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Acarosporales: Acarosporaceae

Cover image: *Acarospora subrufula*, on maritime feldspathic sandstone, Veaux Tremblers Bay, Alderney.

Revisions of British and Irish Lichens is a free-to-access serial publication under the auspices of the British Lichen Society, that charts changes in our understanding of the lichens and lichenicolous fungi of Great Britain and Ireland. Each volume will be devoted to a particular family (or group of families), and will include descriptions, keys, habitat and distribution data for all the species included. The maps are based on information from the BLS Lichen Database, that also includes data from the historical Mapping Scheme and the *Lichen Ireland* database. The choice of subject for each volume will depend on the extent of changes in classification for the families concerned, and the number of newly recognized species since previous treatments.

To date, accounts of lichens from our region have been published in book form. However, the time taken to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published. Issuing updates as a serial electronic publication means that important changes in understanding of our lichens can be made available with a shorter delay. The accounts may also be compiled at intervals into complete printed accounts, as new editions of the *Lichens of Great Britain and Ireland*.

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Acarosporales: Acarosporaceae

including the genera *Acarospora*, *Caeruleum*, *Myriospora*,
Pleopsidium, *Sarcogyne* and *Trimmatothelopsis*

by

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ACAROSPORACEAE Zahlbr. (1906)

Thallus endolithic or epilithic, then areolate (the areoles broadly attached, sometimes with an elevated mycelial base) or squamulose (attached with a stipe). **Ascomata** immersed (with or without a true exciple around the disc), elevated within a raised and sometimes carbonaceous margin, or appearing lecanorine (usually by reduction of the areole or squamule to a thalline margin by the expanding apothecium. Disc with or without melanized epithelial accretions and/or umbo. **Hamathecium** of unbranched or branched and anastomosed paraphyses, immersed in gel, to ca 3 μm diam. at mid-level, the apices sometimes expanded, sometimes with gel caps. **Asci** usually with a well-developed apical dome, I– with a well-developed ocular chamber (variably I+ in *Caeruleum*, *Pleopsidium*, *Timdalia* and a few species of *Trimmatothelopsis*), polysporous, hymenial gel hemiamyloid (red, blue to changing to red or various dirty browns, or yellowish, etc.) or euamyloid (dark blue), subhymenium usually I+ blue. **Ascospores** mostly small, colourless, aseptate, globose or narrowly to broadly ellipsoidal. **Conidiomata** pycnidial, immersed in the thallus. **Conidia** colourless, subglobose to ellipsoidal.

Phylogenetic studies demonstrate that the Acarosporaceae as currently circumscribed falls into two major clades, centred on *Acarospora* sensu stricto and *Sarcogyne*, with species such as *A. badiofusca*, *A. macrocarpa* and *A. glaucocarpa* recovered in the *Sarcogyne* clade (Westberg *et al.* 2015, Knudsen *et al.* 2020). Species previously assigned to *Polysporina* are found within both clades, and redistributed accordingly. Currently the tree is biased toward Fennoscandian species, and a larger global sampling is needed before further transfers into *Sarcogyne* are proposed.

The currently accepted genera of the Acarosporaceae are *Acarospora*, *Caeruleum*, *Myriospora*, *Pleopsidium*, *Sarcogyne*, *Timdalia* and *Trimmatothelopsis* (Knudsen *et al.* 2020). The genus *Glypholecia* is still in use but is not supported in current phylogenies. *Lithoglypha* is a monotypic African genus with long conidia and may belong in *Trimmatothelopsis*. The monotypic genus *Thelocarpella* is still recognized in French lichenology, but considered to belong to *Trimmatothelopsis* (Knudsen & Lendemer 2016).

Important diagnostic features are the multisporous asci combined with the crustose habit. A majority of species is found on acid to basic siliceous rock or soil. Phylogeny and morphology are not always congruent, with characters such as carbonization of the ascomata (used to distinguish *Polysporina* and *Sarcogyne* from *Acarospora*) appearing to have evolved on several occasions (Westberg *et al.* 2015). Taxonomic remodelling of the genera has yet to be completed, but it is unlikely that they will be morphologically coherent. Wider species sampling for phylogenetic analyses is also needed.

Eiglera was included within the Acarosporaceae by Lücking *et al.* (2016), based on molecular evidence from Miądlkowska *et al.* (2014). However, those authors were equivocal about its placement and morphological distinctions argue for its previous placement within its own family, the Eigleraceae (Hafellner 1984).

Literature

Crewe *et al.* (2006), Hafellner (1984, 1995), Knudsen (2007), Knudsen *et al.* (2020), Knudsen & Kocourková (2008), Lücking *et al.* (2016), Miądlkowska *et al.* (2014), Reeb *et al.* (2004), Roux *et al.* (2019), Wedin *et al.* (2005), Westberg *et al.* (2015).

Key to British and Irish species of Acarosporaceae

- 1 Thallus present 2
 Thallus absent (lichenicolous)..... *Acarospora subfuscescens*

- 2(1) Thallus bright yellow, normally with marginal lobes *Pleopsidium chlorophanum*
Thallus not yellow 3
- 3(2) Apothecia immersed, elevated or appearing lecanorine, with a thalline margin or true exciple,
not strongly melanized 4
Apothecia lecideine, the margin melanized 28
- 4(3) Thallus C+ red (gyrophoric acid) 5
Thallus C- 6
- 5(4) Thallus areolate to squamulose with lobes, usually pruinose; in calcareous seepage tracks
on old \pm basic walls *Acarospora umbilicata*
Areoles not or rarely pruinose; on nutrient-enriched siliceous rocks *Acarospora fuscata*
- 6(4) Thallus K+ red (norstictic acid crystals) or yellow 7
Thallus K- 9
- 7(6) Areoles scattered to rarely contiguous, often in lines in minor rock fissures; apothecia 1 (–3) per
areole, eventually obscuring the supporting areole; thalline margin raised, swollen, sometimes
white-striate; coastal quartzite rocks; Channel Islands, Isles of Scilly *Acarospora subrufula*
Areoles flat to convex, grouped or \pm widely dispersed; apothecia (1–) 3–7 (–12) per areole,
thalline margin inconspicuous, not raised, not striate 8
- 8(7) Areolate or squamulose, apothecia punctiform, thallus in section forming red needle-shaped
crystals in K *Myriospora smaragdula*
Areolate, apothecia often dilated, thallus in section not forming needle-shaped crystals in K
but usually a yellow mist and occasionally small red granular crystals *Myriospora myochroa*
- 9(6) Squamules not corticate below, with pale rhizines; on soil and plant debris 10
Areolate or squamulose, firmly attached to the substratum; almost always on rock 11
- 10(9) Squamules peltate, deep red- to dull brown; on peaty soil over mica schist; Ben Lawers
range, Perthshire *Trimmatothelopsis rhizobola*
Squamules crust-forming, yellowish brown; thallus pale yellow-grey to grey-brown; on soil of
coastal cliffs, often associated with sheep grazing areas *Trimmatothelopsis benedarensis*
- 11(10) On limestone or other markedly calcareous substrata 12
On siliceous rocks (sometimes \pm basic schists), rarely lignum 16
- 12(11) Thallus of minute dispersed peltate squamules, with excavate soralia under the outer rim
bearing granular black soredia; on concrete *Acarospora moenium*
Thallus not sorediate 13
- 13(12) Areolate or squamulose, apothecial discs \pm densely white or blue-white pruinose; spores
4–8 \times 1.5–3 μm 14
Areoles and apothecial disc never pruinose, spores 6–13 \times 3–6 μm *Acarospora macrospora*
- 14(13) Areoles and/or apothecia minute, usually <0.4 mm diam., grey; ascus tip K/I+ blue; on limestone,
concrete, mortar and old seashells *Caeruleum heppii*
Areoles and/or apothecia >0.5–1.0 mm diam., usually brown, yellow- or red-brown; ascus tip K/I- ... 15
- 15(14) Apothecial disc expanding, the squamule reduced to a thalline margin *Acarospora cervina*
Apothecial disc expanding, the true exciple eventually excluded, usually not obscuring the
entire squamule *Acarospora glaucocarpa*

- 16(11) Thallus pale orange to rust-red..... 17
 Thallus yellow-brown, pale brown to black-brown, sometimes grey- or white-pruinose 20
- 17(16) Discs mostly punctiform, 0.1–0.2 mm diam.; apothecia usually 2–12 per areole/squamule,
 hymenium >180 µm tall..... *Myriospora tangerina*
 Disc mostly wider, 0.2–0.6 mm diam.; apothecia usually 1–3 (–5) per areole/squamule,
 hymenium up to 180 µm tall 18
- 18(17) Algal layer continuous within the medulla; apothecia often with a furrow between disc and
 true exciple; the disc often gyrose..... *Acarospora sinopica*
 Algal layer interspersed with columnar clusters of medullary hyphae; apothecia without a
 furrow between disc and true exciple; disc sometimes rough but not gyrose..... 19
- 19(18) Thallus orange to pale brick-red and often in mixture with brownish areoles; disc reddish
 when wet, not pruinose; on copper- or tin-containing rock..... *Myriospora rhagadiza*
 Thallus mostly dark rusty red; disc black or covered by a rust-red pruina *Myriospora dilatata*
- 20(16) On old fencing, lignum; areoles often with a single apothecium, apothecial disc rough with
 a non-carbonized umbo or other accretions formed from pigment or fragments of thallus
 *Acarospora fusca*
 On rock; apothecia lacking a central umbo 21
- 21(20) Thallus usually strongly grey- or white-pruinose, contrasting markedly with the dark non-
 pruinose apothecia; on iron-rich stone *Acarospora versicolor*
 Thallus not or inconspicuously pruinose..... 22
- 22(21) Apothecial disc with an elevated margin formed from true exciple; thallus pale brown 23
 Apothecia without blackened margin or disc; thallus brown to black-brown 24
- 23(22) Apothecia 1–2 mm diam., hymenium under 100 µm high, montane on mica-schist rocks
 *Acarospora badiofusca*
 Apothecia 0.3–0.5 mm diam, hymenium 100–170 µm high, lowland species on nutrient-enriched
 rocks *Myriospora scabrida*
- 24(22) Areoles widely dispersed, often in lines in minute surface cracks in rock, 0.2–0.5 mm diam.,
 black; apothecia eventually ± obscuring areoles; disc gyrose, often distorted by mutual
 compression *Acarospora veronensis*
 Areoles more coherent, rounded or angular-interlocking 25
- 25(24) Thallus forming small discrete well-defined patches of contiguous interlocking sharp-angled
 flat smooth dark brown areoles 0.5–1.5 mm diam.; apothecia concave, oval-elongate;
 on sunny rocks, often in old mine sites *Acarospora impressula*
 Thallus more wide-spreading; areoles subsquamulose, peltate, the surface flat to convex 26
- 26(25) Areole surface uneven-nodular; apothecial disc flat to concave, slightly roughened, variable
 in shape; often on ± nutrient- or metal-rich (lead) sites (e.g. sills of church windows)
 *Acarospora muddii*
 Areole surface flat to convex, not nodular 27
- 27(26) Areoles 0.5–1 (–3) mm diam., flat to convex, apothecia with an elevated margin; hymenium
 90–120 µm thick..... *Acarospora admissa*
 Areoles 0.4–0.5 mm diam., flat, angular, contiguous; apothecia immersed, hymenium
 120–140 µm thick *Myriospora rufescens*

- 28(3) Apothecial disc pruinose or not, with or without melanized epihymenial accretions or umbo 29
 Apothecial disc not pruinose, with epihymenial melanized accretions or umbonate 32
- 29(28) Apothecial disc ± pruinose; true exciple becoming excluded; on calcareous substrata *Sarcogyne regularis*
 Apothecial disc not pruinose; true exciple persistent; on siliceous or rarely calcareous rocks 30
- 30(29) Apothecia 1–3 (–6) mm diam.; true exciple strongly crenulate; maritime *Sarcogyne clavus*
 Apothecia 0.3–1 mm diam.; true exciple not crenulate (though sometimes split into segments);
 maritime or inland 31
- 31(30) True exciple broad, *ca* 0.3 mm thick, often split into angular segments; hymenium
 100–140 µm tall; mostly inland *Sarcogyne hypophaea*
 True exciple narrow, to 0.1 µm thick, entire; hymenium 50–100 µm tall; maritime (Channel Is)
 *Sarcogyne oceanica*
- 32(28) On rock, with an often endolithic thallus; apothecia sessile 33
 Lichenicolous; apothecia immersed in the host thallus *Acarospora subfuscescens*
- 33(32) On highly calcareous rock; montane *Sarcogyne cyclocarpa*
 On siliceous, acidic or weakly calcareous rock; lowland *Acarospora privigna*

ACAROSPORA A. Massal. (1852)

Thallus crustose, areolate (the areoles broadly attached or with a thick mycelial base) and/or squamulose (having a stipe one half the diameter or less of the squamule). **Epicortex** a protective polysaccharide layer, absent to quite thick, often making areoles or squamules appear shiny, especially common and well-developed in species in xerothermic or arid habitats (only *Careuleum heppii* has an epinecral layer and the term has been misapplied in descriptions of *Myriospora*). **Cortex** formed by hyphae and/or round or irregular cells, upper layer pigmented, lower layer colourless, sometimes containing crystals of secondary metabolites visible in polarized light, or substrate crystals especially in species growing on limestone. **Upper surface** smooth or rugulose, usually pale or red-to black-brown, occasionally rust-coloured, sometimes pruinose, cracks forming in many species, eventually causing replication by division. **Photobiont** chlorococcoid; photobiont layer continuous or less commonly interrupted by bundles of medullary hyphae. **Lower cortex** absent or present. **Ascomata** apothecia, one or several per areole, immersed, elevated, appearing lecanorine or with the margin often concolorous with the thallus but formed by an expanded true exciple around the disc, carbonaceous in a few species, or lecideine, with or without epihymenial accretions or umbo (*Polysporina* type). **Disc** red-brown to brown-black, smooth or rugulose, pruinose or not, sometimes with build-ups of pigment or fragments of the thallus on the surface. **Hamathecium** of paraphyses, numerous, thin (usually 0.5–1.5 µm diam.) to average (*ca* 2 µm diam. at mid-level) to stout (2.5–3.0 µm diam. at mid-level), branching or not, the apices unexpanded, expanded or in gel caps, the epithecium coherent, hymenial gel in squash preparations of thin sections I+ euamyloid (dark blue) or more commonly hemiamyloid (pale blue turning red, red-brown or yellow brown in thin sections, or immediately red). **Asci** more than 100-spored, clavate, the apical dome K/I–. **Ascospores** globose to ellipsoidal, aseptate, colourless, usually narrowly or broadly ellipsoidal in British and Irish taxa and not exceeding 6 µm in length except in *A. macrocarpa*. **Conidiomata** pycnidia, immersed.

Conidia ellipsoidal-globose, $0.5\text{--}2.0 \times 0.5\text{--}1.5 \mu\text{m}$. **Chemistry:** lichen products often not detected by TLC, rarely with gyrophoric or norstictic acid, usually easily detectable by spot tests. **Ecology:** usually on acid to basic siliceous rock, more rarely calcareous rocks or soil, often in nutrient-rich or -enriched habitats, rarely on wood and other anthropogenic substrates. A few species are parasites of lichens (including *Acarospora* species), sometimes suppressing production of ascomata in the host but otherwise not causing symptoms.

The genus in its traditional circumscription is readily distinguished in most species by the numerous, usually tiny ascospores, unbranched paraphyses, immersed apothecia and K/I– ascus tip. *Myriospora* is similar but has an interrupted rather than a continuous algal layer, though the character also occurs in some species of *Acarospora*. *A. heppii* has been transferred to *Caeruleum* on the basis of its ascus tip being K/I+ blue. Several species are variable and difficult to identify and more detailed field studies are necessary to understand phenotypic responses to different habitats and substrata. Environmental modifications have been over-emphasized by some authors (e.g. Weber 1968, Clauzade & Roux 1981), leading to lumping and underestimating diversity. While some species are especially polymorphic (such as *A. fuscata* and *A. glaucocarpa*), phylogenetic analysis has generally vindicated the detailed morphological and anatomical analyses pioneered by Magnusson (Knudsen *et al.* 2020). Diagnostic characters for different species include the hymenial gel which may be euamyloid or not and the thickness of cortex and subhymenium, combined with traditional characters such as hymenium height and paraphysis width etc., while avoiding Magnusson's tendency to have too narrow ranges especially of hymenial heights. Hymenial heights can be variable, frequently more so than the figures given by Magnusson (1929); they often have an average range of about 20–30 μm but can vary by as much as 60 μm .

The diversity of *Acarospora* appears low in Britain and Ireland, and it is expected that new taxa will be discovered and forgotten species re-emerge. *A. amphibola* Wedd. (1875), previously synonymized with *Myriospora smaragdula*, has been resurrected as a species in Scandinavia and N. America but has not been correctly reported from Britain. *Schaereria cinereorufa* has similar squamules that could be mistaken for those of an *Acarospora*, but is readily identified by the open discs of the apothecia and the larger, subglobose ascospores; the C+ pink thallus reaction is variable, even within individual specimens of *Schaereria*.

Literature

Clauzade & Roux (1981), Crewe *et al.* (2006), Fletcher *et al.* (2009), Knudsen *et al.* (2014, 2020, 2021), Knudsen & Kocourková (2017, 2021), Linda in Arcadia & Knudsen (2012), Magnusson (1929), Purvis (2014), Roux *et al.* (2019), Wedin *et al.* (2009), Westberg *et al.* (2011, 2015).

Acarospora admissa (Nyl.) Kullh. (1871)

Acarospora durietzii H. Magn. (1924)

Areoles flat to convex, dispersed or in small groups, 0.5–1 (–3) mm diam. and 300–600 μm thick, the surface smooth and shiny or roughened and matt, pale chestnut brown to dark brown or black, the margins sometimes darker. Apothecia 1–2 per areole, usually 0.2–0.7 mm diam., the disc dark brown, reddish when wet, usually rough; the margin formed from the hypothecium expanding and elevating the disc; hymenium 90–120 μm high, paraphyses *ca* 2 μm diam., often widened to 3–5 μm at the apex, ascospores $3.5\text{--}5 \times 1.5\text{--}2 \mu\text{m}$. Lichen products not detected by TLC. **BLS 0015.**

On sandstone and brick; rare, England (Suffolk, N. Pennines).

When well-developed, *Acarospora admissa* is easy to recognize with its elevated apothecia with a distinct raised margin formed from the true exciple (Knudsen & Kocourková 2021). *A. durietzii* was placed into synonymy with this species by Knudsen & Kocourková (2021), but the status of British collections is uncertain. The widely distributed continental species *A. intermedia* H. Magn. is small (areoles less than 1 mm diam.) and has an elevated thalline margin with narrow true exciple; it possibly occurs in Britain and Ireland.

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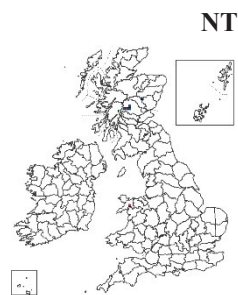
Acarospora badiofusca (Nyl.) Th. Fr. (1861)

Thallus wide-spreading, often rather thin, areolate, areoles 0.5–3.0 mm diam., usually contiguous, flat or slightly convex, sometimes lobulate, fawn-brown; photobiont layer continuous. Apothecia 1–2 mm diam., mostly single, rarely 2–4 per areole, black-brown to reddish brown, contrasting markedly with the paler thalline cortex, starting immersed, becoming elevated with a margin formed from the true exciple, darker than the thallus; hymenium 60–75 (–90) μm high; hymenial gel IKI+ dark blue (euamyloid); paraphyses thick, 2.5–3 μm diam., apices expanded to 4–5 μm . Asci ca 200-spored. Ascospores 3–6 \times 1.5–2.5 μm , usually broadly ellipsoidal. Lichen products not detected by TLC. **BLS 0006**.

On mica-schist boulders, probably base-rich; very rare. Scotland (Mid Perth, Angus), Wales (Caernarvonshire).

The elevated lecideine discs, darker than the thallus, the stout paraphyses, low hymenium and usually broadly ellipsoidal ascospores are diagnostic for this species. *Acarospora irregularis* H. Magn. looks similar, usually has a more reddish brown disc than *A. badiofusca*, and has an interrupted algal layer forming algal palisades (syn. *Acarospora badiofusca* subsp. *badiorubra* Clauzade & C. Roux; Knudsen *et al.* 2014). *Acarospora irregularis* has not been reported from our region.

A. badiofusca belongs in the *Sarcogyne* clade and appears to be closely related to *A. cervina* (Westberg *et al.* 2015; Knudsen *et al.* 2020), but that group requires further revision and formal transfer would be premature at the present.

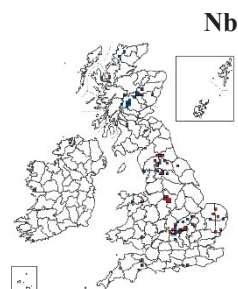
**Acarospora cervina** A. Massal. (1852)

Thallus of areoles or squamules, usually contiguous and often imbricate, 0.5–3 (–4) mm diam., rarely dispersed, the surface smooth, dark brown, not to densely pruinose, the margins usually eroded and white, underside white; photobiont layer irregularly uneven, often interrupted by hyphal bundles. Apothecia large, 2–3 (–4) mm diam., sometimes absent, usually immersed, expanding to reduce the squamule to a thalline margin, the disc usually flat, red when wet, not pruinose; hymenium 60–80 (–100) μm high, paraphyses stout, ca. 3 μm diam, hymenial gel dark blue in IKI (euamyloid). Ascospores 4–8 \times 1.5–3 μm . Lichen products not detected by TLC. **BLS 0008**.

On hard limestones, basic schists and other calcareous rocks, particularly in upland sites; local. Scattered throughout Great Britain, one record from Ireland (Donegal).

The species is often confused with *A. glaucocarpa*. Both species can have white margins and be densely covered with pruina. In *A. glaucocarpa* the apothecia eventually expand, excluding the thalline margin, forming a margin from the expanded true exciple (thus appearing lecideine). In *A. cervina* the apothecia are flat and expand to reduce the squamules to a thalline margin (Knudsen *et al.* 2020). Both species belong to the weakly-supported *Sarcogyne* clade but are retained in *Acarospora* pending further research (Westberg *et al.* 2015; Knudsen *et al.* 2020).

Adelococcus alpestris (Zopf) Theiss. & Syd. (1918) has on been reorded on this host.

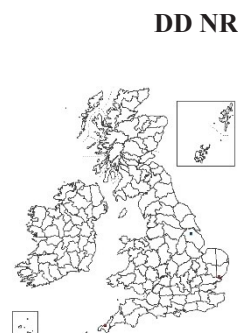
**Acarospora fusca** B. de Lesd. (1914)

Acarospora anomala H. Magn. (1924)

Thallus of dispersed or contiguous areoles, light to dark brown, 0.2–0.9 (–1.5) mm diam., 0.2–0.4 mm thick. Unless in the process of replicating by division, apothecia are solitary, brown to reddish-brown, the disc often roughened with buildups of epithelial pigment or with fragments of thalline tissue, sometimes appearing umbonate, 0.07–0.25 (–0.6) mm diam. Hymenium usually 110–140 μm tall, paraphyses 1.0–1.5 μm diam. at mid-level, sparsely branched or not, tips cylindrical to clavate and widened to ca 2.5 μm , hymenial gel red in IKI (hemiamyloid), ascospores narrowly ellipsoidal to bacilliform, 3–5 (–6) \times (1–) 1.5 (–2) μm . Lichen products not detected by TLC. **BLS 0009**.

On wooden fence rails with heavy metal contamination/preservative; very rare. England (Cornwall, Lincolnshire, Suffolk).

Acarospora fusca is probably widespread in Europe but overlooked. It also grows on siliceous rock including granite and basalt and is often on small stones as well as anthropogenic substrates including stepping stones,



fences, and historically on an outhouse. Magnusson (1929) considered *A. fusca* to be a member of the *A. smaragdula* group, with smaller and dispersed areoles but anatomically close to *Myriospora rufescens* (q.v.) and this hypothesis was accepted by Knudsen *et al.* (2017). However, further studies have confirmed its position in *Acarospora* and synonymy with *A. anomala* (Knudsen *et al.* 2021). Molecular data to confirm the identification of British collections would be valuable.

***Acarospora fuscata* (Nyl.) Arnold (1870)**

Thallus areolate, the areoles sometimes elevated on a mycelial base, wide-spreading in often extensive patches, rarely scattered; areoles 0.5–3 mm diam., very variable, mostly contiguous, irregular in shape, flat, at times sub-lobulate or weakly imbricate, the surface uneven, irregular, pale to dark red- or yellow-brown, often with black margins and undersides. Apothecia 0.2–1 mm diam., 1(–5) per areole, usually numerous, the disk red-brown to black, usually darker than the thallus, smooth or slightly roughened, slightly depressed or level with the thallus, rarely expanding to reduce the areole to a thalline margin (thus appearing lecanorine), hymenium (70–) 80–120 µm high, paraphyses *ca* 1.5 µm diam., 2–3 µm diam. at the tips, hymenial gel IKI+ pale blue turning red or immediately red (hemiamyloid). Ascospores 4–6 × 1–1.5 µm, narrowly ellipsoidal or cylindrical. Thallus C+ red, K–, KC+ red, Pd– (gyrophoric acid). **BLS 0010.**

On nutrient-enriched siliceous rocks, farm walls, memorials, roofing tiles, gravestones and bird-perching rocks; abundant. Throughout Britain and Ireland.

The commonest species of the genus in our region; see Knudsen *et al.* (2019) for a more detailed description and illustrations. Pruina may develop on thalli on base-rich rocks and are then often confused with *A. umbilicata* which differs especially becoming squamulose with distinct lobes and dark underside. *A. fuscata* is a very variable species but is well-characterized by the continuous wide-spreading areolate thallus, the hemiamyloid hymenial gel and C+ red cortex.

Though areoles in the lectotype of *A. gallica* H. Magn. (1929) are pseudo-lecanorine as are some of those in *A. fuscata*, no morphological or anatomical difference clearly distinguishes the two species. They can be distinguished by the amyloid reaction of the hymenial gel; in *A. gallica* it is euamyloid, staining dark blue in IKI (in *A. fuscata* it may stay light blue in old or diluted IKI). The test should be done by making a thin section and squashing it in fresh undiluted IKI under a cover slip. *A. gallica* occurs in France and extends to central Europe at low elevations; it could easily occur in Britain and Ireland considering that *A. fuscata* is usually identified by sight or by spot tests.

Host in Britain and Ireland to the lichenicolous fungi *Polycoccum microsticticum* (Mudd) Arnold (1891), *Llimoniella fuscatae* Hafellner (2007)) and *Stigmidium fuscatae* (Arnold) R. Sant. (1993).

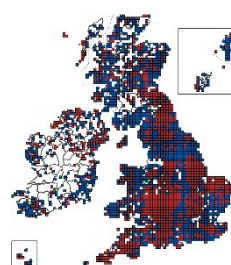
***Acarospora glaucocarpa* (Ach.) Körb. (1859)**

Thallus pale yellow-grey to dark brown, small areoles becoming squamulose, thick, undulate and often upturned, often dispersed, the edges often white from erosion, 1.0–2.5 (–4.5) mm diam., white below. Apothecia usually one per areole or squamule, initially immersed in the centre of the thallus unit, eventually reducing the areole or squamule to a brown thalline margin and then excluding it forming a margin from the true exciple, disc usually round, smooth, not to heavily pruinose, reddish-brown when wetted, rarely becoming convex. True exciple expanding around the disc, 35–150 µm thick, brown, not changing colour in IKI. Algal layer interrupted by hyphal bundles, often forming algal palisades. Hymenium 60–80 (–120) µm high, hymenial gel dark blue in IKI (euamyloid), paraphyses stout, 2–3 µm diam. at mid-level, the apices barely expanded. Ascospores narrowly ellipsoidal, 3–5 × 1–1.5 µm. Lichen products not detected by TLC. **BLS 0011.**

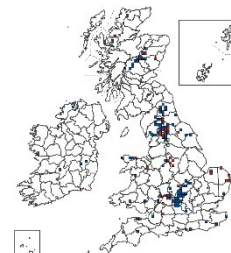
On hard limestones, basic schists and other calcareous rocks, particularly in upland sites; local. Throughout Britain, a few scattered records in Ireland.

Acarospora glaucocarpa is a polymorphic lichen. Magnusson (1929) recognized no fewer than twelve forms or varieties within the species. The thallus is sometimes reduced to a margin-like rim around individual apothecia, which may be referred to var. *depauperata* (Körber) A.L. Smith. In this form the true exciple often forms a distinct inner ring around the apothecia within a thalline margin and there are no squamules present. This is the most common morph and often occurs on south-facing inclines. Westberg *et al.* (2015) and Knudsen *et al.* (2020) found sequence differences between taxa referred to as *A. glaucocarpa* s. str. and *A. glaucocarpa* s. lat.

LC



Nb



Acarospora glaucocarpa and *A. cervina* are often confused, but phylogenetic analyses prove that they are distinct species (Westberg *et al.* 2015, Knudsen *et al.* 2020). The easiest way to tell them apart is that *A. cervina* has predominately flat apothecia that can reduce the squamules to a thalline margin, without eventually being excluded by the expansion of the true exciple as in *A. glaucocarpa*.

Adelococcus alpestris and *Roselliniopsis tartaricola* (Linds.) Matzer (1993) have been recorded on this host.

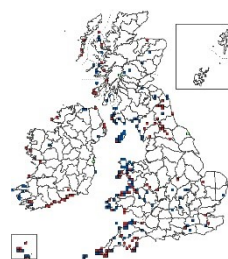
Acarospora impressula Th. Fr. (1871)

Thallus to 2 cm diam., often in small patches, areolate; 0.5–1.5 (–2) mm diam., contiguous, irregular in shape, flat with some areoles becoming slightly convex, dark red- to black-brown. The algal layer is continuous but is occasionally interrupted by thin hyphal columns. Apothecia immersed, 0.2–0.3 (–0.5) mm diam., 1(–2) per areole, mostly punctiform; disc round or variously angular, even elongate, concolorous with the thallus, with the true exciple expanding around the disc up to 40 µm thick, sometimes forming a ring; hymenium (80–) 100–130 µm high, paraphyses stout, 2–3 µm diam. at mid-level, hymenial gel euamyloid. Asci *ca* 100-spored. Ascospores 3–4 (–5) × 2–2.5 µm, broadly ellipsoidal. Lichen products not detected by TLC. **BLS 0005**.

On sunny exposed siliceous or calciferous rocks, sometimes on heavy metal-rich rocks and roofing slates, often on or near the coast; local. Throughout Britain and Ireland.

An areolate thallus with some slightly convex areoles (i.e. not completely flat), euamyloid hymenial gel, stout paraphyses, and broadly ellipsoidal ascospores are the diagnostic characters for this species. Euamyloid hymenial gel can separate it from an “*atrata*” complex of flat areolate crusts with hemiamyloid hymenial gel. This complex includes several taxa, currently treated as synonyms of *A. impressula* (Clauzade & Roux 1981; Roux *et al.* 2019).

LC



Acarospora macrospora (Hepp ex Nyl.) A. Massal. ex Bagl. (1857)

Thallus forming extensive thick patches of dark brown to red-brown non-pruinose areoles and squamules, rarely dispersed, areoles 0.5–5 mm diam. Apothecia 0.5–1 mm diam., usually one per areole, immersed, not pruinose, disc red- or dark brown, almost always darker than the thallus, often somewhat wrinkled; hymenium 100–160 µm high, paraphyses stout, 2–3 µm diam., the apices expanded to 3–5 µm, hymenial gel euamyloid. Asci 30–100-spored. Ascospores 6–13 × 3–6 µm, ellipsoidal. Lichen products not detected by TLC. **BLS 0014**.

On sunny calcareous rocks; very local. Mainly in upland Britain, not recorded from Ireland.

The large spores, dark brown squamules and usually solitary apothecia are diagnostic characters.

Acarospora murorum A. Massal. (1853) is similar but has light brown, often pruinose areoles that become green when wet, and occurs on mortar and calcareous rock and soil. It was found to be phylogenetically distinct from *A. macrospora* by Westberg *et al.* (2015), but no modern revision has been published. Reported as occurring in Great Britain and Ireland by Clauzade & Roux (1981) and accepted as British by Purvis *et al.* (1992), but not mentioned by Fletcher *et al.* (2009). No further data on occurrence can be found, and its status needs further examination. In Europe it has a southern distribution and is especially common in Spain.

NT



Acarospora moenium (Vain.) Räsänen (1936)

Aspicilia moenium (Vain.) G. Thor & Timdal (1992)

Thallus of dispersed minute peltate squamules, convex, pale pink-white-grey, white-pruinose, becoming brown where rubbed, about 0.2 (–1.0) mm diam., raised at one side revealing excavate soralia bearing black, granular soredia 18–24 µm diam. encrusting the lower side. Apothecia very rare, embedded in the centre of squamules; disc concave, brown, pruinose; epithecium N–; paraphyses moniliform, apices 2–4 µm diam.; ascospores unknown. Lichen products not detected by TLC. **BLS 1975**.

On exposed concrete; rarely recorded but probably much overlooked. Scotland (E. Lothian), lowland England (Midlands, Essex), mid Wales.

Squamules are very dispersed, resting on a bed of black soredia which encrust the concrete surface, resembling an exposed crust of cyanobacteria. Apothecial details are based only on a single immature ascoma (not seen at all in our region). The species appears to be related to *A. macrospora* (Westberg *et al.* 2015), within the *Sarcogyne* clade of the Acarosporaceae.

LC NR



Acarospora muddii H. Magn. (1929)

NE

Acarospora nitrophila auct. br., non H. Magn. (1924)

Thallus of contiguous areoles, irregular in shape, dark brown to almost black, the surface very rough and uneven, 0.5–1.5 mm diam., 0.2–0.4 mm thick. When wetted the areoles are beautifully nodulose. Areoles mostly sterile, replicating by division. Apothecia rare, 1–3 per areole, immersed, 0.2–0.5 mm diam., tending to occur in the oldest areoles; true exciple not expanded around the disc. Hymenium mostly 100–120 μ m high with narrow paraphyses 1.0–1.5 μ m diam. at mid-level, with barely expanded apices or apices with pigmented caps. Hymenial gel hemiamyloid. Ascospores average 3–5 \times 1–2 μ m in size. Lichen products not detected by TLC. **BLS 0018.**

On siliceous rocks, and especially often on metal-rich, sandstone windowsills in churchyards; common and probably overlooked. Scattered throughout Britain, mainly in the lowlands. Not reported from Ireland.

Magnusson (1929) cited a specimen on “not or slightly calciferous sandstone” from Durham (Ayton) as the type of *Acarospora muddii*, and also listed a collection from Wales (Radnor). It has also been reported from Cumberland (St Bees). The diagnostic character is the nodulose surface combined with the areolate thallus. *A. muddii* was treated as a depauperate *A. nitrophila* by Clauzade and Roux (1981), and the description of *A. nitrophila* in Fletcher *et al.* (2009) refers to *A. muddii*.

Acarospora nitrophila H. Magn. and *A. praeruptorum* H. Magn. are rare in Fennoscandia and are either rare or do not even occur in the U.K. Knudsen & Kocourková (2017) listed an IKI+ red subhymenium as a diagnostic feature of *A. nitrophila*, but this is no longer considered reliable because of inconsistencies in the formulation of Lugol’s iodine (Kocourková lab, unpublished data). Knudsen & Kocourková (2018a) recommended a protocol using Merck’s Lugol that is stable, and showed that amyloid stains of the subhymenium are common in Acarosporaceae; they are usually reliable as taxonomic characters under this protocol.

Acarospora normanii H. Magn. (1924) is closely related to *A. nitrophila* (Kocourková lab, unpublished data), and differs in having a thallus of areoles firmly attached to the stone. It is need of a modern revision. Short descriptions found in Roux *et al.* (2019) and Muchnik *et al.* (2019) are not helpful for determination, though the illustrations may be of the correct species. Sequences of *Acarospora* cf. *nitrophila* in Westberg *et al.* (2015) are of *A. normanii*. It has been reported from Scotland (Angus, unknown substratum) and England (Suffolk, on a sloping sandstone church wall).

Acarospora praeruptorum H. Magn. (1924) was reported from a plywood board just above high water mark in England (S. Essex). It differs from *A. nitrophila* in having larger squamules (1–2 mm vs. 0.5–1 mm diam.) with stout stipes and brown undersides, and usually narrow hyphal columns (*ca* 10 μ m wide) interrupting the algal layer though in many specimens they are absent (Knudsen & Kocourková 2017). This report could refer to a maritime species of *Myriospora* and needs to be studied further; *A. praeruptorum* is not otherwise known from anthropogenic substrates. The type from Sweden was growing on gneiss in a underhang with a south-facing exposure and was unusually small. It is frequent in central Europe, especially on doleritic rocks on vertical surfaces in full sun.

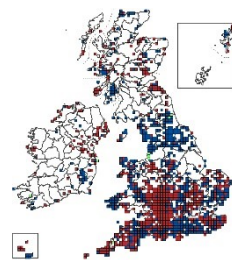
Acarospora privigna (Ach.) A. Schneid. (1898)

LC

Polysporina simplex (Davies) Vězda (1978)

Thallus endolithic, visible as an immersed non-corticate ring around apothecia in colonies on sandstone. Apothecia lecideine, the margin of radiating hyphae, usually 40–50 μ m thick, the outer layer black, splitting, 15–30 μ m thick, inner layer shading to hyaline, partly immersed to epilithic, scattered to clustered, often in lines following cracks in the rock surface, (0.2–) 0.3–0.5 (–1.0) mm diam., usually rounded, carbonized epithelial accretions to 50 μ m tall, forming furrows, ridges and/or an umbo, with small patches of reddish smooth uncarbonized surface, hymenium (60–) 90–130 μ m tall, paraphyses slender, mostly 1.0–1.5 μ m diam., profusely branching. Asci (55–) 65–100 (–110) \times (12–) 15–17 (–20) μ m. Ascospores bacilliform to narrowly ellipsoidal, 3–5 (–5.5) \times 1–1.5 μ m. The algal layer is usually scattered in the substratum or in a cluster below apothecia, rarely are a few algal cells captured in formation of the apothecia either below the apothecium or in the lower part of the margin. The apothecia can replicate by division and in cross-section then appear as several hymenia subdivided by sterile hyphae.

On acidic or weakly calcareous rocks, often in the xeric supralittoral zone on rocky shores, cliffs and on pebbles in stable shingle; often in man-made habitats such as walls, slate roofs and especially in churchyards on slate and granite memorials and granite chips, rarely on consolidated soil on sea-cliffs; common. Throughout England and



Wales, somewhat rarer in Scotland and Ireland.

Acarospora privigna is a common species in Britain and Ireland. A further, apparently undescribed species has apothecia usually 0.5–2 mm diam., a usually thicker margin (to 80 µm wide), a hymenium from ca 120–170 (–200?) µm tall, paraphyses usually (1–) 1.5–2 µm diam., branching absent or not profuse. Asci are usually narrowly clavate, (55–) 65–150 × (12–) 15–17 (–20) µm, and ascospores 3–6 × 1.0–2.0 µm. Algae are more often caught in the lower part of the apothecium as it develops. Like *A. privigna*, it can have several hymenia separated by sterile tissue, eventually replicating by division. This species is expected at least in highland areas and needs more study.

Reports of *Acarospora privigna* forming an epilithic brown thallus on slate probably refer to *Acarospora subfuscescens* or *Sarcogyne dubia* H. Magn. (1935) (not yet reported from our region) parasitic on an unknown host. *A. privigna* can form ecorticate clumps of the normally endolithic thallus with clusters of algae in them, holding together decaying rock. A similar phenomenon has been observed in *S. regularis* growing on brick. It produced an ecorticate epilithic thallus and was called *S. latericola* J. Steiner (Knudsen, unpublished). Specimens with subgyrose apothecia could be confused with the rare *Melaspilea interjecta* (ascospores 1-septate, 17–23 × 7–9 µm) which grows on vertical surfaces of slate and mica-schist rock.

***Acarospora sinopica* (Wahlenb.) Körb. (1859)**

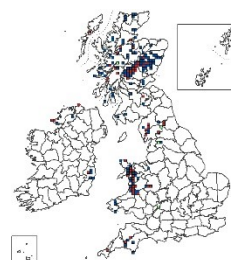
Thallus of areoles mostly around 1 mm diam., usually forming small patches or following lines in cracks of rocks, orange to deep rust-red, flat and smooth, often sterile towards the margin; photobiont layer continuous. Apothecia usually abundant, (1–) 2–5 (–8) per areole, punctiform, 0.1–0.3 mm diam.; hymenium (110–) 120–150 (–170) µm high, paraphyses 1–1.5 µm diam., not capitate, hymenial gel hemiamyloid. Ascospores 3–3.5 × 1–1.5 µm. Lichen products not detected by TLC. **BLS 0024.**

On iron-rich rocks and mine-spoil heaps, often in exposed situations; local. Throughout Scotland, Cumbria and N. Wales, less common in S. Wales and S.W. England, a few records in Ireland.

A distinctive species with a uniformly deep orange or rust-red thallus and punctiform apothecia, often occurring with other mineral-loving lichens such as *Tremolecia atrata*, *Rhizocarpon oederi* and *Lecidea silacea*, which also have rust-coloured thalli but have black leccideine apothecia and 8 spores per ascus. The exciple is said to have a cellular outside layer with opaque brown cells, 2–3 µm diam.

Magnusson (1929) included *Acarospora sinopica* in the *A. smaragdula* group (now *Myriospora*), but it has a continuous algal layer and sequence data (Westberg *et al.* 2015) place it in the main *Acarospora* clade. *Acarospora subfuscescens* (q.v.) grows on *A. sinopica* and other iron-loving lichens with brick-red thalli though is most common on *A. fuscata*.

LC



***Acarospora subfuscescens* (Nyl.) Magnusson (1935)**

Polysporina ferruginea (Lettau) M. Steiner ex Kantvilas (1998)

Polysporina lapponica auct. br., non (Ach. ex Schaer.) Degel. (1983)

Lichenicolous on acidophilic crustose species, not pathogenic but suppressing ascomata production. Apothecia 0.3–0.5 mm diam., not usually immersed; hymenium 80–130 µm high; paraphyses 1.0–2.0 µm diam., usually branching, hymenial gel hemiamyloid. Ascospores ellipsoidal, (3–) 3.5–5.5 × (1–) 1.5–2 µm.

Lichenicolous on a broad range of crustose lichens including species of *Acarospora*, *Buellia*, *Candelariella* and *Lecanora* in U.K. Scattered throughout Britain and Ireland, except S. & S.E. England.

Magnusson made a speculative mistake in taxonomy thinking that parasitic apothecia on hosts were actually the apothecia of different species of lichen distinguished by their thalli. More recently authors thought that *P. ferruginea* or *P. canasiacensis* (Hue) Cl. Roux are lichenicolous lichens developing an independent brown thallus instead of growing on neutered “zombie” taxa (Knudsen & Kocourková 2008). If a species is a lichenicolous lichen it needs to be confirmed by the observation of the independent thallus morphing out of the host which can be seen if enough specimens are studied (see Knudsen *et al.* 2014 for example of morphing). That has not been confirmed in reports of either species. See also above in *A. privigna* the discussion of the usually endolithic thalli becoming epilithic on decaying rock surfaces.

This is *Polysporina lapponica* as interpreted by Hitch *et al.* (2009); the true species was transferred to *Sarcogyne* by Knudsen & Kocourková (2008) and has not yet been reported from Great Britain and Ireland.

LC NS



Additionally, they found that *P. ferruginea* is a synonym of *P. subfuscescens*, and the British material (from Strontian, W. Inverness) is included in this synonymy. There is in Europe at least one other parasitic species, *Sarcogyne dubia* H. Magn. (probably referable to *Acarospora*) with ellipsoidal to broadly ellipsoidal ascospores $4\text{--}5 \times (2\text{--}) 2.5\text{--}3.0 \mu\text{m}$ in size, paraphyses seldom branching and $1\text{--}2 \mu\text{m}$ diam., a high hymenium $140\text{--}150$ ($\text{--}180$) μm tall, hemiamyloid hymenial gel, and parasitic on lichens on siliceous rock. It is not a synonym of *P. subfuscescens* as proposed in Knudsen & Kocourková (2008). The type is from France and it probably occurs in the UK, but specimens need to be confirmed.

***Acarospora subrufula* (Nyl.) H. Olivier (1900)**

Thallus areolate; areoles $0.3\text{--}2 \text{ mm}$ diam., often in lines following minor fissures in the rock surface, edges rounded or irregular by compression, swollen, convex, sometimes faintly pale striate, pale to deep red-brown. Apothecia numerous, round, mostly 1($\text{--}3$) per areole; thalline margin prominent, very swollen and appearing toroidal, sometimes white-striate and often obscuring the areole; disc $0.1\text{--}0.3 \text{ mm}$ diam., flat and sunken, oblong or kidney-shaped, rarely contorted, deep red-chestnut brown, thalline margin paler than the disc, orange-brown to chestnut; hymenium $80\text{--}100 \mu\text{m}$ high, paraphyses $1.5\text{--}2 \mu\text{m}$ diam., $2\text{--}4 \mu\text{m}$ at the apex. Ascospores $4\text{--}6 \times 1\text{--}2.5 \mu\text{m}$. Thallus C -- , K+ red, KC+ red (crystals), Pd+ yellow-orange (norstictic acid).

BLS 0028.

On sunny exposed granitic coastal rocks, typically just above highwater mark; rare. Channel Islands, Isles of Scilly.

A rare species characterized by the convex areoles mostly containing a single swollen almost berry-like apothecium, surrounded by a swollen, sometimes white-striate thalline margin, the disc darker than the surrounding areole, the usually intense K+ red reaction and its southern, coastal distribution. It resembles *Acarospora obpallens* (Nyl. ex Hasse) H. Magn. which occurs in Asia and North and South America and differs in producing gyrophoric acid and having small pits surrounding the apothecia.

VU (D2)



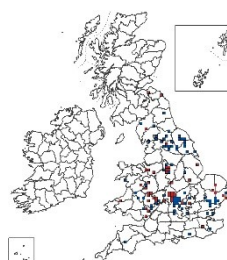
***Acarospora umbilicata* Bagl. (1857)**

Thallus of areoles or squamules $0.5\text{--}1.5 \text{ mm}$ diam., usually contiguous, dull brown but sometimes with a distinctive brown color that is more yellowish than in *A. fuscata*, the surface densely pruinose or almost lacking pruina. The squamules have a dark underside. Apothecia immersed, $0.1\text{--}0.5 \text{ mm}$ diam., 1 $\text{--}2$ ($\text{--}6$) per areole, rarely pruinose, inconspicuous, true exciple narrow; hymenium $85\text{--}110$ ($\text{--}135$) μm high, paraphyses *ca* $1.5 \mu\text{m}$ diam. Ascospores $4\text{--}5$ ($\text{--}6.5$) $\times 1.5\text{--}2 \mu\text{m}$. Thallus C+ red, K -- , KC+ red, Pd -- (gyrophoric acid). **BLS 0029.**

On siliceous rocks subjected to seepage from adjacent calcareous rocks or mortar, particularly on old walls; very local. England and Wales, S.E. Scotland; apparently absent from S.W. England.

GBI material has been assigned to *Acarospora umbilicata* forma *congregians* H. Magn. (1929), which has sublobulate rather than rounded areoles. The white-pruinose surface is due to a dense deposit of calcium oxalate crystals. Much British material proves to be pruinose morphs of *A. fuscata* which has flat non-lobulate areoles, as does a specimen identified as *A. umbilicata* by Westberg *et al.* (2015), which has DNA sequences that match that of the conserved type of *Acarospora fuscata* (Kocourková lab, unpublished data). The taxonomic confusion is not only caused by pruinose morphs of *A. fuscata*. Immature thalli of *A. umbilicata* have areoles that are small and similar to those of *A. versicolor* (which is C --) and in poor microhabitats do not become squamulose or lobulate, for instance on uneven rock or in partial daily shade.

Nb



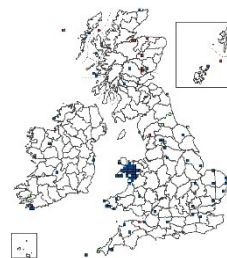
***Acarospora veronensis* A. Massal. (1852)**

Thallus of dispersed areoles, often hardly visible, thinly scattered in lines following cracks, or in places as contiguous groups; areoles $0.2\text{--}0.5 \text{ mm}$ broad, rounded or angular by compression, occasionally slightly lobulate, flat or slightly convex, matt or shiny, yellow-brown when wet, black when dry. Apothecia numerous, $0.2\text{--}0.5 \text{ mm}$ diam., 1 $\text{--}3$ per areole, sometimes confluent, sessile, concave, crater-like, becoming gyrose or umbilicate and obscuring areoles, thalline margin paler than the disc, inconspicuous; disc concolorous or black-brown, rounded, oval or becoming elongate by compression; hymenium $60\text{--}100 \mu\text{m}$ high. Ascospores $3\text{--}5 \times ca 1.5 \mu\text{m}$. Lichen products not detected by TLC. **BLS 0030.**

Nb

On nutrient-rich siliceous rocks, coastal pebbles in dunes and on roofing tiles; rare. Frequent in N. Wales, scattered throughout the rest of Britain and Ireland.

The species as described here is in need of further study; it could actually refer to *A. fusca*. Small brown *Acarospora* species are often mis-identified as *A. veronensis*. Diagnostic characters for identifying *A. veronensis* are the often dispersed-areolate thallus, thickness of the cortex (15–25 µm), the width of the true exciple around the disc (*ca* 15 µm) and the IKI+ red hymenial gel (hemiamyloid). *A. intermedia* H. Magn. (1929) is indistinguishable from *A. veronensis* when immature but has elevated apothecia within a thalline margin and is to be expected in our region.



***Acarospora versicolor* Bagl. & Carestia (1863)**

NE

Thallus of dispersed or contiguous areoles 0.5–1.0 (–2.0) mm diam., 0.3–0.5 mm thick, usually ± flat. Upper surface usually grey to reddish or dark brown and partially or almost completely pruinose, the pruina brown when wetted. Areoles broadly attached, rarely lobulate with a brown lower surface observable. Epicortex thin or lacking. Cortex 20–40 µm tall. Algal layer even, 70–150 µm thick, continuous. Medulla to 300 µm thick, continuous with the attachment hyphae, usually obscure with substrate crystals. Apothecia immersed, 0.1–0.3 mm diam., usually round, one or more per areole, usually black, brown when wetted, usually not pruinose. True exciple narrow, 5–20 µm thick or widening around the disc to 70 µm thick, forming an excipular ring around the disc, concolorous with the thallus or black, I–. Epithecium brown. Hymenium usually 100–120 µm high, I+ blue quickly turning dark red brown (hemiamyloid), K/I+ blue. Paraphyses mostly 1.5–2.0 µm diam., the apices expanded to *ca* 2 µm, some with a brown pigment hood visible in K. Asci usually cylindrical to narrowly clavate, 70–100 × 10–20 (–30) µm. Ascospores 100 to 200 per ascus, 3–5 × *ca* 2 µm. Pycnidia not observed. Lichen products not detected by TLC. **BLS 2797.**

On ironstone gravestones and on iron-contaminated sandstone, England (Buckinghamshire, Warwickshire).

The often strongly pruinose areoles combined with the C– thallus are useful diagnostic features. The apothecial disc is rarely pruinose and contrasts markedly with the surrounding thalline tissues. Pruinoso specimens of *A. fuscata* and *A. umbilicata* are C+ red. A more comprehensive description can be found in Knudsen *et al.* (2015).

CAERULEUM K. Knudsen & L. Arcadia (2012)

Thallus effuse, thin, indistinctly areolate, rarely minutely warted, pale brown or dark greenish grey to black. **Photobiont** chlorococcoid. **Apothecia** minute, single, rarely 2- to 3-contiguous, regularly rounded, pale red-brown, rarely grey-white, disc concave, sometimes grey-pruinose, surrounded by a concolorous or often white- or green-pruinose true exciple. **Paraphyses** very narrow, branched and anastomosing. **Ascus** with K/I+ blue apical dome, multisporous. **Ascospores** colourless, aseptate. **Chemistry:** lichen products not detected by TLC. **Ecology:** on basic rocks.

Caeruleum differs anatomically from *Acarospora* in having emergent, lecanorine apothecia with a lateral exciple only, similar to those found in *Pertusaria*, and the deep-blue staining of the tholus in K/I. Unlike the majority of other species assigned to *Acarospora*, *Caeruleum* has an epinecral layer instead of a polysaccharide epicortex. No sequences are currently available for the genus, so its position is uncertain.

There has been confusion over the application of the name *Myriospora*, which was initially applied to *Caeruleum* by Harris & Knudsen (2006). Further nomenclatural analysis (Linda in Arcadia & Knudsen 2012) established that *Myriospora* was typified by *M. smaragdula* and not *M. heppii*, thus becoming an earlier name for the group recognized as *Silobia* by Westberg & Wedin (2011) and *Trimmatothelopsis* by Roux & Navarro-Rosinés (2011). This disorder was unfortunate, but the situation now appears to be stable.

Only one of the two species occurs in Great Britain and Ireland; it is included in the key to *Acarospora* above.

Literature

Fletcher (2009a), Harris & Knudsen (2006), Linda in Arcadia & Knudsen (2012), Roux & Navarro-Rosinés (2011), Westberg *et al.* (2011).

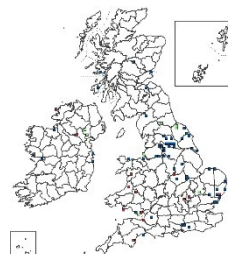
Caeruleum heppii (Nägeli ex Körb.) K. Knudsen & L. Arcadia (2012)

Myriospora heppii (Nägeli ex Körb.) Hue (1909)

Thallus mostly scarcely visible, indistinctly areolate, rarely minutely warted, pale brown to white-grey. Apothecia appearing lecanorine, 0.2–0.4 (–0.6) mm diam., single, rarely 2- to 3-contiguous, pale red-brown, rarely grey-white, surrounded by a concolorous or white- or green-pruinose true exciple; hymenium 80–120 µm high; paraphyses very narrow, 0.5–1 µm diam., widening to 1.5 µm at the tips. Ascospores 3–6 × 1.5–3 µm, shortly ellipsoidal. **BLS 0013**.

On calcareous rocks and stranded seashells, occasionally on concrete or mortar in urban sites; widely distributed but very local. Throughout Britain and Ireland. It can also occur on rotting non-calcareous rock that is occasionally flushed with water which deposits calcium ions when it dries.

This diminutive species is distinguished by the tiny, dispersed apothecia connected by a thin, thalline network. It resembles a large *Thelocarpon* or a minute *Acarospora*.



Nb

MYRIOSPORA Nägeli ex Uloth (1861)

Thallus epilithic, sometimes terricolous or muscicolous; areolate to squamulose, the areoles/squamules dispersed or contiguous, rarely overlapping; upper surface creamy white to brown, sometimes yellow-green or orange to rusty red, rarely with a white pruina; upper cortex sometimes with a polysaccharide epicortex, individual cells of the cortex ± isodiametric, sometimes with a scattered to continuous layer of crystals. **Soredia** and **isidia** absent. **Photobiont** chlorococcoid, the algal layer interrupted by thick anticlinal bundles of medullary hyphae; lower surface not corticate, pale. **Apothecia** one to numerous per areole or squamule, immersed in the thallus or becoming somewhat elevated; disc round to oval, punctiform to dilated, sunken or level with the thallus or somewhat raised, reddish brown to black, flat, smooth or rough, rarely with a rusty red pruina. **True exciple** colourless or yellow-brown, often expanding towards the surface and sometimes seen from the outside as a blackening elevated margin around the disc. **Epithecium** brownish, sometimes with small dark rusty red granular crystals. **Hymenium** colourless below, in the upper part usually with different brown colours, often very tall. **Paraphyses** unbranched to sparingly branched and anastomosing, tips cylindrical to clavate. **Subhymenium** (including hypothecium) colourless or greyish, yellowish or pale brown, always opaque with many oil-drops. **Asci** narrowly clavate, 100+-spored. **Ascospores** ellipsoidal to bacilliform. **Pycnidia** rare, immersed in the thallus, visible as punctiform, brownish pits in the thallus. **Conidia** subglobose to ellipsoidal, colourless. **Chemistry**: norstictic acid in the cortex or lichen substances not detectable by TLC.

Separated from *Acarospora* based on both morphological and molecular evidence; the genus appears to sister to all others in the Acarosporaceae. It can be most easily distinguished by the chambered medulla with a discontinuous algal layer, rather than a continuous layer as found in most species of *Acarospora*. The genus was monographed by Westberg *et al.* (2011) under the name *Silobia*; see notes under *Caeruleum* above for nomenclatural considerations. The description above is derived from that work, as is the relevant part of the key to species under the family heading above.

Literature

Fletcher *et al.* (2009), Linda in Arcadia & Knudsen (2012), Purvis *et al.* (2018), Westberg *et al.* (2011).

Myriospora dilatata (M. Westb. & Wedin) K. Knudsen & L. Arcadia (2012)

NE

Thallus areolate; areoles rounded to angular, contiguous to dispersed, fertile areoles (0.4–) 0.7–1.3 (–1.6) mm diam.; upper surface orange to dark rusty red, occasionally pale rusty red in parts, smooth to ± roughened, flat to convex; epicortex crystalline, golden red, granular, in a 5–15 µm thick layer; upper cortex without crystals, 15–35 µm thick, cells distinct, lumina 2–6 µm wide. Apothecia 1–3 (–5) per areole, immersed, round, often filling areoles and then appearing lecanorine, disc 0.2–0.4 mm diam., mostly black, sometimes rusty red pruinose, flat, smooth or ± rough, thallus often raised around the apothecium forming a distinct, sometimes finely striate margin; true exciple colourless or somewhat yellowish in section, sometimes brownish in parts; epithecium red-brown to dark brown, sometimes with dark rusty red granular crystals; hymenium 130–175 µm tall; paraphyses unbranched or branched near the tips, (1–) 1.5–2 µm diam., tips clavate, to 4 µm diam.; subhymenium colourless to pale brownish with many oil-drops, to 100 µm thick; ascospores narrowly ellipsoidal, 3–4 × 1–1.5 µm. Pycnidia not seen. Chemistry: UV–, K–, KC–, C–; lichen products not detected by TLC. **BLS 2611**.

On metal-rich rock; GBI status very uncertain with a single record from Mid Perthshire needing confirmation.

Easily recognized by the dark rusty colour of the thallus and the wide, usually black apothecia that typically occur singly, filling the thallus areoles. Sometimes difficult to separate from forms of *Acarospora sinopica* with widened apothecial discs, but *A. sinopica* has a medulla with a continuous algal layer and usually with apothecia that have a narrow furrow between the disc and the true exciple.

Myriospora myochroa (M. Westb.) K. Knudsen & L. Arcadia (2012)

NE

Thallus areolate to subsquamulose; areoles scattered to contiguous through vegetative division, fertile areoles (0.6–) 1.0–2.4 mm diam., sometimes becoming squamulose with large squamules to 4.5 mm diam.; upper surface whitish to greyish or more often brown-grey to brown or sometimes even brownish black, flat to mostly uneven and strongly convex, dull to somewhat shiny, sometimes with concentric, wavy markings, not pruinose; epicortex present, often very uneven in thickness; upper cortex 30–60 µm thick, with crystals 2–4 (–5) µm diam. Apothecia 1–4 (–14) per areole, immersed; disc 0.15–0.5 (–0.7) mm diam. often dilating, sunken or level with the thallus, brown to dark brown, smooth to very uneven, not pruinose; true exciple colourless; epithecium reddish brown to golden brown to dark brown; hymenium 120–230 µm tall; paraphyses 1–1.5 µm diam., often branched near the tips, tips ± cylindrical or weakly clavate, to 2 µm diam.; subhymenium colourless to yellowish or greyish, with much oil, 70–90 µm tall; ascospores narrowly ellipsoidal, 3–5 × 1–1.5 µm. Pycnidia rare; conidia ellipsoidal, ca 2 × 1 µm. Chemistry: UV–, K– or (mostly in fresh specimens) K+ red (red needles not seen in microscope slides but the cortex often reacts with a K+ yellow mist). Sometimes small red granular crystals are formed in scattered groups in the lower part of the cortex, KC–, C–; norstictic acid sometimes present in small amounts. **BLS 2601**.

On a granite tor, Dartmoor and on a wall in lead mine workings, mid Wales (Ceredigion).

Similar to *M. smaragdula*, but with a thicker thallus, with larger and strongly convex areoles or squamules.

Myriospora rhagadiza (Nyl.) K. Knudsen & L. Arcadia (2012)

NE

Thallus areolate; areoles mostly irregular to angular, contiguous through vegetative division or sometimes dispersed, separated by broad cracks, fertile areoles 0.7–1.5 (–2) mm diam., dirty greyish brown to dark brown or pale rusty red, dull, not pruinose, usually flat or with margins somewhat upturned or somewhat convex; epicortex absent or thin; upper cortex with uppermost cells with red-brown to dark brown caps. Apothecia 1–4 (–6) per areole, immersed; disc 0.15–0.55 (–0.65) mm diam., level with the thallus, reddish brown to brown, reddish when wet, smooth, not pruinose; true exciple colourless but uppermost cells with dark brown caps, from the outside seen as a distinct, somewhat raised, pale brown to blackened margin; epithecium yellow-brown to dark red-brown; hymenium 110–160 µm tall; paraphyses sparsely branched, 1–2 µm diam., tips cylindrical to clavate; subhymenium colourless to greyish or yellowish with many oil-drops. Ascospores ellipsoidal, 2.5–3 × 1.0–1.5 µm. Pycnidia not seen. Chemistry: UV–, K–, KC–, C–; no secondary metabolites detected by TLC. **BLS 2455**.

On metal-rich rock from copper and tin mines, Cornwall and Cumbria.

Recognized by the rather large apothecia with a distinct and raised margin, the low hymenium and the absence



of crystals in the cortex; sometimes very similar to *M. myochroa* which has a thicker epicortex and often crystals in the cortex detectable with polarized light.

Myriospora rufescens (Ach.) Hepp ex Uloth. (1861)

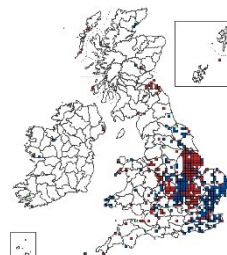
LC

Acarospora rufescens (Ach.) Kremph. (1861)

Thallus forming an extensive smooth, very even crust, dull or dark brown; patches of closely contiguous areoles gradually becoming thinner towards the edge; areoles 0.4–0.5 mm diam., angular, thin, surface flat to concave, distinctly separated by cracks; epicortex absent. Apothecia 0.3–0.4 mm diam., 1–2 in every areole, immersed, deeply concave; thalline margin round, entire, slightly raised, prominent; true exciple colourless but the uppermost cells with dark brown caps, disc concave or flat, concolorous or darker than the thallus; epithecium brown to dark red-brown; hymenium 60–80 µm high, paraphyses 1–1.5 µm diam.; subhymenium opaque. Ascospores 3–4 × 1–1.5 µm. Lichen products not detected by TLC. **BLS 0021**.

On sandstone and other siliceous substrata, chiefly on monuments, gravestones, and wall tops; local. Mostly in S.E. and E. England.

Considered by Westberg *et al.* (2011) to be a rare species; many records may refer to other taxa. *M. rufescens* has been considered a variety of *M. smaragdula*, but the continuous, evenly cracked, spreading thallus, K–reaction, and lower hymenium separate it from that species. Often confused with *Acarospora muddii* which has dull brown, nodulose areoles. *A. fuscata*, with which it often grows, differs in the larger, more uneven, thicker, often paler, red-brown squamules which are C+ red. *A. impressula* has convex apothecia and small, angular areoles.



Myriospora scabrada (Hedl. ex H. Magn.) K. Knudsen & L. Arcadia (2012)

Nb

Acarospora verruciformis H. Magn. (1852)

Thallus sometimes areolate, with round smooth scattered to crowded bullate areoles, but mostly squamulose; squamules rounded, incised to irregularly lobate, often imbricate, fertile areoles/squamules 0.5–3.5 (–7) mm diam., pale grey to brown, occasionally partly white-pruinose, flat to somewhat convex; epicortex present, 10–23 µm thick; upper cortex without crystals. Apothecia 1–7 (–12) per areole/squamule, immersed or becoming somewhat elevated; disc rounded, 0.2–1.0 (–1.8) mm diam., red-brown to almost black, flat, often scabrid, not pruinose; true exciple colourless to yellow-brown, the uppermost cells with golden to dark brown caps, from the outside seen as a distinct, somewhat raised and often blackened margin; epithecium dark golden brown to dark red-brown; hymenium 100–170 µm tall; paraphyses 1.5–2 µm diam., tips clavate, to 4 µm diam.; subhymenium colourless to yellowish to pale brown, with much oil; ascospores ellipsoidal, 3–5 × 1.5–2 µm. Pycnidia rare; conidia ellipsoidal to subglobose, 1.5–2.5 × ca 1 µm. Chemistry: UV–, K–, KC–, C–; no substances detected by TLC. **BLS 0031**.

On sandstone, sometimes associated with metal-rich rock; very rare. Scattered throughout Britain and Ireland, primarily in the north.

According to Westberg *et al.* (2011), *A. verruciformis* represents aberrant and poorly developed material of *M. scabrada*. In young stages, when the apothecia are still punctiform and immersed, it is very similar to *M. smaragdula*.

A second, apparently undescribed entity has been named as this species, but occurs on serpentine rocks on the Lizard Peninsula, Cornwall and W. Scotland. The thallus is black-encrusted with cyanobacteria and perhaps *Ephebe*, areoles contiguous, 0.4–3 mm broad, obscured by cyanobacteria, following crevices and depressions in rock, angular, crowded, compressed, surface flat, mid-brown where not black-stained, edges often raised. Ascomata black, 0.3–0.5 mm diam., neatly round, flat, with cracked, ‘piecrust’ thalline margin. Lichen products not detected by TLC.



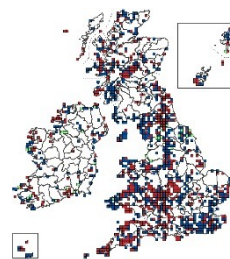
Myriospora smaragdula (Wahlenb. ex Ach.) Nägeli ex Uloth (1861)

LC

Acarospora smaragdula (Wahlenb. ex Ach.) A. Massal. (1852)

Thallus areolate; areoles dispersed or contiguous through vegetative division, sometimes growing along fissures in the rock, rounded to irregular, the margin not raised from the substratum, sometimes with a blackened margin, fertile areoles (0.4–) 0.6–1.7 (–3.2) mm diam.; greyish white to pale brown or yellow–green (in copper-rich

forms), flat to slightly convex, often appearing waxy, sometimes concentrically ridged, not pruinose; epinecral layer present, 5–20 μm thick; upper cortex with a dense layer of crystals (norstictic acid). Apothecia (1–) 2–7 (–8) per areole, immersed; disc rounded, 0.07–0.20 (–0.35) mm diam., usually sunken, sometimes level with the thallus, brown to dark brown, smooth, not pruinose, thallus sometimes blackening around the apothecia and occasionally somewhat raised forming a thin margin; true exciple colourless; epithecium reddish brown; hymenium 140–240 μm tall, paraphyses 1–1.5 μm diam., tips cylindrical to clavate, to 3.5 μm diam.; subhymenium colourless to greyish; ascospores narrowly ellipsoidal to bacilliform, (2.5–) 3.5–4.5 \times 1–1.2 μm . Pycnidia not seen. Chemistry. UV⁻, K⁺ red (red needles visible in microscope slides), KC⁻, C⁻, norstictic acid detected by TLC. **BLS 0025**.



On siliceous rocks, slightly base-rich or rich in heavy metals, often in somewhat sheltered situations, also on worked stone below metal grills protecting stained glass windows, rarely on soil and fence posts treated with wood preservatives; apparently absent from iron-rich substrata; common. Throughout Britain and Ireland.

The thallus varies in colour according to the rock mineralogy; yellow-green morphotypes occur on copper-rich rocks. All forms have minute, dark, punctiform discs becoming wide, emergent apothecia with a dark distinct thalline margin and a K⁺ red (crystals) reaction of the medulla, best observed in microscope preparations. See also *Acarospora subrufula* which is also K⁺ red.

Endococcus perpusillus Nyl. (1857 has been recorded on this host.

Myriospora tangerina (M. Westb. & Wedin) K. Knudsen & L. Arcadia (2012)

NE

Thallus areolate to subsquamulose; areoles dispersed or somewhat contiguous through vegetative division, rounded to very irregular, the margin not raised from the substratum, fertile areoles (0.65–) 1.1–2.6 (–5.8) mm diam.; pale rusty red to bright orange, often paler towards the margin, areoles without rusty colour may occur fairly frequently mixed with areoles with distinct reddish colours, often uneven, often strongly convex, dull to somewhat shiny, sometimes with concentric ridges; epicortex present or not; upper cortex usually with small orange crystals. Apothecia (1–) 2–10 (rarely many more) per areole, immersed; disc rounded, (0.07–) 0.10–0.25 (–0.40) mm diam., brown, sometimes blackening, sunken or level with the thallus, smooth to very uneven, sometimes with a conical tip in the centre, not pruinose, the thallus not forming a raised rim around the disc; true exciple colourless; epithecium yellow brown to golden red; hymenium 180–250 μm tall; paraphyses sparsely branched and anastomosing, 0.8–1 μm diam., tips \pm cylindrical; subhymenium colourless to greyish, with much oil; ascospores narrowly ellipsoidal to bacilliform, 3–4 \times 1–1.5 μm . Pycnidia not seen. Chemistry. UV⁻ or UV⁺ yellow-green, K⁻, KC⁻, C⁻; no substances detected by TLC. **BLS 2674**.

On copper-rich rocks, Westmorland.

Usually easily recognized by the large pale orange-ochraceous squamules, and the small punctiform apothecia.

PLEOPSISIDIUM Körb. (1993)

Thallus crustose, areolate, smooth, marginal lobes elongate to effigurate. **Upper surface** smooth or wrinkled, usually bright yellow, occasionally paler and slightly green. **Photobiont** chlorococcoid, algal layer continuous. **Upper cortex** prosoplectenchymatous, with small cells. **Lower cortex** absent. **Ascomata** apothecia, sessile to slightly immersed, flat, becoming convex. **Thalline margin** prominent, at least initially. **Disc** yellow to brown-yellow. **Hamathecium** of paraphyses, numerous, thin, septate, branched, clavate at the apices. **Asci** clavate, with more than 100 spores, with a distinct apical dome and broad chamber, K/I⁺ blue. **Ascospores** ellipsoidal, aseptate, colourless. **Conidiomata** pycnidia, immersed, not obvious; **Conidia** ellipsoidal, somewhat contracted at the posterior end. **Chemistry**: Rhizocarpic acid plus fatty acids (acaranoic and acarenoic acids). **Ecology**: saxicolous, cool humid environments.

Acarospora differs in ascus type, the thallus which rarely has elongate marginal lobes and in British and Irish species the absence of rhizocarpic acid (causing the bright yellow thallus in *Pleopsidium*). Only one species is found in Britain & Ireland.

Literature

Crewe *et al.* (2006), Fletcher (2009b), Hafellner (1993).

Pleopsidium chlorophanum (Wahlenb.) Zopf (1985)

Thallus to several cm broad with \pm radiating marginal lobes, 0.5–1 mm broad and 1 mm thick, centre warted-areolate or with massed wart-like lobes or numerous apothecia, bright yellow. Apothecia usually abundant; disc at first immersed, becoming flat or slightly convex, smooth, often shiny, with a \pm distinct thalline margin, hymenium 50–60 μ m high, colourless below, the upper part yellow; paraphyses 1.5–1.8 μ m diam., tips 2–3 μ m diam. Ascospores numerous, elongate with guttules at each end, 3–4 \times 1.5–1.7 μ m. Conidia broadly ellipsoidal, 1.5–2 μ m in length. Thallus C–, K–, Pd–, I–, hypothecium I+ brown-yellow or pale blue, hymenium I+ dark blue. **BLS 1739.**

Known from single collections on a sandstone gravestone in N.E. Yorkshire (now extinct), and on a wall in S. Aberdeenshire.

The bright yellow thallus combined with the polyspored asci make the species unmistakable. Formerly placed in the yellow, subsquamulose to lobate *Acarospora schleicheri* group which is principally known from deserts.



SARCOGYNE Flot. (1851)

Thallus crustose, superficial or more commonly immersed. **Prothallus** absent. **Photobiont** chlorococcoid, including *Dictyochloropsis* and *Myrmecia*. **Ascomata** apothecia, sessile or immersed in pits in the substrate, red-black to black, sometimes pruinose. **Thalline margin** absent. **True exciple** thin, black and friable, becoming excluded or persistent and then in some species crenulate, composed of compacted radiating hyphae, colourless internally, tips swollen and dark brown at the surface. **Epithecium** pale red- to dark brown. **Hymenium** colourless, often IKI+ blue. **Hypothecium** colourless to brown, often thick. **Hamathecium** of paraphyses, simple to sparsely branched, regularly septate, the end cells \pm swollen and sometimes often brown-capitate. **Asci** multi-spored, elongate-clavate to obclavate, often swollen in the lower third when mature, strongly thickened at the apex, the apical dome K/I–; outer coat K/I+ blue. **Ascospores** narrowly ellipsoidal, colourless, aseptate, smooth, lacking a distinct perispore. **Conidiomata**, when present, pycnidia, immersed in multilocular black warts. **Conidiogenous cells** subcylindrical, acrogenous. **Conidia** subglobose to ellipsoidal, aseptate, colourless. **Chemistry**: no lichen products detected by TLC. **Ecology**: on rocky substrata.

Work by Westberg *et al.* (2015) and Knudsen *et al.* (2020) indicates that traditional means of distinguishing *Sarcogyne* from *Acarospora* do not reflect their evolution, and it is possible that the genus will be expanded to include the *A. glaucocarpa* group and possibly others, especially from calcareous habitats.

Literature

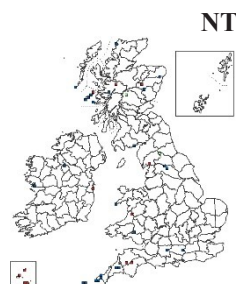
Fletcher & Hawksworth (2009), Knudsen *et al.* (2013, 2020), Knudsen & Kocourková (2018b), Westberg *et al.* (2015).

Sarcogyne clavus (DC.) Kremp. (1861)

Thallus ± immersed and inconspicuous, sometimes appearing as a dark grey stain. Apothecia sessile, 1–3 (–6) mm diam.; disc red-black to black, not pruinose; true exciple black, persistent, raised, distinctly crenulate, 0.3–0.7 (–1) mm thick; hymenium 85–115 µm tall; hypothecium brown, 60–100 µm tall. Asci 45–80 × 12–15 µm, at least 200-spored. Ascospores 4–5 (–6) × (1–) 1.5–2 µm. Conidiomata in wart-like, multilocular stromata to 1 mm diam.; conidia 2–3.5 × 1–1.5 µm. **BLS 1304.**

On coastal siliceous rocks, often following minute fissures, terrestrial-halophobic, rarely inland; rare. Channel Islands, Isles of Scilly, S. Wales (Brecon), W. Scotland.

The strongly crenulate exciple and habitat distinguish this species from *S. hypophaea* in the field.

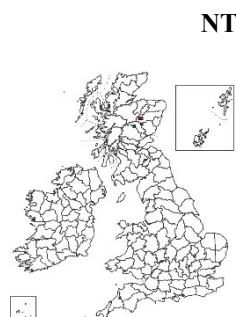
**Sarcogyne cyclocarpa** (Anzi) J. Steiner (1905)

Polysporina cyclocarpa (Anzi) Vězda (1978)

Thallus endolithic, inconspicuous, a thin or thickish black stain on the rock. Apothecia superficial, black, dull and carbonized, peltate, 0.5–1.0 mm diam., single or clustered, round, triangular or slit-like, becoming strongly gyrose or almost stellate, the margin strongly fissured; hymenium shallow, 60–110 µm thick, yellowish in thick section, I+ red or blue; paraphyses broad at the apices, to 2.7 µm diam., often with pigmented caps. Asci 50–70 µm, cylindrical to saccate, containing *ca* 100 spores; ascospores 3–5 × 1.5–2.0 (–2.5) µm. **BLS 1670.**

On hard weathered, strongly calcareous and freely draining exposed montane rocks to 2500 m; rare. Scotland (Aberdeenshire, Angus, Perthshire, Wester Ross).

Westberg *et al.* (2015) have shown that this species is more closely related to *Sarcogyne* than other species assigned to *Polysporina* by Hitch *et al.* (2009) which cluster within the *Acarospora* clade. The placement by Steiner is therefore provisionally accepted, pending further phylogenetic research.

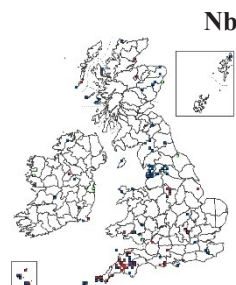
**Sarcogyne hypophaea** (Nyl.) Arnold (1870)

Sarcogyne privigna sensu auct. mult., non (Ach.) A. Massal. (1854)

Thallus ± immersed and inconspicuous, sometimes appearing grey or gelatinous when wet. Apothecia sessile, (0.4–) 0.5–1 mm diam., disc pale red-brown to dark red, not pruinose; true exciple black, persistent, splitting into angular segments, about 0.3 mm thick; hymenium usually 100–140 µm tall; hypothecium colourless. Asci 45–55 × 10–12 µm, *ca* 100-spored. Ascospores 3.5–5 × 1–1.5 (–2) µm. Conidiomata unknown. **BLS 1305.**

On hard siliceous rocks and walls, often in somewhat humid situations; less commonly on calcareous substrata. S.W. & N. England, scattered elsewhere.

Knudsen *et al.* (2013) showed that *S. privigna* in its original concept is a synonym of *Acarospora* (*Polysporina*) *simplex*, so the name *S. hypophaea* is adopted here. *S. clavus* differs in having a crenulate true exciple. *S. praetermissa* K. Knudsen & Kocourk. is similar to *S. hypophaea* and occurs on calcareous rock in central and northern Europe, but has not so far been reported from Britain and Ireland. (Knudsen & Kocourková 2018b).

**Sarcogyne oceanica** K. Knudsen & Kocourk. (2021)

Thallus endolithic, scattered lichenized algal cells among substrate crystals, hyphae 1–2 µm diam., IKI–. Apothecia stipitate, (0.3–) 0.5–1.0 mm diam., 0.2–0.3 mm thick, round to irregular, dispersed, rarely replicating by division. Margin lecidine, not pruinose, black, not incised, slightly elevated above the disc and curling inward, 80–100 µm thick, of radiating hyphae 1–1.5 µm diam., the outer layer black, melanized, 20–80 µm thick, inner layer colourless. Disc not pruinose, dark red, barely changing colour when hydrated, becoming convex. Underside black. Epithecium 10 µm tall, reddish brown, conglutinate. Hymenium (50–) 65–100 µm high, hymenial gel IKI+ blue (euamyloid). Hypothecium hyaline to yellowish, continuous with the stipe and the endolithic thallus. Subhymenium 20–30 µm thick, IKI+ blue, usually with oil drops. Paraphyses 1.0–1.5 (–2.0) µm diam. at mid-level, apices barely expanded, with gel caps. Asci (40–) 50–80 × 16–20 µm, narrowly clavate to clavate, containing about a hundred ascospores. Ascospores 4–5 × 1.0–1.5 (–2.0) µm. No secondary metabolites detected with spot tests. **BLS 2801.**

NE

On maritime granite, Channel Is. (Jersey).

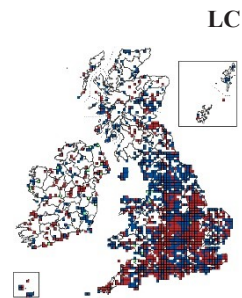
The species is formally described on p. 23. Similar to *S. regularis*, but differing in a thicker margin (80–100 μm vs. usually *ca* 50 μm), a usually lower hymenium, more irregular apothecia with a red disc and occurring on non-calcareous rock. Currently known from two collections from Jersey, but also recorded on non-maritime rocks from Greece and Sardinia.

Sarcogyne regularis Körb. (1855)

Thallus generally immersed and inconspicuous, or white to grey and scurfy. Apothecia sessile or \pm sunken into pits in the substrate, (0.3–) 0.4–1.5 (–2) mm diam.; disc red-brown to black, generally densely blue-grey pruinose but sometimes not; exciple black, often more densely pruinose than the disc and then white-grey, not or slightly raised, not crenulate, finally becoming excluded, to 50 μm thick; hymenium (65–) 70–100 (–110) μm tall; hypothecium \pm colourless. Asci 60–85 \times 14–18 μm , 100- to 200-spored. Ascospores 3–5 (–6) \times 1.5–2 μm . Conidiomata unknown. **BLS 1306.**

On calcareous rocks, walls, chalk pebbles, sea-shells, asbestos-cement and old mortar, particularly in lowland areas; frequent. Throughout Britain and Ireland.

Morphs with red-brown, densely pruinose apothecia embedded in pits in the substrate, usually hard limestones, are sometimes distinguished as a separate species, '*S. pruinosa* auct.', the status and correct name of which remains unclear. Specimens lacking pruina are rare but occur.



TRIMMATOTHELOPSIS Zschacke (1934)

Thallus forming a narrow band around the base of apothecia in thalline warts, or areolate to squamulose, light to dark brown or black, often with rhizohyphae in root-like bundles, saxicolous or terricolous. **Algal layer** interrupted or not. **Apothecia** immersed, the hymenium globose with a disc half or less than the width of the equatorial diameter of the hymenium, the true exciple incurved, carbonized or not. **Hymenium** tall, 150–300 μm high. **Paraphyses** thin, 0.5–2.0 μm diam., branching moderately. **Asci** 140–220 \times 20–60 μm , cylindric-clavate, bluing variably in iodine, with 100–500 ascospores per ascus. **Ascospores** small, bacilliform, aseptate. **Pycnidia** punctiform, one-chambered, conidiogenous cells hyphal, filiform. **Conidia** bacilliform, mostly 4–6 \times 1–1.5 μm . **Chemistry:** no secondary metabolites detected with TLC. **Ecology:** on siliceous or calcareous rocks and in soil crusts.

There has been substantial difference of opinion as to the correct identity and disposition of the genus *Trimmatothelopsis*, but the situation has now stabilised with the *Acarospora smaragdula* group being assigned to *Myriospora* (Arcadia & Knudsen 2012, Knudsen & Lendemer 2016) rather than *Trimmatothelopsis* as advocated by Roux & Navarro-Rosinés *et al.* (2011). There are two British species.

Literature

Gueidan *et al.* (2014), Knudsen & Lendemer (2016), Knudsen *et al.* (in press), Linda in Arcadia & Knudsen (2012), Roux *et al.* (2016), Roux & Navarro-Rosinés (2011).

Trimmatothelopsis benedarensis (M. Knowles) K. Knudsen & Kocourk. (in press, ined.) **Nb**

Acarospora benedarensis M. Knowles (2013)

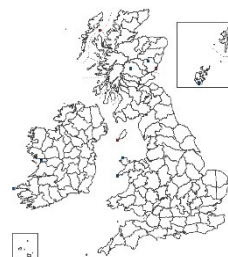
Myriospora benedarensis (M. Knowles) Cl. Roux (2019)

Areoles aggregated into a crust, sometimes inseparably combined, 1–3 mm diam., 0.3–0.6 mm thick, unequal, very pale yellow-grey, grey-brown to medium brown, partly verruciform in places, the margins not raised; cortical cells thin-walled, 1.5–3 μm broad, lower surface not corticate, with well-developed rhizohyphae. Apothecia inconspicuous when dry, 1–5 per areole; disc 0.2–0.5 mm wide, concave, dark brown to red-brown,

surrounded by a conspicuous, thick true exciple, darker than the thallus; exciple distinct, ca 15 µm thick, dark brown; hymenium 180–200 µm high, paraphyses 1–1.5 µm diam., widening to 3–5 µm at the tips. Ascospores 3–4.5 × 1.5 µm, subglobose. Conidia 4–5 × 1 µm. Lichen products not detected by TLC. **BLS 0007**.

On compacted soil on sea-cliffs, or on soil-washed rock; rare. Ireland (Howth Head), Welsh islands (Anglesey, Bardsey), Isle of Man, Scotland (Orkney, Angus). Endemic. Always on coastal sea-cliffs, on soil (boulder clay) compacted by sheep-trampling and on the floors of recesses used by them for shelter.

Some specimens are scarcely areolate and may have a green tinge. The species was thought possibly to be an ecotype of *Silobia* (now *Myriospora*) *rhagadiza*, q.v., by Westberg *et al.* (2011), and it was placed in *Myriospora* by Roux *et al.* (2019). It will be transferred to *Trimmatothelopsis* based on the long conidia and rhizohyphae, tall hymenium and rarely uninterrupted algal layer (Knudsen & Fox 2011, Knudsen *et al.* in press).



Trimmatothelopsis rhizobola (Nyl.) K.Knudsen & Lendemer (2016)

Acarospora rhizobola (Nyl.) Alstrup (1986)

Thallus of large squamules to 4 mm diam., 0.2–0.3 mm thick; squamules peltate and scattered or with some overlapping, deep red- to dull brown, bright green when wet, margin paler, surface smooth or finely cracked-areolate, usually densely studded with pycnidia, edges and underside white, medulla yellow, with an algal layer occasionally interrupted by hyphal bundles; bundles of rhizohyphae present below, 0.1–0.2 mm diam., black-stained, entangling soil and plant detritus (the areoles need turning over for detection). Apothecia unknown in British material; 1–6 per areole, 0.1–0.6 mm diam., completely immersed, the hymenium globose with an incurved true exciple. Asci 200–250 × 15–20 µm. Ascospores 3–4 × ca 2 µm. Pycnidia 80–150 µm diam., frequent; conidia 4–6 × ca 1 µm. Lichen products not detected by TLC. **BLS 0767**.

Directly on peaty soil on mica-schist; very rare. Scotland (Perthshire).

The thick squamules, rounded or extended, distinctly overlapping and with rhizines below, are distinctive and resemble those of a *Psora* sp. The rhizines have been described as ‘radiculose’ (tap-roots).

VU (D2)



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Nomenclature

Sarcogyne oceanica* K. Knudsen & Kocourk., *sp. nov.

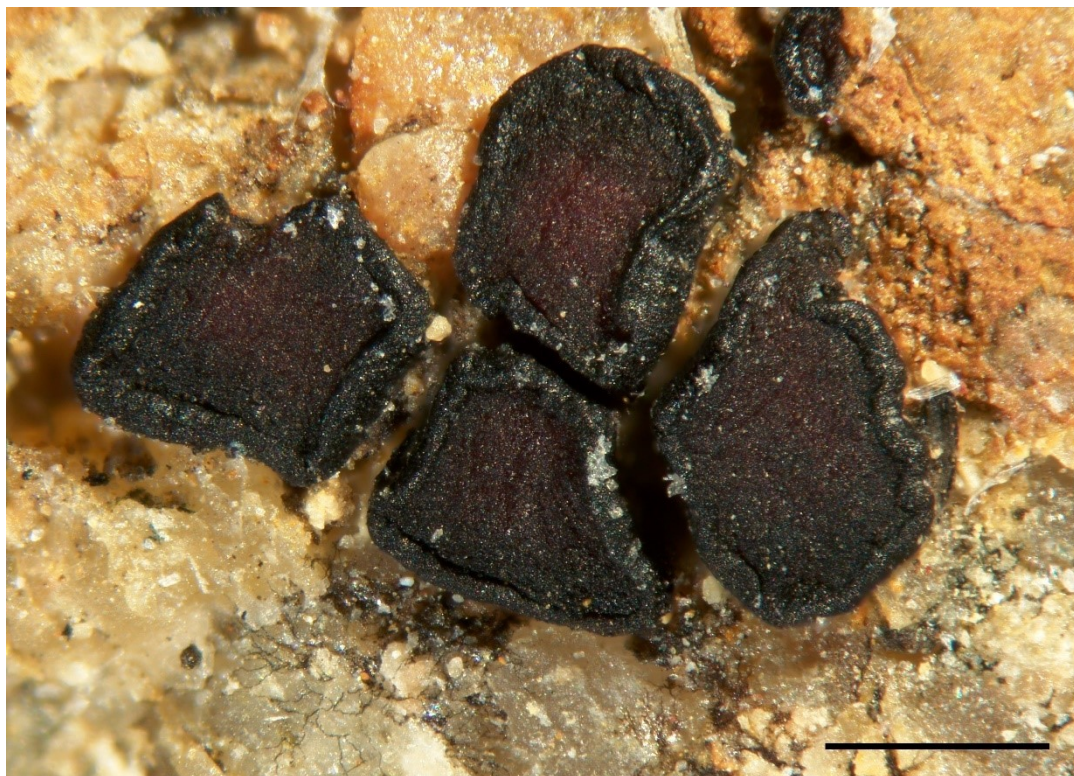
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Diagnosis. Similar to *Sarcogyne hypophaea* but differing especially in having an elevated incurved margin without fissures, rather than an incised margin of angular segments.

Description. Thallus endolithic, scattered lichenized algal cells among substrate crystals, hyphae 1–2 µm diam., IKI–. Apothecia stipitate, (0.3–) 0.5–1.0 mm diam., 0.2–0.3 mm thick, round to irregular, dispersed, rarely replicating by division. Margin lecideine, not pruinose, black, not incised, slightly elevated above the disc and curling inward, 80–100 µm thick, of radiating hyphae 1–1.5 µm diam., the outer layer black, melanized, 20–80 µm thick, inner layer colourless. Disc not pruinose, dark red, barely changing colour when hydrated, becoming convex. Underside black. Epithecium 10 µm tall, reddish brown, conglutinate. Hymenium (50–) 65–100 µm high, hymenial gel IKI+ blue (euamyloid). Hypothecium hyaline to yellowish, continuous with the stipe and the endolithic thallus. Subhymenium 20–30 µm thick, IKI+ blue, usually with oil drops. Paraphyses 1.0–1.5 (–2.0) µm diam. at mid-level, apices barely expanded, with gel caps. Asci (40–) 50–80 × 16–20 µm, narrowly clavate to clavate, containing about a hundred ascospores. Ascospores 4–5 × 1.0–1.5 (–2.0) µm. No secondary metabolites detected with spot tests.

Typification. UNITED KINGDOM: Jersey, St. Brelade Parish, N of Corbière Point, on vertical, westerly exposed granite, 9 April 1966, *A. Henssen* 18817 & *M. Jahns* (H! – holotype of *Sarcogyne oceanica*).

Distribution and substrate. On siliceous rock, granite and shale, in Greece, Italy (Sardinia), and the United Kingdom (Jersey) with highest reported elevation of 600 m. The species could be widespread in Europe.



Sarcogyne oceanica, holotype. Scale= 0.5 mm. A group of irregularly shaped apothecia, formed via replication by division. The elevated, incurving margin that lacks fissures is typical of this species. Solitary apothecia are usually round.

Discussion. *Sarcogyne oceanica* differs from *S. hypophaeoides* Vain. (1935) in having a colourless hypothecium. *S. oceanica* differs from *S. similis* H. Magn. (1934) especially in having an IKI+ euamyloid hymenium. *S. hypophaea* (Nyl.) Arnold (1871) occurs on siliceous and calcareous rock and differs especially in forming an incised margin of angular segments; young apothecia are round but always mixed with older incised apothecia. The species was in all cases misidentified as *S. hypophaea* (misapplied name *Sarcogyne privigna*).

Other specimens examined: GREECE: Peloponnese: on low blocks between shrubs just north of the pass over the Taygetus between Sparti and Kalamata, 13 April 1971, on rock (shale?) with much quartz, *J. Poelt* (GZU); Samos: on the way to Pyrgos from Mesogi, 3 Aug. 1984, on pale shale, *J. Poelt* (GZU). ITALY: Sardinia, Prov. Nùoro, Lanusei, surroundings of the Ville Selene Hotel, ca 600 m alt., on granite in wall, 4 May 1986, *J. Poelt* (GZU). UK. Channel Is., Jersey, St Brelade's, on felspathic rocks. Larbalestier Lichen Herbarium, Exsiccatum Britannicum 254 (as *Lecanora squamulosa* var. *privigna*, **H**).

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