnold (as *V. purpurascens* Hoffm.) (Kazandzhiev 1900). Later *V. nigrescens* from Dragoman in Sofia region was recorded by the same author (Kazandzhiev 1906). A significant contribution to the knowledge of the genus *Verrucaria* in this country was made by Szatala (1929, 1930), who reported 12 new species of *Verrucaria* including one species new to science – *V. bulgarica* (Szatala 1930). The second edition of the *Lichen flora of Bulgaria* (Popnikolov & Zhelezova 1964) contained 24 species of *Verrucaria*. After the research activity of Zhelezova there has been a serious gap in the studies of *Verrucaria* in the country over the last four decades and there have been no new records. Therefore the catalogue of the lichenized and lichenicolous fungi of Bulgaria (Mayrhofer *et al.* 2005) contains only data for *Verrucaria* species reported from 1900 to 1964. This genus is obviously very poorly studied in Bulgaria, and moreover many frequent and common species have been reported only from a few localities.

## Material and Methods

This study is based on the collection of *Verrucaria* lichens gathered by Janusz Nowak in 1960–1962 and 1975–1976 in Bulgaria and housed in the Herbarium of the W. Szafer Institute of Botany, Polish Academy of Sciences, Krakow (KRAM-L). The specimens were collected in the Black Sea coast region, Stara Planina Mts, Pirin Mts, and the Rhodopes. The material studied herein was determined using standard methods.

Distribution of *Verrucaria* species is discussed based on data from the catalogue of the lichenized and lichenicolous fungi of Bulgaria (Mayrhofer *et al.* 2005). New records for the country are marked in the text by an asterisk (\*).

## Results and Discussion

Within the examined collection of pyrenocarpous lichens from Bulgaria 22 species of *Verrucaria* were distinguished. Seven species are reported for the first time from this country: *V. dolosa*, *V. funckii*, *V. halizoa*, *V. hydrela*, *V. obfuscanus*, *V. parmigerella*, and *V. procopii*. Many of the examined species represent new regional records. Below the list of determined

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species is provided with short ecological notes for each species and discussion of its distribution in Bulgaria.

*Verrucaria aethiobola* Wahlenb.

A freshwater species reported from the mountain streams in Bulgaria such as from Stara Planina Mts, Rila Mts, and the Rhodopes. It occurs mainly on siliceous rocks but sometimes it is reported on limestones. It is known in many countries of Europe in moist habitats.

*Specimens examined:* Stara Planina Mts, Ray chalet, alt. 1600 m, on rock in stream, 7 Aug 1962 (KRAM-L 1163); Koznitsa, between Petrochan and Golyama Mogila, alt. 1600 m, on sandstone in stream, 28 Jul 1962 (KRAM-L 8755, 19 498, 19 503).

*V. baldensis* A. Massal.

This species is distinguished by flat, lid-like and radially grooved involucrellum, white or grayish thallus with black prothallus and an absence of coloured crystals in the cortical layer. It is very variable and according to Halda (2003) eleven species, and 75 varieties or forms should be synonymized with *V. baldensis*. It occurs on hard limestones, in sunny and exposed sites. It is widespread throughout the whole of Europe. This is the first record from the Pirin Mts.

*Specimens examined:* Black Sea coast, Zlatni Pyasutsi, Aladzha monastery, on calcareous rocks, 2 Aug 1962 [KRAM-L 7956(b)]; Stara Planina Mts, Koznitsa, Golyama Mogila, alt. 1900 m, on limestone, 28 Jul 1962 [(KRAM-L 3244(b)); Pirin Mts, Orelek peak, alt. 1910 m, on limestone rocks, 22 Sep 1975 (KRAM-L 35 249); the Rodopes, Beglika Reserve, 4-5 km NW of Beglika, alt. 1600 m, on calcareous rocks, 27 Sep 1975 (KRAM-L 30 292).

*V. caerulea* DC.

It occurs on hard limestone rocks on sunny and exposed sites. It is widespread on calcareous areas in Europe where it is known from montane to alpine localities. In Bulgaria it is known in both upper and lower altitudes. It is the first report from the Pirin Mts.

*Specimen examined:* Pirin Mts, Orelek peak, alt. 2040 m, on limestone rocks, 22 Sep 1975 [KRAM-L 35 093(c)].

*V. calciseda* auct.

Occurs on hard limestones, in sunny and exposed sites. This endolithic species is widespread in Europe in areas rich in limestone. In the field it can be distinguished by the white thallus and the radiating cracks running from the perithecial pits.

*Specimens examined:* Black Sea coast, Zlatni Pyasutsi, Aladzha monastery, on calcareous rocks, 2 Aug 1962 [KRAM-L 7956(a)].

\**V. dolosa* Hepp

This species is distinguished by the small perithecia, small ascospores (15-18 × 6-8 µm), and more or less conical involucrellum. It occurs on siliceous and calcareous rocks in both dry and moist habitats, in shaded places. In Europe it is reported mainly from the central and southern part of the continent.

*Specimen examined:* Stara Planina Mts, Koznitsa, alt. 1900 m, on limestone, 28 Jul 1962 [KRAM-L 8009(c)].

*V. dufourii* DC.

This species occurs on calcareous rocks, mostly on hard limestone and dolomite, in shady habitats. In Bulgaria it occurs in Slavyanka Mt, Pirin Mts, and the Rhodopes mainly from montane to alpine belts, rarely lower.

*Specimen examined:* Pirin Mts, Orelek peak, alt. 1820 m, on calcareous rocks, 22 Sep 1975 (KRAM-L 35 041).

\**V. funckii* (Spreng.) Zahlbr.

This freshwater species occurs on submerged siliceous rocks in streams and rivers of Europe where it is widespread. This species has been confused with *V. elaeomelaena*, but it can be distinguished by entirely immersed perithecia, narrower and shorter ascospores and substratum preference; *V. funckii* grows exclusively on siliceous rocks and *V. elaeomelaena* on calcareous. The nomenclatural problems connected with both species were discussed in detail by Hawksworth (1989) and Thüs (2002).

*Specimens examined:* Stara Planina Mts, Berkovska Planina, between Petrohan and Kom, alt. 1700 m, on submerged siliceous rocks in stream, 29 Jul 1962 (KRAM-L 3942); Vitosha region, Vitosha Mt, Selimitsa peak, alt. ca 1800-1900 m, on submerged siliceous rocks in stream, 25 Jul 1962 (KRAM-L 1166, 8248, 8298, 9348); Vitosha Mt, below Aleko chalet, alt. 2000 m, on submerged pebbles, 25 Jul 1962 (KRAM-L 1164); Vitosha Mt, Cherni Vruh peak, alt. 2000 m, 25 Jul 1962 (KRAM-L 8080).

*V. fuscella* (Turner) Winch.

This species prefers the habitats of sunny calcareous rocks and occurs on natural outcrops but is frequently also recorded from walls and buildings. Young thalli are parasitic on *Verrucaria nigrescens*, often forming few small patches up to ca 5 mm wide and scattered on the host thallus. This species has been confused with *V. polysticta* and for a long time both taxa were misidentified, and also often named *V. glaucina*. The problem was discussed by Orange (2004).

*Specimens examined:* Stara Planina Mts, Koznitsa, Golyama Mogila, alt. 1900 m, on limestone, 28 Jul 1962 [KRAM-L 3244(c), 8009(d)]; Pirin Mts, Bayovi Douпки cirkus, alt. 1960 m, on limestone, 21 Sep 1975 (KRAM-L 35 203); in the vicinity of Papaz Chair chalet, alt. 1710 m, on limestone, 22 Sep 1975 (KRAM-L 35 258); Yavorov chalet, alt. 1800 m, on limestone, 21 Sep 1975 (KRAM-L 35 228).

\**V. halizoa* Leight.

This maritime species grows on siliceous rocks in the mid-littoral zone. It is distinguished by the thin thallus without ridges and without black punctae. It is known from the seashores of western and southern Europe.

*Specimens examined:* Black Sea coast, Sozopol, on acidic rocks submerged in sea water, 4 Aug 1962 [KRAM-L 9340(a)].

*V. hochstetteri* Fr.

This endolithic species occurs on calcareous rocks and mortar, in rather shaded and humid places. It is widespread

from Scandinavia to Mediterranean region. In Bulgaria it is reported from the Rodopes and Vitosha region. This is the first note from the Pirin Mts.

*Specimen examined:* Pirin Mts, in the vicinity of Papaz Chair chalet, alt. 1640 m, on limestone, 22 Sep 1975 (KRAM-L 35 085).

\**V. hydrela* Ach.

This freshwater species occurs on submerged siliceous pebbles and rocks in streams, rivers and lakeshores, mainly on shaded sites but also from sunny places (Krzewicka & Galas 2006). It is widespread in Europe.

*Specimens examined:* Stara Planina Mts, Koznitsa, between Petrohan and Golyama Mogila, alt. 1600 m, on submerged sandstones in stream, 28 Jul 1962 (KRAM-L 8011); Ray chalet, alt. 1600 m, on submerged granite rocks in stream, 7 Aug 1962 (KRAM-L 8924).

*V. lecideoides* (A. Massal.) Trevis.

It occurs on limestone rocks on natural outcrops and on walls and buildings in sunny, nutrient-enriched situations. It is known from central and southern Europe; reported also from Bulgaria.

*Specimens examined:* Stara Planina Mts, Sinite Kamuni, peak Bulgarka, alt. 1100 m, on calcareous rocks, 6 Aug 1962 (KRAM-L 1769, 17 160); Sredna Gora Mts, Lozenska Planina, Garvanets near Pasarel, alt. 760 m, on limestone rocks, 22 Oct 1976 [KRAM-L 35 301(a)]; the Rhodopes, Chernatitsa, Byala Cherkva, alt. 1300 m, on limestone rocks, 29 Sep 1975 (KRAM-L 34 962).

*V. macrostoma* Dufour ex DC.

This species occurs on calcareous rocks, walls, and tombstones. It belongs to the *V. nigrescens* group and can be distinguished by larger (up to 400 µm) and paler areoles, with single perithecia immersed in areoles. So far, in Bulgaria it has been reported only from the region of the Black Sea coast.

*Specimen examined:* Black Sea coast, Dikili Tash Reserve, near Varna, on calcareous rock, 31 Jul 1962 (KRAM-L 1376).

*V. margacea* (Wahlenb.) Wahlenb.

This freshwater species occurs on submerged siliceous rocks in streams and rivers. It is widespread in Europe. In Bulgaria it is reported from Pirin and Rila Mts and now from Stara Planina Mts.

*Specimen examined:* Stara Planina Mts, Koznitsa, between Petrohan and Golyama Mogila, alt. 1600 m, on siliceous rocks in stream, 28 Jul 1962 (KRAM-L 3243).

*V. maura* Wahlenb.

This maritime species occurs on both calcareous and siliceous rocks, or even on shells, forming a black band in the upper littoral zone and continuing into the salt-spray zone. This cosmopolitan halophilous species has a worldwide distribution from the Arctic to Antarctic regions. In Bulgaria it has been reported from the Black Sea coast from Sozopol (Szatala 1929; Zhelezova 1963) but probably it is widespread throughout the seashores of Bulgaria.

*Specimens examined:* Black Sea coast, Sozopol, on acidic rocks submerged in sea water, 4 Aug 1962 (KRAM-L 4339, 8185, 9343, 9344, 17 158).

*V. minuta* (Hepp) Zschacke

It occurs on non- or weakly calcareous substrata. In Bulgaria it is reported from a few floristic regions, such as the Black Sea coast, Forebalkan, Vitosha region, and now also from Stara Planina Mts. In Europe it is reported mainly from central and southern regions.

*Specimens examined:* Stara Planina Mts, Sinite Kamuni, Bulgarka peak, on calcareous rocks, 6 Aug 1962 (KRAM-L 19 772).

*V. muralis* Ach.

This species occurs on limestone, mortar, bricks, concrete and calcareous soil, sometimes on siliceous substrates, frequently on pebbles embedded in the ground, in natural and semi-natural habitats. It is widespread and common in the whole Europe. In Bulgaria it is known from three floristic regions, but it is very likely to be much more frequent there. This is the first note of the species from the Black Sea coast and Stara Planina Mts.

*Specimens examined:* Black Sea coast, Zlatni Pyasutsi, near Varna, Aladzha monastery, on calcareous rock in sunny place, 2 Aug 1962 (KRAM-L 9347); Stara Planina Mts, Koznitsa, Golyama Mogila, alt. 1900 m, on limestone, 28 Jul 1962 [(KRAM-L 8009(a)); the Rhodopes, Shoptsi, on sandstone rocks, 27 Nov 1976 [KRAM-L 29 532(b)].

*V. nigrescens* Pers.

In Bulgaria one of the most frequent species of *Verrucaria* reported from calcareous areas. It can be distinguished within *V. nigrescens* group by the dark brown thallus with dark brown to black medulla and mainly 1 (–3) perithecia immersed in each areole, areoles less than 1 mm diam; sometimes the edges of the areoles are sorediate.

*Specimens examined:* Stara Planina Mts, Koznitsa, Golyama Mogila, alt. 1900 m, on limestone, 28 Jul 1962 [(KRAM-L 3244 (a)); Ray chalet, alt. 1500 m, on limestone, 7 Aug 1962 (KRAM-L 40 115); Pirin Mts, Orelek peak, alt. 1820 and 2040 m, on limestone rocks, 22 Sep 1975 [KRAM-L 35 042, 35 093(a), 35 243]; in the vicinity of Yavorov chalet, alt. 1740 m, on limestone rocks, 21 Sep 1975 [KRAM-L 35 107]; the Rhodopes, Chernatitsa, Byalocherovski Rid, alt. 1300 m, on limestone rocks, 29 Sep 1975 (KRAM-L 35 132); ditto, Oct 1976 (KRAM-L 30 241).

\**V. obfuscans* Nyl.

It can be easily distinguished from other members of the *V. nigrescens* group by multiple perithecia (7–14) in irregular areoles which have a dark brown to black basal layer. It is known mainly from calcareous areas in central Europe.

*Specimens examined:* Stara Planina Mts, Koznitsa, alt. 1900 m, on limestone, 28 Jul 1962 [KRAM-L 8744(a), 8009(b)]; Sredna Gora Mts, Lozenska Planina, Garvanets near Pasarel, alt. 760 m, on limestone rocks, 22 Oct 1976 [KRAM-L 35 301(b)].

\**V. parmigerella* Zahlbr.

This species is distinguished by flat, lid-like and radially grooved involucrellum, a grey, blue grey to grey-green thallus,

at the margin often bordered by a dark prothallus, and the presence of blue-green crystals in the cortical layer. This species occurs in the larger limestone and dolomite areas of Europe including Bulgaria.

*Specimen examined:* Stara Planina Mts, Koznitsa, Golyama Mogila, alt. 1900 m, on limestone, 28 Jul 1962 [(KRAM-L 3244 (d))].

#### *V. polysticta* Borrer

It occurs on calcareous rocks, on natural outcrops and on walls. This species has been confused with *V. fuscella* and for long time both taxa have often incorrectly been determined as *V. glaucina*. According to Orange (2004) it can be distinguished from *V. fuscella* by thallus growth form (distinct primary areoles arising on a prothallus), and by the perithecia mostly arising between the units which become delimited in the upper thallus.

*Specimens examined:* Black Sea coast, near Varna, Zlatni Pyasutsi, Aladzha monastery, on limestone rocks, 2 Aug 1962 (KRAM-L 656, 9346); Stara Planina Mts, Koznitsa, alt. 1900 m, on limestone, 28 Jul 1962 [KRAM-L 8744(c)]; Pirin Mts, Bayuvi Douпки cirkus, alt. 1960 m, on limestone on *Verrucaria nigrescens*, 21 Sep 1975 (KRAM-L 35 082); the Rhodopes, Shoptsi, on sandstone rocks, 27 Nov 1976 [KRAM-L 29 532(a)].

#### \**V. procopii* Servit

It can be distinguished within the *V. nigrescens* group by the dark brown areoles, which are isidiate at the margins. *Verrucaria macrostoma* f. *furfuracea* de Lesd. differs in the isidia the same brown color as the thallus areoles whereas they are black and thus conspicuously darker than the thallus in *V. procopii*. This species is known mainly from calcareous areas in central Europe where it occupies calcareous rocks, or rocks with calcareous constituents. It occurs on sunny and exposed sites.

*Specimen examined:* the Rhodopes, Beglika Reserve, on calcareous rocks, 28 Sep 1975 (KRAM-L 34 998).

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