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Pertusariales: Megasporaceae
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to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published.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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Pertusariales: Megasporaceae

including the genera *Aspicilia, Aspiciliella, Circinaria, Lobothallia, Megaspora* and *Sagedia*

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MEGASPORACEAE Lumbsch (1994)

**Thallus** usually crustose, weakly cracked to distinctly areolate, areoles contiguous to scattered, in some species foliose to placodioid with radiating marginal lobes; chalk-white, grey, green or brown, occasionally pruinose. **Isidia** and **soredia** present in some species. **Cortex** pseudoparenchymatous. **Photobiont** chlorococcoid, cells globose to ellipsoid. **Medulla** I–. **Ascomata** apothecia, mostly immersed, sometimes initially poriform but usually widely emergent, more rarely ± sessile. **Thalline exciple** poorly developed and becoming excluded, more rarely well developed and persistent, often little more than a slightly raised rim of thallus tissue, but well differentiated in some species. **True exciple** usually colourless and poorly developed, lateral to and below the hymenium, sometimes broadening above and concolorous with the epithecium. **Disc** flat to concave, black-brown, sometimes white-pruinose. **Epithecium** with green pigment, N+ intensifying green, K± fading to brown (‘Aspicilia green’). **Hymenium** usually more than 100 µm high, colourless, I+ green or blue. **Hypothecium** with photobiont below, colourless or very pale brown. **Hamathece** of paraphyses, simple to sparingly branched, frequently anastomosed, short-celled and moniliform above, the apices cohering to form a well-defined epithecium. **Asci** 4- to 8-spored, cylindrical to clavate, thin outer coat K+/I+ blue, wall and apical dome K/I–. **Ascospores** asperate, ellipsoid to globose, colourless, thin-walled, sometimes with a thin outer sheath, I–. **Conidiomata** pycnidia, immersed, elongate and flask-shaped to almost globose, scattered or in clusters; wall colourless, or at least in upper part brown or green (pigment as in epithecium) **Conidigenous cells** sessile or on short conidiophores, subcyllindrical. **Conidia** asperate, bacilliform to shortly thread-like and ± straight, colourless. **Chemistry**: some species with fatty acids (especially aspicilin), β-orcinol depsidones (especially norstictic and stictic acids), or unidentified terpenoids. **Ecology**: on calcareous and siliceous rocks, rarely on soil.

The Megasporaceae currently contains around ten genera, of which six occur in Great Britain and Ireland. Several of these are segregates from Aspicilia, which here has a more restricted circumscription than in the second edition of this publication (Fletcher et al. 2009). They are all monophyletic (see Nordin et al. 2010, Wheeler 2017, Zakeri et al. 2017) but are difficult to distinguish at generic level using field characters, so a key to the entire family is included below. In most species the apothecia are immersed within the thallus and broadly emergent (often described as ‘aspicilioid’), but a number of unrelated genera show this feature.

Many species require collecting in winter and spring to obtain conidia, which are important for identification. The pycnidia are often restricted to the outer, younger parts of thalli so these portions should not be ignored as being ‘sterile’. It is important that the cortex colour should be accurately recorded on collection as it may alter rapidly in dried collections.

**Literature:****

1 Thallus foliose, placodioid, scurfy or granular .......................................................... 2
   Thallus crustose, often areolate .................................................................................. 4

2(1) Thallus not strongly delimited, scurfy or ± granular, often strongly pruinose, on soil or mosses; apothecia poriform when young; ascospores very large (> 30 µm long). ............... **Megaspora verrucosa**
   Thallus foliose or placodioid, on rock; apothecia immersed but not strongly poriform; ascospores 10–15 µm long .......................................................... 3

2(1) Thallus foliose, lobes >1 cm long (Physcia-like), K– ............................................ **Lobothallia melanaspis**
   Thallus placodioid, lobes K+ red (crystals) ........................................................... **Lobothallia radiosa**
4(1) On limestone, cement or base-enriched rocks ................................................................. 5
On siliceous rocks ..................................................................................................................... 8

5(4) Thallus of widely scattered squamules <0.5 mm diam., black-sorediate below at the edges
.................................................................................................................. Acarospora moenium (Acarosporaceae)
Thallus crustose, cracked-areolate, lacking soredia ................................................................. 6

6(5) Areoles circular, widely separated especially at the margin; prothallus very thin........ Cincinaria contorta
Areoles a continuous crust to the edge of the thallus; prothallus usually evident ..................... 7

7(6) Thallus margin abrupt, usually zonate; areoles elongated, separated by radiating cracks;
cortex smooth................................................................. Cincinaria calcarea
Thallus margin effuse; areoles rimose, regular, lacking radiating cracks at the edge;
cortex scabrid................................................................. Cincinaria hoffmanniana

8(4) Thallus with isidia, soralia or areoles with granules or marginal squamules or folioles........... 9
Thallus sometimes knobbled but not isidiate or sorediate ......................................................... 11

9(8) Thallus K+ yellow—red (norstictic acid); areoles with isidia or soralia; not strongly maritime..... 10
Thallus K–; areoles with marginal squamules or folioles; on sea-bird perches in the xeric
supralittoral zone, rarely inland............................................................................................. Cincinaria leprosescens

10(9) Thallus ± smooth, with dot-like soralia or scattered patches of smooth corticate branched isidia
which develop to resemble soredia and eventually obscure the areoles................ Sagedia simoensis
Thallus nodulose, with an erose crust of knob-like isidiate granules ........................................ Aspicilia granulosa

11(8) Thallus Pd+ orange, K+ yellow or red .................................................................................. 12
Thallus Pd–, K– ....................................................................................................................... 14

12(11) Thallus smooth, glossy, dark green-black; aquatic .................................................. Aspicilia laevata
Thallus cracked-areolate, not glossy, shades of grey or brown; on open, dry rock ............... 13

13(12) Conidia 7–11 µm long; ascospores 22–28 µm long ........................................ Aspiciliella intermutans
Conidia 11–16 µm long; ascospores 11–16 µm long ...................................................... Aspicilia cinerea
Conidia 15–28 µm long; ascospores 20–25 µm long .................................................. Aspicilia epiglypta

14(13) On semi-inundated rocks in freshwater streams; thallus white; apothecial discs black Aspicilia aquatica
Thallus terrestrial, grey to brown, discs brown or black .................................................. 15

15(14) Areoles obscured by dense large sessile apothecia; ascospores 12–14 µm long; conidia
3–5 µm long ...................................................... Lobothallia reedes
Apothecia small, sunken, widely separated; ascospores >12 µm long; conidia >6 µm long ........ 16

16(15) Thallus a continuous rimose-areolate crust .............................................................. Cincinaria tuberculosa
Areoles widely scattered, almost hemispherical, on a thin, grey prothallus; prothallus fimbriate
at the edge, dark grey-black ........................................................................... Cincinaria caesiocinerea
Thallus dark grey with a brownish tinge, often zonate; apothecia with a distinct black rim;
asci 8-spored .................................................................................................................. Sagedia zonata
**ASPICILIA** A. Massal. (1852)

**Thallus** crustose, weakly to distinctly cracked or areolate, sometimes zonate, rarely granular with scattered areoles; mostly grey to brownish, in one species white to yellowish. **Prothallus** sometimes prominent, grey to black, occasionally fimbriate. **Soralla** present in some species. **Photobiont** chlorococcoid, cells globose to ellipsoidal. **Medulla** 1–. **Ascomata** apothecia, mostly immersed, occasionally becoming emergent, more rarely lecanorine and soon emergent and ± sessile. **Thalline margin** poorly developed and becoming excluded, often little more than a slightly raised rim of thallus tissue, but well differentiated in some species. **True exciple** usually colourless and poorly developed, lateral to and below the hymenium, sometimes broadening above and concolorous with the epithecium. **Disc** flat to concave, black-brown, rarely pruinose. **Epigies** pigment green, N+ intensifying green, K± fading to brown (‘Aspicilia green’). **Hymenium** tall, colourless, I+ green or blue. **Hypothecium** with photobiont below, colourless or very pale brown. **Hymathecium** of paraphyses, unbranched or sparingly branched, frequently anastomosed, short-celled and moniliform above, the apices cohering to form a well-defined epithecium. **Asci** 4- to 8-spored, cylindrical to clavate, thin outer coat K/I+ blue, wall and apical dome K/I–. **Ascospores** asceptate, ± globose, colourless, thin-walled, sometimes with a thin perispore, I–. **Conidiomata** pycnidia, immersed, elongate and flask-shaped to almost globose, single or in clusters; wall colourless, or at least in the upper part brown or green (pigment as in epithecium). **Conidiogenous cells** sessile or on short conidiophores, subcylindrical. **Conidiose** asceptate, bacilliform to filiform and ± straight, colourless. **Chemistry:** with β-orcinol depsidones (especially norstictic and stictic acids), or unidentified terpenoids. **Ecology:** on siliceous rocks.

*Aspicilia* in its phylogenetic interpretation is monophyletic (Nordin et al. 2010) and in Great Britain and Ireland can largely be defined using a combination of morphological and ecological criteria. Species have crustose thalli that are not usually strongly areolate, and occur on siliceous rather than calcareous rocks. The rare *A. tuberculosa* has not been sequenced and probably belongs in *Circinaria* rather than *Aspicilia*, but the species appears to be extinct in our area and more studies are needed before a transfer is appropriate. There are historical records of *A. subdepressa* Arnold (1869) from Wales, but they appear to be misidentified; a comprehensive description of the species can be found in Roux et al. (2011).

*Aspicilia* species from our region can be found in the key to all species of Megasporaceae above.

**Literature:**

**Aspicilia aquatica** Körb. (1855)

Thallus thin, smooth, weakly rimose, white, tinged yellow in places; prothallus thick, grey, delimiting. Apothecia immersed, the disc black, turning translucent green when wet, concave; thalline margin thin and inconspicuous; hymenium 150-170 µm high, I+ blue turning dark red-brown; epithecium green-olive, N+ intensifying green, fading to straw-brown in K; paraphyses branched, moniliform, the apical cell blackened, 2-3 µm diam. Ascii cylindrical, *ca* 140 × 35 µm. Ascospores 25–35 × 14–20 µm. Thallus K–, Pd–. **BLS 2396.**

On siliceous boulders in montane streams and lakes; apparently rare, but overlooked. Scotland (W. Sutherland, Westerness, Southern Uplands), N. and C. Wales.

*Aspicilia aquatica* may be confused with pale morphs of *Circinaria caesiocinerarea*, which may grow in similar habitats but in less strongly inundated positions. *Ionaaspis lacustris* also may form whitish thalli and occurs in freshwater habitats, but it has fawn to orange apothecial discs with a green N+ crimson epithecium.

The lichen *Placopyrenium formosum* is initially parasitic on *A. aquatica* (Orange 2009), but subsequently develops an independent thallus.
Aspicilia cinerea (L.) Körb. (1855)

Thallus areolate on a shiny black hypothallus, areoles very irregular, becoming warted or with knobby papillae along margins in nutrient-rich environments, smooth, dull grey, becoming brown-tinged, grey-brown or rarely rust-coloured or green, to 1 mm diam.; prothallus black, delimiting. Apothecia (0.2–) 0.4–1.2 (–2) mm diam., slightly concave to flat, one or two per areole, at first immersed, later sometimes becoming sessile, round; thalline margin thick, even, persistent; disc concave, matt black. Asci (6-) 8-spored. Ascospores 12–22 × 6–13 µm, broadly cylindrical to ellipsoidal. Conidia 11–16 × ca 1 µm. Thallus K+ red, Pd+ orange (norstictic acid).

On exposed siliceous rocks; locally frequent but probably over-recorded as many specimens in dried collections have proved to be Aspicilliella intermutans. N. & W. Britain, rare elsewhere.

Because of variations in colour and roughness of the areoles it is likely that several described species are included here. Thalli often resemble Circinaria caesiocinerea especially when they lose their brown colour after collection. See also the commoner Aspicilliella intermutans and the rare Aspicilia epiglypta, which have shorter and longer conidia respectively. Material is best collected in winter and spring to find conidia. As conidial length within a pycnidium is very variable, their maximum lengths need to be measured. Pertusaria chiodectonoides can superficially resemble A. cinerea and has similar chemical reactions, but has larger, more tuberculate areoles and more elevated, rounded apothecia.

Reports for when this species is not distinguished from Aspicilia epiglypta, Aspicilliella intermutans and Circinaria caesiocinerea are recorded as Aspicilia cinerea s. lat. (BLS 1014).

Host to Rosellinula haplospora (Th. Fr. & Almq. ex Th. Fr.) R. Sant. (1986). Additionally reported, but only for A. cinerea s. lat. are Endococcus rugulosus Nyl. (1855), Muellerella lichenicola (Sommerf.) D. Hawksw. (1979) and M. pygmaea (Körb.) D. Hawksw. (1979).

Aspicilia epiglypta (Norrl. ex Nyl.) Hue (1912)

Thallus crustose, rimose, shiny, becoming markedly cracked-areolate and matt, irregular, angular areoles to 1.5 mm diam., rounded-warted, usually smooth but at times roughened, usually pale grey with a yellow-fawn to brown tinge, usually markedly zonate at the margin, sometimes for up to 15 mm; prothallus black, delimiting, often broadly zonate at the margin. Apothecia 2–5 per areole, rarely single, small (0.2–0.3 (–1.0) mm diam.); thalline margin raised, thick, angular-Indented or convoluted, persistent; disc black, flat, generally rough and appearing wrinkled or wavy-margined when old, even slit-like; paraphyses branched, moniliform, swollen to 5–6 µm diam. at the tip; epithecium dark olive-green, N+ intensifying to bright green; epithecium and true exciple with a colourless (dead?) outer layer of enlarged cells in a gelatinous matrix. Ascospores 20–25 × 12–15 µm. Conidia 15–28 × ca 1 µm. Thallus K+ red, Pd+ yellow-orange (norstictic acid). BLS 1019.

On schists and granitic rocks, maritime, often in sunny, nutrient-rich situations; rare. N. and W. Britain, Channel Is, a few records from coastal Ireland.

The fawn-grey thallus and irregular apothecia are distinctive. It seems to be the rarest of a morphologically similar trio including A. cinerea and Aspicilliella intermutans, which differ principally in conidial and ascospore size, lack the yellow tinge, and have regular apothecial margins. It can resemble fertile forms of maritime Pertusaria pseudocorallina but lacks isidia and has characteristic irregular discs.

Aspicilia granulosa A. Nordin (2011)

Thallus grey or green-grey to brownish, often minutely white-spotted, thin, the inner part finely granular or subsidiate to verrucose or indistinctly areolate, the margin usually with elongate areoles forming a dendroid pattern. Areoles 0.1–0.2 mm wide and up to 1 mm long, often brown at the tips, in the central part indistinct, irregularly rounded, often nodulose or subdivided into granules, sometimes bursting open and exposing the medulla. Epinecral layer usually present, to 15 µm thick. Hypothallus dark brown to black, smooth, often fimbriate at the margins. Apothecia urceolate, irregularly rounded, 0.2–0.6 mm diam. Thalline margin indistinct, smooth to subcrenulate; disc black, smooth, concave, not pruinose; epithecium brown-green, N+ green, K+ brown; paraphyses branched and anastomosing, predominantly moniliform, the apical cells to 3 µm diam.
Ascospores 15–18.5 × 9–12 µm. Pycnidia not found. Thallus K+ yellow turning red, C−, Pd+ yellow-orange, containing norstictic and connorstictic acids. **BLS 2794.**

Confirmed records on old mine spoil, Cumbria and siliceous streamside rocks, Wales (Caernarvon) but probably more widespread and extending north to the Outer Hebrides.

Distinctive for its strongly granular thallus, with isidium-like structures that may form an extensive, erose crust of chunky knobly propagules. The description has been largely adapted from Nordin et al. (2011).

**Aspicilia laevata** (Ach.) Arnold (1887)

Thallus continuous or slightly rimose, with few discrete areoles, smooth and even, thin, colour varying from black-green to pale green-grey, becoming grass-green when wet, usually glossy; with a black hypothallus and delimiting prothallus. Apothecia 2–5 per areole, round, even, immersed and inconspicuous until wetted, 0.2–0.5 mm diam., numerous and usually crowded, crater-like to emergent; thalline margin inconspicuous; true exciple inconspicuous, thin; disc brown, flat to concave; epithecium green, N+ intensifying, without colourless cells above the epithecium; paraphyses weakly branched, scarcely swollen at the tips. Asci 8-spored. Ascospores 13–20 × 9–13 µm, broadly ellipsoid. Conidia 18–25 × ca 0.8 µm. Thallus K± yellow or red, Pd+ orange (stictic and ± norstictic acids, ± an unidentified terpenoid). **BLS 0115.**

On rocks and boulders in streams or woodland, especially in shaded situations; scarce. W. & N. Britain. The thallus could be taken for a Rhizocarpon. Aspicilia aquatica, also found in montane streams, has a pale white-grey thallus that is K–, Pd–, and black discs. *Ionaspis lacustris* occasionally forms pale yellowish thalli, but has orange-red discs and is also K–.

Reported as host to *Endococcus perpusillus* and the lichenicolous lichen *Rinodina parasitica.*

**Aspiciliella** M. Choisy (1932)

Thallus crustose, rimose-areolate, partially continuous; photobiont chlorococcoid. **Apothecia** pale brown to dark grey or black. **True exciple** always present, rarely surrounded by an additional thalline margin. **Epithecium** green to olive green to greenish-brown, N+ light green. **Hypothecium** and subhymenium colourless, I+ blue to rusty red. **Hymenium** colourless, I+ blue to rusty red. **Asci** 8-spored, *Aspicilia*-type. **Ascospores** ellipsoidal, colourless, aseptate. **Conidia** straight, 7–11 µm long.

**Chemistry:** thallus K+ red, C–, UV–. **TLC:** norstictic acid and sometimes connorstictic and stictic acids.

*Aspiciliella* differs from *Aspicilia* in having small conidia, and ascospores that are always ellipsoidal. Only one species (as currently delimited) is known from our region.

**Literature:**

Fletcher et al. (2009), Zakeri et al. (2017, 2019).

**Aspiciliella intermutans** (Nyl.) M. Choisy (1932)

Like *Aspicilia cinerea,* but ascospores (20–)22–28 × (11–)12–14 µm and conidia 7–11 × ca 1 µm; apothecia 2 or 3 per areole; epithecium dark olive, N+ green; paraphyses scarcely swollen, to 2 µm diam. at the tip; epithecium with an outer, clear cellular layer. Thallus K+ red, Pd+ orange (norstictic, connorstictic, constictic acids). **BLS 0114.**

On low-lying rocks, slate roofs, etc., especially maritime; rare but probably very much under-recorded;
scattered throughout Britain and Ireland. Many records of *Aspicilia grisea s. lat.* (see under *Sagedia simoensis* below) will belong to this species.

This species is virtually indistinguishable in morphological terms from *Aspicilia cinerea* and *A. epiglypta* apart from in conidial length and differences in ascospore size and shape. However, DNA evidence shows that it is more closely related to *Circinaria* and *Megaspora* than to *Aspicilia* (Zakeri et al. 2017). According to Zakeri et al. (2019), *A. intermutans* is a species complex containing at least six segregate taxa, but these have not been named to date and no British or Irish material was included in their study.

Reported as host to *Endococcus perpusillus*.

**CIRCINARIA** Link (1809)

**Thallus** crustose, sometimes strongly areolate or rimose, sometimes minutely squamulose or with scattered areoles; white to pale grey or blueish grey to brownish. **Prothallus** sometimes prominent, pale to dark grey, occasionally zonate. **Soralia** and/or **isidia** present in some species. **Photobiont** chlorococcoid, cells globose to ellipsoidal. **Medulla** I–. **Ascomata** apothecia, mostly immersed, occasionally becoming emergent. **Thalline margin** usually poorly developed and becoming excluded, often little more than a slightly raised rim of thallus tissue. **True exciple** usually colourless and poorly developed, lateral to and below the hymenium, sometimes broadening above and concolorous with the epithecium. **Disc** flat to concave, black-brown, sometimes pruinose. **Epithecium** pigment olive to green, N+ intensifying green, K+ fading to brown (‘*Aspicilia* green’). **Hymenium** tall, colourless, I+ green or blue. **Hypothecium** with photobiont below, colourless or very pale brown. **Hamathecium** of paraphyses, unbranched or sparingly branched, frequently anastomosed, short-celled and moniliform above, the apices cohering to form a well-defined epithecium. **Asci** 4- to 8-spored, cylindrical to clavate, thin outer coat K/I+ blue, wall and apical dome K/I–. **Ascospores** aseptate, ± globose, colourless, thin-walled, sometimes with a thin perispore, I–. **Conidiomata** pycnidia, immersed, elongate and flask-shaped to almost globose, single or in clusters; wall colourless, or at least in the upper part brown or green (pigment as in epithecium). **Conidiogenous cells** sessile or on short conidiophores, subcylindrical. **Conidia** bacilliform to filiform and sometimes curved, colourless. **Chemistry:** some species with fatty acids (especially aspicilin), β-orcinol depsidones (especially norstictic and stictic acids), or unidentified terpenoids. **Ecology:** on calcareous or siliceous rocks.

Not well delimited from *Aspicilia* in morphological terms, but species contain the fatty acid aspicilin and lack substictic acid which is present in some species of *Aspicilia* s. str. (Nordin et al. 2010). Most species of *Circinaria* have asci containing fewer than eight ascospores.

**Literature:**
Clauzade & Roux (1984), Fletcher et al. (2009), Nordin et al. (2010), Roux et al. (2011, 2016).

**Circinaria caesiocinerea** (Nyl. ex Malbr.) A. Nordin, Savić & Tibell (2010) **Aspicilia caesiocinerea** (Nyl. ex Malbr.) Arnold (1886)
Thallus to 20 cm diam., rather thick, becoming wide-spreading, rimose at the edge to warded-areolate; areoles continuous, flat or convex, occasionally subsquamulose in the centre of the thallus, irregular to rounded, 0.3–1 (–2) mm wide, often uneven with distinct edges and a rough, matt surface, typically pale grey with a blue tinge, becoming dirty dark grey; prothallus, if present, grey, delimiting. Apothecia 0.2–0.8 mm diam., immersed, crater-
like, sometimes becoming emergent, well separated; thalline margin evident from an early stage, thin, entire, somewhat wavy but rarely prominent; disc black, shiny, concave, becoming expanded. Asci (4–) 6–8-spored. Ascospores very variable in size, often poorly developed, 14–30 × 7–16 µm, broadly ellipsoidal to globose. Conidia 6–12 × ca 1 µm. Cortex and medulla K–, Pd– (ascicillin). BLS 0102.

On nutrient-rich rocks, especially by lakes, seashores and bird-perching stones, also on walls and memorials; locally common. Widespread in Britain and Ireland, especially in N. & W. Britain.

The commonest K– Aspicilia-like lichen on siliceous rocks. Most British material previously identified as Aspicilia gibbosa seems to be this species.

The lichenicolous lichens Placopyrenium formosum and Rinodina parasitica are parasitic on C. caesiocineraria on siliceous rocks in streams, whereas Rhizocarpon viridiatrum can occur in drier situations. Non-lichen-forming lichenicolous fungi reported are Endococcus perpusillus, E. rugulosus, E. verrucosus, and Sclerococcus (Dactylospora) attendendum (Nyl.) Ertz & Diederich (2018). There are also three unidentified taxa reported from GB&I: Lichenochora sp. with 1-septate ascospores, 15–18 × 6–7 µm; Minutoexcipula sp. with 1-septate conidia, 6.6–9.5 × ca 4 µm; and Roselliella sp. with 0–2-septate ascospores, 16.5–18 × 9–10.5 µm.

Circinaria calcarea (L.) A. Nordin, Savić & Tibell (2010)

Aspicilia calcarea (L.) Mudd (1861)

Thallus usually large, to 30 cm diam. or more, forming circular patches, thick, finely cracked-areolate; areoles radially orientated especially at the outer edge of the thallus, concave to flat when old, matt, chalk-white to pale grey, rarely stained rust-coloured, cortex smooth; prothallus usually delimiting, dark grey, conspicuously zoned. Apothecia 0.2–1 mm diam., immersed, rounded or angular; thalline margin thickened but only slightly raised; disc concave, black, rarely slightly white-pruinose. Asci 4-spored. Ascospores 18–30 × 14–27 µm, broadly ellipsoidal to subglobose, with a thin perispore. Conidia 7–11 × 0.5–1 µm. Thallus K–, Pd– (ascicillin). BLS 0103.

On hard limestones, tombstones and memorials, intolerant of nutrient enrichment; frequent. Widespread in England, Ireland and Wales, with a more scattered distribution in Scotland. However, certainly over-recorded especially in urban areas as many specimens from concrete have proved to be C. hoffmanniana.

Aspicilia lilliei B. de Lesd. (1906), described from N.E. Scotland, is a doubtful species said to closely resemble C. calcarea but apparently differing in being yellow internally and in having much narrower ascospores 13–25 × 5–6 µm. Hymenelia cyanocarpa is superficially similar but is on siliceous rock. H. heteromorpha also can resemble C. calcarea; both Hymenelia species have Trentepohlia as photobiont and much smaller ascospores.

Lichenicolous fungi include Kiliasia episema, Lichenostigma elongatum Nav.-Ros. & Hafellner (1996), Muellerella lichenicola, M. pygmaea, Opegrapha parasitica, Pyrenidium actinellum (Nyl.) (1865) and Weddellomyces mac sporus D. Hawksw., Renob. & Coppins (1990). Heteroplacodium fusculum and Placopyrenium canellum initially grow on the thallus of C. calcarea but later assume an independent thallus.

Circinaria contorta (Hoffm.) A. Nordin, Savić & Tibell (2010)

Aspicilia contorta (Hoffm.) Kremp. (1861)

Thallus of circular, rounded areoles, chalk-white to pale grey, scattered, sometimes becoming crowded and angular due to compression, 0.2–1.2 (–1.8) mm diam., matt, often convex, with darker margins; prothallus white to pale grey, effuse, visible between areoles but indistinct at the perimeter. Apothecia 0.2–0.6 (–0.8) mm diam., mostly one per areole, often occupying almost the entire areole; epithecium olive, K+ yellow-orange, N+ green. Asci 4-spored. Ascospores ca 20 × 11 µm. Thallus K–, Pd–, no lichen substances detected. BLS 0107.

On calcareous rocks and hard limestones, frequently on mortar, concrete and sandy limestones, tolerant of nutrient-enrichment; common. Throughout Britain and Ireland.

Like a very dispersed form of C. calcarea but darker, with a poorly developed prothallus and effuse at the perimeter. The circular, convex areoles are widely separated at the thallus perimeter and are distinctive, resembling miniature flying saucers but becoming angular when crowded in the thallus centre.

Reported lichenicolous fungi are Arthonia aff. urceolata (Elenkin) Calat., Barrena & V.J. Rico (2004),

**Circinaria hoffmanniana** (S. Ekman & Fröberg ex R. Sant.) A. Nordin (2016)  
Frequently confused with *Circinaria calcarea*, but is darker grey, thinner, scabrid or somewhat pruinose, with an effuse margin and with prominent apothecia. The areoles are flat and pressed together at the margin, unlike in *C. contorta* which has distinctive separated circular convex areoles at the thallus perimeter. **BLS 0113**.

Proving very common, and widespread, particularly on cement in urban areas, and on soft limestones, tolerant of nutrient-enrichment. Most certainly under-recorded historically through confusion with *C. calcarea*. Throughout Britain and Ireland, particularly common in the south and east.

Formerly treated as a subspecies of *C. contorta* and morphological intergradations exist, but preliminary molecular data (see Roux *et al.* 2016) indicates that two species are involved.

Host to *Muellerella lichenicola* and *Opegrapha parasitica*, and there is one report of the lichenicolous lichen *Placopyrenium canellum* on this host.

**Circinaria leprosescens** (Sandst.) A. Nordin, Savić & Tibell (2010)  
*Aspicilia leprosescens* (Sandst.) Motyka (1995)  
Thallus cracked-areolate, scurfy or mealy, areoles slightly convex, later ascending at the edges and resembling minute folioles, squamules or papillae, at times appearing granular, isidiate or sorediate, pale white-grey to dark blue-grey, later brown-grey; prothallus sometimes evident, dark green-grey, delimiting. Apothecia often absent, one or two per areole, 0.3–1 mm diam., round, at first deeply concave, later emergent; thalline margin thin, often granular or not obvious, mostly paler than the thallus, disc black. Asci (4–) 8-spored. Ascospores 14–30 × 7–16 µm, subglobose to ellipsoidal. Pycnidia black, gnarled, conidia curved, ca 25 µm long. Thallus K–, Pd– (aspicilin). **BLS 0116**.

On nutrient-rich siliceous rocks, forming conspicuous white films on rock pinnacles used as sea-bird perches, and in associated seepage tracks in the xeric supralittoral zone; locally frequent. Widespread on rocky shores in Britain and Ireland except in S. and E. England, very rarely inland on wind-exposed rocks (S. England, Wilts).


**Circinaria tuberculosa** (Ach.) Coppins (2023)  
*Aspicilia tuberculosa* (Ach.) J.R. Laundon (1986)  
Thallus of widely scattered regular hemispherical brown-grey shiny granules 0.1–0.3 (–0.7) mm diam., at times resembling isidia, on a wide-spreading dark grey-black fimbriate prothallus. Apothecia rare, sessile or almost stalked, sub-globose, ca 1 mm diam.; thalline margin swollen, undulating, smoothly granular like the thallus; disc flat, black, often pruinose. Asci (4–) 8-spored; paraphyses moniliform; epithecium olive, N+ green. Ascospores 22–28 × 20–26 µm, ± globose. Cortex and medulla K–, Pd– (aspicilin). The cortex has been reported to be uniquely C+ white. **BLS 1851**.

On flint nodules near the sea coast (Isle of Wight) and on chalk downs (Hampshire and Sussex); very rare and possibly extinct. Searches to rediscover a population reported from S. Hampshire in 1991 were unsuccessful.

Like an extremely dispersed form of *Circinaria caesiocinerea*, which has a continuous thallus, obscure prothallus and narrower ascospores. The status of this species needs further investigation. However, the presence of aspicilin indicates that a transfer to *Circinaria* is appropriate, and the species was contrasted with *C. caesiocinerea* by Laundon (1986).
LOBOTHALLIA (Clauzade & Cl. Roux) Hafellner 1991

Thallus crustose to foliose, without clearly differentiated rhizines, areolate, radiating and often conspicuously placodioid at the margin. Apothecia immersed and concave when young, later becoming sessile and flat or sometimes stalked. Thalline margin thick and prominent, sometimes undulating. Disc reddish brown to black, flat to concave, sometimes becoming contorted. Epithecium olivaceous to red-brown, N- or N+ greenish. Paraphyses simple or weakly branched, somewhat moniliform and swollen at the apices. Asci Aspicilia-like, 8-spored. Ascospores relatively small compared to other genera of Megasporaceae, broadly ellipsoidal, colourless, thin-walled. Conidia small, ellipsoidal or bacillar.

Distinguished by the lobate, often strongly radiating thallus, and the small, ellipsoidal to bacillar conidia. Nordin et al. (2010) demonstrated that the genus is monophyletic and clearly distinct in molecular terms. The three species known from Britain and Ireland are included in the key to species of the Megasporaceae above.

Literature:

Lobothallia melanaspis (Ach.) Hafellner (1991)

Aspicilia melanaspis (Ach.) Poelt & Leuckert (1973)

Thallus foliose, of elongate radiating overlapping lobes, several cm long, 0.5–1.5 mm wide, in large patches over 6 cm diam.; lobes convex, cylindrical, white, pale-grey or glaucous, darkened to blue-black at the widened and rounded tips, turning bright green when wet, white below, lacking distinct rhizines, very loosely appressed and readily removed from the substratum. Apothecia to 1.8 mm diam., sessile, constricted below, often stalked; thalline margin prominent; disc flat to convex, red-brown to black-brown; epithecium red-brown, with a clear layer above, N+ green intensifying; hymenium 60–75 (–90) µm tall; paraphyses weakly branched, cellular, widening to ca 3 µm diam. Ascospores 10–13 × (6–) 8–10 µm. Conidia 4.5–6 × ca 1 µm. Thallus K–, Pd–. BLS 0120.

On siliceous lakeside rocks (quartzite) near 700 m altitude; rare, endangered. N. Scotland (W. Sutherland), with an unconfirmed report from Argyll.

The only foliose species of Megasporaceae in Britain. The large, loosely attached lobes and sessile apothecia resemble a white form of Anaptychia runcinata or a very large Physcia species.

Lobothallia radiosa (Hoffm.) Hafellner (1991)

Aspicilia radiosa (Hoffm.) Poelt & Leuckert (1973)

Thallus rather thin, medium grey, cracked-areolate towards the centre, radiating and placodioid-lobate at the margins, lobes slightly convex, forming conspicuous orbicular, closely appressed patches; surface matt, somewhat white-pruinose especially towards the ends of the lobes; marginal lobes narrow, 0.4–1 (–1.5) mm wide, contiguous, flat or slightly convex; prothallus not evident. Apothecia abundant, one to three per areole, becoming crowded towards the thallus centre, immersed and concave when young, later becoming sessile and flat; thalline margin thick, crowded and undulating; disc 0.2–0.6 mm diam., black, brown when wet. Ascospores 10–15 × 6–9 µm, broadly ellipsoidal. Conidia 4–6 × ca 1 µm. Thallus C–, K+ red, Pd+ orange (norstictic acid). BLS 0124.

On sunny calcareous rocks, memorials, bridge parapets etc., also on flints; frequent. Mainly in S. & E. Britain, extending northwards locally to eastern Scotland (E. Perth, Angus).

The thallus resembles a dark form of Circinaria calcarea which is K–, Pd–, or even Diploicia canescens which is pruinose, K–, and prefers shade.

In E. Scotland, L. radiosa has been found in three sites with the thallus parasitized by Lichenostigma elongatum.
**Lobothallia recedens** (Taylor) A. Nordin, Savić & Tibell (2010)  
*Aspicilia recedens* (Taylor) Arnold (1896)

Thallus thick, coarsely warted to deeply cracked-areolate, areoles large, 2–2.5 mm diam., sharply angular, separated by deep cracks, rounded-wavy at the thallus edge, dark blue-grey or becoming brown, irregularly white-pruinose or minutely white-flecked (as with *Physcia* thalli). Apothecia very numerous, crowded and completely obscuring the areoles, 3–6 per areole, elevated, 0.3–1.0 mm diam., round, crowded, becoming irregular through compression, black when wet; thalline margin thin, persistent, with a white sheen, cracking radially when old; disc dark brown-black, matt, flat, becoming pseudogyrose when old; epithecium olive-green, N+ green, with a gelatinous layer of colourless cells above; paraphyses sparingly branched, moniliform, widening to ca 3 µm diam. at the tips. Ascospores (9–)12–14 × 7–9 µm. Conidia 3–5 × ca 1 µm. Thallus K–, Pd– (unidentified compound by TLC). BLS 0123.

On rocks by the seashore; rare. N.W. Scotland (Eigg, Skye), Wales (Brecon), England (Westmorland); recorded in the nineteenth century from Wales (Merioneth, Barmouth, Llyn Bodlyn) and C. Scotland (Perth, Aberfoyle; Roxburgh, Kelso), Ireland (Kerry).

The areoles are usually completely hidden by the abundant large irregular apothecia. The species differs from other *Lobothallia* spp. by the poorly developed radial structure of the thallus, but molecular data indicate that it belongs in that genus.

**MEGASPORA** (Clauzade & Cl. Roux) Hafellner & V. Wirth (1987)


The sessile, poriform apothecia with thick thalline margins, with the disc occupying one third or less of the apothecial width, are reminiscent of young *Ochrolechia* or *Pertusaria*. The sub-globose ascospores with uniformly thickened walls and thin, numerous anastomosing paraphyses also suggest a relationship with *Ochrolechia*. However, recent molecular studies have united the genus with *Aspicilia* in the family Megasporaceae.

**Literature:**

**Megaspora verrucosa** (Ach.) Hafellner & V. Wirth (1987)  
*NT*

Thallus continuous or dispersed in irregular patches, of compacted or loosely co-ordinated coarse confluent inter-connecting granules or tubercles, ± obscured by apothecia; granules white to grey-white, somewhat mottled, swollen, convex or unevenly flattened, the surface smooth, roughened or in part (especially near the apothecia) finely scabrid-areolate, tartareous or densely white-pruinose. Apothecia 0.5–1.5 mm diam., 1(-2) in coarse thalline warts; disc 0.2–0.4 (–0.7) mm diam., poriform or becoming expanded, grey-black or black, surface roughened but not pruinose, the disc colour extending outwards over the inner part of the thalline margin and
true exciple, forming a dark halo around the disc; thalline margin like the cortex, with small, dense granular crystals; photobiont zone without granules; the medulla and area below apothecia also densely granular, not dissolving in K; epithecium grey-black in part, K+ brownish, non-granular; hymenium 200–250 µm tall. Asci 200–230 × 45–50 µm. Ascospores (30–) 35–50 (–60) × (21–) 25–39 (–42) µm, wall 1.5–2.5 µm thick.

BLS 0971.

On soil or, more frequently, over mosses and plant remains on calcareous rocks (epidiorite, mica-schist, limestone) and soils, usually in mountains, very rarely on consolidated dunes rich in shell sand; widely distributed but very local. S. England (Somerset, Isle of Wight & Sussex), N. Wales, N. England (Pennines) to N. & W. Scotland.

Reported lichenicolous fungi are *Cercidospora verrucosaria* (Linds.) Arnold (1874) (not seen since 1861) and *Sclerococcum* (*Dactylospora*) *urceolatum* (Th. Fr.) Ertz & Diedering (2018).

**SAGEDIA** Ach. (1809)

**Thallus** crustose, weakly to distinctly cracked or areolate, sometimes zonate; mostly grey to pale brownish. **Prothallus** usually inconspicuous, grey to black, fibrous or fimbriate. **Sorallia** present in some species, conglutinated in discrete patches. **Photobiont** chlorococcoid. **Medulla** ±–. **Ascomata** apothecia, mostly immersed. **Thalline margin** thin and slightly raised. **True exciple** usually colourless and poorly developed, lateral to and below the hymenium, sometimes broadening above and concolorous with the epithecium. **Disc** ± flat, black-brown, rarely pruinose. **Epithecium** pigment green, N+ intensifying green, K± fading to brown (‘Aspicilia green’). **Hymenium** tall, colourless, I+ green or blue. **Hypothecium** with photobiont below, colourless or very pale brown. **Hamathecium** of paraphyses, unbranched or sparingly branched, frequently anastomosed, short-celled and moniliform above, the apices cohering to form a well-defined epithecium. **Asci** 8-spored, cylindrical to clavate, thin outer coat K/I+ blue, wall and apical dome K/I–. **Ascospores** aseptate, medium to large, ellipsoidal, colourless, thin-walled. **Conidiomata** pycnidia, immersed, elongate and flask-shaped to almost globose, single or in clusters; wall colourless, or at least in the upper part brown or green (pigment as in epithecium). **Conidiogenous cells** sessile or on short conidiophores, subcylindrical. **Conidia** aseptate, bacilliform to cylindrical and ± straight, colourless. **Chemistry**: lichen products not detected by TLC. **Ecology**: on siliceous rocks.

**Literature**: Fletcher *et al.* (2009), Nordin *et al.* (2010).

*Sagedia simoensis* (Räsänen) A. Nordin, Savić & Tibell (2010)

*A. simoensis* Räsänen (1925)

*A. grisea* Arnold (1891)

Thallus thin, rimose, becoming irregularly cracked-areolate, with a narrow zonate margin that may often be poorly delimited, medium to dark grey, medulla yellow-white; areoles flat to convex, discrete, often rounded, 0.3–0.5 mm diam., petering out at the thallus edge; prothallus black, distinct; areoles bearing either scattered circular dot-like flat abraded soralia, or patches of smooth yellowish-grey corticate branched isidia. The soralia develop a few yellow-white farinose and erose soredia 50–80 µm diam. which are much paler than the cortex, sometimes developing shiny black tips and resembling isidia, while in isidiate morphs the isidia may fragment to produce soredia and may eventually cover the areoles. Apothecia 0.3–0.6 mm diam.
infrrequent, sessile; true exciple well-developed; disc black, epithecium N+ green, with a thin colourless layer above the epithecium, paraphyses weakly branched, moniliform at the tips, widening to ca 3 µm diam. Ascii 8-spored. Ascospores ellipsoidal, 18–22 × 9–12 µm. Thallus K+ yellow→red or K+ orange, Pd+ orange (norstictic or stictic acid). **BLS 0112.**

On well-lit siliceous rocks, especially when somewhat nutrient-enriched; rare. N. and W. Britain, scattered throughout Ireland.

*Aspicilia grisea* and *Sagedia simoensis* have been much confused, and while the types are definitely conspecific, not all British and Irish material may belong here and some European populations also may belong elsewhere. Many records identified *A. grisea* (not included in the map) should probably be assigned to *Aspicilia cinerea* s.l. *A. grisea* has been understood to be sorediate and *S. simoensis* initially isidiate, but the distinction is not at all clear. The entity with small, delimitated soralia has been referred to historically as *Aspicilia insolata* (H. Magn.) Hav. (1944), but the status of this species in Britain is uncertain. This is the version most seen on gravestones and slate roofs in lowland areas in England and S.E. Scotland.

*Aspicilia grisea* has the older epithet, but that cannot be taken up within *Sagedia* due to existence of the name *S. grisea* (Schleich. ex Schaer.) Anzi 1860, attached to a quite unrelated species.

Reported lichenicolous fungi are *Endococcus perpusillus* Nyl. (1857), *E. verrucosus* Hafellner (1994) and an unidentified *Lichenostigma* sp.

**Sagedia zonata** Ach. (1809)


Thallus crustose, dark grey with a brownish tinge, unevenly areolate, smooth to verrucose, orbicular or effuse, sometimes forming concentric rings, very variable in form; prothallus fibrous, dark-grey to black. Areoles to 2.5 mm diam., sometimes surrounded by zones where the white, necrotic prothallus shines through, with a cortex 25–35 µm thick and cells 3–5 µm diam. Isidia and soredia absent. Apothecia to 1.2 mm diam., often numerous and strongly crowded, level with the thallus or somewhat raised, with a well-defined rim that is concolorous with the disc; true exciple to 50 µm thick, J+ pale to dark blue. Hymenium 85–95 µm thick, gelatinous, with paraphyses that are somewhat swollen (submoniliform) at the apex with the upper two or three cells rounded; epithecium dark green (Caesiocinerea-green or Aspicilia-green), N+ emerald green, K+ brownish. Ascospores (14.5–17–20.5 × (7–8.5–11.5 × 13.5) µm, colourless, aseptate. Conidia straight or rarely curved, 7–10 (12.5) × ca 1 µm. Thallus K−, Pd−; no secondary substances detected with TLC. **BLS 2625.**

On a siliceous boulder in an unshaded stream, Wales (Caernarvon). The only GBI material known is sterile, and identified using molecular methods.

**Nomenclature**

*Circinaria tuberculosa* (Ach.) Coppins, **comb. nov.**  
**IF901047**


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