



British  
Lichen  
Society

# Revisions of British and Irish Lichens

Volume 37

December 2023



**Perithecial genera I**

Cover image: *Pyrenula macrospora* (left) and *P. chlorospila* (right below), on bark of *Acer pseudoplatanus*, Logan Botanic Garden, near Stranraer, Wigtownshire.

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to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published.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

### Editorial Board

Dr P.F. Cannon (Department of Taxonomy & Biodiversity, Royal Botanic Gardens, Kew, Surrey TW9 3AB, UK).

Dr A. Aptroot (Laboratório de Botânica/Liquenologia, Instituto de Biociências, Universidade Federal de Mato Grosso do Sul, Avenida Costa e Silva s/n, Bairro Universitário, CEP 79070-900, Campo Grande, MS, Brazil)

Dr B.J. Coppins (Royal Botanic Garden, Inverleith Row, Edinburgh EH3 5LR, UK)

Dr A.M. Fryday (Department of Plant Biology, Michigan State University, 612 Wilson Rd., East Lansing, MI 48824, USA)

Mr N.A. Sanderson (3 Green Close, Woodlands, Southampton, Hampshire SO40 7HU, UK)

Dr J.A. Simkin (School of Natural and Environmental Science, Newcastle University, Newcastle upon Tyne NE1 7RU, UK)

Dr R. Yahr (Royal Botanic Garden, Inverleith Row, Edinburgh EH3 5LR, UK)

Downloads can be obtained from the British Lichen Society website at <https://www.britishlichensociety.org.uk/content/lgbi3>

Made available under Creative Commons Licence  CC BY-SA

ISSN 2634-7768

© British Lichen Society, 20 December 2023

# *Revisions of British and Irish Lichens* vol. 37

## Perithecial genera I

including *Acrocordia*, *Alloarthopyrenia*, *Anisomeridium*, *Antennulariella*, *Arthopyrenia*, *Celothelium*, *Cyrtidula*, *Dichoporis*, *Eopyrenula*, *Julella*, *Leptorhaphis*, *Leptosillia*, *Lithothelium*, *Mycomicrothelia*, *Mycoporum*, *Naetrocymbe*, *Pyrenula*, *Rhaphidicyrtis*, *Sarcopyrenia*, *Swinscowia* and *Tomasellia*.

by

Paul Cannon

Royal Botanic Gardens, Kew, Surrey TW9 3AB, UK; email p.cannon@kew.org

Brian Coppins

Royal Botanic Garden Edinburgh, 20A Inverleith Row, Edinburgh EH3 5LR, UK

André Aptroot

Laboratório de Botânica/Liquenologia, Instituto de Biociências, Universidade Federal de Mato Grosso do Sul, Avenida Costa e Silva s/n, Bairro Universitário, CEP 79070-900, Campo Grande, MS, Brazil

Neil Sanderson

3 Green Close, Woodlands, Southampton, Hampshire, SO40 7HU, UK

Janet Simkin

School of Natural and Environmental Science, Newcastle University, Newcastle upon Tyne NE1 7RU, UK

### **This publication can be cited as:**

Cannon, P., Coppins, B., Aptroot, A., Sanderson, A. & Simkin, J. (2023). Perithecial genera I, including *Acrocordia*, *Alloarthopyrenia*, *Anisomeridium*, *Antennulariella*, *Arthopyrenia*, *Celothelium*, *Cyrtidula*, *Dichoporis*, *Eopyrenula*, *Julella*, *Leptorhaphis*, *Leptosillia*, *Lithothelium*, *Mycomicrothelia*, *Mycoporum*, *Naetrocymbe*, *Pyrenula*, *Rhaphidicyrtis*, *Sarcopyrenia*, *Swinscowia* and *Tomasellia*. *Revisions of British and Irish Lichens* 37: 1-59.

## Introduction

This volume of *Revisions of British and Irish Lichens* brings together a number of genera of predominantly corticolous perithecial lichens (mostly with fissitunicate asci) associated with green algae and with exciple and/or involucrellum that are at least partially melanized. Additionally, a few dubiously lichenized taxa are included that are traditionally studied by lichenologists. Molecular data are sparse for most of these groups, and not all may be monophyletic.

The families included are:

- Antennulariaceae (*Antennulariella*)
- Celotheliaceae (*Celothelium*)
- Leptosilliaceae (*Leptosillia*, syn. *Cresporhaphis*)
- Monoblastiaceae (*Acrocordia*, *Anisomeridium*)
- Mycoporaceae (*Mycoporum*)
- Naetrocymbaceae (*Leptorhaphis*, *Naetrocymbe*, *Tomasellia*)
- Pyrenulaceae (*Lithothelium*, *Pyrenula*)
- Sarcopyreniaceae (*Sarcopyrenia*)
- Strigulaceae (*Dichoporis*, *Swinscowia*; syn. *Strigula* p.p.)
- Trypetheliaceae (*Alloarthopyrenia*, *Arthopyrenia*, *Julella*, *Mycomicrothelia*)
- Genera of uncertain position (*Cyrtidula*, *Eopyrenula*, *Rhaphidicyrtis*)

Perithecial species that are not treated here include those of the Porinaceae (with orange to purplish exciple/involucrellum; see Orange *et al.* 2021) and Verrucariaceae (almost all on rock; Orange *et al.* 2023); species with cyanobacteria (not yet treated); genera with multispored asci (e.g. *Epigloea*, *Thelocarpon* and *Thelopsis*, not yet treated); species of Ostropales with poroid apothecia (e.g. *Gyalecta*, *Protothelenella*, *Ramonia*, *Thelenella*, *Thelotrema*), and a few further genera of uncertain affinity such as *Epigloea* and *Mycoglaena*.

A key to the species treated follows, and also a key for species with prominent macropycnidia that are sometimes present without the ascomata.

- |      |   |  |
|------|---|--|
| 1    | Ascomata forming as locules within a common stroma ..... 2  |  |
|      | Ascomata not stromatic, each covered by an individual involucrellum (rarely in clusters with the involucrella fused)..... 6 |  |
| 2(1) | Asci ± cylindrical with relatively even wall thickenings and a short, broad stipe ..... 3                                   |  |
|      | Asci obpyriform to obclavate with the wall in the upper third very much thickened and with virtually no stipe..... 4        |  |
| 3(2) | Stromata with 4–12 locules; ascospores mostly 1-septate, dark brown..... <i>Tomasellia diffusa</i>                          |  |
|      | Stromata with 10–55 locules; ascospores soon 3-septate, colourless to pale brown ..... <i>Tomasellia gelatinosa</i>         |  |
| 4(2) | Stromata 1- to 6-locular; ascospores submuriform to muriform ..... <i>Cyrtidula quercus</i>                                 |  |
|      | Stromata (1-) 2- to 15-locular; ascospores 1-septate ..... 5  |  |
| 5(4) | Ascospores clavate, 16–19 × 6–7 µm..... <i>Mycoporum sparsellum</i>   |  |
|      | Ascospores fusiform, 18–26 × 5–7 (–8) µm..... <i>Mycoporum lacteum</i>  |  |

6(1)	Ascospores brown at maturity, sometimes distinctly ornamented.....	7
	Ascospores colourless at maturity (sometimes brownish when overmature and degenerate), smooth-walled but sometimes with a gelatinous perispore .....	25
7(6)	Ascospores 1-septate.....	8
	Ascospores 3- or more septate .....	11
8(7)	Ascospores large (27–40 × 8–13 μm), becoming brown at a late stage .....	<i>Mycoporum antecellens</i>
	Ascospores smaller (rarely more than 20 μm in length), brown at a fairly early stage .....	9
9(8)	Basal fringe around the perithecia inconspicuous, <0.12 mm wide, ± circular .....	10
	Basal fringe around the perithecia conspicuous, 0.12–0.30 mm wide, elliptical to broadly fusiform .....	<i>Mycomicrothelia wallrothii</i>
10(9)	Ascospores (12.5–) 13.5–16 (–17.5) × (5.5–) 6.5–8 (–9) μm; pycnidia present .....	<i>Mycomicrothelia atlantica</i>
	Ascospores (15.5–) 17.5–21 (–25) μm in length; pycnidia absent .....	<i>Mycomicrothelia confusa</i>
11(7)	Ascospores distoseptate, with thick walls and angular to lenticular lumina.....	12
	Ascospores euseptate, not strongly thick-walled.....	22
12(11)	Mature ascospores olivaceous, with relatively small angular lumina; asci without a distinct ocular chamber; lichenized with <i>Trentepohlia</i> .....	13
	Mature ascospores reddish brown, with large rounded lumina; asci with a conspicuous ocular chamber; British species apparently not lichenized.....	<i>Lithothelium phaeosporum</i>
13(12)	Ascospores muriform; perithecia, often in radially arranged groups, large, with lateral ostioles .....	<i>Pyrenula hibernica</i>
	Ascospores (1-) 3-septate; perithecia scattered, not in radially arranged groups.....	14
14(13)	Involucrellum much extended laterally; exciple not continuously pigmented below the perithecial cavity; ascospores 10–17 μm long; photobiont apparently absent .....	<i>Pyrenula coryli</i>
	Involucrellum not or slightly extended laterally, exciple pigmented throughout; ascospores often >17 μm long; photobiont present .....	15
15(14)	Thallus superficial, UV+ yellow-orange (lichexanthone); perithecia usually immersed in the thallus with only the ostiole visible, sometimes exposed as black discs to 0.4 mm diam. .....	<i>Pyrenula dermatodes</i>
	Thallus immersed, UV– or UV+ pale yellow or whitish (unidentified substances, lichexanthone absent); perithecia conspicuous, appearing black even when covered by a thin layer of bark .....	16
16(15)	Perithecia 0.2–0.4 mm diam., forming low projections in the thallus .....	17
	Perithecia 0.4–1.2 mm diam., forming distinct projections in the thallus .....	18
17(16)	Hymenium at sides with masses of an orange-brown pigment, K+ purple-red in solution .....	<i>Pyrenula nitidella</i>
	Hymenium K– .....	<i>Pyrenula chlorospila</i>
18(16)	Ostiole central .....	19
	Ostiole lateral; thallus without pseudocyphellae, all parts of perithecium lacking K+ purple-red substances .....	<i>Pyrenula acutispora</i>
19(18)	Perithecium with K+ purple-red substances on the upper surface or within the hymenium; hymenium densely interspersed with oil droplets or not .....	20
	Perithecium lacking K+ purple-red substances; hymenium not interspersed with oil droplets .....	21

- 20(19) Hymenium with lateral parts containing an abundant orange-brown pigment which is K+ purple-red going into solution; not interspersed with oil droplets; thallus sometimes with pseudocyphellae ..... *Pyrenula nitida*  
 Hymenium without K+ purple-red substances, but these present on outer surface of perithecial apex (sometimes sparse); interspersed with oil droplets; pseudocyphellae absent ..... *Pyrenula occidentalis*
- 21(19) Pseudocyphellae present; ascospores (24-) 27-33 (-36)  $\mu\text{m}$  long; perithecia not or scarcely flattened in section ..... *Pyrenula macrospora*  
 Pseudocyphellae absent; ascospores (14-) 17-22 (-26)  $\mu\text{m}$  long; perithecia often flattened in section ..... *Pyrenula laevigata*
- 22(11) Involucrellum clasping sides of centrum; spores 3- or more septate; macroconidia with one pale septum or (5-)7 dark septa ..... 23  
 Involucrellum outwardly spreading; spores 3-septate; macroconidia with three pale septa and rounded locules ..... 24
- 23(22) Ascospores mostly 18-26  $\times$  6.5-10  $\mu\text{m}$  and 3- to 5-septate; macroconidia with one pale septum; microconidia 6.5-9.5  $\mu\text{m}$  long ..... *Eopyrenula leucoplaca*  
 Ascospores mostly 21-34  $\times$  9-10  $\mu\text{m}$  and 5- to 7-septate; macroconidia with (5-)7 dark septa; microconidia 10-16.5  $\mu\text{m}$  long ..... *Eopyrenula septemseptata*
- 24(22) Ascospores 10.5-16  $\mu\text{m}$  long, macroconidia 9.5-13  $\mu\text{m}$  long ..... *Eopyrenula avellanae*  
 Ascospores (12-) 14-19 (-22)  $\mu\text{m}$  long, macroconidia (13-) 14-19 (-21)  $\mu\text{m}$  long ..... *Eopyrenula grandicula*
- 25(6) Ascospores submuriform to muriform ..... 26  
 Ascospores with transverse septa ..... 31
- 26(25) Photobiont trentepohlioid; forming a distinct thallus; interascal filaments not or sparsely branched except adjacent to the exciple ..... 27  
 Not lichenized, or at most with an indistinct thallus weakly lichenized with a trentepohlioid alga; interascal filaments branched and anastomosing (exclusively on bark) ..... 28
- 27(26) Ascospores (35-) 40-58 (-62)  $\mu\text{m}$  long; ostiole central; on rock ..... *Swinscowia confusa*  
 Ascospores (22-) 24.5-31.5  $\mu\text{m}$  long; ostiole usually lateral; on bark ..... *Swinscowia tagananae*
- 28(26) Asci cylindrical-clavate; interascal tissue composed of narrow, remotely septate, frequently branched and anastomosing pseudoparaphyses; ascospores with a perispore ..... *Julella sericea*  
 Asci subglobose to saccate; interascal tissue composed of irregular branched short-celled bead-like pseudoparaphyses, often evanescent at maturity; ascospores without a perispore ..... 29
- 29(28) Ascomata circular in outline, unilocular but sometimes densely clustered and merging at the base ..... 30  
 Ascomata irregular, sometimes in clusters under a common involucrellum; ascospores 12-25  $\times$  4.5-9  $\mu\text{m}$ ; mainly on *Corylus* and *Quercus* ..... *Cyrtidula quercus*
- 30(29) Ascomata densely clustered; ascospores 11-17  $\times$  4-6.5  $\mu\text{m}$ , with 3(-4) transverse and 0-2 longitudinal septa; on a wide range of woody plants ..... *Cyrtidula hippocastani*  
 Ascomata scattered, solitary; ascospores 15-21  $\times$  7-8  $\mu\text{m}$ , with 3-4 (-6) transverse and 1 longitudinal septum (usually in the apical cell); on *Betula* ..... *Cyrtidula major*
- 31(25) Ascospores  $\pm$  filiform or narrowly falcate, the apices  $\pm$  pointed ..... 32  
 Ascospores clavate to ellipsoidal, cylindrical or fusiform, the ends  $\pm$  obtuse to rounded ..... 40
- 32(31) Ascospores >70  $\mu\text{m}$  long, filiform, multiseptate and often helically coiled within the ascus ..... 33  
 Ascospores < 50  $\mu\text{m}$  long, curved, falcate, lunate or sigmoid, usually 1- or 3-septate ..... 34

- 33(32) Hymenial gel K-; ascomata sometimes forming under a common involucrellum; conidiomata often present ..... *Celothelium ischnobelum*  
 Hymenial gel K+ dark blue; ascomata always single; conidiomata not known  
 ..... *Rhaphidicyrtis trichosporella*
- 34(33) Asci thin-walled, not fissitunicate (the apical part sometimes slightly thickened); hamathecium of rarely branched paraphyses; involucrellum not present ..... 35  
 Asci thick-walled and fissitunicate; hamathecium of branched and anastomosed pseudoparaphyses; involucrellum usually well-developed ..... 36
- 35(34) Ascospores aseptate, mostly 25–30 µm long; asci frequently sigmoidally curved  
 ..... *Leptosillia wienkampii*  
 Ascospores 1- to 3-septate, 30–55 µm long; asci sometimes curved but not sigmoid  
 ..... *Leptosillia slaptonensis*
- 36(34) Ascomata circular, sometimes confluent, less than 300 µm diam.; if surrounded by a dark basal fringe, this is less than 50 µm broad ..... 37  
 Ascomata elliptical in outline, 300–525 µm in length, surrounded by a distinct dark basal fringe 50–75 µm broad, remaining as a distinct scar once the ascomata fall; hymenial gel not blue in iodine; always on *Betula* ..... *Leptorhaphis epidermidis*
- 37(36) Ascomata always arising singly; ascospores 1- to 3-septate, always > 25 µm long ..... 38  
 Ascomata in clusters, sometimes ± confluent, 140–200 µm; hymenial gel bluish in iodine; ascospores 1-septate, 15–20 (–25) × 1.5–2 µm; on *Ilex* ..... *Leptorhaphis confertior*
- 38(37) Hymenial gel bluish in iodine ..... 39  
 Hymenial gel not bluish in iodine, at most amber; ascomata circular to slightly elliptical in outline, 135–300 µm in size; involucrellum of hyphal to epidermal tissue; ascospores 1- to 3- septate, (30–) 35 – 45 (–50) × 1.5 – 2.5 µm; on *Corylus* and *Castanea* ..... *Leptorhaphis maggiana*
- 39(38) Thallus whitish grey; ascomata sessile, 100–250 µm diam.; involucrellum mostly non-clypeate, of globose cells, becoming hyphal only at the base; ascospores 1- to 3-septate, 25–32 × 2–3.5 µm, with rounded apices; on *Populus* ..... *Leptorhaphis atomaria*  
 Thallus inconspicuous; ascomata semi-immersed, 100–150 (–200) µm; involucrellum clypeate, of epidermoid to hyphal tissue; ascospores 1-septate, 30–40 × 1.5–2.5 µm, with pointed apices; on conifer bark, mostly *Larix* and *Cedrus* ..... *Leptorhaphis laricis*
- 40(31) Ascospores mostly 7-septate ..... *Swinscowia stigmatella*  
 Ascospores 1- or 3-septate ..... 41
- 41(40) Ascomata sessile, covered with stiff black hairs ..... *Antennulariella lichenisata*  
 Ascomata at least partially immersed and usually clypeate, not hairy ..... 42
- 42(41) Thallus usually with prominent pycnidia (sometimes lacking ascomata) ..... 43  
 Thallus either with ascomata only, or with both morphs but with inconspicuous pycnidia ..... 53
- 43(42) Macroconidia formed ± laterally or subterminally on the conidiogenous cell, with gelatinous appendages ..... 44  
 Macropycnidia formed terminally, without gelatinous appendages ..... 49
- 44(43) Ascospores (3-)7(-9)-septate ..... *Swinscowia stigmatella*  
 Ascospores 1- or 3-septate ..... 45
- 45(44) Ascospores 1-septate, sometimes separating into part-spores ..... 46  
 Ascospores 3-septate ..... 47

- 46(45) Ascospores (16–) 19–24 (–27)  $\mu\text{m}$  long, separating into part-spores at ascus dehiscence or before; macroconidia 12.5–20  $\mu\text{m}$  long ..... *Dichoporis taylorii*  
Ascospores 6.5–14.5  $\mu\text{m}$  long, not separating into part-spores; macroconidia 6–10  $\mu\text{m}$  long [see also text for information on an undescribed species] ..... *Dichoporis phaea*
- 47(45) Involucrellum absent, ascomatal wall orange to pale brown; ostiolar region elongated into a neck (section); ascospores (9.5–) 10.5–13 (–14.5)  $\mu\text{m}$  long, without perispore ..... *Swinscowia thelopidoides*  
Involucrellum present, ascomatal wall dark brown; ostiolar region not elongated ..... 48
- 48(47) Ascomata 0.1–0.2 mm diam.; ascospores 13.5–16 (–17.5)  $\mu\text{m}$  long ..... *Swinscowia jamesii*  
Ascomata 0.2–0.3 mm diam.; ascospores (17.5–) 19–21  $\mu\text{m}$  long ..... *Swinscowia muscicola*
- 49(43) Ascospores 1-septate, with the lower cell much longer than the upper cell, and with a slight median constriction when mature..... *Anisomeridium ranunculosporum*  
Ascospores 1- or 3-septate, with the upper cell equal in length or longer than the part below the primary septum ..... 50
- 50(49) Ascospores 40–55  $\times$  10–12  $\mu\text{m}$  [not known in GBI material] ..... *Anisomeridium macropycnidiatum*  
Ascospores <25  $\mu\text{m}$  long..... 51
- 51(50) Ascospores with cells  $\pm$  equal in length; macroconidia 9–10.5  $\mu\text{m}$  long, cylindrical, 2- to 3-guttulate ..... *Anisomeridium viridescens*  
Ascospores usually with the upper cell longer than the part below the primary septum; macroconidia < 5  $\mu\text{m}$  long, ellipsoidal or ovoid..... 52
- 52(51) Ascomata 300–400 (–500)  $\mu\text{m}$  diam.; ascospores 1-septate; conidiomata  $\pm$  globose to hemispherical ..... *Anisomeridium bifforme*  
Ascomata 150–250  $\mu\text{m}$  diam.; ascospores 1- to 3-septate; conidiomata conical *Anisomeridium polyperi*
- 53(42) Asci cylindrical, the ascospores uniseriately arranged, with a warted perispore visible in water mounts..... 54  
Asci broadly cylindrical, the ascospores arranged biseriately ..... 59
- 54(53) On rocks, rarely on soil ..... 55  
On bark, rarely on wood..... 58
- 55(54) Involucrellum spreading laterally away from the exciple; never continuous below ..... 56  
Involucrellum incurved under the exciple, often  $\pm$  continuous below ..... 57
- 56(55) Ascospores 12–19  $\times$  6–9  $\mu\text{m}$ ; perithecia with the ostiole often projecting as a papilla; thallus usually immersed ..... *Acrocordia conoidea*  
Ascospores 19–26 (–28)  $\times$  9.5–12  $\mu\text{m}$ ; perithecia without a distinctly papilla-like ostiole; thallus superficial ..... *Acrocordia macrospora*
- 57(55) Perithecia 0.7–1.5 mm diam.; ascospores 20–35  $\times$  10–15  $\mu\text{m}$  ..... *Acrocordia salweyi*  
Perithecia 0.4–0.7 mm diam.; ascospores 13–14  $\times$  5–7  $\mu\text{m}$  ..... *Acrocordia subglobosa*
- 58(54) Perithecia 0.5–1 mm diam.; ascospores 15–27 (–30)  $\times$  8–12  $\mu\text{m}$  ..... *Acrocordia gemmata*  
Perithecia 0.3–0.6 mm diam.; ascospores 11–16.5  $\times$  5.5–9.5  $\mu\text{m}$  ..... *Acrocordia cavata*
- 59(53) Asci  $\pm$  cylindrical (sometimes broad in relation to their length); interascal tissue composed of robust thick-walled pseudoparaphyses with  $\pm$  remote septa ..... 60  
Asci ovoid to obpyriform, rarely clavate; interascal tissue absent or composed of thin-walled short-celled paraphyses that tend to deliquesce at maturity..... 62

- 60(59) Ascospores 3-septate.....*Arthopyrenia cerasi*  
Ascospores 1-septate (rarely 3-septate in old degenerating spores) ..... 61
- 61(60) Ascomata 120-180  $\mu\text{m}$  diam., with a broad involucrellar fringe; ascospores often with a distinct median constriction in each cell; vegetative mycelium often slightly bleaching the bark surface .....*Alloarthopyrenia italica*  
Ascomata (300-) 350-500  $\mu\text{m}$  diam., with a narrow fringe; ascospore cells without a median constriction, or only in the lower cell; vegetative mycelium inconspicuous, not discoloring the bark .....*Arthopyrenia analepta*
- 62(59) Pseudoparaphyses absent, but periphysoids arising from upper wall of ascoma (a section is needed); asci very broadly obpyriform..... "*Arthopyrenia*" *salicis*  
Pseudoparaphyses present, thin-walled and slender to moniliform, sometimes evanescent; asci obpyriform to clavate ..... 63
- 63(62) On limestone; ascospores  $18.5\text{--}22.5 \times 6\text{--}7.5 \mu\text{m}$ .....*Naetrocymbe saxicola*  
On bark ..... 64
- 64(63) Ascospores 3- to 4- (to 7-) septate..... 65  
Ascospores all (or almost all) 1-septate..... 66
- 65(64) Asci obpyriform, very thick-walled; ascospores  $21\text{--}25.5 \times 7\text{--}9 \mu\text{m}$ , 3-septate ..... "*Arthopyrenia*" *subcerasi*  
Asci clavate; ascospores  $26\text{--}30 \times 8\text{--}12 \mu\text{m}$ , mostly 3- to 4-septate ..... "*Arthopyrenia*" *platypyrenia*
- 66(64) Ascomata  $250\text{--}500 \times 200\text{--}400 \mu\text{m}$  diam., asci (50-) 60-100  $\mu\text{m}$  long, narrowly obpyriform .....*Naetrocymbe fraxini*  
Ascomata 100-230  $\mu\text{m}$  diam., asci 30-70  $\mu\text{m}$  long, ovoid to obpyriform ..... 67
- 67(66) Not lichenized (*Trentepohlia* absent); ascospores  $16\text{--}20$  (-22)  $\times 4.5\text{--}5 \mu\text{m}$ , usually with a distinct gelatinous sheath *ca* 1  $\mu\text{m}$  thick .....*Naetrocymbe punctiformis*  
Lichenized (*Trentepohlia* present); ascospores without a gelatinous sheath ..... 68
- 68(67) Ascospores 4.5-5 (-6)  $\mu\text{m}$  broad; thallus whitish to pale buff.....*Naetrocymbe nitescens*  
Ascospores 3-4.5  $\mu\text{m}$  broad; thallus pale fawn to darkish brown ..... 69
- 69(68) Ascospores (14-) 15-19 (-21)  $\times 3\text{--}4.5 \mu\text{m}$ , asci 31-45  $\mu\text{m}$  long; usually on smooth bark .....*Naetrocymbe carneobrunneola*  
Ascospores 17-21 (-26)  $\times 3\text{--}4 \mu\text{m}$ , asci 55-70  $\mu\text{m}$  long; usually on rough bark .....*Naetrocymbe atractospora*

### Key to genera with macropycnidia

- 1 Macroconidia pigmented..... 2  
Macroconidia colourless ..... 5
- 2(1) Macroconidia with one pale septum or (5-)7 dark septa ..... 3  
Macroconidia with three pale septa and rounded locules ..... 4
- 3(2) Macroconidia with one pale septum; microconidia 6.5-9.5  $\mu\text{m}$  long ..... *Eopyrenula leucoplaca*  
Macroconidia with (5-)7 dark septa; microconidia 10-16.5  $\mu\text{m}$  long ..... *Eopyrenula septemseptata*

- 4(2) Macroconidia 9.5–13 µm long; microconidia 2.8–4 × ca 0.7 µm, bacilliform ..... *Eopyrenula avellanae*  
 Macroconidia (13–) 14–19 (–21) µm long; microconidia not known ..... *Eopyrenula grandicula*
- 5(1) Macroconidia with gelatinous appendages..... 6  
 Macroconidia without gelatinous appendages..... 10
- 6(5) Macroconidia 5- to 11-septate, at least 20 µm long ..... 7  
 Macroconidia 1- to 3-septate, up to 20 µm long..... 8
- 7(6) Macroconidia 5- to 7-septate, 20–30 µm long..... *Swinscowia stigmatella*  
 Macroconidia (7- to) 11-septate, 36–44 µm long ..... *Swinscowia tagananae*
- 8(6) Macroconidia 3-septate; microconidia bacillar ..... *Swinscowia jamesii*  
 Macroconidia (0-)1-septate; microconidia ± fusiform ..... 9
- 9(8) Macroconidia 6–10 µm long ..... *Dichoporis phaea*  
 Macroconidia 12.5–20 µm long ..... *Dichoporis taylorii*
- 10(5) Pycnidia conical, with a globose base tapering into a short or long ostiolar neck ..... 11  
 Pycnidia globose, without an extended neck..... 13
- 11(10) Macropycnidia to 1 mm high, the conidia extruded as a white blob; microconidia ± globose,  
 2.5–3 µm diam. .... *Anisomeridium macropycnidiatum*  
 Macropycnidia to 0.5 (–0.75) mm high, the conidia extruded as a white tendril 10–20 µm diam..... 12
- 12(11) Macropycnidia 80–150 µm diam., containing conidia 3.5–4.5 µm long; microconidia  
 2–3 × 1–1.3 µm, rod-shaped to narrowly ellipsoidal ..... *Anisomeridium polypori*  
 Macropycnidia 200–580 µm diam., containing conidia 5.5–6.5 µm long; microconidia  
 not known ..... *Anisomeridium robustum*
- 13(10) Macropycnidia 40–50 µm diam.; macroconidia 9–10.5 × 2–2.5 µm, cylindrical;  
 microconidia 4–5 × 1–1.3 µm, ovoid-cylindrical to bacilliform ..... *Anisomeridium viridescens*  
 Macropycnidia 100–200 µm diam.; macroconidia 2.3–4 × 1.8–2.7 µm, subglobose to  
 ellipsoidal; microconidia globose, 1–1.5 µm diam..... *Anisomeridium biforme*

## ANTENNULARIELLACEAE Woron. (1925)

**Superficial mycelium** usually conspicuous, irregular, dark, smooth or rough-walled, adpressed or erect. **Ascomata** small, perithecial, ± globose, stalked or sessile, opening by a small poorly defined lysigenous pore, sometimes with hyphal appendages. **Hamathecium** absent or of inconspicuous apical periphysoids. **Asci** small, ovoid, fissitunicate, not blueing in iodine, 8-spored. **Ascospores** hyaline to brown, usually 1-septate, sheath lacking. **Anamorphs** coelomycetous and hyphomycetous, if the latter then conidia elongate, multiseptate. **Chemistry**: no information available. **Ecology**: most species are sooty moulds on leaves, presumably gaining nutrition from plant exudates; very rarely lichenized.

The family includes the genera *Achaetobotrys*, *Antennulariella*, *Capnofrasera* and *Eumela*.

### Literature:

Chomnunti *et al.* (2014), Hyde *et al.* (2013), Hughes (1976), Wijayawardene *et al.* (2018).

## ANTENNULARIELLA Woron. (1925)

**Thallus** crustose, very thin, without a well-defined margin; prothallus absent. **Photobiont** *Trentepohlia*-like, with pale brown, perpendicular filaments or absent (in the type species). **Ascomata** perithecia, black, ornamented with hairs. **Hamathecium** absent or consisting of loose cells. **Asci** pyriform, bitunicate, K/I– and I–. **Ascospores** clavate, 1-septate, colourless. **Conidiomata** unknown. **Chemistry**: no lichen substances detected by TLC. **Ecology**: on bark.

The description of the genus refers only to the single lichenized species; a description of the non-lichenized members can be found in Hyde *et al.* (2013).

### Literature:

Coppins & Aptroot (2008, 2009), Hyde *et al.* (2013).

### *Antennulariella lichenisata* (Nyl.) Coppins & Aptroot (2008)

Thallus very thin, inconspicuous, forming a pale pinkish area on bark; photobiont *Trentepohlia*-like, with pale brown perpendicular filaments 7–14 µm diam. with rounded apical cells. Perithecia sessile, globose, black, non-ostiolate with a paler irregular opening, 50–75 µm diam.; surface with black hairs to 40 µm long, built of somewhat wavy cells 5–10 × ca 2 µm in size; ostiole brown; hamathecium absent, but some loose cells present between asci. Asci fissitunicate, 8-spored, pyriform, 25–36 × 10–13.5 µm, very thick-walled especially in the upper half. Ascospores colourless, 1-septate, clavate, the upper cell shorter and broader than the lower cell, 13–16 × 2.5–3.5 µm, not ornamented, ends rather pointed. Pycnidia not seen. Lichen products not detected. **BLS 2500**.

On mostly rough-barked *Alnus*, *Betula*, *Corylus* and *Quercus*, probably widespread in W. Britain, S. England, and the north of Ireland.

The minute globose, hairy perithecia are sessile on the bark or even elevated on hyphal mycelium and intermixed with upright, thick *Trentepohlia* filaments. It gives the overall impression of a fungus, but it is consistently associated with algae, and the delimitation of the area with ascomata coincides with the delimitation of the pinkish colour indicating the thallus. It is so far known only from Britain and Ireland, but it may be overlooked elsewhere, as this kind of fungal material is generally neither collected by mycologists nor by lichenologists.



## CELOTHELIACEAE Lücking, Aptroot & Sipman (2008)

The family is monotypic, so the description of the genus *Celothelium* (below) constitutes that of the family. The phylogenetic position of *Celothelium* has been uncertain, with links postulated with various unrelated families and genera. Following studies by Del Prado *et al.* (2006) and Gueidan *et al.* (2014), Chen *et al.* (2015) suggested placement within the order Phaeomoniellales, close to the Chaethyriales and Pyrenulales.

Based on ITS sequences discussed by Vondrák *et al.* (2023), *Leptorhaphis* (here placed in Naetrocymbaceae) and *Rhaphidicyrtis* (not assigned to a family) were linked to the Phaeomoniellales, but further data are required before the family structure can be updated.

## CELOTHELIUM A. Massal. (1860)

**Thallus** crustose, immersed in bark; prothallus sometimes present. **Photobiont** *Trentepohlia*-like, the filaments of which are mixed with the bark cells below the surface of the substratum. **Ascomata** perithecia, circular to elongated in surface view, black, immersed to superficial, dimidiate and flattened, arising singly or in groups, covered by a common carbonized involucrellum with a separate ostiole for each ascoma, clypeate. **Exciple** pale to dark brown and intergrading with the involucrellum, but colourless and almost inconspicuous below the asci. **Hamathecium** a branched and anastomosing net of paraphysoids; periphyses absent; hymenial gel not turning deep blue in iodine. **Asci** 8-spored, arising from the base or angles of the ascomata, narrowly elongate-cylindrical, fissitunicate, sometimes with a small internal apical beak, generally capped by a meniscus visible in Congo Red and Cotton Blue. **Ascospores** entwined or helically coiled, very long and filiform, colourless, multiseptate, the apices pointed. **Conidiomata** pycnidial or stromatic, immersed to superficial, dark brown to black. **Conidiogenous** cells  $\pm$  elongate-bottle-shaped, lining the conidiomatal cavity. **Conidia** thread-like, colourless, multiseptate. **Chemistry**: an unidentified yellow pigment has been detected on the exciple of *C. lutescens* (Berger & Aptroot 1998) when adding K. **Ecology**: corticolous, subcuticular.

This genus has been confused with both *Tomasellia* and *Leptorhaphis* (Naetrocymbaceae), both of which have cellular pseudoparaphyses, not paraphysoids, in the hamathecium. The very long, thread-like ascospores and conidia and the often grouped ascomata, set *Celothelium* apart from *Leptorhaphis*. The genus can also be confused with *Rhaphidicyrtis* because both have paraphysoids and long, thin ascospores; however, the K/I reaction of the centrum is deep blue in *Rhaphidicyrtis*.

### Literature:

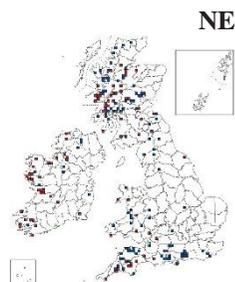
Aguirre-Hudson (1991, 2009c), Berger & Aptroot (1998), Chen *et al.* (2015), Del Prado *et al.* (2006), Gueidan *et al.* (2014), Harris (1995).

### *Celothelium ischnobelum* (Nyl.) M.B. Aguirre (1991)

Thallus pale green, creamy when dry, smooth, sometimes delimited by a dark brown prothallus. Ascomata 0.45–1 mm diam., flattened, in groups; involucrellum pitted with ostiolar openings. Asci 80–110  $\times$  6–10  $\mu$ m, arising from the sides of the exciple, arranged horizontally. Ascospores 80–110  $\times$  1.5–2.5  $\mu$ m, at least 8-septate, with refringent particles within the cells that give the appearance of further septa. Conidiomata 0.4–0.6 mm long, circular to elongated; conidiogenous cells 7–10  $\times$  1.5–2  $\mu$ m; conidia 60–100  $\times$  1.5–2  $\mu$ m. **BLS 1566**.

On smooth bark, especially *Corylus*, but also known on *Betula*, *Fraxinus*, *Ilex*, *Quercus* and *Sorbus*, in humid situations. Throughout most of Britain and Ireland, but most common in the west.

Sometimes occurring with only its irregular, comma-shaped pycnidia. There has been some uncertainty as to whether this species is lichenized, but there is a thin layer of *Trentepohlia* associated with the mycobiont below the bark surface.



## LEPTOSILLIACEAE Voglmayr & Jaklitsch (2019)

The family is monotypic, so the description of the genus *Leptosillia* (below) constitutes that of the family. The Leptosilliaceae is remotely related to the other families in this volume, and phylogenetic studies align it with the Xylariales rather than the Dothideomycetidae (Voglmayr *et al.* 2019). It also

includes various unnamed endophytic isolates (none of them from Britain and Ireland), and the generic arrangement could need modifying in the future. A sister family (in phylogenetic terms) is the poorly known Delonicicolaceae, which contains two genera including one (*Furfurella*) from leguminous shrubs in southern Europe.

### LEPTOSILLIA Höhn. (1928)

**Thallus** absent (not lichenized) or immersed, greyish white, smooth to pulverulent, continuous, not well-delimited. **Photobiont** (when present) chlorococcoid or trentepohlioid. **Ascomata** perithecia, superficial to partly immersed in bark, scattered, gregarious or confluent, conical to flask-shaped, black, sometimes laterally collapsed when dry, with an apical periphysate ostiolar papilla that is sometimes sulcate. **Hymenium** K<sup>-</sup> or K<sup>+</sup> weakly blue. **Hamathecium** composed of colourless septate, occasionally branched paraphyses embedded in a gelatinous matrix. **Asci** arising from the base of the ascomata, sequentially produced; clavate to cylindrical, curved to sinuous, thin-walled, not blueing in iodine and without distinct apical structures, 8-spored. **Ascospores** bi-, triseriately or fasciculately arranged, mostly falcate, lunate, sinuous, sigmoid to hook-shaped, aseptate or septate, not constricted at the septa, colourless, thin-walled, smooth, with rounded to subacute apices, without appendages or perispore. **Conidiomata** pycnidia, superficial to partly immersed in bark, globose to pyriform, dark brown to black, uni- or irregularly plurilocular. **Conidiophores** short, arising from the inner layer of the peridium. **Conidiogenous cells** cylindrical to lageniform, percurrently or sympodially proliferating (sometimes within the same conidioma). **Conidia** allantoid, falcate or filiform, aseptate, hyaline, thin-walled. **Chemistry**: not known. **Ecology**: on bark of broadleaved or coniferous trees.

*Leptosillia* was shown to be an earlier name for the genus *Cresporhaphis* (Voglmayr *et al.* 2019). It constitutes a small group of seven saprotrophic or facultatively lichenized species that are superficially similar to *Leptorhaphis* (Naetrocymbaceae), but have thin-walled, non-fissitunicate asci. Two are known from Great Britain and Ireland.

#### Literature:

Aguirre-Hudson (1991, 2009a), Calatayud & Aguirre-Hudson (2001), Cannon (1997), Voglmayr *et al.* (2019).

- 1 Ascospores aseptate, mostly 25–30 µm long; asci frequently sigmoidally curved..... *wienkampii*  
Ascospores 1- to 3-septate, 30–55 µm long; asci sometimes curved but not sigmoid..... *slaptonensis*

**Leptosillia slaptonensis** (P.F. Cannon) Voglmayr, M.B. Aguirre & Jaklitsch (2019) **NE**  
Thallus absent, not lichenized. Perithecia partially immersed to almost superficial, 130–220 µm diam., ± spherical to pyriform, hardly papillate, commonly laterally compressed when dry; exciple composed of several layers of dark brown, rather indistinct thin-walled angular cells 6–9 µm diam., somewhat more strongly pigmented in the vicinity of the periphysate ostiole; involucrellum absent; hymenium K<sup>-</sup>. Asci 70–97 × 9–12.5 µm, cylindrical-clavate, short-stalked, the apex obtuse to rounded, very thin-walled at all stages of development, without apical structures, 8-spored. Ascospores in two fascicles, 30–55 × 2.5–4 µm, narrowly fusiform, the ends similar, acute to obtuse; usually falcate, thin-walled, becoming 1-septate and eventually 3-septate, the septa thin-walled, ± regularly spaced; smooth-walled, without a gelatinous sheath. Pycnidia black, practically indistinguishable from ascomata except for a slightly smaller size. Conidiophores short, branched up to twice, arising from the inner wall of the pycnidium. Conidiogenous cells mostly 7–10 × 1.6–2.2 µm, with sympodial proliferation, lageniform to cylindrical, in dense terminal whorls of up to 5. Conidia (15–) 19–23 (–25) × (1.5–) 1.7–2.2 (–2.7) µm, falcate to lunate, aseptate, colourless, thin-walled, smooth, with narrowly rounded ends. **BLS 2869**.

On dead cankered, corky branches of *Ulmus minor*, England (S. Devon).

Originally described within the unrelated and poorly known genus *Zignoella* (Cannon 1997) and independently

described as *Cresporhaphis ulmi* by Calatayud & Aguirre-Hudson (2001). It has been reported elsewhere from Austria and Spain, always with the same association. It does not appear to be lichenized.

The description of the anamorph has been adapted from Voglmayr *et al.* (2019).

**Leptosillia wienkampii** (J. Lahm ex Hazsl.) Voglmayr & Jaklitsch (2019)

*Cresporhaphis wienkampii* (J. Lahm ex Hazsl.) M.B. Aguirre (1991)

Thallus immersed, only apparent in section, thin, hyphae associated with *Trentepohlia* (only reported from British material) or chlorococcoid algae. Perithecia scattered, superficial, 150–300 µm diam., black, pyriform, laterally collapsed when dry, with ± sulcate ostioles; involucrellum absent; exciple dark brown, becoming colourless towards the centre, continuing below the ascoma; hymenial gel I+ bluish-green. Asci 80–120 × 8–14 µm, cylindrical, sinuous, thin-walled, also so at the apex, 8-spored. Ascospores (20–) 25–30 (–35) × 3–3.5 µm, fusiform, falcate, aseptate, the apices rounded. Pycnidia ca 150 µm diam., black, immersed in the bark; conidiogenous cells to 12 (–15) µm long, lageniform to cylindrical, in dense terminal whorls; conidia of two types; 5–7 × 1.5–2 µm and allantoid, and/or 20–25 × ca 1 µm, filiform and aseptate. **BLS 1284.**

On bark of *Salix* and *Populus*, in furrows and wound tracks, from S. and E. England (Essex, Suffolk, Surrey) and Scotland (East Lothian, Roxburgshire), probably only facultatively lichenized; rare but probably under-recorded.

The thin-walled asci take the form of the included ascospores, and may themselves be sigmoid in shape. It is quite widely distributed in Europe, though rarely encountered, on a range of broadleaved trees including *Ulmus* spp.

NE



## MONOBLASTIACEAE Walt. Watson (1929)

**Thallus** reduced and ecorticate, white, to distinctly corticate, grey-green to olive brown, sometimes shiny. **Photobiont** trentepohlioid. **Ascomata** perithecia, immersed to sessile, mostly black, globose to pyriform or conical, carbonaceous, ostiolate, the ostiole often eccentric. **Involucrellum** present or reduced, usually carbonized. **Exciple** consisting of compressed hyphae, hyaline to brown or brown-black. **Hamathecium** comprising narrow pseudoparaphyses, branched and anastomosing. **Asci** (1–) 8-spored, fissitunicate, mostly cylindrical, short pedicellate, with a narrow to broad non-amyloid ocular chamber and refractive ring- or cap-structures. **Ascospores**, ovoid to cylindrical or fusiform, colourless or rarely brown, non-septate or 1–3-septate, not distoseptate, smooth or ornamented. **Pycnidia** common, immersed to sessile, sometimes conspicuous and flask-shaped with a short to long beak, or hair-like or asymmetrically cup- or ear-shaped (campylidia). **Conidia** either macro- or microconidia; macroconidia usually aseptate, ellipsoidal to bacillar, colourless, often embedded in a gelatinous matrix; microconidia aseptate, globose to ellipsoidal or fusiform. **Chemistry**: most species without secondary substances; lichexanthone and anthraquinone pigments known from a few taxa.

As treated by Lücking *et al.* (2017a) the Monoblastiaceae contains six genera, of which *Acrocordia* and *Anisomeridium* occur in Great Britain and Ireland. Molecular phylogenetic data are currently sparse, but indications are that the family occupies an isolated position within the Dothideomycetes, and is currently the only representative of the order Monoblastiales (Nelsen *et al.* 2009, 2011, Hyde *et al.* 2013).

**Literature:**

Aptroot *et al.* (2008), Hyde *et al.* (2013), Lücking *et al.* (2017a), Nelsen *et al.* (2009, 2011).

- 1 Ascospores uniseriate within the ascus,  $\pm$  equally septate, with a warted episporium;  
perithecial wall remaining brown in K.....*Acrocordia*  
Ascospores not strictly uniseriate within the ascus, septa often unequal, smooth-walled;  
perithecial wall greenish in K.....*Anisomeridium*

### ACROCORDIA A. Massal. (1854)

**Thallus** crustose, effuse, whitish or pale, thin or immersed in the substratum, not corticate. **Photobiont** *Trentepohlia*. **Ascomata** perithecia, almost entirely immersed to sessile, black (rarely pink or whitish), sometimes compound, with a hemispherical to globose brown-black K–involucrellum surrounding a  $\pm$  globose, colourless or pale brownish exciple. **Hamathecium** of persistent slender sparingly branched or anastomosing long-celled pseudoparaphyses; paraphyses absent. **Hymenial gel** I–, K/I–. **Asci** 8-spored (rarely 4-spored), cylindrical, K/I–, fissitunicate, with a broad bulbous ocular chamber, above which the apical dome may contain a mildly refractive hemispherical structure which can be observed in water mounts and stains in Congo Red. **Ascospores** uniseriately arranged, colourless, ellipsoidal to cylindrical-ellipsoidal, the ends usually rounded, 1(-3)-septate, the median septum thick and cells  $\pm$  equal in size, not or slightly constricted at the septum, additional septa (if present) thin; episporium ornamented with minute warts that disappear in K. **Conidiomata** pycnidia; conidiogenous cells cylindrical, elongate; conidia ellipsoidal, aseptate, colourless. **Chemistry**: lichen products not detected by TLC. **Ecology**: on  $\pm$  base-rich substrata, on bark of broad-leaved trees or on mostly vertical surfaces of calcareous or basic rocks in humid situations.

Characterized by the cylindrical asci and by the uniseriately arranged ellipsoidal ascospores with a warted episporium. The episporium causes the ascospores to appear finely to strongly verrucose in water, and often with a slightly projecting septum; in K the perispore apparently swells or becomes diffuse, so that the warted surface disappears or is represented only by a slightly lumpy, diffuse layer. The K–pigmentation of the perithecial wall (slight darkening in K but remaining brown) is useful in distinguishing specimens of *Acrocordia* from look-alikes in *Anisomeridium* (the latter genus having a K+ greenish pigment in the perithecial wall).

#### Literature:

Harris (1973, 1975), Orange (2013), Purvis & Orange (2009).

- 1 On rocks, rarely on soil ..... 2  
On bark, rarely on wood ..... 5
- 2(1) Involucrellum spreading laterally away from exciple, never continuous below it ..... 3  
Involucrellum incurved under exciple, often more or less continuous below ..... 4
- 3(2) Ascospores 12-19  $\times$  6-9  $\mu$ m; perithecia with the ostiole often projecting as a papilla;  
thallus usually immersed ..... *conoidea*  
Ascospores 19-26(-28)  $\times$  9.5-12  $\mu$ m; perithecia without a distinctly papilla-like ostiole;  
thallus superficial ..... *macrospora*
- 4(2) Perithecia 0.7-1.5 mm diam.; ascospores 20-35  $\times$  10-15  $\mu$ m ..... *salweyi*  
Perithecia 0.4-0.7 mm diam.; ascospores 13-14  $\times$  5-7  $\mu$ m ..... *subglobosa*
- 5(1) Perithecia 0.5-1 mm diam.; ascospores 15-27 (-30)  $\times$  8-12  $\mu$ m ..... *gemmata*  
Perithecia 0.3-0.6 mm diam.; ascospores 11-16.5  $\times$  5.5-9.5  $\mu$ m ..... *cavata*

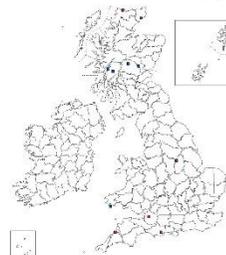
**Acrocordia cavata** (Ach.) R.C. Harris (1974)

Thallus immersed, grey-white. Perithecia scattered, dark brown to black, occasionally somewhat shiny, hemispherical, one-third to two-thirds immersed, 0.3–0.6 mm diam. Involucrellum entire, brown and containing bark cells above, mostly colourless below, 60–80 µm thick above, thinner below. Hymenium 1–. Paraphyses narrow, ca 1 µm thick, not obviously septate, branched and anastomosed. Asci cylindrical, inner wall with an obvious subspherical indentation, 80–115 × 9–10 µm, 8-spored. Ascospores uniseriately arranged, colourless, cylindrical with rounded ends to to somewhat ellipsoidal, 1-septate, mostly not constricted at the ± median septum, the wall ornamented with minute warts, 11–16.5 × 6–9.5 µm. Pycnidia not known. **BLS 0032**.

On wood of *Ilex* and on bark of *Corylus*, *Fraxinus* and *Populus tremula*. Scotland (Argyll, Caithness, Perthshire, Sutherland), S.W. England, Peak District, W. Wales. Rather rare but perhaps under-recorded in favour of *Acrocordia gemmata*.

Similar to *A. gemmata* but with smaller perithecia and ascospores. *Anisomeridium biforme* differs in the ascus structure and the smaller, smooth ascospores. The description has been taken in part from Harris (1973).

Nb

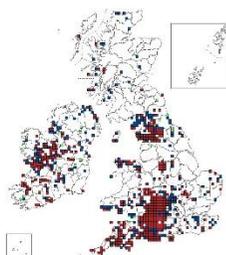
**Acrocordia conoidea** (Fr.) Körb. (1855)

Thallus mainly immersed, occasionally superficial and cracked, smooth or finely granular, effuse, pale grey or brownish grey, often with a pinkish tinge when fresh. Perithecia 0.5–1 mm diam., one quarter to half immersed, conic-hemispherical, the apices often flattened and with the ostiole projecting as a small papilla; involucrellum spreading outwards away from the exciple. Ascospores 12–19 × 6–9 µm, the ends mostly rounded but sometimes pointed, occasionally with a thin secondary septum dividing each cell. Pycnidia 0.14–0.2 mm diam., frequent, often numerous. Conidia ellipsoidal, ca 3.3 × 1.5 µm. **BLS 0033**.

On hard limestones and calcareous walls in ± shaded and moist situations; abundant in areas with naturally occurring hard limestones (particularly Devonian and Carboniferous limestone). C., N., & W. England, rare in Scotland, throughout Ireland.

When well-developed, easily recognized by the shallowly conical shape of the rather evenly dispersed perithecia. Difficult specimens can be distinguished from *Acrocordia macrospora* and *A. salweyi* in sections by the more outwardly spreading base of the involucrellum and the smaller ascospores.

LC

**Acrocordia gemmata** (Ach.) A. Massal. (1854)

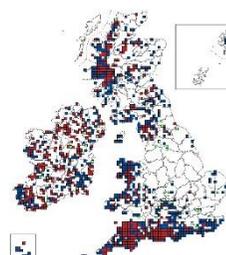
Thallus immersed, white or pale grey in surface view, smooth, continuous, effuse. Perithecia 0.5–1 mm diam., hemispherical, black (rarely pink; see Gilbert 1996), one quarter to ± entirely immersed; the ostiole often eccentric and sometimes papilla-like. Asci cylindrical, 8- or occasionally 4-spored. Ascospores 15–27 (–30) × 8–12 µm, with a median septum. Pycnidia 0.1–0.25 mm diam., frequently seen but rarely numerous. Conidia 3–5 × 0.8–1 µm. **BLS 0034**.

In woodlands or open situations on rough base-rich bark of mature trees, especially *Fraxinus*, *Quercus* and *Ulmus*, more rarely on smooth bark of *Corylus*; widespread and locally common but absent from many areas due to historical air pollution. Throughout Britain and Ireland but absent from much of C. & E. England.

Distinguished from the rare *Acrocordia cavata* by the larger perithecia and ascospores. The distinctive ascus and ascospore morphology of the genus distinguish *A. gemmata* from other superficially similar bark-inhabiting taxa, e.g. *Anisomeridium* spp., *Lithothelium phaesporum*, *Pyrenula* spp. and the non-lichenized *Navicella pileata* (Tode) Fabre (1879). Occasionally found with pycnidia only.

Surprisingly, the host-specific parasite *Unguiculariopsis acrocordiae* (Diederich) Diederich & Etayo (2000) has not yet been found from GBI.

LC

**Acrocordia macrospora** A. Massal. (1855)

Thallus superficial, grey to grey-brown, smooth or rimose, irregular in thickness. Perithecia 0.8–1 mm diam., rather prominent, ostiole not papilla-like; involucrellum ± spreading laterally, never continuous below the

Nb

exciple. Ascospores  $19\text{--}26$  ( $-28$ )  $\times$   $9.5\text{--}12$   $\mu\text{m}$ . Pycnidia  $0.2\text{--}0.3$  mm diam., usually few. **BLS 0035**.

On sheltered, often shaded siliceous or weakly calcareous rocks in coastal areas. W. Britain & E. Scotland (Fife), S.W. Ireland.

Resembles *Acrocordia conoidea* but the perithecia are not flattened, lack papillate ostioles and the ascospores are larger. *A. salweyi* is distinguished in section by the tightly incurved involucrellum which is often continuous below the true exciple; it occurs on strongly calcareous substrata.

#### **Acrocordia salweyi** (Leight. ex Nyl.) A.L. Sm. (1911)

Thallus epilithic or  $\pm$  immersed, whitish to pale brownish grey, thin, granular or smooth to rimose, effuse. Perithecia  $0.7\text{--}1.5$  mm diam., one quarter to half immersed; black, the involucrellum usually tightly incurved around the exciple and sometimes continuous below, appearing  $\pm$  subglobose. Asci 8-spored. Ascospores  $20\text{--}35$   $\times$   $10\text{--}15$   $\mu\text{m}$ , with a  $\pm$  median septum. Pycnidia  $0.2\text{--}0.3$  mm diam., usually few. **BLS 0036**.

On soft,  $\pm$  sheltered, often damp, highly calcareous rocks and especially old mortar, rarely terricolous. Throughout Britain and Ireland, common in S. & W. England.

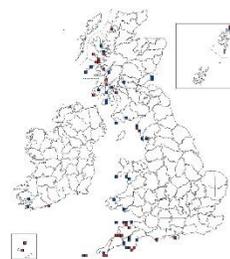
See *Acrocordia macrospora* if on acid or only weakly calcareous substrata. Some specimens may resemble *A. conoidea* but the perithecia are not flattened, lack papilla-like ostioles and the ascospores are smaller.

#### **Acrocordia subglobosa** (Vězda) Vězda & Poelt (1977)

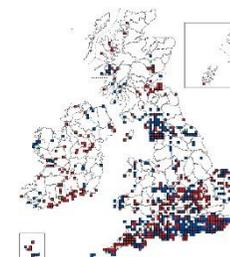
Thallus  $\pm$  immersed, whitish. Perithecia  $0.4\text{--}0.7$  mm diam., one quarter to half immersed; involucrellum usually tightly incurved around the exciple and often continuous below, appearing black, globose. Ascospores  $13\text{--}14$   $\times$   $5\text{--}7$   $\mu\text{m}$ . Pycnidia not seen. **BLS 2437**.

On a calcareous seam in a N.E.-facing schistose cliff at 500 m altitude; very rare. Scotland (S. Aberdeenshire).

Very similar to *Acrocordia salweyi*, differing mainly in the smaller dimensions of its perithecia and ascospores. It was confirmed as a member of the Monoblastiaceae by Nelsen *et al.* (2009) using phylogenetic methods.



LC



Nb

### **ANISOMERIDIUM** (Müll. Arg.) M. Choisy (1928)

**Thallus** crustose, immersed, whitish or pale grey. **Photobiont** *Trentepohlia*. **Ascomata** perithecia, hemispherical to globose, simple to compound; wall composed of  $\pm$  cellular hyphae, usually without bark cells, thicker in the upper part, often with a well-differentiated involucrellum, brown-black above, pale brown to  $\pm$  colourless below; pigment K+ greenish. **Hamathecium** of slender branched and anastomosed long-celled pseudoparaphyses, ca  $1$   $\mu\text{m}$  diam.; paraphyses absent; hymenial gel I-. **Asci** cylindric-clavate, K/I-, fissitunicate, the apical dome with an indistinct or short and broad ocular chamber, 8-spored (sometimes a few spores aborting), the spores uniseriate to biseriata. **Ascospores** 1- to 3-septate, ovoid to clavate-fusiform, the first-formed septum often towards the lower end of the ascospore; colourless, smooth, without a distinct perispore. **Conidiomata** pycnidia, immersed to sessile, globose or conical, black. **Conidiogenous cells** cylindrical, with collarettes, often percurrently proliferating. **Macro- and microconidia** (produced in separate pycnidia) subglobose, ellipsoidal, ovoid or rod-shaped, 0- (to 1-) septate; sometimes extruded as a white, thread-like tendril of conidia bound by mucilage. **Chemistry**: no lichen products detected in European species. **Ecology**: mainly on bark, also on lignum, mosses, and rock.

Differs from *Arthopyrenia* in a combination of features, especially the  $\pm$  cellular structure of the involucrellum. *Strigula* differs in having a narrow ocular chamber in the ascus apex and septate macroconidia, which are obliquely attached to the conidiogenous cells. *Acrocordia* has a different ascus structure, the equal-celled ascospores are ellipsoidal to cylindrical-ellipsoidal, and have a median septum and a warted perispore. The genus is probably polyphyletic.

The non-lichenized species *Lophiostoma corticola* (Fuckel) E.C.Y. Liew, Aptroot & K.D. Hyde (syn. *Massarina corticola* (Fuckel) L. Holm) mostly occurs on dead bark and wood but may be found on bark of living broad-leaved trees; those populations may be mistaken for *Anisomeridium* species. It has  $\pm$  hemispherical ascomata 300–500  $\mu\text{m}$  diam. and fusiform, often curved 1-septate colourless ascospores 25–35  $\times$  4–7  $\mu\text{m}$  in size, with the upper cell noticeably broader immediately above the septum (Bose 1961, Aptroot 1998). Its affinities are unclear; Thambugala *et al.* (2015) suggested a placement within the Amorosiaceae.

An unidentified species on the smooth bark of *Crataegus* is known from Oxfordshire and S. Somerset (perithecia 0.14–0.16 mm diam.; ascospores 9–12  $\times$  3.5–4  $\mu\text{m}$ ; macroconidia 7–8.5  $\times$  2–2.3  $\mu\text{m}$ ).

#### Literature:

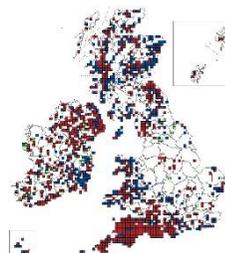
Coppins *et al.* (2009), Orange (2013), Van den Boom (2015).

- |      |   |                         |
|------|---|-------------------------|
| 1    | Conical pycnidia present (globose base tapering into a short or long ostiolar neck); perithecia present or absent .....   | 2                       |
|      | Conical pycnidia absent; perithecia or $\pm$ globose pycnidia present .....   | 4                       |
| 2(1) | Pycnidia to 1 mm high; conidia extruded as a white blob at the apex .....   | <i>macropycnidiatum</i> |
|      | Pycnidia to 0.5 (–0.75) mm high; conidia extruded as a white tendril 10–20 $\mu\text{m}$ diam. ....   | 3                       |
| 3(2) | Conical pycnidia 80–150 $\mu\text{m}$ diam., containing conidia 3.5–4.5 $\mu\text{m}$ long .....  | <i>polypori</i>         |
|      | Conical pycnidia 200–580 $\mu\text{m}$ diam., containing conidia 5.5–6.5 $\mu\text{m}$ long .....   | <i>robustum</i>         |
| 4(1) | Ascospores 1-septate, with the lower cell much longer than the upper cell, and with a slight median constriction when mature .....                                      | <i>ranunculosporum</i>  |
|      | Ascospores 1-septate, the lower cell equal to or slightly shorter than the upper cell, or 3-septate .....   | 5                       |
| 5(4) | Ascospores 40–55 $\times$ 10–12 $\mu\text{m}$ [not known in GBI material] .....   | <i>macropycnidiatum</i> |
|      | Ascospores <25 $\mu\text{m}$ long .....   | 6                       |
| 6(5) | Ascomata 300–400 (–500) $\mu\text{m}$ diam.; ascospores 1-septate, (9–) 12–16 $\times$ 4.5–6 (–7) $\mu\text{m}$ , cells equal or the lower shorter than the upper ..... | <i>biforme</i>          |
|      | Ascomata 140–250 $\mu\text{m}$ diam. ....   | 7                       |
| 7(6) | Ascospores 1- to 3-septate, (3–) 4.5–5 (–6) $\mu\text{m}$ diam., the part above the primary septum wider and about twice as long as the part below .....                | <i>polypori</i>         |
|      | Ascospores 1-septate, 3.5–4.7 $\mu\text{m}$ diam., the cells $\pm$ equal in length .....  | <i>viridescens</i>      |

#### **Anisomeridium biforme** (Borrer) R.C. Harris (1978)

LC

Thallus usually conspicuous, whitish or pale greyish, effuse or delimited by a thin blackish prothallus. Perithecia 0.3–0.4 (–0.5) mm diam., one quarter to almost totally immersed, usually numerous; upper wall with a usually well-differentiated involucrellum, 50–100  $\mu\text{m}$  thick; lower wall pale or colourless. Asci 65–90  $\times$  9–12  $\mu\text{m}$ , cylindrical, the spores  $\pm$  obliquely uniseriate. Ascospores (9–) 12–16  $\times$  4.5–6 (–7)  $\mu\text{m}$ , 1-septate, ovoid- to fusiform-ellipsoidal, the septum one half to two thirds from the upper end. Pycnidia of two types: (a) 100–200  $\mu\text{m}$  diam., with subglobose to ellipsoidal macroconidia 2.3–4  $\times$  1.8–2.7  $\mu\text{m}$ , extruded as a white tendril; or (b) 40–



100 µm diam., ± immersed, hemispherical to globose, with globose microconidia 1–1.5 µm diam. **BLS 0048**.

On smooth or rough bark of broad-leaved trees in woodland or sheltered open situations; common. Throughout Britain, especially in the N. & W., widespread in Ireland.

Often confused with *Acrocordia gemmata*, which has much larger perithecia (0.5–1 mm diam.) and ascospores (15–30 µm long), and often a hemispherical structure within the ascus apex. See also *Anisomeridium polypori*.

An unidentified *Lichenodiplis* sp. (conidia 1-septate, ca 6.5–7 × 2 µm) has been recorded on this host from Westernness.

### **Anisomeridium macropycnidiatum** van den Boom (2015)

NE

Thallus whitish grey to grey, immersed or very thin and filmy, continuous, to 30 µm thick. Perithecia [not seen in GBI material] 0.25–0.4 mm diam., solitary or sometimes 2–3 confluent, subglobose or mostly globose, strongly constricted at the base, black, glossy, shining, sometimes covered by a thalline layer at the base, young perithecia immersed to semiimmersed, ostiole apical. Perithecial wall lacking cellular hyphae, black, involucrellum not differentiated. Asci 8-spored, cylindric-clavate, 70–95 × 25–40 µm. Ascospores colourless, 40–55 × 10–12 µm, 1-septate, cells equal or distal cells sometimes somewhat enlarged, without a perispore, rarely fragmenting at the septum. Macropycnidia abundant, black, elongate, superficial, conical, to 1 mm high, 0.1–0.2 mm diam., with a white blob of jelly with extruding conidia at the top. Macroconidia ellipsoidal to slightly ovoid, 0–1-septate, 4.5–6 × 1.8–2.5 µm. Micropycnidia rarely found, semi-immersed, black, roundish to conical, to 0.15 mm high, 50–100 µm diam. Microconidia roundish, 2.5–3 µm diam. Chemistry: no lichen compounds detected. **BLS 2679**.

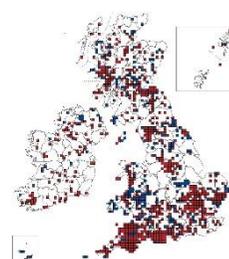
On bryophytes overgrowing bark of *Quercus*, Ireland (Cork, Kerry).

Distinguished by its sessile and sometimes stalked, bottle-shaped (ampulliform) pycnidia, overall up to 1 mm high. Its conidia are produced in globose to ovoid packets, and not in a narrow cylindrical cirrus as in *A. polypori* and *A. robustum*. Perithecia have so far not been detected in the Irish collections.

### **Anisomeridium polypori** (Ellis & Everh.) M.E. Barr (1996)

LC

Thallus often inconspicuous, effuse, whitish grey or pale grey-green. Perithecia 0.15–0.25 mm diam., rarely numerous, subconical to ± globose, initially immersed, becoming ± superficial; upper wall with a scarcely differentiated involucrellum, 30–50 µm thick; lower wall thinner and paler. Asci 55–75 (–90) × 12–15 µm, cylindric-clavate. Ascospores (12–) 14–20 (–23) × (3–) 4.5–5 (–6) µm, 1- to 3-septate, clavate-fusiform, the part above the primary septum wider and about twice as long as the lower. Pycnidia black, of two types: (a) 80–150 µm diam., 100–560 (–760) µm high, ± sessile, conical with an ostiolar neck comprising vertically arranged, brown-walled hyphae, which at the apex of the neck have free, colourless, pointed ends, with ellipsoidal or ovoid macroconidia with a truncate base, 3.5–4.5 × 1.8–3 µm in size, extruded as a white tendril 10–20 µm diam. in which the conidia are bound by a gelatinous matrix; or (b) 50–100 µm diam., ± immersed, globose, with rod-shaped to narrowly ellipsoidal microconidia 2–3 × 1–1.3 µm. **BLS 0049**.



On rough bark of broad-leaved trees, especially *Sambucus* and *Ulmus*, sometimes overgrowing bryophytes; also on damp lignum of *Fraxinus*, shaded rock, especially damp pebbles, and bone; in humid woodland and tall scrub, tolerant of deep shade; common even in moderately polluted areas. Throughout Britain and Ireland.

Most often found only with abundant conical macropycnidia; the ostiolar neck is variable in length. When fertile it differs from *Anisomeridium bifforme* in its less conspicuous thallus, the smaller perithecia with a thinner upper wall, and longer and narrower ascospores, which are often 2- or 3-septate. *A. polypori* has become more abundant in recent decades, but there is no evidence that it is a new arrival from outside Europe. See also *A. robustum*.

### **Anisomeridium ranunculosporum** (Coppins & P. James) Coppins (2002)

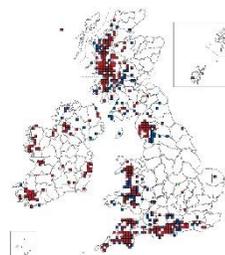
LC

Thallus immersed, white to fawn, often pinkish when fresh. Ascromata 0.22–0.36 × 0.2–0.3 mm, circular or elliptical in outline, often matt or ± pruinose due to a thin covering of bark cells; involucrellum brown, K+ greenish; pseudoparaphyses 0.5–1.5 µm diam., persistent, much branched, cells 4–10 µm long. Asci 35–42 × 12–17 µm, obpyriform. Ascospores 14–16 × 4.5–5.7 µm, 1-septate, constricted at the septum, with a short uniguttulate upper cell and an elongate, biguttulate lower cell with a median constriction. Pycnidia frequent, of

two types: (a) 80–120  $\mu\text{m}$  diam., with macroconidia 7.5–10 (–12)  $\times$  3.5–4.3  $\mu\text{m}$ , cylindrical-ellipsoidal, 0(–1)-septate; (b) 30–60  $\mu\text{m}$  diam., with microconidia 3.5–4  $\times$  0.5–0.8  $\mu\text{m}$ , bacilliform. **BLS 1584**.

Usually on smooth areas of at least mildly acidic fissured bark of tree trunks, especially *Fraxinus* and *Quercus*, sometimes on smooth bark of trunks or main stems of e.g. *Corylus*, *Ilex* and *Sorbus*, also *Calluna*; widely distributed in sheltered, old woodlands. W. Britain and Ireland.

Easily identified by its ‘tadpole-shaped’ ascospores; it is occasionally found only with macroconidia.



### **Anisomeridium robustum** Orange, Coppins & Aptroot (2008)

Thallus white or pale greyish, often cracked. Ascomata very rare, perithecia ca 0.4 mm diam., globose, ascospores ca 9  $\times$  5  $\mu\text{m}$ , 1-septate, the septum towards the lower end of ascospore. Pycnidia 0.2–0.58 mm diam. and 0.2–0.5 mm high, with a globose base tapering into a narrow neck; conidia pyriform-ellipsoidal, the base truncate, 5.5–6.5  $\times$  2.5–3  $\mu\text{m}$ , sometimes extruded as a tendril. Microconidia not detected. **BLS 2499**.

On bark of mature *Quercus* and *Acer pseudoplatanus* in old woodland and parkland, sometimes overgrowing bryophytes, very local. W. Britain and Ireland, and possibly overlooked elsewhere.

Macropycnidia and conidia are similar to those of *A. polypori*, but much larger. So far recorded mainly from sites rich in old-forest lichens. In collections on bryophytes, the body of the pycnidium is immersed within the thallus/bryophyte matrix with only the ostiole protruding. When growing on bark the neck of the pycnidium can be quite short. The fertile specimen was collected in Co Kilkenny, Ireland.



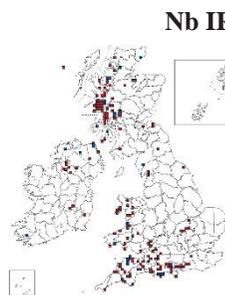
**Nb**

### **Anisomeridium viridescens** (Coppins) R.C. Harris (1995)

Thallus a whitish or pale fawn stain on bark, sometimes pinkish when fresh. Ascomata 0.14–0.2  $\times$  0.1–0.15 mm, circular to elliptical in outline, mostly scattered; involucrellum brown, K+ green; pseudoparaphyses 0.8–1  $\mu\text{m}$  thick, persistent, much branched; cells 4–10  $\mu\text{m}$  long. Asci 31–49  $\times$  11–17  $\mu\text{m}$ , obclavate to short-cylindrical. Ascospores 12–17 (–19)  $\times$  3.5–4.7  $\mu\text{m}$ , 1-septate, usually constricted at the septum; the upper cell usually distinctly wider than the lower, the cells usually biguttulate, without a median constriction; colourless or sometimes brownish and faintly warted when old; perispore indistinct. Pycnidia 40–50  $\mu\text{m}$  diam., with either: (a) macroconidia 9–10.5  $\times$  2–2.5  $\mu\text{m}$ , cylindrical, 2- to 3-guttulate; or (b) microconidia 4–5  $\times$  1–1.3  $\mu\text{m}$ , ovoid-cylindrical to bacilliform, not guttulate. **BLS 1607**.

On smooth bark of *Corylus* and rarely *Ilex* in old woodlands, but also currently colonising formerly coppiced *Corylus* in abandoned coppices in lowland England. Western Britain, but now spreading east, Ireland.

A pioneer species of young *Corylus* branches, along with *Eopyrenula grandicula*, and latterly displaced by more strongly lichenised species. Differs from species of *Naetrocymbe* with very small ascomata in having a K+ green involucrellum and thin, slender paraphyses.



**Nb IR**

## **MYCOPORACEAE** Zahlbr. (1903)

The Mycoporaceae contains the single genus *Mycoporum*, so the description of the genus below constitutes that of the family. It is currently placed provisionally in the Pleosporales (Lücking *et al.* 2017a) but no detailed molecular phylogenetic studies are available for any of its species. Vondrák *et*

*al.* (2023) suggested a placement within the Capnodiales based on mtSSU sequences, and a relationship with *Naetrocymbe*.

The status of *Mycoporum* as a lichen is uncertain; some species appear to be associated (perhaps facultatively) with trentepohlioid algae, while others appear to be bark saprotrophs.

The name of the type genus *Mycoporum* Flot. ex Nyl. (1855) has been conserved against *Mycoporum* G. Mey (1825), of uncertain application (see Hawksworth & Sherwood 1981).

### MYCOPORUM Flot. ex Nyl. (1855)

**Thallus** inconspicuous or slightly bleaching the bark, or whitish green, immersed. **Photobiont** apparently absent. **Ascomata** perithecia, solitary or aggregated in clusters with a compound upper wall, circular, elliptical or irregular in outline, black. Compound ascomata  $\pm$  flattened, composed of few to many perithecium-like locules each with its own, often raised, ostiole (best seen when wet).

**Involucrellum** indistinct or absent. **Hamathecium** of irregularly branched pseudoparaphyses, typically rather obscured by oil bodies, not blueing in iodine. **Asci** fissitunicate, obpyriform to obclavate with the wall in the upper third much thickened, 8-spored. **Ascospores** clavate to soleiform, 1- (to 3-) septate, constricted at the septum, the upper half at least slightly wider than the lower, colourless or brown and finely warted; perispore indistinct. **Conidiomata** pycnidia, black.

**Conidiogenous cells**  $\pm$  cylindrical, presumably proliferating percurrently. **Conidia** bacilliform. **Chemistry**: lichen products not detected by TLC. **Ecology**: on smooth bark of trees and shrubs.

The type species of *Mycoporum*, *M. elabens* (A. Massal.) Flotow ex Nyl. [not known from our region] was examined by Lumbsch (1999), who noted the stromatic nature of the compound ascomata. They were found by Thiyagaraja *et al.* (2020) to be similar to those of species belonging to a “mycoporoid” clade within the Arthoniaceae, but it is not clear whether the similarity is due to convergence or a common phylogeny. *Mycoporum* as currently circumscribed is likely to be polyphyletic, with our species probably not correctly assigned to that genus.

The demarcation between *Mycoporum* and *Tomasellia* (currently assigned to the Naetrocymbaceae) is disputed and this account follows Harris (1995). The asci of *Mycoporum* are obpyriform with the wall in the upper third very much thickened, the hamathecium is of irregular pseudoparaphyses and almost entirely obscured by oil droplets, and the ascospores are thin-walled. In *Tomasellia* the ascospores are  $\pm$  cylindrical with comparatively thicker and more even walls, pseudoparaphyses are more regular and ascospores are comparatively thicker-walled. *Cyrtidula* differs in having submuriform ascospores. The species of *Mycoporum* with single ascomata differ from *Arthopyrenia* in having a thick-walled ascus, hamathecial features and larger spores.

#### Literature:

Harris (1995), Lumbsch (1999), Sanderson & Coppins (2009), Thiyagaraja *et al.* (2020).

- |      |  |                    |
|------|--|--------------------|
| 1    | Ascomata simple, ascospores 27–40 $\times$ 8–13 $\mu$ m .....                              | <i>antecellens</i> |
|      | Ascomata compound with (1–) 2–15 locules; ascospores 16–26 $\times$ 5–7 (–8) $\mu$ m ..... | 2                  |
| 2(1) | Ascospores clavate, 16–19 $\times$ 6–7 $\mu$ m.....  | <i>sparsellum</i>  |
|      | Ascospores fusiform, 18–26 $\times$ 5–7 (–8) $\mu$ m.....                                  | <i>lacteum</i>     |

**Mycoporum antecellens** (Nyl.) R.C. Harris (1995)

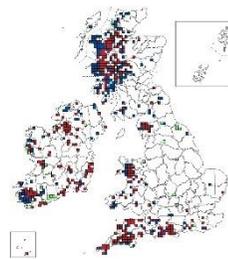
LC

Thallus whitish, greenish white or pale brown, not lichenized but thick and strongly developed. Ascomata not compound, 0.2–0.4  $\times$  0.2–0.3 mm, circular to elliptical in outline; involucrellum yellowish brown in K;

pseudoparaphyses 1.5–2.5  $\mu\text{m}$  diam., persistent, much branched, cells 7–16  $\mu\text{m}$  long. Asci 65–105  $\times$  (20–) 25–35 (–40)  $\mu\text{m}$ , obpyriform. Ascospores 27–40  $\times$  8–13  $\mu\text{m}$ , 1- (to 3-) septate, at first colourless but often becoming brownish and finely warted, apices  $\pm$  pointed; perispore indistinct. Pycnidia ca 100  $\mu\text{m}$  diam., usually numerous; conidia 4–6  $\times$  ca 0.8  $\mu\text{m}$ , bacilliform. **BLS 0075.**

On smooth bark, especially of *Corylus*, *Fagus*, *Ilex* and *Sorbus*; mostly in old woodlands. Widely distributed in W. Britain, very rare but apparently recently spreading in the east. Throughout Ireland.

Usually recognized in the field by the abundant pycnidia contrasting with the intermixed, larger ascomata and easily confirmed by the large ascospores that often become brownish; the ascospores of *Mycomicrothelia* species become dark brown at an earlier stage.



### **Mycoporum lacteum** (Ach.) R.C. Harris (1995)

Thallus silvery white. Ascomata 0.25–0.6 (–0.8) mm, usually irregular in outline and sometimes  $\pm$  circular, with (1–) 2–15 locules, sometimes decaying at the centre leaving an irregular circle of locules; tissue between locules colourless or pale brown; pseudoparaphyses 1.2–1.7 (–2)  $\mu\text{m}$  diam., the cells 7–12  $\mu\text{m}$  long. Asci 44–75  $\times$  17–24  $\mu\text{m}$ . Ascospores 18–26  $\times$  5–7 (–8)  $\mu\text{m}$ , 1-septate, the upper cell broader and with a  $\pm$  pointed apex, each cell biguttulate, colourless, but a few old spores may be 3-septate and/or brownish. Pycnidia rare, 30–60  $\mu\text{m}$  diam.; conidia 3–4  $\times$  ca 0.8  $\mu\text{m}$ . **BLS 1576.**

On the lower parts of trunks of ancient *Ilex*, rarely *Betula*, *Quercus*, *Fagus*, *Sorbus* and *Corylus* in old woodland; locally abundant in *Ilex* dominated woods in the New Forest, Hampshire and thinly across Ireland but otherwise rare and very local; in many western woods a relict species of former cattle grazed pasture woodlands found on cliff *Ilex*, where the bush has been grazed out by sheep or deer in accessible areas. S. England (Sussex, New Forest and N. coast of S.W. England), Lake District, N.E. England, N. Wales, W. Scotland (Kintyre to West Ross), Easternness, West Ireland (Donegal to Cork), Antrim, Down, Wicklow, Wexford.

*Mycoporum lacteum* grades into the pantropical *M. eschweileri* (Müll. Arg.) R. C. Harris (1995), which has smaller spores, but there are no other clear differences and the two taxa may be conspecific.

**NT**



### **Mycoporum sparsellum** Nyl. (1867)

Thallus pale brown. Ascomata 0.3–0.6 mm, usually irregular in outline but sometimes circular, with (1–) 2–15 locules; tissue between locules colourless or pale brown; pseudoparaphyses 1–2  $\mu\text{m}$  diam., the cells difficult to distinguish, interspersed with oil droplets. Asci 43–50  $\times$  18–24  $\mu\text{m}$ . Ascospores clavate, 16–19  $\times$  6–7  $\mu\text{m}$ , 1-septate, the upper cell broader and shorter, each cell often uniguttulate (the lower cell occasionally has an additional, smaller oil drop), colourless, but a few old spores brownish. Pycnidia not seen. **BLS 2509.**

On *Corylus* in W. Scotland: Morvern (Westernness) and the islands of Islay & Eigg.

Can be confused with *Tomasellia gelatinosa*, which differs in the more slender fusiform ascospores.

**Nb**



## **NAETROCYMBACEAE** Höhnelt ex R.C. Harris (1995)

**Thallus** crustose. **Photobiont** (if present) trentepohlioid. **Ascomata** perithecia with a broad apical or lateral ostiole, solitary or clustered, or as locules within a common stromatic structure,  $\pm$  spherical or flattened (dimidiate) the wall black and composed of isodiametric cells. **Involucrellum** absent or poorly defined. **Hamathecium** of frequently branched and anastomosed narrow short-celled cellular

pseudoparaphyses. **Asci** clavate or obpyriform, fissitunicate, without an ocular chamber or clear apical structure. **Ascospores** colourless or brown, fusiform to ellipsoidal or acicular, transversely septate, ornamented, thin-walled, not blueing in iodine. **Conidiomata** pycnidia. **Conidia** bacillar, colourless, aseptate. **Chemistry**: no lichen substances known. **Ecology**: saprotrophic or facultatively lichenized, occasionally lichenicolous.

A small family of four genera, three of which occur in our region. Its phylogenetic position is uncertain due to the lack of sequence data; it was placed in an uncertain position within the Dothideomycetes by Hyde *et al.* (2013) and Hongsanan *et al.* (2020), and within the Pleosporales by Jaklitsch & Frey (2016). Vondrák *et al.* (2023) postulated a position within the Capnodiales based on ITS and mtSSU sequences of *Naetrocymbe punctiformis*.

The family was not included in the global lichen checklist by Lücking *et al.* (2017a) due to the lack of clear evidence of a lichen association.

#### *Literature:*

Aguirre-Hudson (1991), Harris (1995), Hyde *et al.* (2013), Hongsanan *et al.* (2020), Lücking *et al.* (2017a, b).

- |      |   |                     |
|------|---|---------------------|
| 1    | Ascomata forming as locules within a common stroma .....                  | <i>Tomasellia</i>   |
|      | Ascomata not stromatic, each covered by an individual involucrellum ..... | 2                   |
| 2(1) | Ascospores ± filiform, narrow and ± pointed .....                         | <i>Leptorhaphis</i> |
|      | Ascospores clavate to ellipsoidal, the ends obtuse to rounded .....       | <i>Naetrocymbe</i>  |

### LEPTORHAPHIS Korb. (1855)

**Thallus** absent, or immersed, pale grey to greenish, smooth, continuous, not well-delimited. **Photobiont** absent; sometimes loosely associated with trentepohlioid algae. **Ascomata** perithecia, scattered or sometimes confluent, circular to elliptical in outline, immersed but becoming superficial, hemispherical to mammiform, ostiolate. **Involucrellum** dark brown to greenish black, the hyphae not changing colour in K, clypeate, forming an interlocking hyphal structure in squash mounts; radiating hyphae sometimes extending to form a basal fringe. **Exciple** pseudoparenchymatous, colourless to pale brown, developed within the involucrellum, inconspicuous or not continuous below the asci. **Hamathecium** of cellular pseudoparaphyses, branched and anastomosed; periphyses and periphysoids absent. **Hymenial gel** I+ yellowish-orange to bluish, never deep blue. **Asci** cylindrical-clavate, fissitunicate, with a broad truncate, exceptionally shortly pointed, apex, 8(-16)-spored. **Ascospores** acicular-fusiform, curved or sigmoid, colourless, 1- to 3-septate (in British spp.), smooth, thin-walled. **Conidiomata** pycnidia, immersed to semi-superficial, hemispherical to spherical. **Conidiogenous cells** flask- to bottle-shaped. **Macroconidia** colourless, acicular-fusiform, arc-shaped, smooth, thin-walled, somewhat reminiscent of the ascospores. **Microconidia** colourless, bacilliform. **Chemistry**: not known. **Ecology**: mainly on bark of deciduous trees, some ± host-specific.

Essentially bark saprobes, but algal cells are occasionally seen on the surface of the bark near the ascomata in fresh collections. Exceptionally, as in *L. atomaria*, differentiated thalli with intimate fungal-algal associations are observed on the surface and in vertical section. Distinguished from other pyrenocarpous genera by the acicular-fusiform ascospores. *Celothelium* and *Rhaphidicyrtis*, previously included in *Leptorhaphis*, have thread-like ascospores, and differ in ascomatal wall structure, hamathecial tissues and ascus morphology. Distinguished from *Leptosillia*, which also has

acicular to narrowly fusiform ascospores, by the presence of a well-developed involucrellum, and fissitunicate asci.

The genus remains poorly known in Britain and Ireland, and collections from a young *Populus* tree in Northamptonshire have been identified provisionally as *Leptorhaphis opunticola* L.A. Fiol & M.B. Aguirre (Aguirre-Hudson & Fiol 1993) and a sample from bark of *Tamarix* in Sussex is close morphologically to *L. tremulae*. Host specificity is uncertain in this genus, and both are currently excluded from the formal British and Irish list.

Vondrák *et al.* (2023) concluded that the genus belonged in the Phaeomoniellales (Chaetothyriomycetidae) based on BLAST searches of ITS and SSU sequences, but further phylogenetic analysis is needed. It was not included in the global lichen checklist by Lücking *et al.* (2017a) due to the lack of clear evidence of a lichen association.

#### Literature:

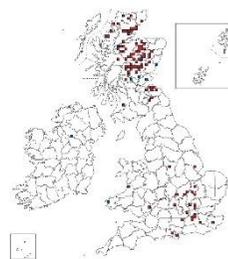
Aguirre-Hudson (1991, 2009b), Aguirre-Hudson & Earland-Bennett (2015).

- 1 Ascomata circular, sometimes confluent, less than 300 µm diam.; if surrounded by a dark basal fringe, this is less than 50 µm broad.....2  
Ascomata elliptical in outline, 300–525 µm in length, surrounded by a distinct dark basal fringe 50–75 µm broad, remaining as a distinct scar once the ascomata fall; hymenial gel not blue in iodine; always on *Betula* ..... *Leptorhaphis epidermidis*
- 2(1) Ascomata always arising singly; ascospores 1- to 3-septate, always > 25 µm long ..... 3  
Ascomata in clusters, sometimes ± confluent, 140–200 µm; hymenial gel bluish in iodine; ascospores 1-septate, 15–20 (–25) × 1.5–2 µm; on *Ilex* ..... *Leptorhaphis confertior*
- 3(2) Hymenial gel bluish in iodine ..... 4  
Hymenial gel not bluish in iodine, at most amber; ascomata circular to slightly elliptical in outline, 135–300 µm in size; involucrellum of hyphal to epidermal tissue; ascospores 1- to 3- septate, (30–) 35 – 45 (–50) × 1.5 – 2.5 µm; on *Corylus* and *Castanea* ..... *Leptorhaphis maggiana*
- 4(3) Thallus whitish grey; ascomata sessile, 100–250 µm diam.; involucrellum mostly non-clypeate, of globose cells, becoming hyphal only at the base; ascospores 1- to 3-septate, 25–32 × 2–3.5 µm, with rounded apices; on *Populus*..... *Leptorhaphis atomaria*  
Thallus inconspicuous; ascomata semi-immersed, 100–150 (–200) µm; involucrellum clypeate, of epidermoid to hyphal tissue; ascospores 1-septate, 30–40 × 1.5–2.5 µm, with pointed apices; on conifer bark, mostly *Larix* and *Cedrus*..... *Leptorhaphis laricis*

#### **Leptorhaphis atomaria** (Ach.) Szatala (1928)

Nb

Thallus immersed, pale grey, smooth, continuous, not well-delimited, the upper levels associated with trentepohlioid algae. Perithecia 0.1–0.25 mm diam., blackish, circular, scattered, superficial, sometimes dark brown below; involucrellum greenish to dark brown, consisting of globose and angular cells; exciple colourless to dark brown, continuing below the ascomata; hymenial gel I+ bluish. Asci (35–) 40–55 × 10–15 µm, short-clavate, broadly stalked, (6–)8-spored, the apex broad, truncate. Ascospores (20–) 25–32 × 2–3.5 µm, fusiform, curved, sometimes sigmoid, 1- to 3-septate, the apices rounded. Conidiomata 0.1–0.15 mm diam., scattered amongst the perithecia, becoming superficial, globose; conidiogenous cells ca 11.5 × 1.5–2 µm; macroconidia (11–) 16–18 × 1.5–2 µm, fusiform, curved, aseptate; microconidia unknown. **BLS 1618.**



On bark of *Populus*, especially *P. tremula* (in continental Europe also known from *Fraxinus* and *Salix*), often in nutrient-rich communities, probably only partly lichenized. Widespread in Scotland, quite frequently encountered in C. and S.E. England, scattered in Wales and Ireland. Gaps in distribution may well be due partly to under-recording.

Two other species of *Leptorhaphis* occur on *Populus* spp. in Europe and could well occur here also; *L. lucida* Körb. (1865) has larger ascomata and much longer 1-septate ascospores [ $45\text{--}70 \times 2.5\text{--}4 \mu\text{m}$ ], and *L. tremulae* Körb. (1855) has an inconspicuous rather than pale grey thallus and asci that are 8- to 16-spored. Despite its epithet, *L. tremulae* does not appear to occur on *Populus tremula* but only on *P. alba* and *P. nigra*.

### **Leptorhaphis confertior** Norman (1884)

NE

Thallus: whitish to pale brown, smooth or slightly scurfy, continuous, not well delimited; superficial to immersed in the substratum; associated with trentepohlioid algae. Ascomata  $140\text{--}200 \mu\text{m}$  diam. and *ca*  $85 \mu\text{m}$  high, blackish, shiny, smooth, mostly in small clusters and often confluent, circular, not surrounded by a basal fringe; initially immersed, becoming half immersed to superficial, hemispherical, dimidiate; involucrellum reddish-brown to black,  $20\text{--}30 \mu\text{m}$  thick, not extending beyond the ascomata; exciple intergrading with the involucrellum, colourless to pale brown; pseudoparaphyses  $1.5\text{--}2 \mu\text{m}$  diam., pale bluish-green in iodine. Asci cylindrical-clavate, short-stalked,  $50\text{--}60 \times 9\text{--}14 \mu\text{m}$ , 8-spored. Ascospores arranged in a bundle in the ascus, colourless, 0- or 1-septate, fusiform,  $15\text{--}20$  ( $\text{--}25$ )  $\times 1.5\text{--}2 \mu\text{m}$ , attenuated at the apices. Conidiomata not observed.

Known from a single collection on *Ilex* bark, Skye.

The species was placed into synonymy with *Leptorhaphis deformis* Norman (1868) by Aguirre-Hudson (1991), known from *Salix* bark in Norway, but neither species is well-known and *L. deformis* appears to differ by having an olivaceous green to brown thallus and ascomata that are aggregated but not confluent.

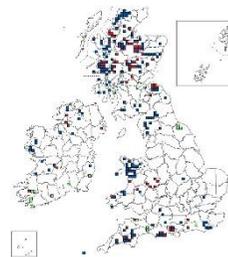
### **Leptorhaphis epidermidis** (Ach.) Th. Fr. (1860)

LC

Thallus immersed, generally absent, occasionally with trentepohlioid algae in patches around the ascomata. Perithecia  $0.3\text{--}0.5 \text{mm}$  diam. (including the involucrellum fringe), circular to elliptical in outline, immersed, becoming superficial; involucrellum dark brown, consisting of interlocking hyphae, extending to form a dark basal fringe *ca*  $75 \mu\text{m}$  broad; exciple colourless to pale brown, continuing below the ascoma; hymenial gel I–, at most amber. Asci  $40\text{--}65$  ( $\text{--}70$ )  $\times 10.5\text{--}15.5 \mu\text{m}$ , short-clavate, broadly stalked, 8-spored, the apex broad and truncate. Ascospores ( $20\text{--}$ )  $25\text{--}35 \times 2\text{--}3.5 \mu\text{m}$ , fusiform, curved, 1-septate, the apices pointed. Conidiomata *ca*  $75 \mu\text{m}$  diam., scattered amongst the perithecia, immersed; conidiogenous cells *ca*  $7.5 \times 1.5\text{--}2 \mu\text{m}$ ; macroconidia *ca*  $25 \times 1.5 \mu\text{m}$ , fusiform, curved, aseptate; microconidia to  $4 \mu\text{m}$  in length. bacilliform. **BLS 1553.**

On bark of *Betula*, probably not lichenized but sometimes loosely associated with *Trentepohlia*; locally abundant. N. and W. Britain, scattered along south coast and throughout Ireland.

Characterized in particular by the involucrellum which extends laterally from the ascomata into a broad basal fringe. Found especially on the bark of young trees, or on bare (white) patches of the trunk and branches. *Arthopyrenia analepta* frequently grows in similar habitat on *Betula*, and these occurrences may have been over-recorded in the field as *L. epidermidis*, but they have very different spores.



### **Leptorhaphis laricis** (Lahm) Aguirre (1991)

NE

Thallus inconspicuous, immersed, occasionally associated with chlorococcoid and/or trentepohlioid algae around the ascomata. Ascomata  $100\text{--}150$  ( $\text{--}200 \mu\text{m}$  diam. and *ca*  $65 \mu\text{m}$  high, black, glossy, smooth, numerous, scattered, circular to slightly elliptical in outline, not surrounded by a basal fringe; immersed in the substratum, becoming superficial, hemispherical to applanate; involucrellum dark brown, black in places,  $10\text{--}15 \mu\text{m}$  thick, not extending beyond the ascomata; exciple colourless to pale brown, intergrading with the involucrellum; pseudoparaphyses  $1.5\text{--}2 \mu\text{m}$  diam., hymenial gel bluish in iodine. Asci cylindrical-clavate, short-stalked, ( $35\text{--}$ )  $45\text{--}55 \times 8\text{--}17 \mu\text{m}$ , 8-spored. Ascospores usually arranged in one bundle in the asci, slightly twisted, fusiform, arcuate or sigmoidal, ( $27\text{--}$ )  $34\text{--}40 \times 1.5\text{--}2.5 \mu\text{m}$ , 1-septate, not constricted at the septum, attenuated at the apices. Conidiomata not observed.

On conifer bark, mostly on *Larix* and *Cedrus*, S. England (Northamptonshire, Somerset, Suffolk, Surrey).

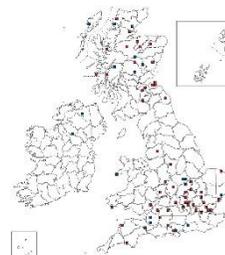
The species has been redescribed and illustrated by Aguirre-Hudson & Earland-Bennett (2015). It appears not to be actively lichenized.



**Leptorhaphis maggiana** (A. Massal.) Körb. (1865)

Nb

Thallus immersed, generally absent, trentepohlioid algae occasionally seen on the surface. Perithecia 0.13–0.3 µm diam., circular to slightly elliptical in outline, immersed but becoming superficial; involucrellum dark brown to greenish black, consisting of interlocking hyphae, sometimes extending as a small basal fringe; exciple colourless to greenish black; hymenial gel I+ yellowish. Asci 50–55 × 9–11 µm, cylindric-clavate, shortly stalked, 8-spored, the apex broad, truncate. Ascospores (30–) 35–45 (–50) × 1.5–2.5 µm, thread-like, slightly curved or arcuate or sigmoid, 1(–3)-septate, the apices attenuated. Conidiomata 0.1–0.15 mm diam., scattered amongst the perithecia, immersed; conidiogenous cells 5–10 × 1.5–2.5 µm; macroconidia 20–25 × ca 1.5 µm, thread-like, curved, 1-septate; microconidia 3.5–4 × 1–1.5 µm, bacilliform. **BLS 1537.**



On young branches of *Corylus*, rarely recorded also from *Castanea* and *Salix* (also on young *Quercus* in C. Europe), not lichenized but superficial algae fortuitously present; rare. Scattered throughout S. and C. England, throughout Scotland, a few reports from Ireland.

The preponderance of recent records for this species may indicate that it has been overlooked in the past.

**NAETROCYMBE** Körber (1865)

**Thallus** immersed in bark, inconspicuous or slightly paler than the surrounding tissues, effuse, not or facultatively lichenized with *Trentepohlia*. **Ascomata** perithecia, circular to elliptical in surface view, with a dark, often laterally spreading, clypeate involucrellum composed of compacted hyphae and bark cells, and a thin, colourless or pale brown true exciple that surrounds the centrum; hyphae dark brown, not changing colour in K. **Interscal tissue** of delicate thin-walled frequently branched and anastomosed pseudoparaphyses, the cells short, the hymenial gel I–. **Asci** fissitunicate, with two functional wall layers, obpyriform, ± sessile, ocular chamber present, often conical, I–, 8-spored. **Ascospores** clavate to cylindric-clavate, 1- or 3-(rarely 5- or 7-) septate, strongly constricted at the septa, colourless, smooth (occasionally brownish and finely warted when old), usually with a narrow gelatinous sheath. **Conidiomata** pycnidia; blackish, wall with same pigment as the involucrellum of ascomata. **Conidiogenous cells** ± cylindrical, lageniform or ± globose, often percurrently proliferating. **Conidia** cylindrical to bacilliform, hyaline, 0-septate. **Chemistry**: no substances detected by TLC. **Ecology**: on smooth bark. **Distribution**: ca 15 species, mostly temperate.

Species of *Naetrocymbe* were included in *Arthopyrenia* (Trypetheliaceae) by Coppins & Orange (2009), but can mostly be easily distinguished from *Arthopyrenia* using microscopic features, in particular the shape of the ascus and structure of interscal tissue.

The type of *Naetrocymbe*, *N. rhypona* (Ach.) R.C. Harris (1995) (syn. *N. fuliginea* Körber) has a variably developed dark brown thallus-like structure and 3-septate ascospores 17–20 × 5.5–7 µm in size. The thallus has been referred to by Eriksson (1981) as a subiculum and is probably not lichenized, but it consists of a network of dark brown subcuticular hyphae broadly similar to those making up the involucrellum of other species of *Naetrocymbe*. Foucard (1992) has observed that the thallus extent varies considerably. *N. rhypona* has been incorrectly reported from Britain and Ireland; records refer to *N. punctiformis* or *Stigidium microspilum* (Körb.) D. Hawksw. Coppins (1988) considered that *Arthopyrenia laburni* Arnold, which also has abundant brown vegetative hyphae, to be a probable synonym of *N. punctiformis*, but it should also be compared with *N. rhypona*.

**Literature:**

Coppins & Orange (2009), Eriksson (1981), Foucard (1992), Harris (1995).

- 1 On limestone; ascospores  $18.5\text{--}22.5 \times 6\text{--}7.5 \mu\text{m}$ .....*Naetrocymbe saxicola*  
On bark ..... 2
- 2(1) Ascomata  $250\text{--}500 \times 200\text{--}400 \mu\text{m}$  diam., asci (50–) 60–100  $\mu\text{m}$  long, narrowly obpyriform  
.....*Naetrocymbe fraxini*  
Ascomata  $100\text{--}230 \mu\text{m}$  diam., asci 30–70  $\mu\text{m}$  long, ovoid to obpyriform ..... 3
- 3(2) Not lichenized (*Trentepohlia* absent); ascospores  $16\text{--}20$  (–22)  $\times 4.5\text{--}5 \mu\text{m}$ , usually with a  
distinct gelatinous sheath *ca* 1  $\mu\text{m}$  thick .....*Naetrocymbe punctiformis*  
Lichenized (*Trentepohlia* present); ascospores without a gelatinous sheath ..... 4
- 4(3) Ascospores  $4.5\text{--}5$  (–6)  $\mu\text{m}$  broad; thallus whitish to pale buff .....*Naetrocymbe nitescens*  
Ascospores  $3\text{--}4.5 \mu\text{m}$  broad; thallus pale fawn to darkish brown ..... 5
- 5(4) Ascospores (14–)  $15\text{--}19$  (–21)  $\times 3\text{--}4.5 \mu\text{m}$ , asci 31–45  $\mu\text{m}$  long; usually on smooth bark  
.....*Naetrocymbe carneobrunneola*  
Ascospores  $17\text{--}21$  (–26)  $\times 3\text{--}4 \mu\text{m}$ , asci 55–70  $\mu\text{m}$  long; usually on rough bark  
.....*Naetrocymbe atractospora*

***Naetrocymbe atractospora* (Zahlbr.) R.C. Harris (1995)**

NT

*Arthyrenia atractospora* Zahlbr. (1935)

Thallus lichenized. Ascomata circular in outline, 100–200  $\mu\text{m}$  diam., subglobose, mostly immersed in outer layers of bark; pseudoparaphyses somewhat gelatinized. Asci  $55\text{--}70 \times 12\text{--}16 \mu\text{m}$ , narrowly ovoid, the wall strongly thickened in the apical region, 8-spored. Ascospores  $17\text{--}21$  (–26)  $\times 3\text{--}4 \mu\text{m}$ , 1-septate, narrowly ovoid, the lower cell often somewhat longer and narrower than the upper cell; perispore inconspicuous. Conidia  $4\text{--}5 \times ca 1 \mu\text{m}$ , bacillar. **BLS 1979.**

On rough bark of *Quercus*, typically in crevices; rare. England (Somerset, New Forest), Wales, Scotland.

A poorly known species, originally described from collections made in eastern North America. *Naetrocymbe carneobrunneola* differs in the shorter asci and ascospores, and usually occurs on smooth bark.



***Naetrocymbe carneobrunneola* (Coppins) R.C. Harris (1995)**

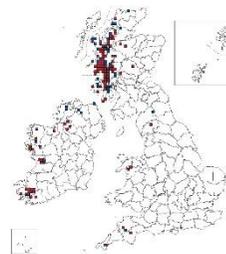
Nb IR

*Arthyrenia carneobrunneola* Coppins (1988)

Thallus pale fawn to darkish brown, often pinkish when fresh, lichenized. Ascomata  $100\text{--}150$  (–200)  $\times 100\text{--}130$  (–160)  $\mu\text{m}$ ,  $\pm$  circular in outline, 60–80  $\mu\text{m}$  tall, occasionally a few confluent; involucrellum brown in water and K; pseudoparaphyses  $1.5\text{--}2 \mu\text{m}$  diam, short-celled and swollen between the septa,  $\pm$  deliquescent at maturity. Asci  $34\text{--}42 \times 16\text{--}22 \mu\text{m}$ , obpyriform,  $\pm$  sessile. Ascospores 1-septate,  $15.5\text{--}21 \times 3.5\text{--}5 \mu\text{m}$ , narrowly clavate to  $\pm$  fusiform, not or only slightly constricted at the median or somewhat suprmedian septum, occasionally with a secondary septum in the upper cell, without a perispore or gelatinous sheath. **BLS 1622.**

On smooth bark, mainly *Corylus* (often with *Naetrocymbe nitescens*), distribution hyperoceanic and frequent in temperate rainforest habitats; locally common in W. Scotland and W. Ireland, rare in Wales and S.W. England.

*N. nitescens* is similar, but differs in the paler thallus, and larger asci and ascospores. *N. punctiformis* has similarly sized ascospores, but they usually have a gelatinous sheath.



***Naetrocymbe fraxini* (A. Massal.) R.C. Harris (1995)**

Nb

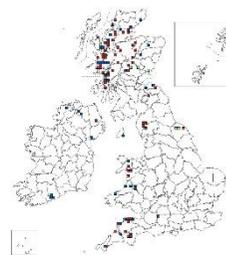
*Arthyrenia fraxini* A. Massal. (1852)

Vegetative tissues inconspicuous, or visible as a pale fawn or pale brown stain, non-lichenized or sometimes with *Trentepohlia* present. Ascomata  $250\text{--}400 \times 200\text{--}350 \mu\text{m}$ , circular or elliptical in outline, the ostiole sometimes

minutely papillate; involucrellum brown in water and concolorous or olivaceous in K, forming a fringe 30–60 (–100)  $\mu\text{m}$  broad around the ascoma. Interascal tissue of thin-walled pseudoparaphyses 1.5–2  $\mu\text{m}$  diam., sparingly branched, cells 6–12  $\mu\text{m}$  long,  $\pm$  deliquescent at maturity. Asci (50–) 60–90 (–100)  $\times$  (13–) 15–25 (–30)  $\mu\text{m}$ , narrowly obpyriform to saccate, 8-spored. Ascospores (17–) 19–22 (–26)  $\times$  (4.5–) 5–7.5  $\mu\text{m}$ , narrowly clavate, 1- (to 3-) septate, hardly constricted at the  $\pm$  median septum, the apices  $\pm$  rounded; with a  $\pm$  distinct gelatinous sheath 1–1.5  $\mu\text{m}$  thick in K. Pycnidia infrequent, *ca* 100  $\mu\text{m}$  diam.; conidia 4–6  $\times$  *ca* 0.8  $\mu\text{m}$ , bacilliform. **BLS 1648.**

On smooth bark, usually on branches, of *Fraxinus*, also on *Alnus*, *Betula*, *Corylus*, *Ilex* and *Quercus*; quite frequent in Scotland, Wales and S.W. England, Ireland.

*Naetrocymbe fraxini* externally resembles *N. punctiformis*, which has smaller ascomata and shorter and relatively broader asci. Its characters are intermediate in some ways between *Naetrocymbe* and *Arthopyrenia* (Trypetheliaceae), in that the paraphyses are thin-walled but sparingly branched, and the asci are hardly obpyriform in some collections. It could possibly represent yet another genus, or belong to *Alloarthopyrenia* (Trypetheliaceae; see below). No sequences are available.



### **Naetrocymbe nitescens** (Salwey) M.B. Aguirre, P.F. Cannon & Minter (2015)

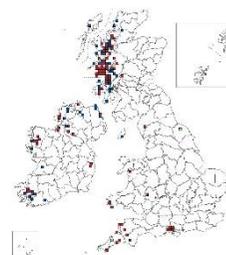
**Nb IR**

*Arthopyrenia nitescens* (Salwey) Mudd (1861)

Thallus whitish to buff, usually pinkish when fresh, usually lichenized. Ascomata 150–220  $\times$  120–170  $\mu\text{m}$ , circular to elliptical in outline, mostly scattered, the ostiole depressed. Involucrellum brown in water and unchanged or olivaceous in K, forming a narrow fringe to 40  $\mu\text{m}$  broad around the ascomata, the exciple colourless. Interascal tissue of thin-walled pseudoparaphyses 1.5–2.5  $\mu\text{m}$  broad, persistent, much branched,  $\pm$  moniliform, the cells 3–8  $\mu\text{m}$  long,  $\pm$  deliquescent at maturity, the hymenial gel sometimes I+ yellow-green. Asci 43–50 (–60)  $\times$  18–26  $\mu\text{m}$ , obpyriform or obclavate. Ascospores (18–) 22–24 (–27)  $\times$  4.5–5.5 (–6.5)  $\mu\text{m}$ , narrowly cylindrical-ellipsoidal to narrowly clavate, 1-septate, scarcely constricted at the septum; cells  $\pm$  equal, each usually biguttulate; gelatinous sheath indistinct. Pycnidia frequent, 30–40  $\mu\text{m}$  diam., dark brown to black. Conidia 3–4  $\times$  *ca* 1  $\mu\text{m}$ , bacilliform. **BLS 1605.**

On smooth bark, mainly *Corylus* but also old *Ilex* and *Fagus* and young *Quercus*, in old woodlands. W. Scotland, rare in Wales and S. & S.W. England, W. Ireland.

May be confused with *Naetrocymbe punctiformis*, but the ascospores never have a distinct gelatinous sheath, and the species typically grows in mature, species-rich communities. *N. carneobrunneola* may be closely related and occurs in similar habitats; it has shorter asci, slightly narrower ascospores and a darker thallus. In the field it has been overlooked on *Ilex* and *Fagus* as *Anisomeridium ranunculosporum*, lacking pycnidia, but that grows on more acid bark, has larger ascomata and nearly always has at least a few pycnidia.



### **Naetrocymbe punctiformis** (Pers.) R.C. Harris (1995)

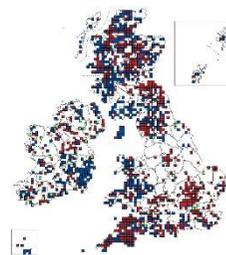
**LC**

*Arthopyrenia punctiformis* (Pers.) A. Massal. (1852)

Vegetative tissues inconspicuous, or the bark darkened due to abundant brown subcuticular hyphae, non-lichenized. Ascomata 150–180 (–230)  $\mu\text{m}$  diam.,  $\pm$  circular, scattered or clustered. Involucrellum brown in water and K. Interascal tissue of thin-walled  $\pm$  moniliform frequently branched and anastomosed pseudoparaphyses 1.5–2.5  $\mu\text{m}$  diam. with cells 3–8  $\mu\text{m}$  long. Asci 42–57  $\times$  18–20  $\mu\text{m}$ , obpyriform. Ascospores 17–19.5 (–22)  $\times$  4–5  $\mu\text{m}$ , 1-septate and colourless, (sometimes yellowish brown and 3-septate when old), only slightly constricted at the septum, cells often biguttulate but without median constrictions, occasionally fragmenting at the septum; gelatinous sheath usually distinct, *ca* 1  $\mu\text{m}$  thick. Pycnidia not detected. **BLS 1542.**

On smooth bark of many trees and shrubs, usually as an early colonizer of twigs and thin branches and often accompanied by *Arthonia punctiformis*; common (except in very polluted areas). Throughout Britain and Ireland, but rare in C. England.

A rather broad concept of the species is used here to include extreme morphs with a blackish thallus [i.e., *Arthopyrenia laburni* Arnold (1861)], which should be compared with *N. rhypona*. Colonies with irregularly clustered ascomata have been assigned to *Arthopyrenia cembrina* (Anzi) Grunmann ex D. Hawksw. (1980);



further critical studies on this complex are needed. Usually easily recognized in the field by the small ascomata and habitat ecology, but can be confused with “*Arthopyrenia*” *salicis*, which has slightly larger ascomata and no pseudoparaphyses. Other species with small ascomata and 1-septate ascospores include *N. carneobrunneola* and *N. nitescens*, but these have a clearly lichenized thallus containing *Trentepohlia*.

**Naetrocymbe saxicola** (A. Massal.) R.C. Harris (1995)

*Arthopyrenia saxicola* A. Massal. (1855)

*Pyrenocollema saxicola* (A. Massal.) Coppins (1992)

Thallus immersed to superficial, grey (often discoloured by cyanobacteria), often minutely mottled, sometimes clearly delimited, lichenized. Ascomata 120–160 µm diam., circular in outline, strongly domed, half to almost completely immersed in pits in rock, the apical part black, convex or disc-like, the ostiole inconspicuous. Involucrellum appressed to the upper half of the exciple, or indistinguishable from the thickened apical part of the exciple, brown, K+ slightly darkening. Interascal tissue of richly branched thin-walled pseudoparaphyses 2–2.5 µm diam. Asci 61–79 × 22–26 µm, clavate, obclavate to subcylindrical. Ascospores 18.5–22.5 × 6–7.5 µm, 1-septate, ± cylindrical, the upper cell only slightly broader than the lower; overmature spores brown, finely rugulose, sometimes narrowly 3-septate. Pycnidia frequent, 60–80 µm diam.; conidia 4–5 × 0.5–1.2 µm. **BLS 0090**.

On shaded hard limestones; local. Throughout Britain and Ireland.

Easily confused in the field with *Porina linearis* (Ostropales: Porinaceae), which differs in the 3-septate ascospores, ± unbranched paraphyses, and different pigment in the involucrellum.

**Nb**



**TOMASELLIA** A. Massal. (1856)

**Thallus** inconspicuous or slightly bleaching the bark, as a thin fungal layer 10–20 µm thick on the phorophyte, also becoming endophloedic. **Photobiont** absent. **Ascomata** circular, elliptical or irregular in outline, black, ± flattened, composed of few to many perithecium-like locules each with its own, often raised, ostiole (best seen when wet); overlying wall dark brown, K–, composed of compacted hyphae and bark cells; locules separated by colourless to dark brown compacted hyphae. **Hamathecium** of regularly branched pseudoparaphyses, **Hymenium** K/I–. **Asci** with two functional wall layers, discharge fissitunicate, obclavate, 8-spored, K/I–. **Ascospores** clavate or sole-shaped, 1- or 3-septate, constricted at the middle septum, the upper half at least slightly wider than the lower, colourless or brown and finely warted; perispore thin or indistinct. **Conidiomata** pycnidia, black. **Conidiogenous cells** ± cylindrical. **Conidia** bacilliform. **Chemistry**: lichen products not detected by TLC. **Ecology**: on smooth bark of trees and shrubs.

Differs from other genera of the Naetrocymbaceae in the multilocular ascomata; no sequences are available and thus its placement is provisional.

The demarcation between *Mycoporum* (Mycoporaceae) and *Tomasellia* is disputed and this account follows Harris (1995). The asci of *Mycoporum* are obpyriform with the wall in the upper third very much thickened, the hamathecium is of irregular pseudoparaphyses and almost entirely obscured by oil droplets and the ascospores are thin-walled. In *Tomasellia* the ascospores are ± cylindrical with comparatively thicker and more even walls, pseudoparaphyses are more regular and ascospores are comparatively thicker walled. *Cyrtidula* differs in its ± spherical asci among other features.

**Literature:**

Harris (1995), Minter *et al.* (2015), Sanderson & Coppins (2009).

- 1      Ascomata with 4–12 locules; ascospores mainly 1-septate, dark brown .....*diffusa*  
          Ascomata with 10–55 locules; ascospores soon 3-septate, colourless to pale brown.....*gelatinosa*

**Tomasellia diffusa** (Leight.) J. Lahm (1885)

Similar to *T. gelatinosa*, but ascomata (0.2–) 0.4–1 mm diam., circular to elliptical in outline, with (1–) 4–12 locules; tissue between locules often dark brown; pseudoparaphyses 1.5–2 µm diam., the cells 6–13 µm long. Asci 50–55 × 21–25 µm. Ascospores 19–24 × 6–7 µm, 1-septate, at first colourless but soon becoming dark brown, often with a distinct perispore, 1–1.5 µm thick in K. **BLS 1730.**

On young trunks and thick branches of *Alnus*; local, but rarely recorded. N. Wales, N. Scotland (Highlands).

Inconspicuous owing to the dark colour of *Alnus* bark. Distinguished from forms of *Naetrocymbe punctiformis* with clustered ascomata by the dark brown ascospores.

Nb



**Tomasellia gelatinosa** (Chevall.) Zahlbr. (1922)

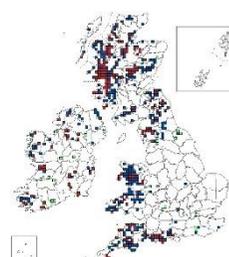
Thallus inconspicuous, not well delimited, but bleaching the bark; forming a thin fungal layer 10–20 µm thick on the bark, also becoming endophloedic; photobiont layer absent, but chlorococcoid algae can be found on the surface of the bark, forming clusters which are more frequent around the ascomata. Ascomata 300–1000 µm diam., multilocular, round or occasionally broadly elliptical in outline, reddish to dark brown, sometimes black; with up to 12 perithecium-like locules linked by a dark brown stroma-like structure, shiny; semi-immersed or sessile; each locule develops a ostiole situated in a small depression; dimidiate in section, up to 150 µm tall, but appearing rather flattened; involucrellum 20–30 µm thick, clypeate, dark brown in water, intensifying in K; exciple to 15 µm thick at its wider point, always colourless, surrounding each locule, consisting of a few layers of isodiametric cells; hamathecium consisting of richly branched and cellular pseudoparaphyses 1.5–2.5 (–3) µm diam., the cells moniliform; hymenial gel I–. Asci (40–) 52–70 (–85) × 18–26 (–30) µm, broadly clavate, ovoid to almost ellipsoidal, fissitunicate, 8-spored. Ascospores 20–28 × (5–) 7–8 (–10) µm, colourless, darkening with age, irregularly arranged inside the ascus, narrowly ellipsoidal to soleiform, 1- to 3-septate, constricted at the septa, upper cell rounded, lower two cells slightly narrower and becoming narrower towards the apex, guttulate, the wall initially smooth but becoming finely warty, with a distinct perispore to 2 µm thick. Pycnidia to 60 µm diam., found at the edge of the ascomata and covered by the same clypeate stromatic tissue. Conidia 4–6 × ca 1 µm, colourless, bacilliform. **BLS 1565.**

On young trunks and branches of various trees and shrubs, especially *Corylus*; local. N. & W. Britain and Ireland.

Distinguished by the more regular ascomata and ascospores that are soon 3-septate. In the field, care is needed to separate this species from the parasite *Stigmidium microspilum* (Körber) D. Hawksw. (1975) which forms irregular black stains on *Graphis scripta* and has 1-septate colourless spores.

*Mycoporum sparsellum* is easily mistaken as immature *Tomasellia gelatinosa* but has shorter but equally broad ascospores, 16–19 × 6–7 µm and obpyriform asci.

LC



## PYRENULACEAE Rabenh. (1870)

**Thallus** inconspicuous and often immersed, sometimes with pseudocypellae. **Photobiont** *Trentepohlia*, rarely absent. **Ascomata** perithecia, sometimes aggregated, globose to flattened, papillate, the ostioles sometimes lateral, sometimes surrounded by an involucrellum that may be common to several perithecia, the wall hyphal in construction. **Hamathecium** initially of narrow

anastomosing trabeculate pseudoparaphyses in an often faintly J+ gel, with true paraphyses subsequently formed from the basal layers. **Asci** cylindrical, fissitunicate, with a small or large ocular chamber, sometimes staining differentially, not blueing in iodine, without an apical ring, rarely thin-walled and evanescent, in which case the ascospores accumulate in a mazaedial mass. **Ascospores** colourless or brown, transversely septate or muriform, the septa often thickened (distoseptate), rarely ornamented with grooves. **Conidiomata** pycnidia, black. **Conidia** filiform, often curved. **Chemistry**: lichexanthone and/or anthraquinones, or absent. **Ecology**: most species corticolous, on smooth bark; some are on calcareous rock.

A large and diverse family, predominantly tropical in distribution. Lücking *et al.* (2017) recognized eleven genera (of which two occur in our region) and around 300 species are currently accepted (Mendonça *et al.* 2020). Molecular data are relatively sparse, although Weerakoon *et al.* (2012) and Gueidan *et al.* (2016) suggested that some of the traditional characters used for separating genera were not well reflected in the phylogeny. The Pyrenulaceae is the only family within the Pyrenulales, an order with phylogenetic affinities to the Chaetothyriales and Verrucariales.

#### Literature:

Aptroot (1991, 2012, 2021), Gueidan *et al.* (2016), Lücking *et al.* (2017), Mendonça *et al.* (2020), Miranda-González *et al.* (2022), Weerakoon *et al.* (2012).

- 1 Mature ascospores olivaceous, with relatively small angular lumina; asci without a distinct ocular chamber; lichenized with *Trentepohlia* ..... **Pyrenula**  
 Mature ascospores reddish brown, with large rounded lumina; asci with a conspicuous ocular chamber; British species apparently not lichenized..... **Lithothelium**

## LITHOTHELIUM Müll. Arg. (1885)

**Thallus** crustose, immersed or superficial. **Photobiont** *Trentepohlia* or absent. **Ascomata** perithecia, black, discrete or fused; ostiole apical or lateral, sometimes fused. **Hamathecium** of paraphyses which are unbranched or only branched near the apices; paraphyses absent. **Hymenial gel** ± blue or orange. **Asci** 6- to 8-spored, usually with a rounded or sagittiform (with 3 pointed lobes) ocular chamber; wall K/I-. **Ascospores** colourless or brown, 3- to 7-septate to submuriform, all septa are distoseptate; cell lumina usually rounded. **Conidiomata** pycnidia. **Conidia** colourless, aseptate, filiform. **Chemistry**: no lichen substances detected by TLC. **Ecology**: on bark or rock.

*Pyrenula* differs by the absence of an ocular chamber in the ascus and the relatively small, often angular, spore lumina. The distinction between the two genera needs further examination from a phylogenetic perspective.

#### Literature:

Aptroot (1991, 2006), Coppins (2009c), Gueidan *et al.* (2016).

#### **Lithothelium phaeosporum** (R.C. Harris) Aptroot (1991)

Apparently non-lichenized. Perithecia immersed, ca 0.80 mm diam., the ostiole protruding, conical-pointed, often asymmetrical; hamathecium with numerous oil drops. Ascospores brown, 3-septate, 24–35 × 9.5–12 (–15) μm, but to 38 × 15 μm when over-mature, the lumina variably ± equal in size, especially the mature ones having smaller end lumina. **BLS 0946**.

On bark of *Fraxinus*; rare. Scattered throughout Scotland (Highlands, Southern Uplands).

The ascospores in Scottish collections have all the lumina variably ± equal in size, especially the mature ones having smaller end lumina, whereas collections from

NT



Austria and N. America have the two middle lumina much larger than the outer. In the field, it is most likely to be confused with *Acrocordia gemmata* or non-lichenized pyrenomycetes such as *Navicella pileata*.

### PYRENULA Ach. (1814)

**Thallus** crustose, immersed or more rarely superficial, continuous or sometimes areolate; pseudocyphellae sometimes present. **Photobiont** *Trentepohlia*, rarely apparently absent. **Ascomata** perithecia, immersed to erumpent,  $\pm$  globose to flattened, black. **Involucrellum** spreading laterally to develop around and closely adhering to the exciple, from which it is then not distinct, composed of filamentous hyphae interspersed with bark cells and often crystals. **Exciple** brown-pigmented, K+ darker brown (at least in British and Irish species), often containing colourless calcium oxalate crystals (insoluble in K, soluble in 10% HCl). **Ostiole** central or lateral. **Hymenium** with gel I $\pm$  greenish blue in parts, sometimes densely interspersed with minute oil droplets, lateral parts sometimes with masses of orange-brown, K+ purple-red pigment (anthraquinones). **Hamathecium** at first of branched and anastomosed, sparsely septate pseudoparaphyses; more or less unbranched paraphyses developing later and replacing the pseudoparaphyses; ostiole with periphyses. **Asci** cylindrical, long-stalked, multilayered in structure, the apex thickened, with a refractive subapical cap, I-, K/I-, discharge fissitunicate, the different wall layers extending to different extents. **Ascospores** ellipsoidal to narrowly ellipsoidal or broadly fusiform, the apices rounded to apiculate, 3-septate to muriform, very thick-walled, distoseptate, cell lumina appearing lenticular to angular; colourless to olivaceous or dark brown, smooth-walled, without a perispore. **Conidiomata** pycnidia,  $\pm$  globose, black (pigment like the ascoma exciple), unilocular or divided into chambers. **Conidia**  $\pm$  thread-like to strongly curved, aseptate, colourless. **Chemistry**: lichexanthone, unidentified anthraquinones, other unidentified substances, or lichen substances absent. **Ecology**: on more or less smooth bark surfaces in humid situations.

Features used to identify the British and Irish species include: presence of pseudocyphellae (appearing as small whitish dots on the thallus surface), size of perithecia (in most species it is sufficient to measure the diameter of the blackish perithecia in situ) and presence of anthraquinones. Anthraquinones can be detected by mounting a section of perithecium and thallus in water and drawing K under the coverslip; anthraquinones will give a purplish-red solution; this reaction is often strong enough to be also easily seen under the dissecting microscope. *Eopyrenula* lacks lenticular lumina in the ascospores and has brown, septate, macroconidia.

#### Literature:

Aptroot (1991, 2012, 2021), Harris (1989), Orange (2013), Orange & Hawksworth (2009).

- |      |   |
|------|---|
| 1    | Ascospores muriform; perithecia, often in radially arranged groups, large, with lateral ostioles<br>..... <i>hibernica</i><br>Ascospores (1-) 3-septate; perithecia scattered, not in radially arranged groups..... 2   |
| 2(1) | Involucrellum much extended laterally; exciple not continuously pigmented below the perithecial cavity; ascospores 10–17 $\mu$ m long; photobiont apparently absent ..... <i>coryli</i><br>Involucrellum not or slightly extended laterally, exciple pigmented throughout; ascospores often >17 $\mu$ m long; photobiont present ..... 3  |
| 3(2) | Thallus superficial, UV+ yellow-orange (lichexanthone); perithecia usually immersed in the thallus with only the ostiole visible, sometimes exposed as black discs to 0.4 mm diam. .... <i>dermatodes</i><br>Thallus immersed, UV- or UV+ pale yellow or whitish (unidentified substances, lichexanthone absent); perithecia conspicuous, appearing black even when covered by a thin layer of bark ..... 4 |

- 4(3) Perithecia 0.2–0.4 mm diam., forming low projections in the thallus ..... 5  
 Perithecia 0.4–1.2 mm diam., forming distinct projections in the thallus ..... 6
- 5(4) Hymenium at sides with masses of an orange-brown pigment, K+ purple-red in solution ..... *nitidella*  
 Hymenium K- ..... *chlorospila*
- 6(4) Ostioles all central ..... 7  
 Ostioles mainly lateral; thallus without pseudocypheallae, all parts of perithecium lacking K+ purple-red substances; hymenium not interspersed with oil droplets ..... *acutispora*
- 7(6) Perithecium with K+ purple-red substances on the upper surface or within the hymenium; hymenium densely interspersed with oil droplets or not ..... 8  
 Perithecium lacking K+ purple-red substances; hymenium not interspersed with oil droplets ..... 9
- 8(7) Hymenium with lateral parts containing an abundant orange-brown pigment which is K+ purple-red going into solution; not interspersed with oil droplets; thallus sometimes with pseudocypheallae ..... *nitida*  
 Hymenium without K+ purple-red substances, but these present on outer surface of perithecial apex (sometimes sparse); interspersed with oil droplets; pseudocypheallae absent ..... *occidentalis*
- 9(7) Pseudocypheallae present; ascospores (24–) 27–33 (–36)  $\mu\text{m}$  long; perithecia not or scarcely flattened in section ..... *macrospora*  
 Pseudocypheallae absent; ascospores (14–) 17–22 (–26)  $\mu\text{m}$  long; perithecia often flattened in section ..... *laevigata*

### **Pyrenula acutispora** Kalb & Hafellner (1992)

NT

Thallus immersed, pale yellow-grey, sometimes stained dark brown near the perithecia; pseudocypheallae absent. Perithecia 0.54–0.8 mm diam., forming projections on the thallus; ostiole excentric to lateral; hymenium not interspersed with oil droplets, anthraquinones absent (K-). Ascospores (17–) 20–25 (–27)  $\times$  (7.5–) 8–10.5 (–11.5)  $\mu\text{m}$ , 3-septate. Thallus C-, K-, Pd-, UV- (lichen substances absent). **BLS 1676.**

On smooth bark in humid woodlands, possibly confined to temperate rainforests; rare. W. Wales, N.W. England, W. Scotland, S.W. Ireland but under-recorded.

The British populations deviate from most material in that they consistently have lateral ostioles, a character that is usually invariable within *Pyrenula* species. Possibly conspecific with *P. microtheca*, which is known from N. & C. America. Distinguished from all British and Irish species, except *P. hibernica*, by the lateral ostioles. However, the lateral ostioles are difficult to spot in the field and can be central on some perithecia, thus best spotted in the field by the distinct range of thallus colours. Some forms are easily overlooked as *P. occidentalis*, but this has an interspersed hymenium.



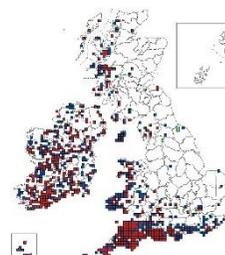
### **Pyrenula chlorospila** Arnold (1887)

LC

Thallus olive-green to pale brown or fawn; pseudocypheallae 40–120  $\mu\text{m}$  diam., white. Perithecia small, 0.2–0.4 mm diam., often rather densely arranged, forming very low projections in the thallus or not forming projections; exciple containing colourless crystals; hymenium not interspersed with droplets, without anthraquinones. Ascospores (25–) 28–32 (–35)  $\times$  (9–) 11–13 (–14)  $\mu\text{m}$ , 3-septate. Thallus C-, K+ yellow, KC-, Pd+ faintly yellow, UV $\pm$  whitish (unidentified substance). **BLS 1221.**

On smooth, shaded bark of deciduous trees, often with *P. macrospora*; locally abundant. S. & W. Britain and Ireland. Appears more southern than *P. macrospora* and some records to the north may refer to stunted examples of that species.

Distinguished in the field by the small, often closely arranged perithecia which scarcely project from the thallus. Most pre-1980 records of *P. nitidella* refer to this species.

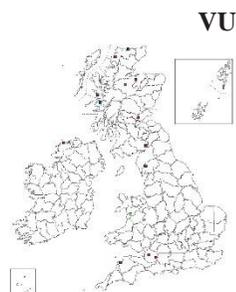


**Pyrenula coryli** A. Massal. (1852)

Thallus pale grey; pseudocyphellae more or less absent; probably lichenized. Perithecia 0.2–0.3 mm diam. and *ca* 0.1 mm high, with a laterally extending involucrellum; pigmented exciple not continuous below the perithecial cavity; anthraquinones absent. Ascospores 10–17 × 4–6 μm, 3-septate. Pycnidia scattered amongst the perithecia; conidia *ca* 20 × 0.5 μm, thread-like. **BLS 1675.**

On *Corylus* bark; very rare. S.W. England (Devon, Somerset), North Wales (Merioneth), Cumbria, scattered in Scotland, N.W. Ireland.

Difficult to separate in the field from species of *Arthopyrenia* and *Eopyrenula*. Indications are that the species has greatly declined in distribution since the pre-industrial era (Ellis *et al.* 2018), doubtless in tandem with many other lichen species.

**Pyrenula dermatodes** (Borrer) Schaer. (1850)

Thallus superficial, yellowish green to ± orange-rust-coloured, fading to pale yellow-brown in dried preserved specimens, continuous to finely cracked or areolate; pseudocyphellae absent. Perithecia 0.2–0.44 mm diam. (measured in section), completely immersed in the thallus, forming very low projections, with only the 50–60 μm diam. grey ostiole visible from above, or sometimes perithecia becoming exposed as a black disc to 0.38 mm diam.; hymenium not interspersed with oil droplets, without anthraquinones (K–). Ascospores 14–19 × 6.5–7.5 (–8.5) μm, 3-septate. Conidia curved, *ca* 15 μm long. Thallus C–, K+ orange-red in places, KC–, Pd–, UV+ very bright yellow-orange (lichexanthone). **BLS 1222.**

On smooth bark, mostly commonly *Ilex* in Ireland but also on *Acer pseudoplatanus*, *Corylus*, *Crataegus*, *Fraxinus*, *Fagus* and *Sorbus* in oceanic woodlands, rarely on shaded siliceous rocks; very rare. N. Scotland (Knoydart, West Inverness), N.W. Wales, locally frequent in S.W. Ireland, extending north to Donegal; not known elsewhere in Europe.

Distinguished by the superficial, often cracked thallus, which is very brightly UV+ and by the (at least initially) very inconspicuous immersed perithecia.

**Pyrenula hibernica** (Nyl.) Aptroot (2003)

Thallus immersed, pale olive-green or yellow-buff, sometimes with white dots (pseudocyphellae), smooth, continuous; with age becoming rougher and rarely cracked. Perithecia 1–1.2 mm diam., black, arising 1–1.5 mm below the surface; only the pale ostiole visible at surface, or perithecia visible through the translucent surface of the thallus; occurring singly, or radially arranged in groups of 2 to 5; ostioles lateral, often joined, visible as a pale yellow- or orange-brown depression, or level with the thallus surface. Asci 4- to 8-spored. Ascospores muriform, brown when mature, (57–) 70–135 (–140) × (24–) 26–47 (–55) μm, cylindrical to fusiform-ellipsoidal. Pycnidia *ca* 2 mm diam., divided into chambers; conidia 24–27 × *ca* 1 μm. Thallus C–, K–, KC–, Pd–, UV+ pale yellow (lichen products not tested by TLC). **BLS 1036.**

On smooth bark, typically on *Corylus* but also on *Acer pseudoplatanus*, *Fraxinus*, *Ilex* and *Sorbus* in very sheltered, moist woods, often in ravines but also on more open slopes, especially in Ireland, very rare. N.W. Wales (Merioneth), Cumbria, W. Scotland (Westerness, Loch Sunart, Mull), S.W. Ireland (Kerry, Killarney, Clare).

Distinguished by the large, immersed perithecia arranged in groups, with lateral ostioles and the muriform ascospores. The perithecia are very striking when visible through the upper layers of the thallus, but sometimes they are very inconspicuous, detectable in surface view only by the pale ostioles.

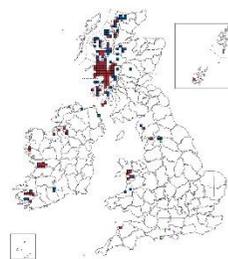
**Pyrenula laevigata** (Pers.) Arnold (1885)

Thallus immersed, silvery or cream to pale yellow-brown; pseudocyphellae absent. Perithecia 0.45–0.66 mm diam., forming projections in the thallus, somewhat flattened in section, with an involucrellum separable from the exciple and spreading somewhat; hymenium not containing anthraquinones, K–. Ascospores (14–) 17–22 (–26) × (7–) 8–9 (–11) μm, 3-septate. Pycnidia black, to *ca* 100 μm diam., scattered or in lines; conidia 10–19 × *ca* 0.5 μm, curved. Thallus C–, K+ yellow, KC–, Pd–, UV–. **BLS 1223.**

**Nb**

On smooth bark, especially of *Corylus*, in oceanic woodlands and characteristic of temperate rainforests; local. S.W. England (N. Devon), N. Wales (Cardigan, Merioneth), N.W. England, W. Scotland, W. Ireland.

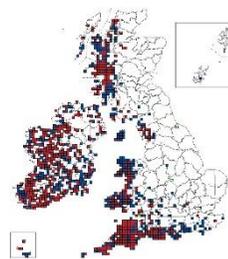
The status of this taxon in Britain and Ireland deserves closer study as it is primarily continental in distribution. A K+ fleeting blue reaction has been reported in the hymenium of this species, but has not been detected in British or Irish material. See also *P. occidentalis*.



**Pyrenula macrospora** (Degel.) Coppins & P. James (1980)

LC

Thallus olivaceous, or fawn to dark brown, with a smooth surface, even near the perithecia; pseudocyphellae 40–120 µm diam., white. Perithecia (0.4–) 0.5–0.9 (–1.2) mm, forming convex projections; exciple containing numerous colourless crystals; hymenium not containing anthraquinones. Ascospores (24–) 27–33 (–36) × (8–) 10–13 µm, 3-septate. Pycnidia visible as dark dots 100–180 µm diam., frequent, mostly in young parts of thallus, often clustered along junctions between adjacent thalli; conidia curved, 10–16 × ca 0.8 µm. Thallus C–, K+ yellow, KC–, Pd+ faintly yellow, UV± weak yellow (unidentified substance). **BLS 1224**.



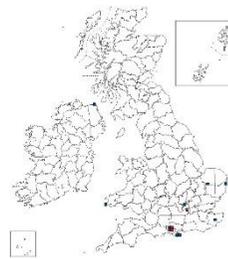
On smooth, more or less shaded bark of deciduous trees; locally common. Throughout S. & W. Britain and Ireland, strongly oceanic.

The commonest British species of the genus. Most pre-1980 records of *P. nitida* from Britain and Ireland refer to this species. Distinguished in the field from most other species by the large perithecia and presence of pseudocyphellae. The rare *P. nitida* differs in the K+ red substance flanking the inner exciple and the smaller ascospores. *P. macrospora* often grows with *P. chlorospila*, which differs in the smaller perithecia which scarcely form projections on the thallus.

**Pyrenula nitida** (Weigel) Ach. (1814)

Thallus olive- to yellow- or dark brown, with an uneven surface, which rises to the perithecial ostioles; pseudocyphellae often absent, but sometimes frequent, 50–75 µm diam., whitish. Perithecia 0.6–0.8 (–1) mm diam.; exciple containing colourless crystals; outer part of hymenium adjacent to the exciple with orange-brown (by transmitted light) masses of anthraquinone, K+ purple-red going into solution; hymenium with or without sparse oil droplets. Ascospores (17–) 19–24 (–26) × 6–8 (–9) µm, 3-septate. Conidia 16.5–19 × ca 0.8 µm, curved. Thallus C–, K+ orange-red, KC+ reddish, Pd–, UV± whitish (unidentified anthraquinones). **BLS 1226**.

VU



On smooth, dry, shaded bark of old *Carpinus* and *Fagus*; very rare. S. England, confirmed records only from Buckingham (Burnham Beeches), E. Kent (Ashford), Hampshire (New Forest) but potentially overlooked elsewhere in the south-east.

Most pre-1980 British records of this species refer to *P. macrospora*. *P. nitida* is primarily a continental species, as reflected by its distribution in Britain. The lack or sparsity of pseudocyphellae and a typically uneven thallus surface rising up to the perithecial ostioles are field indications for this species, the K+ purple hymenium with care can be detected in the field by crushing a single perithecium, applying K and drawing this into tissue.

**Pyrenula nitidella** (Flörke ex Schaer.) Müll. Arg. (1885)

Ex

Thallus olive-brown to fawn; pseudocyphellae 50–75 µm diam., often sparse, whitish. Perithecia 0.2–0.3 (–0.35) mm diam.; hymenium not interspersed with oil droplets, at sides with K+ purple-red material. Ascospores (20–) 22–26 (–28) × (8–) 8.5–11 (–12) µm, 3-septate. Thallus C–, K+ yellow to pale orange in parts, KC–, Pd–, UV± whitish (unidentified anthraquinones). **BLS 1227**.

On smooth bark of trees; very rare in Britain. Previously known with certainty from only two sites in England (N.E. Yorkshire) and Scotland (E. Perthshire), recently discovered in Hampshire (New Forest) and Buckingham (Burnham Beeches) on veteran *Fagus*, associated with *P. nitida*.

Most pre-1980 records of this species in Britain and Ireland refer to *P. chlorospila*, which differs in the lack of anthraquinones in the perithecia. As with *P. nitida* (see above) the K+ purple hymenium can be detected in the field.

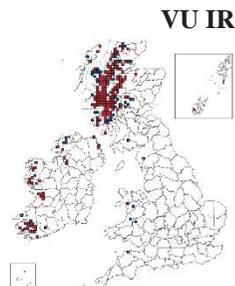
**Pyrenula occidentalis** (R.C. Harris) R.C. Harris (1987)

Thallus immersed, yellow- to orange-brown; pseudocyphellae absent; surface K+ purple-red in parts in section. Perithecia 0.4–0.8 mm diam., forming projections in the thallus; exciple usually with K+ purple-red pigment associated with the upper outside wall; hymenium densely inspersed with minute oil droplets 0.5–2.5  $\mu\text{m}$  diam., thus appearing cloudy; anthraquinones absent (K–). Ascospores (1–) 3-septate, (17–) 18–22  $\times$  (7–) 8.5–10.5 (–11)  $\mu\text{m}$ . Conidia *ca* 20  $\mu\text{m}$  long, curved. Thallus C–, K+ yellowish to + purplish in parts, KC–, Pd+ pale orange, UV– (unidentified anthraquinones). **BLS 1225.**

On smooth bark, particularly of *Corylus*, *Ilex* and *Sorbus*, in more or less shaded, constantly humid woodland and sheltered stream valleys valleys and characteristic of temperate rainforests; local. S.W. England, Mid & N. Wales, Cumbria, W. Scotland, W. Ireland.

Anthraquinones are responsible for the K+ purple-red reaction in the thallus and on the outer surface of the exciple (but not the inner surface); small rusty patches of anthraquinone can sometimes be seen on the thallus surface under a dissecting microscope. This species has been much confused with *P. laevigata*, which differs in the paler thallus, absence of anthraquinones, and the hymenium which is not inspersed with droplets. *P. acutispora* has ostioles that are mainly lateral and the hymenium is not inspersed.

Host to *Skyttea pyrenulae* Diederich, Etayo & Coppins, and to a species of *Stigmidium* that may be *S. pyrenulae* Van den Boom (2020).

**SARCOPYRENIACEAE** Nav.-Ros. & Cl. Roux (1998)

The family contains a single genus, *Sarcopyrenia*, so the description below constitutes that of the family. No molecular data are available. Diederich *et al.* (2018) placed the family within the Verrucariales, but the ascomata structure is rather distinct from other members of the order and the arrangement must be regarded as provisional.

Species of *Sarcopyrenia* are generally regarded as lichenicolous fungi, although Aguirre-Hudson (1991) and Hitch (2009) specified a chlorococcoid photobiont. While it seems clear that colonies originate as parasites of crustose lichens, the ascomata frequently remain on patches of bare rock once the host lichen has degenerated and their nutritional status then becomes obscure.

**SARCOPYRENIA** Nyl. (1858)

**Thallus:** when present, olivaceous grey, squamulose, granulose, not well delimited, associated with a green photobiont; presumably derived from deteriorated host lichens. **Prothallus** rarely present, white or pale grey. **Ascomata** perithecia, conical to subglobose, carbonaceous, black and brittle, smooth to verrucose, scattered; sometimes initially half-immersed but becoming superficial as the thallus degenerates, with a central papillate ostiole. **Exciple** composed of three layers, each formed of angular cells: the outer always carbonaceous, the middle layer colourless to blackish, and the inner layer thinner, composed of smaller laterally compressed cells. **Hamathecium** of paraphyses, soon becoming evanescent; periphyses present in the ostiole; hymenial gel not changing colour in iodine.

**Asci** cylindrical to cylindric-clavate, short-stalked, thin-walled and not fissitunicate or rostrate, thicker towards the apex, becoming evanescent, not blueing in iodine; apical structures not observed; 8-spored. **Ascospores** biserially arranged, colourless, thin-walled, filiform to dumb-bell shaped, sometimes sigmoid, with somewhat capitate apices, aseptate or septate, without appendages or gelatinous sheaths. **Conidiomata**: not known. **Chemistry**: lichen products not detected by TLC. **Ecology**: on lichens on calcareous and siliceous rocks or on bark when heavily impregnated with quarry lime dust.

The genus is frequently overlooked, although colonies may be detected by the presence of prominent perithecia in areas cleared of lichen thalli.

#### Literature:

Aguirre-Hudson (1991), Diederich *et al.* (2018), Hitch (2009), Navarro-Rosinés *et al.* (1998, 2009).

- |      |   |                      |
|------|---|----------------------|
| 1    | Ascospores septate, cylindrical or slightly curved .....      | <i>cylindrospora</i> |
|      | Ascospores aseptate, filiform or dumb-bell shaped .....       | 2                    |
| 2(1) | Ascospores 40–60 × (1.5–) 2–2.5 μm, filiform .....            | <i>beckhausiana</i>  |
|      | Ascospores capitate, 26–44 × 2.5–5 μm, dumb-bell shaped ..... | <i>geisleri</i>      |

#### **Sarcopyrenia beckhausiana** (J. Lahm) M.B. Aguirre, Nav.-Ros. & Hladun (1990)

NE

Lichenicolous. Perithecia ± spherical to applanate, carbonaceous, glossy, 0.5–1.2 μm diam.; paraphyses not observed, periphyses sparingly septate with slightly capitate terminal cells. Asci cylindrical, short-stalked, apparently evanescent, 60–70 × 4–6.5 μm, 8-spored. Ascospores aseptate, colourless, smooth, filiform with rounded ends, straight or slightly bent, 40–60 × (1.5–) 2–2.5 μm. **BLS 1985**.

On a moribund member of the Verrucariaceae making delicate pits in chalk, on chalk pebbles in close turf on a west-facing bank; and on a limestone pebble on quarry spoil; very rare. Sussex (South Downs), Derbyshire.

Apparently lichenicolous on *Bagliettoa* spp. and *Verrucaria hochstetteri*.



#### **Sarcopyrenia cylindrospora** (P. Crouan & H. Crouan) M.B. Aguirre (1990)

NE

Thallus partially immersed in moribund crustose lichen thalli, or yellowish and granulose, of clustered, narrow septate hyphae and chlorococcoid algae. Perithecia 0.4–0.6 mm diam., the central layer of the exciple exceptionally thick, 70–100 μm broad; paraphyses not observed, periphyses < 2 μm diam., infrequently septate. Asci cylindric-clavate, short-stalked, not fissitunicate, 4.5–5.5 × 5–6.5 μm, thickened at the apex. Ascospores 1-septate, colourless, smooth, filiform, with rounded ends, straight, 35–40 × 2–3 μm. **BLS 1847**.

On moribund thalli of *Candelariella vitellina* on a rusty steel farm roller, a sandstone chest tomb and a basalt outcrop; very rare. E. England (Essex, Suffolk), W. Gloucestershire, mid Wales, E. Scotland.

The type collection was described as growing on gneiss. However, a more recent collection from Spain was found to be parasitic on a thallus of *Circinaria cf. contorta*.

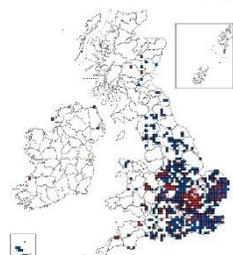


#### **Sarcopyrenia geisleri** (Beckh.) P.F. Cannon (2023)

NE

*Sarcopyrenia gibba* var. *geisleri* (Beckh.) Nav.-Ros. & Hladun (1990)

Thallus inconspicuous, reduced to a scurfy, effuse collar around the perithecia or evanescent and immersed, rarely superficial, ochraceous-green to yellowish-ochre, granulose, of clustered, septate hyphae and chlorococcoid algae. Perithecia 0.5–1 mm diam., the wall three-layered with an intermediary colourless area, the central excipular layer thick, to 90 μm. Asci 55–70 × 7–9.5 μm; hamathecium of paraphyses ca 1.75 μm diam. with infrequent septa, occasionally branched, covered in mucus, evanescent; hymenium and subhymenium I–, periphyses narrow, rarely septate with swollen terminal cells. Ascospores aseptate, colourless, 26–44 × 2.5–5 μm, dumb-bell



shaped with swollen ends. **BLS 1307.**

In sunny exposed situations, particularly walls and flat-topped chest tombs in churchyards and flagstones, also on oolite, black limestone monuments, marble, concrete and base-rich sandstones, rarely on *Larix* and *Corylus* bark heavily impregnated with quarry lime dust (Scotland); locally frequent. Channel Islands, throughout England and Wales (commonest in S. & S.E. England), scattered throughout Scotland, E. and N. Ireland.

This species is easily recognized by the single or clusters (2-3) of perithecia in 'cleared' areas of stone and the dumb-bell-shaped ascospores. There have been suggestions that the species is initially parasitic on other lichens (possibly *Caloplaca* s.l.).

*Sarcopyrenia gibba* (Nyl.) Nyl. (1858) s.str, from the Mediterranean regions of Spain, Greece & N. Africa, has somewhat narrower ascospores that are twisted in the asci.

## STRIGULACEAE A.B. Frank (1877)

**Thallus** crustose, superficial, or subcuticular on living leaves, non-corticate or pseudo-corticate, white to green in foliicolous species, variously coloured in corticolous taxa. **Photobiont** *Trentepohlia*, *Cephaleuros* or *Phycopeltis*. **Ascomata** perithecia, scattered, clustered, or aggregated in pseudostromata, immersed to prominent, mostly brown or black, rarely pale, often at least partly covered by the thallus, globose to pyriform or conical, ostiolate, the ostiole usually central. **Involutrellum** present in some genera, usually carbonized. **Exciple** composed of compressed hyphae, colourless to brown or brown-black. **Hamathecium** composed of narrow unbranched or branched to sparsely anastomosing paraphyses. **Asci** fissitunicate, obclavate to mostly cylindrical, short-stalked with a distinct ocular chamber, non-amyloid, 1- to 8-spored. **Ascospores** fusiform to ellipsoidal, colourless, transversely septate to muriform, smooth-walled, often constricted and sometimes fragmenting at the septa, perispore often present. **Conidiomata** pycnidia, immersed to erumpent, often visible as black dots, rarely pale and inconspicuous. **Macroconidia** 1-septate to rarely muriform, ellipsoidal to bacillar, sometimes rather large, colourless, with variously shaped gelatinous appendages. **Microconidia** usually aseptate, fusiform-ellipsoidal to bacillar, small, colourless. **Chemistry**: most species without secondary substances. **Ecology**: on leaves, bark or rocks, mostly tropical to subtropical with a few species extending into temperate regions.

The Strigulaceae is the largest family within the Strigulales (Hongnanan *et al.* 2020), with diversity concentrated on tropical leaves. Currently, 13 genera are recognized, of which two occur within our region. The species treated within the genus *Strigula* by Coppins & Orange (2009) are now placed within *Dichoporis* and *Swinscowia*.

The non-lichenized genus *Oletheriostrigula* was included within the Strigulaceae by Lücking *et al.* (2017a), and there are a few records from southern England of the monotype species *O. papulosa* (Durieu & Mont.) Huhndorf & R.C. Harris (1996). However, it was excluded from the family by Hongnanan *et al.* (2020) and the very limited molecular data available suggest a relationship with *Stigmatodiscus* (Stigmatodiscaceae); see Voglmayr *et al.* (2016).

The gelatinous appendages of the macroconidia are best observed using phase-contrast microscopy, or in a solution of a stain such as Brilliant Cresyl Blue, when they appear pale and unstained in contrast to the coloured solution. The conidia often need to be strongly clarified, for instance with nitric acid or warmed lactic acid, to clear false septa caused by the juxtaposition of oil droplets.

### Literature:

Coppins & Orange (2009b), Hongnanan *et al.* (2020), Huhndorf & Harris (1996), Jiang *et al.* (2020), Lücking *et al.* (2017a), Roux & Sérusiaux (2004), Voglmayr *et al.* (2016).

- 1      Ascospores and macroconidia 1-septate; macroconidial appendages relatively long and narrow, 3–6 times as long as wide; microconidia typically fusiform .....*Dichoporis*  
 Ascospores and macroconidia 3-septate to muriform; macroconidial appendages relatively short and broad, 1–2(–5) times as long as narrow, microconidia typically bacillar.....*Swinscowia*

### DICHOPORIS Clem. (1909)

**Thallus** usually not corticate, whitish to brownish. **Photobiont** *Trentepohlia*. **Ascomata** perithecia, often densely scattered, very rarely fused, immersed-erumpent to sessile, the exposed parts black, lenticular to hemispherical, ostiolate. **Involucrellum** usually present and carbonized, very rarely reduced or absent. **Exciple** pale to brown. **Hamathecium** composed of flexuose paraphyses, typically branched and sometimes somewhat anastomosing. **Asci** usually 8-spored, fissitunicate, cylindrical to narrowly obclavate, short-stalked, with narrow ocular chamber, non-amyloid. **Ascospores** fusiform to ellipsoidal or bacillar, colourless, 1-septate, very rarely with two inconspicuous secondary septa, smooth-walled, often constricted (and sometimes breaking apart) at the septum. **Conidiomata** pycnidia, common, immersed to erumpent, usually visible as black dots. **Macroconidia** 1-septate, cylindric-bacillar, colourless, typically with narrow gelatinous appendages; **microconidia** aseptate, typically fusiform, colourless, small. **Chemistry**: No secondary substances known. **Ecology**: on bark of broadleaved trees, rarely saxicolous.

A genus of about 20 species, of which two occur in Britain and Ireland. Molecular data are lacking, but *Dichoporis* can be easily distinguished in morphological terms from *Swinscowia*, based on research by Roux & Sérusiaux (2004) and Jiang *et al.* (in Hongsanan *et al.* 2020).

The two species from our region are included in a key to *Swinscowia* (see below). There is also a currently undescribed species of *Dichoporis* with a white thallus on bark of *Fagus* and *Ilex*, known from the New Forest and Ireland. It has 1-septate ascospores 11–13 × 4–5 μm in size that do not fragment at the septa, and (0-) 1-septate conidia with dimensions 10–13 × ca 3 μm.

#### *Dichoporis phaea* (Ach.) S.H. Jiang, Lücking & Sérus. (2020)

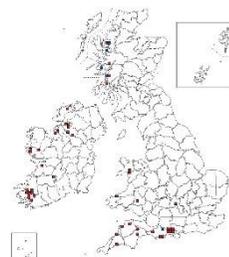
*Strigula phaea* (Ach.) R.C. Harris (1975)

Thallus grey-green or brownish, continuous, usually thicker and fairly swollen, sometimes fairly thin. Ascomata 0.2–0.35 mm diam., projecting, but mostly covered by a thin layer of thallus; involucrellum reaching the base of the exciple; exciple at first colourless, but soon dark brown; paraphysoids to (1-) 1.5 μm diam. Asci cylindrical to ± elongate-clavate. Ascospores (6.5-) 9–12.5 (–14.5) × (2-) 2.5–3.5 (–4.5) μm, fusiform, 1-septate, constricted at the septum but not separating into part-spores, cells often containing two oil-drops in historical dried material; perispore often visible, thin, 0.2–0.5 (–1) μm thick. Macropycnidia 100–170 μm diam., globose, brown or blackish, projecting but covered by a thin thalline layer; covered by an involucrellum; macroconidia (6-) 7–8.5 (–10) × (1.5-) 2–2.2 (–2.5) μm, cylindrical, 1-septate, not or scarcely constricted at the septum, each end with a rather short and wide appendage 2–5 × 0.5–2 μm in size which is often curved, flexuose or helical; in dried material each cell often with two persistent oil droplets; conidiogenous cells elongate, (4-) 7–25 (–27) × 1–1.5 μm; micropycnidia like the macropycnidia but 50–100 μm diam.; microconidia fusiform or subfusiform, 2.5–4 × 1–1.5 μm; conidiogenous cells very elongated, 5–21 × 1–1.5 μm in size. **BLS 2392**.

On bark of *Fagus*, *Fraxinus*, *Quercus* and *Ulmus*, in areas of old woodland, has also recently been found on damp rocks by streams; very local. S. and S.W. England, Wales, W. Scotland, throughout W. Ireland. Judging from the timing of distributional observations, the species may be increasing in range.

Ascomata often absent, but specimens are distinguished by the 1-septate macroconidia borne on a very elongated conidiogenous cell. An unidentified species has been rarely collected on *Ulmus* bark, calcareous rock

Nb



and on herbaceous stems (*Aubrieta*) in England and Scotland (Orange 2013); the collections on rock and *Aubrieta* have macropynidia only. It is similar to *S. phaea* but differs in the following characters: ascomata 0.1–0.2 mm diam., projecting, globose; ascospores  $9.5\text{--}12$  (–13)  $\times$   $2.5\text{--}3$  (–3.5)  $\mu\text{m}$ , fusiform or subfusiform, without a distinct perispore; macroconidia (7.5–) 8–11  $\times$  1.5–2.5  $\mu\text{m}$ , each end with a  $1.5\text{--}2 \times ca$  1  $\mu\text{m}$  appendage.

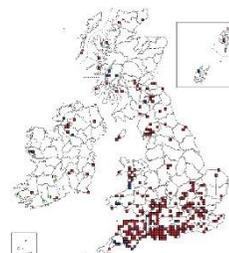
**Dichoporis taylorii** (Carroll ex Nyl.) S.H. Jiang, Lücking & Sérus. (2020)

*Strigula taylorii* (Carroll ex Nyl.) R.C. Harris (1975)

Thallus brown, olive brown or dark brown, continuous or slightly cracked, thin, mostly immersed in bark. Ascomata 0.2–0.3 mm diam., projecting, immersed only in the lower quarter, conical. Ascospores (16–) 19–24 (–27)  $\times$  (3.5–) 4–5  $\mu\text{m}$ , 1-septate, separating into part-spores at ascus dehiscence or before, part-spores (8.5–) 9.5–12.5 (–14.5)  $\times$  (3–) 3.5–5 (–5.5)  $\mu\text{m}$ . Macropynidia semiglobose, 50–120  $\mu\text{m}$  diam., with an involucrellum; macroconidia (12.5–) 13.5–17.5 (–20)  $\times$  (2–) 2.5–3 (–3.5)  $\mu\text{m}$ , (0–)1-septate, at each end with a poorly visible gelatinous appendage  $1.5\text{--}4.5 \times 1\text{--}2 \mu\text{m}$  in size; each cell containing (2–) 3–4 (–5) persistent oil droplets; conidiogenous cells  $5\text{--}11.5 \times 2\text{--}2.5 \mu\text{m}$  in size; micropynidia like the macropynidia but 50–100  $\mu\text{m}$  diam.; microconidia fusiform or subfusiform,  $2.5\text{--}4 \times 1\text{--}1.5 \mu\text{m}$ . **BLS 1378.**

On usually  $\pm$  smooth bark of mature trees in wound and rain tracks (especially *Acer*, *Fagus* and *Fraxinus*) in sheltered situations, or more rarely on limestone; local. Throughout Britain and Ireland, rarer in N. England and N. Scotland. The species has become much more common in recent years, especially in southern England.

Usually distinguished in the field from *Porina aenea* or *P. borrieri* by the numerous pycnidia scattered among the larger, often  $\pm$  conical perithecia.



Nb

**SWINSCOWIA** S.H. Jiang, Lücking & Sérus. (2020)

**Thallus** usually not corticate, whitish to brownish. **Photobiont** *Trentepohlia*. **Ascomata** perithecia, immersed-erumpent to sessile, usually partly covered with thalline tissue, the exposed parts black or rarely pale, lenticular to hemispherical, ostiolate. **Involucrellum** usually present and carbonized, rarely reduced or pale. **Exciple** pale to brown or blackish. **Hamathecium** composed of flexuose paraphyses, typically branched and sometimes somewhat anastomosing. **Asci** usually 8-spored (rarely with as few as 2-spored), fissitunicate, cylindrical to narrowly obclavate, short-stalked, with narrow ocular chamber, non-amyloid. **Ascospores** fusiform to ellipsoidal or bacillar, colourless, mostly 3–7-septate to (sub-) muriform, smooth-walled, often constricted (and sometimes breaking apart) at the septa. **Conidiomata** pycnidia, common, immersed to erumpent, usually visible as black dots. **Macroconidia** (1–)3–7(–11)-septate or more rarely submuriform, cylindric-ellipsoidal to bacillar, colourless, with variably shaped gelatinous appendages; **microconidia** aseptate, ellipsoidal to fusiform, colourless, small. **Chemistry**: No secondary substances known. **Ecology**: on bark of broadleaved trees, more rarely on rocks or overgrowing bryophytes.

*Swinscowia* corresponds to “ensemble 2” in the treatment of *Strigula* s.l. from Europe and Macaronesia by Roux & Sérusiaux (2004), and differs from “ensemble 1” (i.e. *Dichoporis* above) by ascospores and macroconidia that are multiseptate. Very little molecular data are available, and it may be that this arrangement will be modified further in future.

**Literature:**

Coppins & Orange (2009b), Hongsanan *et al.* (2020), Roux & Sérusiaux (2004).

**Key to species of *Dichoporis* and *Swinscowia***

- 1** Ascomata present; macropycnidia present or not ..... 2  
 Ascomata absent; macropycnidia present ..... 10
- 2(1)** Ascospores muriform ..... 3  
 Ascospores transversely 1- to 9-septate, rarely with one longitudinal septum ..... 4
- 3(2)** Ascospores (35-) 40-58 (-62)  $\mu\text{m}$  long; ostiole central; on rock ..... *Swinscowia confusa*  
 Ascospores (22-) 24.5-30.5 (-31.5)  $\mu\text{m}$  long; ostiole usually lateral; on bark  
 ..... *Swinscowia tagananae*
- 4(2)** Ascospores (3- to) 7 (to 9-) septate ..... 5  
 Ascospores 1- or 3-septate ..... 6
- 5(4)** Thallus thick and verrucose, with perithecia half to three quarters immersed; on mosses over rock,  
 upland ..... *Swinscowia alpestris*  
 Thallus  $\pm$  smooth, partially immersed, ascomata one quarter to half immersed; on mosses or bark  
 of old broad-leaved trees, S. England ..... *Swinscowia stigmatella*
- 6(4)** Ascospores 1-septate, sometimes separating into part-spores ..... 7  
 Ascospores 3-septate ..... 8
- 7(6)** Ascospores (16-) 19-24 (-27)  $\mu\text{m}$  long, separating into part-spores at ascus dehiscence  
 or before; macroconidia 12.5-20  $\mu\text{m}$  long; thallus thin, brown ..... *Dichoporis taylorii*  
 Ascospores 6.5-14.5  $\mu\text{m}$  long, not separating into part-spores; macroconidia 6-10  $\mu\text{m}$  long;  
 thallus thick, green to green-brown [see also information on an undescribed species with a  
 white thallus in the text above] ..... *Dichoporis phaea*
- 8(6)** Involucrellum absent, ascomatal wall orange to pale brown; ostiolar region elongated  
 into a neck (section needed); ascospores (9.5-) 10.5-13 (-14.5)  $\mu\text{m}$  long, without  
 a perispore ..... *Swinscowia thelopidoides*  
 Involucrellum present, ascomatal wall dark brown; ostiolar region not elongated ..... 9
- 9(8)** Ascomata 0.1-0.2 mm diam.; ascospores 13.5-16 (-17.5)  $\mu\text{m}$  long ..... *Swinscowia jamesii*  
 Ascomata 0.2-0.3 mm diam.; ascospores (17.5-) 19-21  $\mu\text{m}$  long ..... *Swinscowia muscicola*
- 10(1)** Macroconidia 5- to 11-septate, at least 20  $\mu\text{m}$  long ..... 11  
 Macroconidia 1- to 3-septate, up to 20  $\mu\text{m}$  long ..... 12
- 11(10)** Macroconidia 5- to 7-septate, 20-30  $\mu\text{m}$  long ..... *Swinscowia stigmatella*  
 Macroconidia (7- to) 11-septate, 36-44  $\mu\text{m}$  long ..... *Swinscowia tagananae*
- 12(10)** Macroconidia 3-septate ..... *Swinscowia jamesii*  
 Macroconidia (0-)1-septate ..... 13
- 13(12)** Macroconidia 6-10  $\mu\text{m}$  long ..... *Dichoporis phaea*  
 Macroconidia 12.5-20  $\mu\text{m}$  long [see also information on an undescribed species with a white  
 thallus in the text above] ..... *Dichoporis taylorii*

**Swinscowia alpestris** (Vězda) S.H. Jiang, Lücking & Sérus. (2020)

**Nb**

*Strigula alpestris* (Vězda) Hafellner (2002)

*Strigula stigmatella* var. *alpestris* (Vězda) Coppins (1980)

Similar to *Swinscowia stigmatella*, but with a thicker and  $\pm$  verrucose thallus, perithecia that are half to three-quarters immersed, the involucrellum that is not delimited from the exciple which is pale brown but blackish

brown and thickened around the ostiole, and asci that are  $100\text{--}110 \times 13\text{--}15 \mu\text{m}$  in size (Purvis *et al.* 1992). It differs also in ecology and habitat. There does not appear to be any published information regarding the pycnidia or conidia. **BLS 1377.**

On mosses over epidiorite or mica-schist, N. Scotland, Cumbria, N. Wales.

Distinguished from *S. stigmatella* at varietal level by Purvis *et al.* (1992), but Roux & Sérusiaux (2004) could not distinguish the varieties, in contrast to Hafellner (2002) and Jiang *et al.* (in Hongnan *et al.* 2020) who separated the taxa at species level. That last approach is followed here tentatively with emphasis on the differences in ecology and habitat, but molecular data would certainly be useful to confirm (or otherwise) this assessment.



**Swinscowsia calcarea** (Bricaud & Cl. Roux) S.H. Jiang, Lücking & Sérus. (2020)

**NE**

*Strigula calcarea* Bricaud & Cl. Roux (1991)

Thallus crustose, endolithic, pale greyish green to brownish or sometimes tinged pink (especially in exposed situations), the surface rather irregular, frequently with round holes  $0.2\text{--}0.4 \text{ mm}$  diam. in which fruit-bodies were formerly situated. Ascromata  $200\text{--}400 \mu\text{m}$  diam., fully immersed with only a minute ostiole visible from the surface, globose to pyriform; involucrellum absent; exciple thin and only brown-pigmented in the ostiolar region; paraphyses broad and irregular, not or hardly branched. Asci cylindrical to cylindrical-clavate. Ascospores  $(15\text{--}) 17\text{--}23 \times (4\text{--}) 5.5\text{--}7 (-8) \mu\text{m}$ , ellipsoidal to ellipsoidal-fusiform, colourless, constricted at each of the three septa and sometimes fragmenting into two part-spores. Macropycnidia  $120\text{--}180 \mu\text{m}$  diam., globose, only pigmented near the ostiole, remaining immersed. Macroconidia  $15\text{--}20 (-23) \times 4\text{--}5.5 \mu\text{m}$ , cylindrical, mostly 3-septate, colourless, with a  $\pm$  globose gelatinous appendage at each end. Micropycnidia similar to the macropycnidia but smaller,  $80\text{--}120 \mu\text{m}$  diam. Microconidia  $3\text{--}4 \times 1\text{--}1.5 \mu\text{m}$ , bacillar, aseptate. **BLS 2605.**



On shaded limestone cliffs and walls, England (Somerset, Gloucestershire), Wales (Glamorgan).

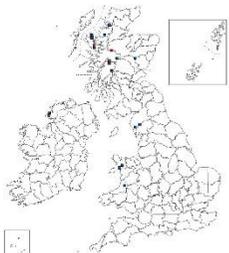
British populations appear to contain only pycnidia. Easily distinguished from other British and Irish species of *Strigula* s. lat. by its limestone habitat; could be mistaken for species of *Bagliettoa* (Verrucariaceae) which also have colonies with immersed fruit-bodies and holes formerly occupied by old ascromata.

**Swinscowsia confusa** (Fryday, Coppins & Common) S.H. Jiang, Lücking & Sérus. (2020)

**Nb IR**

*Strigula confusa* Fryday, Coppins & Common (2004)

Thallus grey or white-grey, continuous and fairly thin. Ascromata  $0.3\text{--}0.5 \text{ mm}$  diam., globose, at first almost completely immersed then half to three-quarters immersed in the thallus, blackish or rarely whitish (on frequently submerged rocks); involucrellum absent or not separable from the exciple; exciple brown above, at first colourless below, then completely brown; paraphysoids  $1.5\text{--}2.5 \mu\text{m}$  diam. Asci (4-) 6- to 8-spored. Ascospores  $(35\text{--}) 40\text{--}58 (-62) \times (7\text{--}) 8\text{--}12 \mu\text{m}$ , subfusiform or fusiform, muriform, with (6-)  $12\text{--}14 (-17)$  transverse septa and 1-3 longitudinal septa per tier. Macropycnidia unknown; micropycnidia  $40\text{--}60 \mu\text{m}$  diam., largely immersed in the thallus; microconidia  $3.5\text{--}4.5 \times 1\text{--}1.5 \mu\text{m}$ . **BLS 2322.**



Over bryophytes on mildly base-rich rocks (including andesite, mica-schist and basalt), rarely directly on shaded mudstone. Hyperoceanic regions of N. and W. Britain, N.W. Ireland. Possibly endemic.

*Thelenella muscorum* var. *octospora* occurs in similar habitats and could be confused with this species, but it has a trebouxoid photobiont.

**Swinscowsia jamesii** (Swinscow) S.H. Jiang, Lücking & Sérus. (2020)

**Nb**

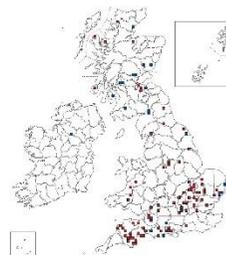
*Strigula jamesii* (Swinscow) R.C. Harris (1980)

Thallus whitish or pale grey, very thin, largely immersed. Ascromata  $0.1\text{--}0.2 \text{ mm}$  diam., half immersed in the substrate, upper part rounded or flattened, rarely conical; involucrellum confined to the apical part of the exciple. Asci narrowly clavate. Ascospores  $13.5\text{--}16 (-17.5) \times 4\text{--}5 (-5.5) \mu\text{m}$ , subfusiform, 3-septate, lightly constricted at the septa, the two upper cells usually wider than the lower two, perispore  $0.2\text{--}2.5 \mu\text{m}$  thick. Macropycnidia  $50\text{--}100 \text{ mm}$  diam., largely immersed; involucrellum present in the upper part; macroconidia  $(13\text{--}) 13.5\text{--}16.5 (-$

18)  $\times$  (2-) 2.5 (-3)  $\mu\text{m}$ , narrowly cylindrical, 3-septate, not or scarcely constricted at the septa, each end with an appendage 1.5-3  $\times$  1.5-2  $\mu\text{m}$  in size; microconidia 2.5-4  $\times$  1-1.5  $\mu\text{m}$ . **BLS 1375.**

On moist base-rich bark, especially on *Ulmus* trunks, or on exposed roots in sheltered woodland, rarely over mosses on mortar; local. Throughout Britain and Ireland (commoner in the south), one record from Ireland.

*Swinscowia affinis* (A. Massal.) S.H. Jiang, Lücking & Sérus. is similar but has larger ascomata and slightly larger ascospores and conidia; it is not yet recorded from Britain and Ireland but could well occur here.



**Swinscowia muscicola** (F. Berger, Coppins, Cl. Roux & Sérus.) S.H. Jiang, Lücking & Sérus. (2020)

*Strigula muscicola* F. Berger, Coppins, Cl. Roux & Sérus. (2005)

**Nb**

Thallus whitish or whitish grey, thin. Ascomata 0.2-0.3 mm diam., globose, hardly immersed in the thallus, single or usually in clusters of 2-4 (-8); involucrellum well-developed, black, extending almost to the base of the ascomata; paraphyses 1.5-2  $\mu\text{m}$  diam., sometimes slightly branched and anastomosed at their base. Ascospores 3-septate, (17.5-) 19-21  $\times$  4.5-6  $\mu\text{m}$ . Pycnidia not observed. **BLS 2438.**

On moss on soil in a crevice on a boulder; only a single record so far. C. Scotland (South Aberdeenshire, Braemar).

Distinguished by the muscicolous habit, aggregated ascomata and non-muriform spores. It differs from *S. jamesii* in its larger ascomata and ascospores, and fruit-bodies that are almost superficial.



**Swinscowia stigmatella** (Ach.) S.H. Jiang, Lücking & Sérus. (2020)

**EN**

*Strigula stigmatella* (Ach.) R.C. Harris (1975)

Thallus greenish or pale grey, usually quite conspicuous, continuous and partly immersed. Ascomata 0.3-0.4 mm diam., globose, one-quarter to half immersed, partly covered by a thin thalline layer; involucrellum distinct from the exciple when young, later not clearly distinct and usually appearing as a thickening of the upper part of the exciple; exciple colourless to pale brown below. Ascospores (25-) 26-36.5 (-40.5)  $\times$  (3.5-) 5.5-7  $\mu\text{m}$ , fusiform, (3-) 7 (-9)-septate, rarely also with a longitudinal septum, perispore absent. Macropycnidia ca 100  $\mu\text{m}$  diam.; macroconidia 20-30  $\times$  4-6  $\mu\text{m}$ , cylindrical-fusiform, 5- to 7-septate, not or scarcely constricted at the septa, appendages not recorded but almost certainly present; micropycnidia 50-100  $\mu\text{m}$  diam.; macroconidia 2.5-3  $\times$  0.5-1.5  $\mu\text{m}$ . **BLS 1376.**

On bark of old broad-leaved trees or over mosses on tree bases; rare. S. England (?extinct in Sussex and Hampshire), Wales (Ceredigion). A record from Scotland (E. Inverness) may refer to *S. alpestris* (see below).

*Swinscowia alpestris* was treated as a variety of *S. stigmatella* by Coppins & Orange (2009); see under that name for comparative information. It is not clear whether the information on pycnidia and conidia given here (following Purvis *et al.* 1992) derives from specimens of *S. stigmatella* or *S. alpestris*.



**Swinscowia tagananae** (Harm.) S.H. Jiang, Lücking & Sérus. (2020)

**Nb**

*Strigula tagananae* (Harm.) R.C. Harris (1995)

Thallus white to grey, continuous, largely immersed, usually inconspicuous. Ascomata 0.2-0.5 mm diam., circular or slightly elliptical in outline, flattened and scarcely projecting to projecting and hemispherical, solitary or often in groups of 2-7, often in lines, black and usually glossy, the ostiole usually lateral. Ascospores subfusiform to fusiform, (22-) 24.5-30.5 (-31.5)  $\times$  (6-) 6.5-8.5 (-9.5)  $\mu\text{m}$ , muriform, with (5-) 6-7 (-9) transverse septa and (0-) 1-5 longitudinal septa. Macropycnidia 0.1-0.2 mm diam.; macroconidia cylindrical, (7-) 9-11-septate, 36-44  $\times$  4-5  $\mu\text{m}$ , each end with an elongated appendage 10-30  $\times$  1-4  $\mu\text{m}$ ; microconidia 2.5-3  $\times$  1  $\mu\text{m}$ . **BLS 1919.**

On *Corylus* and *Fraxinus* in Ireland and on old *Fagus* trees in England; very rare. Ireland (Clare, Fermanagh), England (Hampshire, New Forest).



The ascomata with lateral ostioles appear to be unique within *Strigula* (see Aptroot & Van den Boom 1995), and molecular data would be helpful to confirm the position of this species. “*Arthopyrenia*” *platypyrenia* (see under Trypetheliaceae below) also exhibits this feature, but the ascospores are quite distinct and macropycnidia are not known.

**Swinscowia thelopsidoides** (Coppins, Cl. Roux & Sérus.) S.H. Jiang, Lücking & Sérus. (2020) NT

*Strigula thelopsidoides* Coppins, Cl. Roux & Sérus., in Roux & Sérusiaux (2004)

Thallus whitish or inconspicuous, immersed. Ascomata at first immersed in the substrate and elongated, later partially projecting, with a well-developed ostiolar canal lined with paraphysoids; involucrellum absent; exciple orange to pale brown, ostiolar region sometimes brown. Ascospores ellipsoidal to subfusiform, 3-septate, not constricted at the septa, (9.5–) 10.5–13 (–14.5) × 2.5–3.5 (–4.5) μm, without a perispore. Macropycnidia unknown; micropycnidia immersed in the substrate, ca 0.1 mm diam., wall colourless; microconidia 2–4 × 1–1.5 μm; conidiogenous cells 4–8.5 × 1–1.5 (–2) μm. **BLS 1682.**

On bark of *Fraxinus* and *Quercus*; rare. Wales (Merionethshire), W. Scotland.

Easily distinguished by its ascomata with orange to brown walls that are ± immersed in bark, though may eventually partially project. It resembles a diminutive *Thelopsis rubella*, which differs in having multispored asci.



## TRYPETHELIACEAE Eschw. (1824)

**Thallus** crustose. **Photobiont** *Trentepohlia*, or absent. **Ascomata** perithecia, the ostiole apical or lateral, solitary, in compound stromatic structures or laterally fused with a shared ostiole. **Thalline margin** usually absent. **Involucrellum** absent or poorly developed. **Hamathecium** of narrow branched and anastomosed pseudoparaphyses embedded within a gelatinous matrix, often densely interspersed with oil droplets, not blueing in iodine. **Asci** fissitunicate, with a broad ocular chamber and refractive ring, not blueing in iodine, cylindrical to clavate, usually 8-spored. **Ascospores** transversely septate to muriform, often distoseptate with angular lumina (not in British and Irish species), colourless to dark brown. **Conidiomata** pycnidia. **Conidia** colourless, aseptate, bacillar to cylindrical. **Chemistry**: anthraquinones, perylenquinones and lichenxanthone frequently present. **Ecology**: mostly corticolous, occasionally overgrowing bryophytes or on rocks.

The family contains around 15 genera, not all of which are exclusively lichenized, and most are primarily tropical in distribution. It is the only family currently recognized in the order Trypetheliales (Lücking *et al.* 2016, 2017a). *Arthopyrenia* (see below) was formerly placed in its own family Arthopyreniaceae, but molecular phylogenetic analysis shows that the genus belongs within a monophyletic clade that includes the Trypetheliaceae (Thiyagaraja *et al.* 2021).

**Literature:**

Hyde *et al.* (2013), Lücking *et al.* (2016), Nelsen *et al.* (2014), Thiyagaraja *et al.* (2021).

- |      |   |                                   |
|------|---|-----------------------------------|
| 1    | Ascospores brown, ornamented .....  | 2                                 |
|      | Ascospores colourless, sometimes pale brown when overmature .....                                       | 4                                 |
| 2(1) | Basal fringe around the perithecia inconspicuous, <0.12 mm wide, ± circular .....                       | 3                                 |
|      | Basal fringe around the perithecia conspicuous, 0.12–0.30 mm wide, elliptical to broadly fusiform ..... | <i>Mycomicrothelia wallrothii</i> |

- 3(2) Ascospores (12.5–) 13.5–16 (–17.5) × (5.5–) 6.5–8 (–9) µm; pycnidia present ..... *Mycomicrothelia atlantica*  
 Ascospores (15.5–) 17.5–21 (–25) µm in length; pycnidia absent ..... *Mycomicrothelia confusa*
- 4(1) Ascospores submuriform ..... *Julella sericea*  
 Ascospores transversely septate ..... 5
- 5(4) Ascospores 3-septate ..... *Arthopyrenia cerasi*  
 Ascospores 1-septate (rarely 3-septate in old degenerating spores) ..... 6
- 6(5) Ascomata 120–180 µm diam., with a broad involucrellar fringe; ascospores often with a distinct median constriction in each cell; vegetative mycelium often slightly bleaching the bark surface ..... *Alloarthopyrenia italica*  
 Ascomata (300–) 350–500 µm diam., with a narrow fringe; ascospore cells without a median constriction, or only in the lower cell; vegetative mycelium inconspicuous, not discoloring the bark ..... *Arthopyrenia analepta*

### ALLOARTHOPYRENIA Phukhams., Lücking & K.D. Hyde (2016)

The genus is currently monotypic, so the description of *Alloarthopyrenia italica* below constitutes that of the species.

The genus is not effectively distinguished from *Arthopyrenia* (see below) using morphological criteria, and a broader range of sequenced species may result in the genera being merged. For the moment it must be accepted.

#### Literature:

Hyde *et al.* (2016), Thiyagaraja *et al.* (2021).

#### *Alloarthopyrenia italica* Phukhams., Camporesi, Ariyaw. & K.D. Hyde (2016)

*Arthopyrenia cinereopruinosa* auct. br., non (Schaer.) A. Massal. (1855)

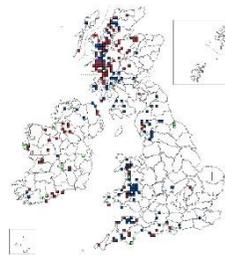
Thallus absent. Vegetative tissues immersed, sometimes slightly bleaching the bark, apparently non-lichenized. Ascomata 120–180 × 100–150 µm, circular or elliptical in outline, sometimes with a ± flat central portion, often covered by a thin layer of bark cells giving a whitish pruinose appearance, surrounded by a broad fringe of involucrellum tissue; involucrellum brown, K+ greenish; pseudoparaphyses robust, 1–1.5 µm diam., the cells 8–16 µm long. Asci 62–90 × 17–21 µm, cylindrical to cylindric-clavate. Ascospores 14.5–19.5 (–20.5) × 6–7.5 (–8) µm, clavate, with rounded apices, 1-septate, much constricted and occasionally fragmenting at the septum, occasionally with a secondary septum dividing the upper cell, often with a strong median constriction in each cell; gelatinous sheath distinct, ca 2 µm thick. Pycnidia 60–100 µm diam., with either macro- or microconidia; macroconidia 8–11 × 1.8–2.2 µm, cylindrical, aseptate; microconidia 4.7–6 × ca 1 µm, bacilliform. **BLS 0082.**

On smooth bark, especially young *Fraxinus* and *Corylus*; frequent. N. & W. Britain and Ireland, rare in E. England.

Close to *Arthopyrenia analepta* (q.v.), but the ascomata are somewhat smaller, the involucrellum fringe is broader, the ascospores often have a distinct median constriction in both cells, and the conidia are different.

Thiyagaraja *et al.* (2021) highlighted the similarities between *Alloarthopyrenia italica* and *Arthopyrenia cinereopruinosa*, and noted that the latter species as described by Coppins & Orange (2009) did not correspond to the type.

LC



### ARTHOPYRENIA A. Massal. (1852)

**Thallus** immersed in bark, inconspicuous or slightly paler than the surrounding tissues, effuse, not lichenized. **Ascomata** perithecia, circular to elliptical in surface view, with a dark, often laterally spreading, clypeate involucrellum composed of compacted hyphae and bark cells, and a thin, usually colourless exciple that surrounds the centrum; hyphae dark brown, K+ greenish. **Hamathacium** of robust thick-walled sparingly branched and anastomosed pseudoparaphyses,  $\pm$  remotely septate, the hymenial gel I-. **Asci** fissitunicate, with two functional wall layers,  $\pm$  cylindrical, ocular chamber present, often conical, I-, 8-spored. **Ascospores** clavate to cylindric-clavate, 1- or 3-septate, strongly constricted at the septa, colourless, smooth (occasionally brownish and finely warted when old), with a broad persistent gelatinous sheath. **Conidiomata** pycnidia; blackish, wall with same pigment as the involucrellum of ascomata. **Conidiogenous cells**  $\pm$  cylindrical, lageniform or  $\pm$  globose, often percurrently proliferating. **Conidia** cylindrical to bacilliform, colourless, 0- or 3-septate; some species have two anamorphs. **Chemistry**: no substances detected by TLC. **Ecology**: on smooth bark.

The genus is more narrowly circumscribed than in previous editions (Coppins & Orange 2009). Species with thin-walled, often inconspicuous pseudoparaphyses and obpyriform asci are treated in *Naetrocymbe* (Naetrocymbaceae), following Harris (1995). That family is of uncertain position within the Dothideomycetes, according to Hyde *et al.* (2013). *Arthopyrenia salicis* does not have interascal tissue and does not belong to the genus; it is discussed further below. Molecular data are needed for the British and Irish species of *Arthopyrenia* and similar genera.

The mounting medium can make a significant difference to measurement of internal structures. In this account all measurements of teleomorph structures are made in water mounts, and ascospore measurements do not include the gelatinous sheath. Those of the anamorph are taken from Coppins & Orange (2009) unless otherwise indicated. Measurements of ascomata do not include the involucrellum fringe that is evident in some species.

*Anisomeridium* (Monoblastiaceae) differs in the  $\pm$  cellular (not hyphal) involucrellum which typically does not contain bark cells (non-clypeate); the ascospores in that genus are always hyaline and lack a perispore or gelatinous sheath. *Tomasellia* (Naetrocymbaceae) and several species of *Mycoporium* (Mycoporaceae) have the ascomata united under a common stroma; *M. antecellens* has non-stromatic ascomata like *Arthopyrenia* but has much larger ascospores that become brown with maturity.

*Arthopyrenia allogena* (Nyl.) Arnold (1870) (**BLS 2011**) was referred provisionally to this genus by Coppins & Orange (2009). The type has not been re-examined, and the only British material referred to this species (a parasite of *Rhizocarpon petraeum* from Ben Lawers) is in poor condition. However, that specimen appears to have ascomata with lower walls, and rather thick-walled pale brown 3-septate ascospores 15-17.5  $\times$  6-7.5  $\mu$ m in size; it appears to be a slightly immature collection of *Phaeospora rimosicola* (Leight.) Hepp. *A. desistens* (Nyl.) A.L. Sm. (**BLS 2012**) was considered by Coppins & Orange (2009) to be a doubtful taxon on 'old trees' described from Co. Kerry. No material has been traced, and the species could be lichenicolous or a non-lichenized bark fungus.

#### Literature:

Coppins & Orange (2009a), Harris (1995), Hyde *et al.* (2013), Minter *et al.* (2015).

#### **Arthopyrenia analepta** (Ach.) A. Massal. (1852)

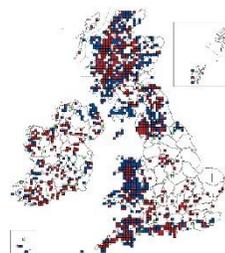
LC

Thallus absent. Vegetative tissues immersed, not discoloring the bark surface, non-lichenized. Ascomata (300–) 350–500  $\times$  240–360  $\mu$ m, strongly domed and often  $\pm$  hemispherical, usually broadly elliptical in outline and with a flat border formed by the spreading involucrellum, the ostiole slightly sunken; involucrellum brown, K+ greenish; pseudoparaphyses robust,  $\pm$  distantly branched, 1.5–2  $\mu$ m diam., the cells 8–15 (–18)  $\mu$ m long. Asci 65–95  $\times$  16–18.5  $\mu$ m,  $\pm$  cylindrical, almost sessile. Ascospores 14–19  $\times$  5–7  $\mu$ m, 1-septate (a few old spores occasionally 3-septate), clavate with rounded apices, markedly constricted at the septum, each cell often

biguttulate but without a median constriction (except sometimes faintly so in the lower cell); gelatinous sheath conspicuous, *ca* 2  $\mu\text{m}$  thick and visible in both K and water. Pycnidia frequently absent, 60–100  $\mu\text{m}$  diam.; conidia 7–11  $\times$  0.8–1  $\mu\text{m}$ , thread-like,  $\pm$  straight. **BLS 1540**.

On smooth bark of many trees, often as an early colonizer on thin branches. Common throughout much of Britain and Ireland, recolonizing in C. & E. England.

Usually recognized by the rather large ascomata with an  $\pm$  elliptical outline, without a lichenized thallus. Particular care should be taken with field identification as several unrelated species have a similar external appearance, including *Naetrocymbe fraxini*, *Julella sericea* and *Pyrenula coryli*.

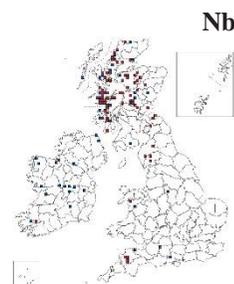


### **Arthopyrenia cerasi** (Schrad.) A. Massal. (1852)

Thallus absent. Vegetative tissues immersed, sometimes slightly bleaching the bark, non-lichenized. Ascomata 300–400  $\times$  220–320  $\mu\text{m}$ , strongly domed and often elliptical in outline, the ostiole distinctly sunken; involucrellum brown, K+ greenish; pseudoparaphyses robust,  $\pm$  distantly branched and anastomosed, 1.5–2  $\mu\text{m}$  diam., cells 8–14  $\mu\text{m}$  long. Asci 67–85  $\times$  17–19  $\mu\text{m}$ , cylindrical to cylindrical-clavate. Ascospores 14.5–19.5  $\times$  5.5–6.5  $\mu\text{m}$ , clavate with rounded apices, 3-septate, strongly constricted at the septa, especially the median one, occasionally fragmenting at the septa; gelatinous sheath distinct, *ca* 2  $\mu\text{m}$  thick. Pycnidia 80–120  $\mu\text{m}$  diam., with either macro- or microconidia; macroconidia 11–13  $\times$  2–2.5  $\mu\text{m}$ , cylindrical, 3-septate; microconidia 9–14  $\times$  *ca* 0.8  $\mu\text{m}$ . **BLS 0081**.

On smooth bark, especially *Corylus*; frequent in the north. N. & W. British Isles.

Easily distinguished from other British and Irish species of *Arthopyrenia* by the 3-septate ascospores. The species was sequenced from a Scottish collection and redescribed by Thiyagaraja *et al.* (2021).



The following species do not belong in *Arthopyrenia*, based on morphological data, but their correct placement is uncertain.

### **Arthopyrenia platypyrenia** (Nyl.) Arnold (1870)

Thallus absent or inconspicuous, probably non-lichenized. Ascomata scattered, shallowly domed to almost flat, circular in outline, (350–) 400–600  $\mu\text{m}$  diam., subepidermal, the ostiole lateral, inconspicuous. Involucrellum brown, sometimes extending beyond the ascoma by 20–30  $\mu\text{m}$ , not changing colour in K, composed of hyphal to epidermoid cells; exciple thin, mid brown. Interascal tissue of thin-walled pseudoparaphyses *ca* 2  $\mu\text{m}$  diam., copiously branched and anastomosing above the ascus apices. Asci clavate, (85–) 105–125  $\times$  18–25  $\mu\text{m}$ , fissitunicate, 8-spored; Ascospores (19.5–) 23–27.5  $\times$  8–11  $\mu\text{m}$ , ellipsoidal to fusiform-ellipsoidal, sometimes slightly ovoid, 3- to 4- (to 7-) septate, constricted at all the septa, rather thick-walled, colourless, with a gelatinous sheath 2–3  $\mu\text{m}$  thick. Conidia 3–5  $\times$  1–1.5  $\mu\text{m}$ , cylindrical. **BLS 2336**.

On bark of *Hedera*, especially on young lianas around 10 mm diam.; apparently rare but likely to be under-recorded. S.W. England, S. Wales, W. Scotland & S. Ireland. Endemic.

A non-lichenized species of uncertain affinity; ITS sequences are not sufficiently similar to other species to suggest a placement in other than the broadest terms. The ascomata with lateral ostioles are distinctive.



### **Arthopyrenia salicis** A. Massal. (1852)

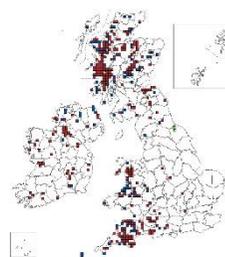
Thallus immersed in bark, often inconspicuous, pale fawn brown, sometimes pinkish when fresh, more rarely dark brown (due to abundant brown hyphae), usually lichenized with *Trentepohlia*. Ascomata 100–150 (–250)  $\times$  150–220  $\mu\text{m}$ , 80–120  $\mu\text{m}$  tall, circular or elliptical in outline, often with a small and sunken ostiole. Involucrellum brown in water and K, composed of thick-walled brown hyphae, extending into the surrounding bark tissues as a fringe *ca* 40  $\mu\text{m}$  broad, the exciple colourless. Interascal tissue absent, the ostiolar region lined with

LC

periphysoids, 7–15 × 1–1.5 µm, unbranched, 0- to 2-septate. Hymenial gel sometimes I+ pale blue. Asci 30–37 (-45) × (14-) 17–21 µm, obpyriform to saccate, thick-walled and fissitunicate with rostrate dehiscence, 8-spored. Ascospores arranged biserially, (12-) 14–17 (-21) × 4–5.5 µm, 1-septate, constricted at the slightly suprmedian septum, each cell biguttulate, the lower cell sometimes with a median constriction, the apices obtuse, with a narrow gelatinous sheath. Pycnidia infrequent, ca 60 µm diam., ± black. Conidia 2–3 (-4) × ca 1 µm, narrowly ellipsoidal or bacilliform, aseptate. **BLS 1606.**

On smooth bark, especially of *Corylus*. Throughout Britain, mostly in the north and west, potentially colonising abandoned *Corylus* coppices in E. England, and in most parts of Ireland.

Apart from the lack of interascal tissue, *Arthopyrenia salicis* fits appropriately in morphological terms within *Naetrocymbe*. Initial molecular studies by Nelsen *et al.* (2011) indicated that *A. salicis* belongs to the Pleosporales rather than the Trypetheliales. Thiyagaraja *et al.* (2021) and Chander *et al.* (2022) postulated a relationship with *Aaospaeria* and *Rousoella* (Pleosporales: Rousoellaceae), but the evidence for this is weak and species of that genus are quite different in morphological terms. Vondrák *et al.* (2023) suggested placement within the Capnodiales and a relationship with *Naetrocymbe* was discussed.



#### **Arthopyrenia subcerasi** (Vain.) Zahlbr. (1921)

Thallus absent or inconspicuous, probably non-lichenized. Ascumata 200–260 × 140–200 µm, ± elliptical in outline. Involucrellum brown in water and K. Interascal tissue of pseudoparaphyses 1.5–2.5 µm diam., persistent, much branched, with a mucous coating; cells 4–10 µm long. Asci 61–70 × 28–33 µm, obpyriform, sessile, very thick-walled, 8-spored. Ascospores 21–25.5 × 7–9 µm, 3-septate, hyaline, thick-walled, sometimes brownish and warted when old, with a well-developed gelatinous sheath 1–2 µm thick. Pycnidia 40–60 µm diam; conidia 4–5 × 0.8–1 µm, bacilliform. **BLS 1592.**

On smooth bark of *Betula* trunks mainly in old boreal woodlands, but with a few records to the south; rare. Scotland, with an old record from the Lake District, N.W. England. A collection from S.W. England is on *Corylus*, and may be referable to another species.

As suggested by Coppins & Orange (2009), this species may belong in *Mycoporum*. However, the circumscription of that genus needs confirmation and none of the species currently accepted in GBI may be congeneric with the type.

*Arthopyrenia subalbicans* Bagl. & Carestia (1881) may represent an earlier name for this species (Ravera 2014) and would need to be taken up if the synonymy is confirmed, following a nomenclatural conservation decision by the Nomenclature Committee for Fungi (May 2017).



### **JULELLA** Fabre (1879)

**Thallus** crustose. **Photobiont** (if present) *Trentepohlia*, not or only facultatively lichenized. **Ascumata** perithecia, circular to elliptical in outline. **Involucrellum** present, dark, usually laterally spreading, composed of compacted hyphae mingled with bark cells; wall pigment greenish or brown, K+ greenish, N-. **Exciple** thin, pale or colourless, surrounding the centrum. **Hymenium** I-. **Hamathecium** of abundant, richly branched and anastomosing, slender paraphyses. **Asci** (2- to) 8-spored, cylindrical to clavate, K/I-, the inner wall thickened towards the apex, ± with a shallow, broad ocular chamber. **Ascospores** ellipsoidal, submuriform to muriform, colourless, with a distinct gelatinous perispore. **Conidiomata** pycnidia, black. **Conidia** bacilliform to shortly thread-like, aseptate, colourless. **Chemistry**: no lichen products detected by TLC. **Ecology**: on bark.

*Julella* is a poorly known genus; the type has not been sequenced and probably does not belong in Trypetheliaceae. It appears to be heterogenous in phylogenetic terms.

Distinguished from *Mycoglaena* by the halonate ascospores, less strictly cylindrical asci, more richly branched hamathecial filaments, and the N- ascomatal pigments.

**Literature:**

Aptroot & van den Boom (1995), Coppins (2009b), Hongsanan *et al.* (2020), Lücking *et al.* (2017b), Thiyagaraja *et al.* (2021).

**Julella sericea** (A. Massal.) Coppins (1992)

Thallus effuse, pale grey or yellowish grey, smooth, immersed in the substrate, often inconspicuous; exciple 200–400 µm diam. Perithecia 0.3–0.6 mm diam., flattened-hemispherical, 20–50% immersed, blackish, but covered by a thin layer of bark cells; involucrellum dark brown. Ascospores 15–25 × 10–15 µm (excluding the gelatinous perispore), muriform, with 5 to 7 transverse septa and 1 or 2 longitudinal septa. Pycnidia not seen in British material. **BLS 1945.**

On smooth bark of branches of *Corylus* and *Quercus*; very rare. Wales (Monmouthshire, Pembrokeshire), Scotland (Perthshire) and S.W. Ireland (Glengarriff). Likely to be under-recorded, but probably still a rare species.

Closely resembles *Arthopyrenia analepta* when examined under a hand lens but that species has 1-septate ascospores. The more widely recorded *Julella fallaciosa* (Stizenb. ex Arnold) R.C. Harris (1987) from Europe and N. America is possibly a synonym, but is described with ascospores 17–23 × 7–9 µm, irregularly submuriform to muriform, with 4 to 6 transverse and 1 to 2 longitudinal septa (Harris 1995). *J. fallaciosa* was transferred to *Arthopyrenia* by Thiyagaraja *et al.* (2021) based primarily on sequence similarity, but phylogenetic data are sparse and transfer of *J. sericea* must await further research.



**MYCOMICROTHELIA** Keissl. (1936)

**Thallus** crustose, immersed, rarely superficial, silvery or cream, sometimes ± absent, sometimes with a ± black limiting fringe. **Photobiont** absent in most species, when present *Trentepohlia*. **Ascomata** perithecia, ± globose to flattened, usually lacking a lower wall, black; **involucrellum** present, dark brown, often olivaceous in K, extending laterally and sometimes forming a distinct fringe around the perithecia, formed of hyphae and incorporated bark cells (clypeate in structure). **Exciple** ± globose to flattened, often poorly developed to absent below, of interwoven brown to colourless hyphae. **Hamathecium** of pseudoparaphyses, branched and anastomosed, septate; gel I± violet (not blue). **Asci** 8-spored, elongate-clavate or broadly clavate to subcylindrical, with two functional wall layers, discharge fissitunicate, with an internal apical beak, K/I-. **Ascospores** ellipsoidal to sole-shaped, 1- (to 3-) septate, the upper cell usually larger, brown, usually distinctly warted, often with a thin gelatinous sheath swelling in K. **Conidiomata** pycnidia, similar to the ascomata in structure. **Conidiogenous cells** elongate-ampulliform. **Conidia** (1) bacilliform, aseptate, colourless, (2) ellipsoidal, 1-septate and brown, or (3) ellipsoidal, aseptate, with centrally thickened walls and brown. **Chemistry:** lichen products not detected by TLC. **Ecology:** on bark.

Most species in *Mycomicrothelia* are ± host-specific and not lichenized. It is close to *Arthopyrenia* s. str. in morphological, from which it differs in that the ascospores turn brown within the ascus prior to discharge and also have warted walls. Old degenerating ascospores in some *Arthopyrenia* s.l. species can become brownish, but then their walls are not usually warted. *Mycoporum antecellens* has larger, brownish ascospores. Reports of *Mycomicrothelia melanospora* (Hepp) D. Hawksw. (1982) from Britain and Ireland are based on misidentifications; that species has ascospores (12.5–) 13.5–15.5 (–17) × (6–) 6.5–7.5 (–8) µm, cells ± equal in size and rounded apices, and elongate-

ellipsoidal brown 1-septate conidia  $13\text{--}14.5 \times 5.5\text{--}6.5 \mu\text{m}$ ; it occurs on smooth bark of *Mespilus germanicus* and perhaps also *Crataegus* in C. Europe.

The genus is confirmed as a member of the Trypetheliaceae using sequence data by Nelsen *et al.* (2011) and Lücking *et al.* (2016).

**Literature:**

Hawksworth (1985), Hawksworth & Orange (2009), Lücking *et al.* (2016), Nelsen *et al.* (2011), Sipman & Aptroot (2005).

- 1 Basal fringe around the perithecia inconspicuous,  $<120 \mu\text{m}$  broad,  $\pm$  circular ..... 2  
 Basal fringe around the perithecia conspicuous,  $120\text{--}300 \mu\text{m}$  broad, elliptical to broadly fusiform ..... *wallrothii*
- 2(1) Ascospores  $(12.5\text{--}) 13.5\text{--}16 (-17.5) \times (5.5\text{--}) 6.5\text{--}8 (-9) \mu\text{m}$ ; pycnidia present ..... *atlantica*  
 Ascospores  $(15.5\text{--}) 17.5\text{--}21 (-25) \mu\text{m}$  in length; pycnidia absent ..... *confusa*

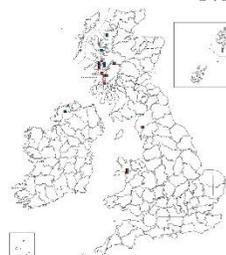
**Mycomicrothelia atlantica** D. Hawksw. & Coppins (1985)

Thallus silvery grey to  $\pm$  indistinct, lacking a delimiting fringe, sometimes loosely associated with *Trentepohlia*, probably not lichenized. Perithecia  $(150\text{--}) 200\text{--}300 (-350) \mu\text{m}$  diam.,  $90\text{--}120 \mu\text{m}$  tall, with a purple-black involucrellum fringe  $30\text{--}50 \mu\text{m}$  broad; hymenial gel I+ pale violet when young. Asci  $40\text{--}55 \times 12\text{--}17 \mu\text{m}$ , clavate. Ascospores  $(12.5\text{--}) 13.5\text{--}16 (-17.5) \times (5.5\text{--}) 6.5\text{--}8 (-9) \mu\text{m}$ , ellipsoidal, 1-septate, scarcely constricted at the septum, the cells  $\pm$  equal in size; apices rounded. Pycnidia  $40\text{--}70 \mu\text{m}$  diam., scattered amongst the perithecia; conidia  $3\text{--}4 \times 0.5\text{--}0.7 \mu\text{m}$ , bacilliform, colourless, aseptate. **BLS 1094.**

On smooth bark of *Corylus*, once on *Betula*, generally in deep shade in temperate rainforests; very rare. Wales (Merionethshire), England (Cumbria), W. Scotland, S.W. Ireland (Kerry, Clare).

The combination of the loosely lichenized thallus, the narrow involucrellum fringe and the pycnidia mixed with the perithecia is very distinctive in the field. An unidentified species with a similar spore size ( $12\text{--}15 (-17) \times 5\text{--}6 \mu\text{m}$ ) is known from *Fraxinus* twigs in Scotland (Easternness and W. Ross).

NT



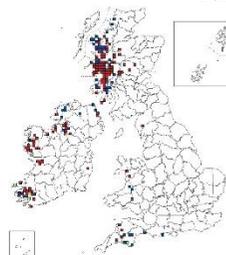
**Mycomicrothelia confusa** D. Hawksw. (1985)

Thallus creamy or whitish, often with a delimiting purplish black fringe, loosely associated with algae, facultatively lichenized with *Trentepohlia*. Perithecia  $200\text{--}300 (-400) \mu\text{m}$  diam., basal fringe to  $25 \mu\text{m}$  broad; hymenial gel I-. Asci  $55\text{--}70 \times 12\text{--}18 \mu\text{m}$ , elongate-clavate. Ascospores  $(15.5\text{--}) 17.5\text{--}21 (-25) \times (6\text{--}) 7\text{--}9 (-10) \mu\text{m}$ , slipper-shaped, 1-septate, markedly constricted at the septum, the upper cell generally larger and rounded, the lower generally attenuated. Pycnidia unknown. **BLS 1840.**

On smooth bark, particularly of *Corylus*, but also *Betula*, *Fraxinus*, *Ilex*, *Quercus* and *Sorbus*, in shaded,  $\pm$  constantly humid situations; local. S.W. England (S. Devon) to W. Scotland (Westernness, Skye), W. Ireland (Kerry, Cork, Galway), N. Ireland (Fermanagh).

Most British records of '*Microthelia micula* Körber (1855)' are misidentifications for this species. *Mycomicrothelia confusa* is distinguished from the much rarer *M. atlantica* by the distinct white thallus, the larger and  $\pm$  slipper-shaped ascospores, with an attenuated lower cell, and the absence of pycnidia. Sometimes this species has been mis-recorded as *Pyrenula laevigata* in the field, but that has pycnidia at the thallus edges and is very different internally.

NE



**Mycomicrothelia wallrothii** (Hepp) D. Hawksw. (1980)

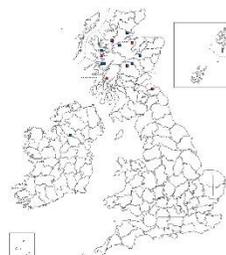
Nb

Thallus inconspicuous, not delimited, with algal cells occasionally scattered on the surface, but not lichenized. Perithecia  $150\text{--}250 (-300) \mu\text{m}$  diam., situated in an elliptical dark grey basal fringe to  $300 \mu\text{m}$  broad; hymenium I-. Asci  $35\text{--}60 \times 14\text{--}16 (-20) \mu\text{m}$ , elongate-clavate. Ascospores  $(12\text{--}) 14\text{--}18 (-20) \times 6\text{--}8 (-8.5) \mu\text{m}$ , ellipsoidal,

1-septate, not to slightly constricted at the septum; apices rounded. Pycnidia 50–100 (–120)  $\mu\text{m}$  diam., intermixed with the ascomata or present alone; conidia (9–) 11–12.5 (–14)  $\times$  4–6.5  $\mu\text{m}$ , ellipsoidal to doliiform, brown, thickened centrally internally and sometimes  $\pm$  distoseptate. **BLS 1093**.

On trunks of *Betula* and once on *Corylus*; rare. Scotland (Highlands, E. Ross, E. Lothian), N. Ireland.

Superficially recalling *Leptorhaphis epidermidis*, which also occurs on *Betula* bark; microscopic examination is necessary to conclusively separate these taxa. The conidia are similar to those of *Eopyrenula leucoplaca* (q.v.).



## Genera not assigned to families

### CYRTIDULA Minks (1876)

**Thallus** apparently saprotrophic, doubtfully lichenized, mostly endophloeodal, discolouring the bark. **Photobiont** generally absent, occasionally associated with *Trentepohlia*. **Ascomata** perithecia, irregularly circular in outline and usually aggregated into weakly stromatic units. **Involucrellum** dark brown, K–, of compact hyphae intermixed with bark, black, not continuous below the hamathecium. **Hamathecium** of branched but not anastomosing, short-celled, bead-like pseudoparaphyses, sometimes pseudoparenchymatous, I–. **Asci** 8-spored, fissitunicate,  $\pm$  globose or broadly pear-shaped with an I– tholus. **Ascospores** colourless, ellipsoidal to clavate, 3- to 5-septate, sometimes submuriform. **Conidiomata** unknown. **Chemistry**: none detected by TLC. **Ecology**: endophloeodal in young, smooth barked twigs.

Though superficially similar, *Cyrtidula* is separated from *Arthopyrenia* and *Naetrocymbe*, which have 1- or 3- septate ascospores, and *Mycoporum* and *Tomasellia* in which the pseudoparaphyses are more discernible. The genus is much in need of a modern revision; its phylogenetic position is doubtful and no sequences are available. It is currently placed in an uncertain position within the Dothideomycetes. Species delimitation also requires study.

#### Literature:

Coppins & Earland-Bennett (2009), Harris (1995), Minter *et al.* (2015), Riedl (1964).

- 1      Ascomata circular in outline, unilocular but sometimes densely clustered and merging at the base ..... 2  
       Ascomata irregular, sometimes in clusters under a common involucrellum; ascospores  
       12–25  $\times$  4.5–9  $\mu\text{m}$ ; mainly on *Corylus* and *Quercus* ..... *quercus*
- 2(1)   Ascomata densely clustered; ascospores 11–17  $\times$  4–6.5  $\mu\text{m}$ , with 3(–4) transverse and 0–2  
       longitudinal septa; on a wide range of woody plants ..... *hippocastani*  
       Ascomata scattered, solitary; ascospores 15–21  $\times$  7–8  $\mu\text{m}$ , with 3–4 (–6) transverse and 1  
       longitudinal septum (usually in the apical cell); on *Betula* ..... *major*

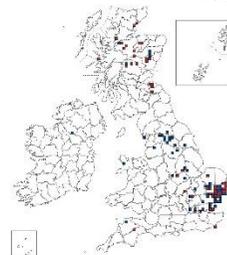
**Cyrtidula hippocastani** (DC.) R.C. Harris (1995)

Ascomata 0.1–0.2 mm diam., ± circular in outline, unilocular. Paraphyses short, thin-walled, moniliform. Asci 40–45 × 17–20 μm, clavate, with a greatly thickened I-apical cap visible when immature. Ascospores colourless, 11–17 × 4–6.5 μm, with 3 (–4) transverse septa, 0–2 transverse cells with a longitudinal septum. **BLS 0911.**

On twigs and branches of *Populus tremula*, frequent in Scotland (Highlands), also in N. and C. England and East Anglia, where it is recorded on twigs of *Alnus*, *Crataegus*, *Fraxinus* and *Prunus*. One record from Ireland.

Easily confused in the field with *Naetrocymbe punctiformis* (Naetrocymbaceae), which has 1(–3)-septate ascospores with no longitudinal septa. It has been much under-recorded until recently.

NE

**Cyrtidula major** (Nyl.) Vain. (1921)

NE

Ascomata scattered, 0.20–0.34 mm, rarely confluent, somewhat circular to slightly elliptical in outline, black. Ascospores colourless, submuriform, 14–21 × 7–8 μm, with 3–4 (–6) transverse septa and 1 longitudinal septum which is usually in the apical cell. **BLS 2338.**

On bark of *Betula*; rare. England (Essex & Suffolk).

Another poorly known species, which has been placed into synonymy with *C. hippocastani* by some authors (e.g. Vitikainen *et al.* 1997) and given varietal status by others (e.g. Riedl 1964).

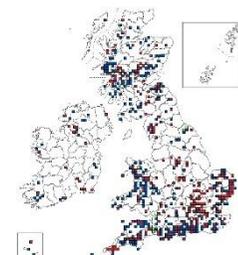
**Cyrtidula quercus** (A. Massal.) Minks (1891)

NE

Thallus inconspicuous to greyish, partially endophloedal, occasionally discolouring the bark, not well delimited; photobiont generally absent, but clusters of *Trentepohlia* occasionally observed. Perithecia to 250 μm diam. and 100 μm tall, dimidiate, appearing as small shiny dark brown to black ± circular to elliptical spots, soon becoming confluent with several beneath a single thin blackened involucrellum, with a central ostiole; exciple colourless, to 10 μm wide, consisting of a few layers of isodiametric cells. Hamathecium of filaments of short cells *ca* 3 μm diam., moniliform, not anastomosing, I–. Asci globose to broadly clavate, 25–31 × 19–22 μm, fissitunicate, 8-spored. Ascospores colourless, soleiform, 12–25 × 4.5–9 μm, submuriform, with 3 or 4 transverse septa and 2 or 3 longitudinal septa in the middle cells, upper cells rounded, lower cells slightly narrower and becoming pointed at the apex, smooth-walled, with a gelatinous perispore. Conidiomata not known. **BLS 0912.**

Mainly on smooth, thin twigs of *Quercus*, occasionally on *Corylus* and rarely on *Ilex*, *Malus* and *Sorbus*; common. Throughout Britain and Ireland.

Material of *Mycoporium quercus* var. *ilicis* (Riedl) Coppins (1979), on *Ilex* from W. Ireland, has not been traced but is likely to be related to *C. quercus*; it is said to have ascomata with (3–)7–10 locules.

**EOPYRENULA** R.C. Harris (1973)

**Thallus** immersed, inconspicuous or whitish, effuse. **Photobiont** *Trentepohlia*, or absent. **Ascomata** perithecia, ± globose or hemispherical, with a dark brown involucrellum, which either clasps the sides of the centrum or spreads outwardly. **True exciple** pale brown, colourless or almost absent below; dark tissue K–. **Hamathecium** of numerous unbranched or sparingly branched and anastomosed paraphysoids; short periphyses sometimes evident near the ostiole; gel matrix I+ yellowish or pale bluish (especially around the asci). **Asci** subcylindrical, without apical ring-structure and usually

without a distinct ocular chamber, the wall K/I± blue (especially below), 8-spored but often with up to 6 spores aborting. **Ascospores** (1–) 3– or more septate, brown, the end cells often paler, without a conspicuous perispore or ornamentation. **Conidiomata** pycnidia, black. **Conidiogenous cells** ± cylindrical or narrowly lageniform. Conidia of two types: **macroconidia** ellipsoidal to cylindrical, brown, 1- or more septate; **microconidia** bacilliform to filiform, colourless, aseptate. **Chemistry**: lichen products not detected by TLC. **Ecology**: on bark in woodland.

Distinguished from *Pyrenula* (Pyrenulaceae, Pyrenulales) by ascospores lacking lenticular lumina, straight microconidia, and brown, septate macroconidia. It was included in Pyrenulaceae by Harris (1973) and that placement was followed by a number of other authors including Lumbsch & Lücking (in Jaklitsch *et al.* 2016), but there is no strong evidence for a close relationship with *Pyrenula*. Relationships with the Dacampiaceae (Pleosporales) have been claimed by a number of authors (most recently by Doilom *et al.* 2018 who redescribed the type species), but again the evidence for this arrangement is not robust. Molecular data are available for two of the species (Vondrák *et al.* 2023), but only for barcoding sequences that are not good predictors of broader relationships. They suggested a possible link with the Ostropomycetidae. The genus was placed in an uncertain position within the Pezizomycotina by Lücking *et al.* (2017), and this seems the best approach pending more detailed sequence analysis.

#### Literature:

Aptroot (1991), Coppins (2009a), Coppins *et al.* (1992), Doilom *et al.* (2018), Harris (1973), Jaklitsch *et al.* (2016), Lücking *et al.* 2017), Orange (2013).

- |      |  |                      |
|------|--|----------------------|
| 1    | Involucrellum clasping the exciple laterally; ascospores with 3 or more septa; macroconidia with one pale septum or (5- to) 7 dark septa ..... | 2                    |
|      | Involucrellum outwardly spreading; spores 3-septate; macroconidia with three pale septa and rounded locules .....                              | 3                    |
| 2(1) | Ascospores mostly 18–26 × 6.5–10 µm and 3- to 5-septate; macroconidia with one pale septum; microconidia 6.5–9.5 µm long .....                 | <i>leucoplaca</i>    |
|      | Ascospores mostly 21–34 × 9–10 µm and 5- to 7-septate; macroconidia with (5- to) 7 dark septa; microconidia 10–16.5 µm long .....              | <i>septemseptata</i> |
| 3(1) | Ascospores 10.5–16 µm long, macroconidia 9.5–13 µm long .....  | <i>avellanae</i>     |
|      | Ascospores (12–) 14–19 (–22) µm long, macroconidia (13–) 14–19 (–21) µm long .....   | <i>grandicula</i>    |

#### **Eopyrenula avellanae** Coppins (1992)

Thallus inconspicuous, not delimited, scarcely discolouring the bark, *Trentepohlia* photobiont filaments sometimes present. Perithecia broadly elliptical in outline, 0.2–0.28 × 0.16–0.22 mm, with a distinct ostiolar depression, ± hemispherical in section; true exciple indistinct; involucrellum outwardly spreading. Asci subcylindrical, 55–60 × ca 10 µm, 2- to 8-spored. Ascospores 9.5–16 × (5–) 6–7 µm, ellipsoidal, brown, (1- to) 3-septate; septa pale or mid septum becoming dark, with ± lenticular lumina. Macroconidia 9.5–13 × (4–) 4.5–6 µm, 3-septate, with rounded locules and pale septa; microconidia 2.8–4 × ca 0.7 µm, colourless, bacilliform. **BLS 1561**.

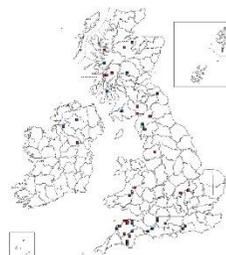
On smooth bark of *Corylus* in old woodlands; rare. W. and S.W. Britain (two recent records from the Midlands), N. Ireland.

Easily mistaken in the field for *Arthopyrenia* s.l. species or *Pyrenula coryli*; the latter has ascospores with markedly lens-shaped lumina and curved microconidia (macroconidia are not known).

#### **Eopyrenula grandicula** Coppins (1992)

Thallus usually causing a whitening or silvering of the bark. Perithecia similar to *E. avellanae*, but usually absent; ascospores 3-septate, (12–) 14–19 (–22) × 6–7.5 µm. Macroconidia 3-septate, brown, (13–) 14–19 (–21) × 6–7.5 µm. **BLS 1616**.

Nb IR



Nb IR

On smooth bark of *Corylus*, also *Ilex* and *Sorbus*, as well as on plateaus of fissured bark of *Fraxinus*, *Platanus* and *Quercus*; usually in old woodland; often common in high rainfall areas; local. S.W. England, Wales, N. England, W. Scotland (and further east in Mid-Perthshire), throughout Ireland.

Although much more common than the closely related *E. avellanae*, *E. grandicula* has been found only rarely with mature perithecia. However, it is easily identified by its brown, 4-locular macroconidia, which are larger than those of *E. avellanae*.

### **Eopyrenula leucoplaca** (Wallr.) R.C. Harris (1973)

**Nb IR**

Thallus whitish; photobiont present. Perithecia 0.2–0.35 mm diam., ± globose; involucrellum clasping the exciple. Asci 8-spored, cylindrical-clavate. Ascospores (13–) 18–26 × 6.5–10 (–12) μm, ellipsoidal to clavate-fusiform, (1–) 3- to 5( to 7)-septate; septa dark; the middle two cells darkest and the outer cells progressively paler. Macroconidia 6.5–9.5 × 3–4 μm, ellipsoidal, ovoid or pyriform, (0- to) 1-septate, the septum pale; microconidia 6–10 × 0.5–0.7 μm, filiform. **BLS 1752.**

On rough bark of *Fraxinus* and *Quercus* in old woodlands. N. Scotland (Moniack Gorge in Easternness, Ledmore Wood in E. Sutherland, Grantown on Spey in Moray); the only British records but perhaps overlooked.

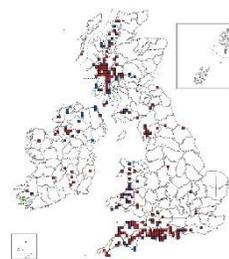
Could be mistaken in the field for a species of *Anisomeridium*. Often occurring with pycnidia only. *Mycomicrothelia wallrothii*, which is mainly found on *Betula* bark, has similar conidia, which are ± distoseptate or polarilocular. The species was redescribed and illustrated by Doilom *et al.* (2018), though the ascospore measurements quoted suggest that *E. septemseptata* might have been involved.

### **Eopyrenula septemseptata** Coppins (1992)

**Nb IR**

Similar in appearance and structure of perithecia to *E. leucoplaca*; photobiont absent. Ascospores 5- to 7- (to 8-) septate, 21–34 (–38) × 9–10 μm. Macroconidia (5- to) 7-septate, 18–26 × 4–5 μm, ± cylindrical, the distal end ± obtuse and the proximal end truncate with a distinct but unthickened scar; brown, but the end cells often pale; microconidia (10–) 13–16.5 μm long. **BLS 1562.**

On *Corylus* in old woodlands; rare. W. Scotland (Argyll to W. Sutherland). Similar in appearance and in peritheciaal structure to *E. leucoplaca*, but differs in having longer ascospores that are commonly 7-septate, and its much longer, mainly 7-septate macroconidia with dark septa.



## **RHAPHIDICYRTIS** Vain. (1912)

As this is a monotypic genus the description below (*R. trichosporella*) constitutes the generic description. It was assigned to the Pyrenulales by Aguirre-Hudson (1991) and Lücking *et al.* (2017a), but this placement must be regarded as provisional. Vondrák *et al.* (2023) analyzed ITS sequences from *R. trichosporella* and concluded that the genus belongs to the Phaeomoniellales, to which *Celothelium* (Celotheliaceae) has been assigned. Sequences from more conservative genes are needed to be sure of the family arrangement.

*Rhaphidicyrtis* may be confused with *Celothelium* (Celotheliaceae) because of its filiform and multi-septate ascospores. However, the structures of the ascomata are very different in both genera. In *Celothelium* they are mostly grouped under a rather brittle involucrellum, the hamathecium is never

I+ deep blue and lacks periphysoids or paraphysoids, whereas in *Rhaphidicyrtis* the ascomata lack an involucrellum, are I+ deep blue and have periphysoids. The long, filiform ascospores and the hamathecial tissues set *Rhaphidicyrtis* apart from *Leptorhaphis*, with which it was also confused.

#### Literature:

Aguirre-Hudson (1991, 2009d), Ekman *et al.* (2013), Voglmayr *et al.* (2019).

#### **Rhaphidicyrtis trichosporella** (Nyl.) Vain. (1921)

Thallus crustose, smooth but pulverulent in places, not well delimited, cream-white or grey, without a prothallus. Photobiont *Trentepohlia*. Perithecia black, globose, 0.15–0.2 mm diam., individually scattered, semi-immersed in the thallus; involucrellum dark brown, ca 30 µm thick, becoming thicker around the ostiole, clypeate, covering the upper half of the exciple; exciple pseudoparenchymatous, 15–30 µm thick, colourless, becoming dark brown towards the edges, continuous below the asci; hamathecium a branched and anastomosing net of periphysoids; periphyses in the ostiolar channel; hymenial gel I+ deep blue. Asci 8-spored, arising from the base of the ascomata, cylindrical, fissitunicate, without a distinct apex, 75–95 × 9–15 µm. Ascospores filiform, colourless, (60–) 75–95 × 2–3 µm, 7-, 9- or more septate, not constricted at the septa, fasciculate or helically coiled in the ascus. Conidiomata not known. Chemistry not known. **BLS 1799**.

On smooth bark especially of *Ilex*, but also on *Alnus*, *Betula*, *Carpinus*, *Corylus*, *Fagus*, *Fraxinus*, *Quercus* and *Sorbus aucuparia*; frequent but easily overlooked, in old deciduous woodlands. W. & N. Britain and Ireland.

In the past British collections have been confused with *Celothelium ischnobelum*. In the field, it is easily mistaken for *Anisomeridium ranunculosporum*.



## Nomenclature

**Sarcopyrenia geisleri** (Beckh. ex Körb.) P.F. Cannon, **comb. nov.**

**IF901543**

Basionym: *Lithosphaeria geisleri* Beckh. ex Körb. *Parerga lichenol.* (Breslau) 4: 345 (1863) [1865].

## References:

- Aguirre-Hudson, B. (1991). A taxonomic study of the species referred to the ascomycete genus *Leptorhaphis*. *Bulletin of the British Museum of Natural History Botany series*, 21(2): 85–192.
- Aguirre-Hudson, B. (2009a). *Cresporhaphis*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 363–364. London: British Lichen Society.
- Aguirre-Hudson, B. (2009b). *Leptorhaphis*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 551–553. London: British Lichen Society.
- Aguirre-Hudson, B. (2009c). *Celothelium*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 551–553. London: British Lichen Society.
- Aguirre-Hudson, B. (2009d). *Rhaphidicyrtis*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 791. London: British Lichen Society.

- Aguirre-Hudson, B. & Earland-Bennett, P.** (2015). Current status of the genus *Leptorhaphis* in the British Isles. *British Lichen Society Bulletin* **117**: 29–33.
- Aguirre-Hudson, B. & Fiol, L.** (1993). A new species of *Leptorhaphis* (Arthopyreniaceae) on *Opuntia* from the Balearic Islands. *Lichenologist* **25**: 207–210.
- Aptroot, A.** (1991). A monograph of the Pyrenulaceae (excluding *Anthracothecium* and *Pyrenula*) and the Reuquenellaceae, with notes on the Pleomassariaceae, the Trypetheliaceae and *Mycocomrothelia* (lichenized and non-lichenized Ascomycetes). *Bibliotheca Lichenologica* **44**: 1–178.
- Aptroot, A.** (1998). A world monograph of *Massarina* (Ascomycota). *Nova Hedwigia* **66**: 89–162.
- Aptroot, A.** (2012). A world key to the species of *Anthracothecium* and *Pyrenula*. *Lichenologist* **44**: 5–53.
- Aptroot, A.** (2021). World key to the species of Pyrenulaceae and Trypetheliaceae. *Archive for Lichenology* **29**: 91 pp.
- Aptroot, A., Lücking, R., Sipman, H.J.M., Umana, L. & Chaves, J.L.** (2008). Pyrenocarpous lichens with bitunicate asci. A first assessment of the lichen biodiversity inventory in Costa Rica. *Bibliotheca Lichenologica* **97**: 162 pp.
- Aptroot, A. & Van den Boom, P.P.G.** (1995). *Strigula lateralis* spec. nov. with notes on the genus *Julella* (Ascomycetes). *Mycotaxon* **56**: 1–8.
- Berger, F. & Aptroot, A.** (1998). Eine neue Art der Gattung *Celothelium* (lichenisierte Ascomyceten) aus Österreich. *Herzogia* **13**: 151–154.
- Bose, S.K.** (1961). Studies on *Massarina* Sacc. and related genera. *Phytopathologische Zeitschrift* **41**: 151–213.
- Calatayud, V. & Aguirre-Hudson, B.** (2001). Observations on the genus *Cresporhaphis* (Trichosphaeriaceae), with a key to the known species, and *C. ulmi* sp. nov. *Mycological Research* **105**: 122–126.
- Cannon, P.F.** (1997). Two new genera of Ascomycota, and other new or interesting fungi from Slapton Ley National Nature Reserve and its environs. *Systema Ascomycetum* **15**: 121–138.
- Chander, A.M., Teixeira, M.d.M., Singh, N.K., Williams, M.P., Simpson, A.C., Damle, N., Parker, C.W., Stajich, J.E., Mason, C.E., Torok, T. & Venkateswaran, K.** (2022). Description and genome characterization of three novel fungal strains isolated from Mars 2020 Mission-Associated Spacecraft Assembly Facility surfaces—recommendations for two new genera and one species. *Journal of Fungi* **9**: 31.
- Chen, K.-H., Miadlikowska, J., Molnár, K., Arnold, A.E., U'Ren, J.M., Gaya, E., Gueidan, C. & Lutzoni, F.** (2015). Phylogenetic analyses of eurotiomycetous endophytes reveal their close affinities to Chaetothiales, Eurotiales, and a new order – Phaeomoniellales. *Molecular Phylogenetics and Evolution* **85**: 117–130.
- Chomnunti, P., Hongsanan, S., Aguirre-Hudson, B., Tian, Q., Peršoh, D. Dhami, M.K., Alias, A.S., Xu, J.C., Liu, X.Z., Stadler, M. & Hyde, K.D.** (2014). The sooty moulds. *Fungal Diversity* **66**: 1–36.
- Coppins, B.J.** (1988a). Notes on the genus *Arthopyrenia* in the British Isles. *Lichenologist* **20**: 305–325.
- Coppins, B.J.** (2009a). *Eopyrenula*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 389–391. London: British Lichen Society.
- Coppins, B.J.** (2009b). *Julella*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 450. London: British Lichen Society.
- Coppins, B.J.** (2009c). *Lithothelium*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 559. London: British Lichen Society.
- Coppins, B.J. & Aptroot, A.** (2008). New species and combinations in *The Lichens of the British Isles*. *Lichenologist* **40**: 363–374.
- Coppins, B.J. & Aptroot, A.** (2009). *Antennulariella*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 150. London: British Lichen Society.
- Coppins, B.J. & Earland-Bennett, P.M.** (2009). *Cyrtidula*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 368–369. London: British Lichen Society.
- Coppins, B.J., James, P.W. & Hawksworth, D.L.** (1992). New species and combinations in ‘*The Lichen Flora of Great Britain and Ireland*’. *Lichenologist* **24**: 351–369.
- Coppins, B.J., James, P.W. & Orange, A.** (2009). *Anisomeridium*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 148–150. London: British Lichen Society.

- Coppins, B.J. & Orange, A.** (2009a). *Arthopyrenia*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 171–176. London: British Lichen Society.
- Coppins, B.J. & Orange, A.** (2009b). *Strigula*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 869–873. London: British Lichen Society.
- Del Prado, R., Schmitt, I., Kautz, S., Palice, Z., Lücking, R. & Lumbsch, H.T.** (2006). Molecular data place Trypetheliaceae in Dothideomycetes. *Mycological Research* **110**: 511–520.
- Doilom, M., Hyde, K.D., Phookamsak, R., Dai, D.Q., Tang, L.Z., Hongsanan, S., Chomnunti, P., Boonmee, S., Dayarathne, M.C., Li, W.J., Thambugala, K.M., Perera, R.H., Daranagama, D.A., Norphanphoun, C., Konta, S., Dong, W., Ertz, D., Phillips, A.J.L., McKenzie, E.H.C., Vinit, K., Ariyawansa, H.A., Jones, E.B.G., Mortimer, P.E., Xu, J.C. & Promputtha, I.** (2018). Mycosphere Notes 225–274: types and other specimens of some genera of Ascomycota. *Mycosphere* **9**: 647–754.
- Ekman, S., Aguirre-Hudson, B., Arup, U., Fritz, Ö. & Svensson, M.** (2013). *Rhaphidicyrtis trichospora* new to Sweden. *Graphis Scripta* **25**: 6–11.
- Ellis, C.J., Yahr, R. & Coppins, B.J.** (2018). Quantifying the anthropocene loss of bioindicators for an early industrial region: an equitable baseline for biodiversity restoration. *Biodiversity and Conservation* **27**: 2363–2377.
- Eriksson, O.** (1981). The families of bitunicate ascomycetes. *Opera Botanica* **60**: 220 pp.
- Foucard, T.** (1992). Notes on the corticolous *Arthopyrenia* species in Sweden. *Graphis Scripta* **4**: 49–60.
- Gilbert, O.L.** (1996). The occurrence of lichens with albino fruit bodies (ascmata) and their taxonomic significance. *Lichenologist* **28**: 94–97.
- Gueidan, C., Aptroot, A., Cáceres, M.E. da Silva & Binh, N.Q.** (2016). Molecular phylogeny of the tropical lichen family Pyrenulaceae: contribution from dried herbarium specimens and FTA card samples. *Mycological Progress* **15**: 7.
- Gueidan, C., Aptroot, A., Cáceres, M.E. da Silva, Badali, H. & Stenroos, S.** (2014). A reappraisal of orders and families within the subclass Chaetothyriomycetidae (Eurotiomycetes, Ascomycota). *Mycological Progress* **13**: 1027–1039.
- Hafellner, J.** (2002). Zur Diversität lichenisierter Pilze und ihrer Parasiten in den Seckauer Tauern (Ostalpen, Niedere Tauern, Steiermark). *Mitteilungen der Naturwissenschaftlicher Verein für Steiermark* **132**: 83–137.
- Harris, R.C.** (1973). The corticolous pyrenolichens of the Great Lakes Region. *Michigan Botanist* **12**: 1–68.
- Harris, R.C.** (1975). *A taxonomic revision of the genus Arthopyrenia Massal. s. lat. (Ascomycetes) in North America*. Ph.D. thesis. University of Michigan.
- Harris, R.C.** (1989). A sketch of the lichen family Pyrenulaceae (Melanommatales) in eastern North America. *Memoirs of the New York Botanical Garden* **49**: 74–107.
- Harris, R.C.** (1995). *More Florida lichens, including a 10¢ tour of the pyrenolichens*. New York: privately published.
- Hawksworth, D.L.** (1985). A redispotion of the species referred to the ascomycete genus *Microthelia*. *Bulletin of the British Museum of Natural History Botany series*, **14**: 43–181.
- Hawksworth, D.L. & Orange, A.** (2009). *Mycomicrothelia*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 619–620. London: British Lichen Society.
- Hawksworth, D.L. & Sherwood, M.A.** (1981). Proposals for Nomina Conservanda and Rejicienda for ascomycete names (lichenized and non-lichenized). *Taxon* **30**: 338–348.
- Hitch, C.J.B.** (2009). *Sarcopyrenia*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 830–831. London: British Lichen Society.
- Hongsanan, S. and 77 co-authors** (2020). Refined families of Dothideomycetes: orders and families incertae sedis in Dothideomycetes. *Fungal Diversity* **105**: 17–318.
- Hughes, S.J.** (1976). Sooty moulds. *Mycologia* **68**: 693–820.
- Hyde, K.D. and 67 co-authors** (2013). Families of Dothideomycetes. *Fungal Diversity* **63**: 1–313.
- Jaklitsch, W., Baral, H.-O., Lücking, R. & Lumbsch, H.T., eds** (2016), *Syllabus of Plant Families*. Part 1/2. *Ascomycota*. 322 pp. Stuttgart: Borntraeger.
- Jaklitsch, W. & Frey, W.** (2016). Synopsis of classification of the Ascomycota Caval.-Sm. In Jaklitsch, W., Baral, H.-O., Lücking, R. & Lumbsch, H.T. (eds), *Syllabus of Plant Families*. Part 1/2. *Ascomycota* pp. 14–27. Stuttgart: Borntraeger.

- Jiang, S.-H., Lüicking, R., Xavier-Leite, A.B., Cáceres, M.E.S., Aptroot, A., Portilla, C.V. & Wei1, J.-C. (2020). Reallocation of foliicolous species of the genus *Strigula* into six genera (lichenized Ascomycota, Dothideomycetes, Strigulaceae). *Fungal Diversity* **102**: 257–291.
- Lüicking, R., Hodkinson, B.P. & Leavitt, S.D. (2017a). The 2016 classification of lichenized fungi in the Ascomycota and Basidiomycota – approaching one thousand genera. *Bryologist* **119**: 361–416.
- Lüicking, R., Hodkinson, B.P. & Leavitt, S.D. (2017b). Corrections and amendments to the 2016 classification of lichenized fungi in the Ascomycota and Basidiomycota. *Bryologist* **120**: 58–69.
- Lüicking, R., Nelsen, M.P., Aptroot, A., Barillas de Klee, R., Bawingan, P.A., Benatti, M.N., Binh, N.Q., Bungartz, F., Cáceres, M.E.S., Canêz, L. DA S., Chaves, J.L. Ertz, D., Esquivel, R.E., Ferraro, L.I., Grijalva, A., Gueidan, C., Hernández M., J.E., Knight, A., Lumbsch, H.T., Marcelli, M.P., Mercado-Díaz, J.A., Moncada, B., Morales, E.A., Naksuwankul, K., Orozco, T., Parnmen, S., Rivas Plata, E., Salazar-Allen, N., Spielmann, A.A. & Ventura, N. (2016). A phylogenetic framework for reassessing generic concepts and species delimitation in the lichenized family Trypetheliaceae (Ascomycota: Dothideomycetes). *Lichenologist* **48**: 739–762.
- Lumbsch, H.T. (1999). The ascoma development in *Mycoporum elabens* (Mycoporaceae, Dothideales). *Plant Biology* **1**: 321–326.
- May, T.W. (2017). Report of the Nomenclature Committee for Fungi: 20. *Taxon* **66**: 483–495.
- Mendonça, C. de Oliveira, Aptroot, A., Lüicking, R. & Cáceres, M.E. da Silva (2020). Global species richness prediction for Pyrenulaceae (Ascomycota: Pyrenulales), the last of the “big three” most speciose tropical microlichen families. *Biodiversity and Conservation* **29**: 1059–1079.
- Minter, D.W., Aguirre-Hudson, B. & Cannon, P.F. (2015). *IMI Descriptions of Fungi and Bacteria* fasc. **206**: 60 pp. [Arthopyrenia cerasi, A. salicis, Cyrtidula quercus, Leptorhaphis atomaria, L. epidermidis, L. laricis, Mycomicrothelia confusa, Naetrocymbe fraxini, N. nitescens, Tomasellia gelatinosa]. Wallingford: CAB International.
- Miranda-González, R., Bungartz, F., Lüicking, R., Gaya, E., Mendon, C. de Oliveira, Viñas-Portilla, C., Cáceres, M.E. da Silva & Herrera-Campos, M. de los Angeles (2022). Phylogeny of the *Pyrenula ochraceoflava* group (Pyrenulaceae) reveals near-cryptic diversification and the inclusion of the *Mazaediothecium album* aggregate. *Bryologist* **125**: 541–557.
- Navarro-Rosinés, P., Gueidan, C., Hladun, N.L. & Roux, C. (2009). Sinopsis del género *Sarcopyrenia* (Ascomycota, hongos liquenícolas), con la descripción de tres nuevas especies. *Revista Catalana de Micologia* **31**: 49–69.
- Navarro-Rosinés, P., Roux, C. & Bricaud, O. (1998). *Sarcopyrenia acutispora* Nav.–Ros. et Cl. Roux sp. nov., nelikenifiinta fungo likenlofia (Ascomycetes, Verrucariales, Sarcopyreniaceae Nav.–Ros. et Cl. Roux fam. nov.). *Bulletin del la Société Linnéene de Provence* **49**: 125–135.
- Nelsen, M.P., Lüicking, R., Aptroot, A., Andrew, C.J., Cáceres, M., Rivas Plata, E., Gueidan, C., Canêz, M. da S., Knight, A., Ludwig, L.R., Mercado-Díaz, M.J., Parnmen, S. & Lumbsch, H.T. (2014). Elucidating phylogenetic relationships and genus-level classification within the fungal family Trypetheliaceae (Ascomycota: Dothideomycetes). *Taxon* **63**: 974–992.
- Nelsen, M.P., Lüicking, R., Grube, M., Mbatchou, J.S., Muggia, L., Rivas Plata, E. & Lumbsch, H.T. (2009). Unravelling the phylogenetic relationships of lichenised fungi in Dothideomyceta. *Studies in Mycology* **64**: 135–144.
- Nelsen, M.P., Lüicking, R., Mbatchou, J.S., Andrew, C.J., Spielmann, A.A. & Lumbsch, H.T. (2011). New insights into relationships of lichen-forming Dothideomycetes. *Fungal Diversity* **51**: 155–162.
- Orange, A. (2013). *British and Other Pyrenocarpous Lichens*. Version 2. 250 pp. Cardiff: National Museum of Wales, available at <https://museum.wales/media/13849/Orange-A-2013-British-and-other-pyrenocarpous-lichens.pdf>.
- Orange, A. & Hawksworth, D.L. (2009). *Pyrenula*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 776–779. London: British Lichen Society.
- Purvis, O.W., Coppins, B.J., Hawksworth, D.L., James, P.W. & Moore, D.M. (1992). *Lichen Flora of Great Britain and Ireland*. 710 pp. London: Natural History Museum.
- Purvis, O.W. & Orange, A. (2009). *Acrocordia*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 133–135. London: British Lichen Society.

- Ravera, S.** (2014). Proposal to conserve the name *Verrucaria subcerasi* (*Arthopyrenia subcerasi*) against *Arthopyrenia subalbicans* (lichenized Ascomycota: Arthopyreniaceae). *Taxon* **63**: 678–679.
- Riedl, H.** (1964). Bemerkungen über *Dermatina*-Arten aus West- und Mitteleuropa. *Sydowia* **17**: 102–113.
- Roux, C. & Sérusiaux, E.** (2004). Le genre *Strigula* (Lichens) en Europe et en Macaronésie. *Bibliotheca Lichenologica* **90**: 1–96.
- Sanderson, N.A. & Coppins, B.J.** (2009). *Tomasellia*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 894–895. London: British Lichen Society.
- Sipman, H.J.M. & Aptroot, A.** (2005). Notes on *Mycocomrothelia* (Arthopyreniaceae s. lat.) with two new species. *Lichenologist* **37**: 307–311.
- Thambugala, K.M., Hyde, K.D., Tanaka, K., Tian, Q., Wanasinghe, D.N., Ariyawansa, H.A., Jayasiri, S.C., Boonmee, S., Camporesi, E., Hashimoto, A., Hirayama, K., Schumacher, R.K., Promputtha, I. & Liu, Z.-Y.** (2015). Towards a natural classification and backbone tree for Lophiostomataceae, Floricolaceae, and Amorosiaceae fam. nov. *Fungal Diversity* **74**: 199–266.
- Thiyagaraja, V., Lücking, R., Ertz, D., Wanasinghe, D.N., Karunarathna, S.C., Camporesi, E. & Hyde, K.D.** (2020). Evolution of non-lichenized, saprotrophic species of *Arthonia* (Ascomycota, Arthoniales) and resurrection of *Naevia*, with notes on *Mycoporum*. *Fungal Diversity* **102**: 205–224.
- Thiyagaraja, V., Lücking, R., Ertz, D., Coppins, B.J., Wanasinghe, D.N., Karunarathna, S.C., Suwannarach, N., To-Anun, C., Cheewangkoon, R. & Hyde, K.D.** (2021). Sequencing of the type species of *Arthopyrenia* places Arthopyreniaceae as a synonym of Trypetheliaceae. *Mycosphere* **12**: 993–1010.
- Van den Boom, P.P.G.** (2015). Notes on the genus *Anisomeridium* (lichenized Ascomycotina) from Madeira and the Azores (Macaronesia). *Phytotaxa* **205**: 65–70.
- Vitikainen, O., Ahti, T., Kuusinen, M., Lommi, S. & Ulvinen, T.** (1997). Checklist of lichens and allied fungi of Finland. *Norrinia* **6**: 123 pp.
- Voglmayr, H., Aguirre-Hudson, M.B., Wagner, H.G., Tello, S. & Jaklitsch, W.M.** (2019). Lichens or endophytes? The enigmatic genus *Leptosillia* in the Leptosilliaceae fam. nov. (Xylariales), and *Furfurella* gen. nov. (Delonicicolaceae). *Persoonia* **42**: 228–260.
- Voglmayr, H., Gardiennet, A. & Jaklitsch, W.M.** (2016). *Asterodiscus* and *Stigmatodiscus*, two new apothecial dothideomycete genera and the new order Stigmatodiscales. *Fungal Diversity* **80**: 271–284.
- Vondrák, J., Svoboda, S., Košnar, J., Malíček, J., Šoun, J., Frolov, I., Svensson, M., Novotný, P. & Palice, Z.** (2023). Martin7: a reference database of DNA barcodes for European epiphytic lichens and its taxonomic implications. *Preslia* **95**: 311–345.
- Weerakoon, G., Aptroot, A., Lumbsch, H.T., Wolseley, P.A., Wijeyaratne, S.C. & Gueidan, C.** (2012). New molecular data on Pyrenulaceae from Sri Lanka reveal two well-supported groups within this family. *Lichenologist* **44**: 639–647.
- Wijayawardene, N.N., Hyde, K.D., Lumbsch, H.T., Liu, J.K., Maharachchikumbura, S.S.N., Tian, Q. & Phookamsak, R.** (2018). Outline of Ascomycota: 2017. *Fungal Diversity* **88**: 167–263.

## Index

- |                                      |  |
|--------------------------------------|--|
| <b>ACROCORDIA</b> , 13               | <b>Anisomeridium biforme</b> , 16          |
| <b>Acrocordia cavata</b> , 14        | <b>Anisomeridium macropycnidiatum</b> , 17 |
| <b>Acrocordia conoidea</b> , 14      | <b>Anisomeridium polypori</b> , 17         |
| <b>Acrocordia gemmata</b> , 14       | <b>Anisomeridium ranunculosporum</b> , 17  |
| <b>Acrocordia macrospora</b> , 14    | <b>Anisomeridium robustum</b> , 18         |
| <b>Acrocordia salweyi</b> , 15       | <b>Anisomeridium viridescens</b> , 18      |
| <b>Acrocordia subglobosa</b> , 15    | <b>ANTENNULARIELLA</b> , 9                 |
| <b>ALLOARTHOPYRENIA</b> , 43         | <b>Antennulariella lichenisata</b> , 9     |
| <b>Alloarthopyrenia italica</b> , 43 | <b>ANTENNULARIELLACEAE</b> , 8             |
| <b>ANISOMERIDIUM</b> , 15            | <b>ARTHOPYRENIA</b> , 44                   |

- Arthopyrenia analepta**, 44  
*Arthopyrenia atractospora*, 25  
*Arthopyrenia carneobrunneola*, 25  
**Arthopyrenia cerasi**, 45  
*Arthopyrenia cinereopruinosa* auct. br.,  
 43  
*Arthopyrenia fraxini*, 25  
*Arthopyrenia nitescens*, 26  
**Arthopyrenia platypyrenia**, 45  
*Arthopyrenia punctiformis*, 26  
**Arthopyrenia salicis**, 45  
*Arthopyrenia saxicola*, 27  
**Arthopyrenia subcerasi**, 46  
**CELOTHELIACEAE**, 9  
**CELOTHELIUM**, 10  
*Celothelium ischnobelum*, 10  
*Cresporhaphis wienkampii*, 12  
**CYRTIDULA**, 49  
**Cyrtidula hippocastani**, 50  
**Cyrtidula major**, 50  
**Cyrtidula quercus**, 50  
**DICHOPORIS**, 37  
**Dichoporis phaea**, 37  
**Dichoporis taylorii**, 38  
**EOPYRENULA**, 50  
**Eopyrenula avellanae**, 51  
**Eopyrenula grandicula**, 51  
**Eopyrenula leucoplaca**, 52  
**Eopyrenula septemseptata**, 52  
**JULELLA**, 46  
**Julella sericea**, 47  
**LEPTORHAPHIS**, 21  
**Leptorhaphis atomaria**, 22  
**Leptorhaphis confertior**, 23  
**Leptorhaphis epidermidis**, 23  
**Leptorhaphis laricis**, 23  
**Leptorhaphis maggiana**, 24  
**LEPTOSILLIA**, 11  
**Leptosillia slaptonensis**, 11  
**Leptosillia wienkampii**, 12  
**LEPTOSILLIACEAE**, 10  
*Lithosphaeria geisleri*, 53  
**LITHOTHELIUM**, 29  
**Lithothelium phaeosporum**, 29  
**MONOBLASTIACEAE**, 12  
**MYCOMICROTHELIA**, 47  
**Mycomicrothelia atlantica**, 48  
**Mycomicrothelia confusa**, 48  
**Mycomicrothelia wallrothii**, 48  
**MYCOPORACEAE**, 18  
**MYCOPORUM**, 19  
**Mycoporum antecellens**, 19  
**Mycoporum lacteum**, 20  
**Mycoporum sparsellum**, 20  
**NAETROCYMBACEAE**, 20  
**NAETROCYMBE**, 24  
**Naetrocymbe atractospora**, 25  
**Naetrocymbe carneobrunneola**, 25  
**Naetrocymbe fraxini**, 25  
**Naetrocymbe nitescens**, 26  
**Naetrocymbe punctiformis**, 26  
**Naetrocymbe saxicola**, 27  
*Pyrenocollema saxicola*, 27  
**PYRENULA**, 30  
**Pyrenula acutispora**, 31  
**Pyrenula chlorospila**, 31  
**Pyrenula coryli**, 32  
**Pyrenula dermatodes**, 32  
**Pyrenula hibernica**, 32  
**Pyrenula laevigata**, 32  
**Pyrenula macrospora**, 33  
**Pyrenula nitida**, 33  
**Pyrenula nitidella**, 33  
**Pyrenula occidentalis**, 34  
**PYRENULACEAE**, 28  
**RHAPHIDICYRTIS**, 52  
**Rhaphidicyrtis trichosporella**, 53  
**SARCOPYRENIA**, 34  
**Sarcopyrenia beckhausiana**, 35  
**Sarcopyrenia cylindrospora**, 35  
**Sarcopyrenia geisleri**, 35, 53  
*Sarcopyrenia gibba* var. *geisleri*, 35  
**SARCOPYRENIACEAE**, 34  
*Strigula*, 38  
*Strigula alpestris*, 39  
*Strigula calcarea*, 40

*Strigula confusa*, 40  
*Strigula jamesii*, 40  
*Strigula muscicola*, 41  
*Strigula phaea*, 37  
*Strigula stigmatella*, 41  
*Strigula stigmatella* var. *alpestris*, 39  
*Strigula tagananae*, 41  
*Strigula taylorii*, 38  
*Strigula thelopsidoides*, 42  
**STRIGULACEAE**, 36  
**Swinscowia alpestris**, 39

**Swinscowia calcarea**, 40  
**Swinscowia confusa**, 40  
**Swinscowia jamesii**, 40  
**Swinscowia muscicola**, 41  
**Swinscowia stigmatella**, 41  
**Swinscowia tagananae**, 41  
**Swinscowia thelopsidoides**, 42  
**TOMASELLIA**, 27  
**Tomasellia diffusa**, 28  
**Tomasellia gelatinosa**, 28  
**TRYPETHELIACEAE**, 42