New localities of two rare *Ochrolechia* species: *O. azorica* and *O. dalmatica*

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Abstract: Kukwa, M. & Ossowska, E. A. 2021. New localities of two rare *Ochrolechia* species: *O. azorica* and *O. dalmatica*. – Herzogia **34**: 382–386.

The first records of *Ochrolechia azorica* from Madeira and *O. dalmatica* from Syria are presented. *Ochrolechia azorica* was previously known only from the Azores and *O. dalmatica* from Europe (Croatia, Greece, Italy, Montenegro, Spain) and Asia (Turkey) in the Mediterranean region.

Zusammenfassung: Kukwa, M. & Ossowska, E. A. 2021. Neue Nachweise von zwei seltenen *Ochrolechia*-Arten: *O. azorica* und *O. dalmatica*. – Herzogia **34**: 382–386.

Es wird über Erstnachweise von *Ochrolechia azorica* von Madeira and *O. dalmatica* aus Syrien berichtet. *Ochrolechia azorica* war bisher nur von den Azoren und *O. dalmatica* aus der Mediterranregion von Europa (Kroatien, Griechenland, Italien, Montenegro, Spanien) und Asien (Türkei) bekannt.

Key words: Ochrolechiaceae, Pertusariales, Ascomycota, chemotaxonomy.

Introduction

The lichen genus *Ochrolechia* A.Massal. (Ochrolechiaceae, Pertusariales, Ascomycota) comprises crustose lichen species with usually conspicuous, crustose, continuous to areolate-cracked, whitish to greyish thalli, often large apothecia (rarely in some species *Pertusaria*-like) with pruinose or epruinose discs, simple, thin-walled ascospores, strongly amyloid hymenium and asci, hamathecium of thin, branched and anastomosing paraphyses and asci lacking recognizable apex structures. In many species vegetative propagules are present: usually soredia, more rarely isidia (Hanko et al. 1986, Brodo 1988, 1991, Schmitz et al. 1994, Messutti & Lumbsch 2000, Schmitt & Lumbsch 2004, Kukwa 2008, 2011).

During the revision of the *Ochrolechia* specimens from B and SAV, new records of two rarely reported species, *O. azorica* Purvis, P.James & Brodo and *O. dalmatica* (Erichsen) Boqueras, were found. *Ochrolechia azorica* has been reported only from localities in Pico Mountain, Azores Island (Purvis et al. 1994, Kukwa 2011) and *Ochrolechia dalmatica* was previously known from several localities in Croatia, Greece, Italy and Spain in Europe and a single record in Turkey (Asia) (Boqueras et al. 1999, Kukwa 2008, 2011, Nascimbene et al. 2013, Brunalti et al. 2013, Ravera & Brunalti 2013, John & Türk 2017). This paper presents first records of *Ochrolechia azorica* from Madeira and *O. dalmatica* from Syria. Notes on morphology, secondary chemistry, ecology and distribution are provided for both species.

Materials and methods

Examined material is deposited in B and SAV. Additional samples of *O. dalmatica* from Greece and Italy were studied for comparison. Diagnostic morphological features (e.g. morphology and colour of the thallus, shape and size of soralia and apothecia) were studied under a stereo microscope. The lichen substances were studied by thin layer chromatography (TLC) in solvents A, B and C, according to the methods described by ORANGE et al. (2001). A spot-test-reaction with C (sodium hypochlorite solution) was used on different part of the thallus to test the presence of gyrophoric and variolaric acids.

The species

Ochrolechia azorica Purvis, P.James & Brodo

Morphology: Thallus crustose, white to grey-white, thin to moderately thick, smooth, irregularly fissured along substrate cracking, prothallus absent to inconspicuous, white, sorediate; soralia scattered, rounded, punctiform, whitish to pale yellow-grey, with coarsely granular soredia, apothecia up to 1.5 mm in diam.; thalline margin well developed, even, glabrous or matt, concolorous with the thallus; cortex of the margin well developed, laterally thinner, white in section, and up to 75 µm thick, expanded at the base, glassy, but opaque (clearly visible in sectioned apothecia under the stereomicroscope), up to c. 125 µm thick; excipulum proprium not visible from surface view; disc ± plane to slightly concave, flesh-coloured, epruinose; algal layer well developed, consisting of groups of algal cells in margin and below hypothecium, some algal groups radially expanding into the basal margin cortex layer; hypothecium yellowish; hymenium up to 175 µm high; asci 4(–6)-spored; ascospores widely ellipsoid or ellipsoid, 35–57 × 25–45 µm.

Chemistry: Variolaric acid, lichesterinic acid and protolichesterinic acid in thallus, soralia and thalline apothecial margin, gyrophoric acid and lecanoric acid (trace amount) in apothecia (epihymenium). Thallus, thalline margin cortex and soralia C+ yellow, apothecial disc C+ red; see also PURVIS et al. (1994) and KUKWA (2011).

Habitat: The specimen of *Ochrolechia azorica* from Madeira was found on bark of *Picea* sp. In the Azores this taxon grows exclusively on decorticated wood of *Erica azorica* (although on the holotype label *E. arborea* is mentioned probably by a mistake), and branches and stems of *Calluna vulgaris* (PURVIS et al. 1994, KUKWA 2008, 2011).

Distribution: *Ochrolechia azorica* has been reported only from the Azores in the upper slopes of Pico Mountain (PURVIS et al. 1994, KUKWA 2011). The record below is the first one from Madeira. The distribution of the species is restricted to Macaronesia, which comprises the islands situated in the Atlantic Ocean near European and African coasts.

Notes: The species is characterised by a thin to moderately thick and smooth thallus, small, scattered and punctiform soralia, apothecia with epruinose or slightly pruinose discs, and the presence of variolaric, lichesterinic and protolichesterinic acids in soralia, thallus and margin cortex, and gyrophoric acid occurring only in the epihymenium (PURVIS et al. 1994, KUKWA 2011).

PURVIS et al. (1994) reported (1–)2–4-spored asci and ascospores measuring 50–70(–75) × 25–31 µm. The material from Madeira is morphologically and chemically identical with the type collection in BM, but the examination of apothecial anatomy shows that this species is more variable in the number of ascospores in asci (4 or rarely 6 found in asci in Madeiran specimen) and the ascospores dimensions (35–57 × 25–45 µm in Madeiran specimen). Such variation, especially in ascospore size, is known also in other *Ochrolechia* species, e.g. in *O. szatalaensis* Verseghy, which produces ascospores measuring 30–75(–80) × (15–)20–43 µm (KUKWA 2009, 2011).

Ochrolechia azorica is morphologically and chemically similar to *O. alboflavescens* (Wulfen) Zahlbr., *O. microsticotides* Räsänen and *O. turneri* (Sm.) Hasselrot as they all are sorediate and contain variolaric acid in thallus and soralia, and gyrophoric acid in the epihymenium. *Ochrolechia alboflavescens*

is chemically identical to *O. azorica*, but it has a thick and very often folded or areolate thallus, soralia irregular in size and shape (sometimes fusing), and usually distinctly pruinose apothecial discs. *Ochrolechia microstictoides* also contains variolaric and lichesterinic acids, but soralia in that species are irregular and often confluent, and protolichesterinic acid is usually absent. *Ochrolechia turneri* can be readily distinguished by the lack of lichesterinic and protolichesterinic acids and it often produces alectoronic acid in apothecial margin (Kukwa 2008, 2011).

The specimen from Madeira was previously identified as *O. szatalaensis*. Both species are chemically similar due to the presence of variolaric acid, but *O. szatalaensis* always lacks gyrophoric, lichesterinic and protolichesterinic acids, and instead it may produce alectoronic acid and fatty acids of the murolic acid complex (Brodo 1991, Kukwa 2009, 2011). Also the apothecial disc in this species is strongly pruinose and soredia are usually absent (found rarely in North American material only) (Brodo 1991, Kukwa 2009, 2011).

Other *Ochrolechia* taxa reported from Madeira are *O. androgyna* Hoffm., *O. incarnata* (Leight.) Kukwa, Schmitt & Ertz, *O. pallescens* (L.) A.Massal., *O. parella* (L.) A.Massal. (syn. *O. madeirensis* Verseghey), *O. tartarea* (L.) A.Massal. and *O. upsaliensis* (L.) A.Massal. (Hafellner 1992, Kukwa et al. 2018), but they are esoriediate (*O. incarnata*, *O. pallescens*, *O. parella*, *O. tartarea*, *O. upsaliensis*), lack lichesterinic and protolichesterinic acids (all species) and *O. upsaliensis* lacks gyrophoric acid (Brodo 1991, Kukwa 2008, 2009, 2011, Kukwa et al. 2018).

Specimen examined: Madeira, in monte Poiso, alt. 1350 m s.m., ad corticem *Piceae*, 28 Feb. 2003, I. Pišút s.n. (SAV).

Ochrolechia dalmatica (Erichsen) Boqueras

Morphology: Thallus crustose, whitish to grey-brown, thin to thick, areolate and folded, sometimes limited by whitish prothallus. Soralia slightly rounded or irregular, some with a thalline rim, greenish or whitish, flat or hemispherical, with granular soredia. Apothecia absent in the material.

Chemistry: Gyrophoric, lecanoric (trace amounts) and variolaric acids detected. Thallus cortex C+ yellow, soralia C+ red; see also Boqueras et al. (1999) and Kukwa (2011).

Habitat: The specimen of *Ochrolechia dalmatica* from Syria was found on *Quercus cerris*. The species is an epiphyte and was found to grow on the bark of coniferous (*Abies* spp., *Pinus* spp.) and deciduous trees (e.g., *Acer* sp., *Quercus* spp.) (Boqueras et al. 1999, Kukwa 2008, 2011, Ravera & Brunialti 2013).

Distribution: The species has been reported from Mediterranean Europe, where it is known from Croatia, Greece, Italy, Montenegro and Spain (Boqueras et al. 1999, Kukwa 2008, 2011, Nascimbene et al. 2013, Brunialti et al. 2013, Ravera & Brunialti 2013) and from Asia in Turkey (John & Türk 2017). *Ochrolechia dalmatica* is reported here for the first time from Syria. Thus this is the second record of this taxon from Asia.

The material from Syria was previously reported as *O. androgyna* by John et al. (2004). This species has to be excluded from the lichen biota of this country as the record presented by John et al. (2004) was the only one known from there.

Notes: *Ochrolechia dalmatica* is a corticolous lichen characterized by more or less regular soralia, which turn red with C (gyrophoric acid), and cortex reacting yellow with C (variolaric acid). Apothecia were not found in the studied specimens, but they are up to 3 mm in diam., have lightly pruinose discs, variolaric acid is present in the margin cortex and gyrophoric acid in epihymenium (Boqueras et al. 1999, Kukwa 2008).

Ochrolechia gowardii Brodo has identical chemical composition as *O. dalmatica* and C+ red soralia (Brodo 1991, Boqueras et al. 1999, Kukwa 2011). However, the apothecia in *O. gowardii* are smaller (up to 1.5 mm diam.) and with strongly pruinose discs. In addition, the thallus is very thin and does not react with C (Brodo 1991, Kukwa 2011). *Ochrolechia gowardii* has been confirmed so far from North America, and Norway and Sweden in Europe (Brodo 1991, Jonsson 2002, Santesson et al. 2004, Kukwa 2011).

Ochrolechia androgyna also has C+ red soralia, but is distinguished from *O. dalmatica* by having larger apothecia (up to 10 mm diam.) with epruinose discs, C+ red thallus cortex, the absence of variolaric acid and the presence of 'androgyna B unknowns' (BRODO 1991, KUKWA 2011). This species is widely distributed in the Northern Hemisphere (TØNSBERG 1992, JABŁOŃSKA & KUKWA 2007, KUKWA 2011), but so far not confirmed from Syria (see above).

Another sorediate species with gyrophoric acid in soralia is *O. bahusiensis* H.Magn., but it lacks variolaric acid and instead it contains murolic acid complex (KUKWA 2011). So far it is known exclusively from Europe (KUKWA 2011).

Four other *Ochrolechia* taxa are known from Syria: *O. alboflavescens*, *O. pallescens*, *O. parella* and *O. subviridis* (Høeg) Erichsen (JOHN et al. 2004). *Ochrolechia alboflavescens* lacks gyrophoric acid in soralia and produces lichesterinic acid often with protolichesterinic acid, *O. pallescens* and *O. parella* are esorediate, whereas *O. subviridis* is characterised by the presence of isidia and it lacks variolaric acid (BOQUERAS et al. 1999, KUKWA 2011).

Specimen examined: Syria, Muhafazat Lattakia: E of Slenfeh, alt. 1300-1420 m, 35°35.30'N/36°12.59'E, grazed *Abies-Quercus* forest on W-slope on limestone, on trunk of *Quercus cerris*, 06 Apr. 1999, L. Zedda S-434 (B-600146412).

Additional specimens examined: Greece, N Aegean region: Thassos, N slope above Limenas, near Agias Konstantinos, alt. ca. 280 m, on bark of *Platanus* sp., 11 June 2001, R. Düll 3 (B-600131911). **Italy**, Supramonte di Orgosolo, Sa Badde, alt. 900 m, in an ancient forest of *Quercus ilex*, on trunk of *Quercus ilex*, 23 July 1996, L. Zedda 7.1.000249 (B-600146408). **Spain,** Prov. Zamora, Parque Natural del Lago de Sanabria y Alrededores, Sotillo de Sanabria, along track to Cascada de Sotillo, alt. ca. 1000 m, 42°05.2'N/6°43.4'W, treetrunks among abandoned fields and in forest relics in valley bottom, on trunk of *Quercus pyrenaica*, 31 Aug. 2000, H. Sipman 45280 (B-600146409).

Acknowledgements

We are greatly indebted to the Curators of B and SAV herbaria for sending material for study. We also thank Ulf Schiefelbein for providing the German translation of the abstract and two reviewers for their comments.

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Manuscript accepted: 5 July 2021.

Communicated by: Silke Werth

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