

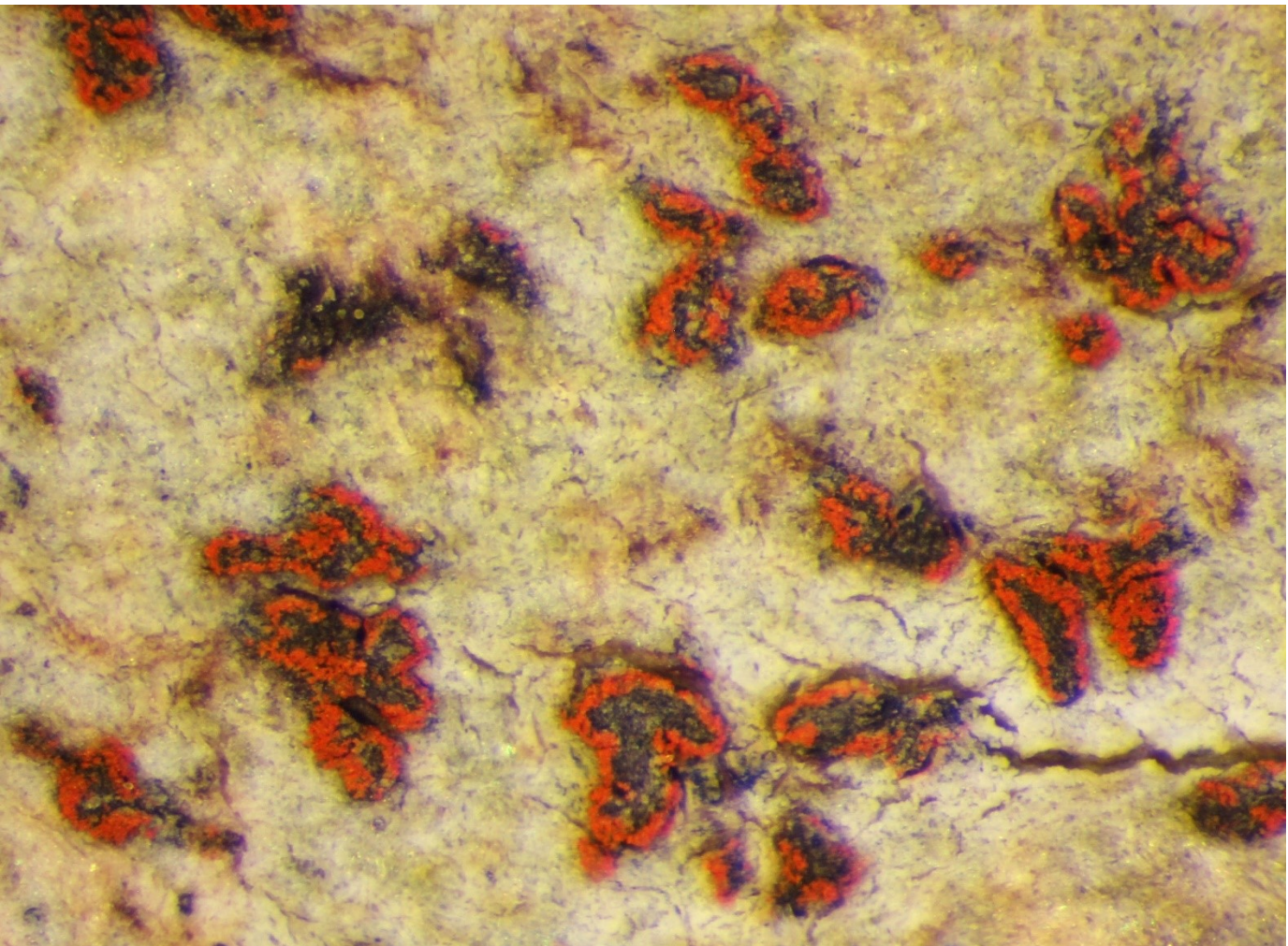
Revisions of British and Irish Lichens



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Volume 1

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Arthoniales: Arthoniaceae

Cover image: *Coniocarpon fallax*, on bark of *Fraxinus excelsior*, Nant Gwynant, Caernarvonshire.

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.

Key to map date classes

- 2000+
- 1960 - 1999
- 1650 - 1959

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. Conservation assessments use the [codes](#) listed in the BLS website. The four-digit number at the end of each description refers to BLS numbers which are part of the recording scheme; they link to species rather than names, and are unchanged (with rare exceptions)

when names alter following improvements in taxonomy.

The choice of subject for each volume will depend on the extent of changes in classification for the families concerned, and the number of newly recognized species since previous treatments. To date, accounts of lichens from our region have been published in book form. However, the time taken to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published. Issuing updates as a serial electronic publication means that important changes in understanding of our lichens can be made available with a shorter delay. The accounts may also be compiled at intervals into complete printed accounts, as new editions of the *Lichens of Great Britain and Ireland*.

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Arthoniales: Arthoniaceae

including the genera *Arthonia*, *Arthothelium*, *Briancoppinsia*, *Bryostigma*, *Coniocarpon*, *Diarthonis*, *Inoderma*, *Naevia*, *Pachnolepia*, *Reichlingia*, *Snippocia*, *Sporodophoron*, *Synarthonia* and *Tylophoron*

by

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ARTHONIACEAE Rchb. (1841)

Thallus crustose, sometimes poorly developed or immersed, absent in lichenicolous and saprotrophic species, effuse or determinate. **Photobiont** trentepohlioid or rarely chlorococcoid. **Ascomata** usually not determinate, appearing apothecial in form but often elongated and/or branched, usually with rudimentary walls but rarely thick- and dark-walled, splitting open to reveal the asci, which form in clusters or singly within the ascomatal tissues. **Hymenium** often reddish or brownish, and blueing in iodine. **Hamathecium** composed of branched cellular paraphysoids in a gelatinous matrix. **Asci** thick-walled, ± fissitunicate, usually with a large apical dome, often blueing in iodine. **Ascospores** usually septate and often multiseptate, occasionally muriform, sometimes becoming brown and/or ornamented, usually without a gelatinous sheath. **Anamorph** coelomycetous (pycnidial) or sporodochial.

One of the larger families of lichens, containing over 700 lichenized species according to Lücking *et al.* (2016), and about a further 140 lichenicolous taxa (Diederich *et al.* 2018). Understanding the inter-relations of families in the Arthoniales has changed markedly in recent years (e.g. Frisch *et al.* 2014). Segregates from *Arthonia* as treated by Coppins & Aptroot (2009) include *Bryostigma*, *Coniocarpon*, *Darthonis*, *Felipes*, *Naevia*, *Pachnolepia*, *Sparria* and *Synarthonia*. *Sparria* has been transferred to the *Opegraphaceae* (Ertz & Tehler 2011, Frisch *et al.* 2014). *Bryostigma* and *Felipes* were considered to belong to unresolved clades within the Arthoniales (Lücking *et al.* 2016), but the former (along with *Diarthonis*) occupies a sister clade alongside the *Arthoniaceae* and is included here for practical reasons. *Felipes* will be included with the Chrysotrichaceae in a future publication. The exclusively lichenicolous genus *Briancoppinsia* also belongs in the Arthoniaceae (Diederich *et al.* 2012), and is included here to complete the new treatment.

A recent phylogenetic analysis by Thiyagaraja *et al.* (2020) has further implications for our understanding of generic limits within the Arthoniaceae, including use of the generic names *Coniangium* and *Naevia* for clades containing *Arthonia spadicea* (assigned to *Diarthonis* in this treatment) and the *A. punctiformis* group respectively. Additionally, *Arthothelium* was shown to be polyphyletic in agreement with Frisch *et al.* (2014) and others, and the species currently accepted probably need to be redispersed throughout the Arthoniaceae.

Frisch *et al.* (2014, 2015) and Thiyagaraja *et al.* (2020) found that *Bryostigma* and a number of lichenicolous species occupied a separate clade to *Arthonia* and its relatives, questionably included within the *Arthoniaceae*. The lichenicolous taxa were not transferred at that time, as earlier names for the clade were potentially available, and sequencing of more species might resolve further genera. Work by Kondratyuk *et al.* (2020) included twelve new combinations into *Bryostigma* for these lichenicolous species, but added minimally to understanding of the clade and introduced several errors. Multiple further lichenicolous species of *Arthonia* probably belong in this broad clade.

Literature

Coppins & Aptroot (2009), Diederich *et al.* (2012), Ertz *et al.* (2009, 2011, 2018a,b), Ertz & Tehler (2011), Frisch *et al.* (2014, 2015), Grube (1998), Lücking *et al.* (2016), Moen (2019), Myllys *et al.* (1998), Nelsen *et al.* (2009), Sundin *et al.* (2012), Thiyagaraja *et al.* (2020), van den Broeck *et al.* (2018).

Key to genera

- 1 Conidia formed from sporodochia; ascomata mazaedial where present [not in British or Irish material] 2
- Conidia formed in pycnidia, or absent; ascomata varied where present but not mazaedial..... 4

- 2(1) Sporodochia dark brown; sexual morph not known *Reichlingia leopoldii*
Sporodochia white or pale cream/yellow 3
- 3(2) Sporodochial conidia in straight, unbranched chains, 0–1-septate, ellipsoidal to cylindrical;
thallus and sporodochia C± red (fleeting), K– *Tylophoron*
Sporodochial conidia in zigzag-shaped chains, 0–2 (–6)-septate, rounded angular to
ellipsoidal or shortly cylindrical; thallus and sporodochia C–, K+ yellow *Sporodophoron*
- 4(1) Lichenicolous, independent thallus absent; pycnidia only present *Briancoppinsia*
Lichenized or lichenicolous, if independent thallus absent then with ascomata 5
- 5(4) Apothecia absent; either soralia or conspicuous pycnidia present 6
Apothecia present; soralia absent or pycnidia rather inconspicuous 7
- 6(5) Thallus Pd+ bright orange-yellow; pycnidia occasional and inconspicuous, black,
immersed, not pruinose; soralia punctiform *Snippocia*
Thallus Pd–; pycnidia conspicuous, black, elevated and sometimes
urceolate, strongly pruinose; soralia absent *Inoderma*
- 7(5) Ascospores muriform *Arthothelium*
Ascospores with one or more transverse septa 8
- 8(7) Thallus and pruina C+ red *Pachnolepis*
Thallus and pruina C– 9
- 9(8) Ascospores with several transverse septa; apothecial sections K+ purple, violet or magenta;
apothecia sometimes with bright red pruina *Coniocarpon*
Ascospores variously septate but if multiseptate then apothecial sections K–; apothecia not
with bright red pruina (if with orange-rusty pruina, see *Synarthonia ochracea*) 10
- 10(9) Apothecia UV+ bright orange-yellow, pruinose, *Synarthonia*
Apothecia UV–, pruinose or not 11
- 11(10) Thallus white to pale grey, matt; apothecia white-pruinose; ascospores with enlarged
apical cell *Reichlingia*
Thallus ± glossy, or immersed; apothecia rarely pruinose and then ascospores without enlarged
apical cell 12
- 12(11) Apothecia large (to ca 1.5 mm diam.), dark brown to black, often maculate; apothecial sections
uniformly orange-brown, K+ pale purple; ascospores 1-septate, <12 µm long; lichenized
with *Trentepohlia* *Diarthonia*
Not with this combination of characters 13
- 13(12) Apparently saprotrophic; thallus absent, but a pale silvery patch of disrupted host
epidermis sometimes visible around the ascomata; ascospores 3- (5-) septate; hymenial
gel I+ blue, KI+ blue *Naevia*
Lichenized (the thallus sometimes inconspicuous) or lichenicolous; ascospores variously
septate; hymenial gel often I+ blue turning reddish, KI+ blue 14
- 14(13) Lichenized with chlorococcoid algae; ascospores 1-septate *Bryostigma*
Mostly lichenized with trentepohlioid algae; ascospores 1- to 7-septate; a number of
species lichenicolous *Arthonia*
[many species phylogenetically allied with *Bryostigma* remain in *Arthonia* pending further research]

ARTHONIA Ach. (1806)

Thallus crustose, immersed or superficial, effuse or delimited (usually by brown lines), or absent; thallus hyphae usually I+ red or pale blue and K/I+ blue. **Photobiont** usually trentepohlioid, sometimes an unknown chlorococcoid alga, some apparently saprobic, weakly lichenized or lichenicolous. **Ascomata** apothecium-like but often not determinate, variously shaped, rounded to elongate and flat to convex, or linear and branched to stellate, emerging apothecia on bark often with a thin rim of thallus tissue and bark cells. **Disc** red-brown to black, sometimes with pale or white pruina. **Thalline exciple** absent. **True exciple** absent in most species, rarely rudimentary and developed only laterally; well-developed and carbonized in a few (the *A. atra* and *A. calcarea* aggregates). **Epithecium** colourless to red- or dark brown. **Hymenium** mostly I+ red and K/I+ blue. **Hypothecium** absent to conspicuous, often poorly delimited from the hymenium. **Hamathecium** of few to numerous, sparingly to richly branched and anastomosed paraphysoids in a gel matrix, often more richly branched above and there often thickened by pigment (or intermixed with crystals); apices often with thin well-defined dark caps 2–4 µm diam. **Asci** usually 8-spored, clavate, subglobose or globose, semi-fissitunicate, with a large apical dome and usually a distinct ocular chamber; apical dome K/I–, or K/I+ pale blue in lower part near the apex of the ocular chamber, *Arthonia*-type. **Ascospores** mostly obovoid to cylindric-obovoid, 1- to 7-septate, sometimes with an enlarged apical cell, often constricted at the mid septum, colourless and smooth; old ascospores often becoming brown and then usually warted; young ascospores often with a thin episore (in most species <1 µm thick in K). **Conidiomata** pycnidia, often present but usually immersed, very small and inconspicuous. **Conidia** colourless, aseptate, mostly bacilliform, sometimes ellipsoidal or thread-like. **Chemistry**: many without lichen products, a wide range of substances (including xanthenes and several anthraquinones) produced by others. **Ecology**: various, rarely found above 500 m alt. **Distribution**: ca 500 species, cosmopolitan.

The genus (at least in its traditional sense) comprises all different life forms: lichens, non-lichenized fungi, lichen parasites and parasymbionts. It is sometimes difficult to make out the life strategy of a particular collection, even whether or not the photobiont belongs to the species. A surprising number of species (with different life strategies) seem to be restricted to bark of *Populus tremula*. *Arthothelium* is polyphyletic and in its current delimitation differs in morphological terms only in the presence of muriform ascospores. Young specimens, with only transversely septate ascospores, could key out here. The lichenicolous species are much under-recorded.

Scutula epicladonia was transferred to *Arthonia* by Zhurbenko & Alstrup (2004), but has recently been shown to belong to the Malmideaceae, within the genus *Zhurbenkoa* by Flakus *et al.* (2019).

The genus *Melaspilea* is currently assigned to the Eremithallales (Ertz & Diederich 2015), but that group is grossly polyphyletic as treated by Sanderson *et al.* (2009). *M. granitophila* is returned to *Arthonia* following Ertz & Diederich, and *M. atroides* probably also belongs within the Arthoniaceae.

Several unidentified, some probably undescribed, lichenicolous species of *Arthonia* s. lat. are known from the British Isles. The host lichens involved include *Blastenia lauri*, *Circinaria contorta*, *Heterodermia obscurata*, *Lecanora pulicaris*, *L. symmicta*, *Lecidella elaeochroma*, *Pertusaria lactescens*, *P. pseudocorallina*, *Phaeographis* spp., *Solenopsora vulturiensis*, *Stereocaulon leucophaeopsis* and *Tephromela atra*.

Literature

Coppins (1989), Coppins & Aptroot (2009), Ertz *et al.* (2009, 2018b, 2019), Fleischhacker *et al.* (2016), Frisch *et al.* (2014, 2020b), Grube *et al.* (1995), Grube & Matzer (1997), Kondratyuk *et al.* (2020), Moen (2019), Sundin *et al.* (2012), Sundin & Tehler (1998), Thiyagaraja *et al.* (2020), Wedin & Hafellner (1998), Zhurbenko & Grube (2010).

The key below includes all of the species assigned to *Arthonia* by Coppins & Aptroot (2009), as well as species discovered since. Those no longer placed in the Arthoniaceae will be included in other publications in this series.

- 1 Not lichenicolous, independent thallus present or not2
 Lichenicolous, independent thallus absent; on apothecia or thallus of other lichens 41

Non-lichenicolous species

- 2(1) Exciple black, ± carbonaceous; ascomata elongate, often in clusters, opening with a well-defined slit...3
 Exciple variously coloured; ascomata usually scattered over the thallus, not opening with a well-defined slit.....6
- 3(2) Ascospores becoming brown and verrucose, 1-septate; thallus inconspicuous4
 Ascospores remaining colourless, 3-septate; thallus well-developed.....5
- 4(3) Ascospores 8.5–11 × 3.5–5 µm; on smooth bark *Melaspilea atroides*
 Ascospores (9.5–) 11–14 (–19) × (3.5–) 4.5–5.5 (–6.5) µm; on shaded siliceous rocks*granitophila*
- 5(3) On smooth bark, rarely lignum *atra*
 On limestone or other base-enriched rock, sometimes on mortar *calcarea*
- 6(2) Ascospores 1-septate 7
 Ascospores 2- or more septate 20
- 7(6) Photobiont trentepohlioid8
 Photobiont not trentepohlioid, or apparently absent 12
- 8(7) Apothecial sections without K+ pale purple, violet or magenta pigments9
 Apothecial sections with K+ pale purple, violet or magenta pigments 10
- 9(8) Thallus pale brown, inconspicuous; ascospores becoming brown and warted; on bark *didyma*
 Thallus chalky white; ascospores remaining colourless; on limestone..... *meridionalis*
- 10(8) Ascospores 7–11 × 3–4 µm, remaining colourless *Diarthonis spadicea*
 Ascospores mostly over 11 × 4 µm, becoming brown when old 11
- 11(10) Apothecia 45–70 (–100) µm tall, fleck-like, flat; thallus pale brown; mainly on young, smooth bark *didyma*
 Apothecia 85–140 µm tall, convex (biatorine); thallus tinged or stained orange; mainly on old, rough bark *vinosa*
- 12(7) Apothecia <0.5 mm diam., rounded, distinctly convex; photobiont cells often numerous; habitat various, rarely smooth bark 13
 Apothecia often >0.5 mm diam., either rounded and flat, or linear-elongate; photobiont cells often absent or few (?adventitious); on smooth bark 18
- 13(12) Photobiont cells not conspicuous; ascospores 29–33 µm long*punctilliformis*
 Photobiont cells numerous; ascospores under 26 µm long 14
- 14(13) Hymenium I–, K/I– 15
 Hymenium I+ red, K/I+ blue 16
- 15(14) Ascospores 17–22 (–26) µm long *ligniarria*
 Ascospores 10.5–14 µm long *ligniarriella*

- 16(14) Ascospores 8–12 (–14) × 2.3–4 μm; epithecium of 2–3 rows of periclinally arranged extensions of the paraphysoids *Bryostigma lapidicola*
Ascospores 11–15 (–18) × 4–7 μm; epithecium of ± erect, ± dark brown capitate apices of paraphysoids 17
- 17(16) Hypothecium colourless to straw-coloured; on twigs of *Populus tremula*, rare *apatetica*
Hypothecium dark, ± red-brown; on calcareous rock and mortar *fusca*
- 18(12) Thallus chalk-white; hymenium K+ violet *galactites*
Thallus inconspicuous; hymenium K– 19
- 18(17) Apothecia linear-elongate, often curved, the disc slit-like *excipienda*
Apothecia rounded to oblong *patellulata*
- 20(6) Apothecial sections K+ purple, violet or magenta 21
Apothecial sections K+ pale green, pale yellow or unchanged 23
- 21(20) Ascospores mostly > 20 μm long; ascomata typically rounded to weakly lobate, rarely lirellate; orange–red pruina present (sometimes missing in grazed material) *Coniocarpon cinnabarinum*
Ascospores mostly ≤ 20 μm long; ascomata typically irregularly lirellate; orange–red pruina present or absent 22
- 22(21) Orange–red pruina present; ascospores (15–) 17–20 (–22) × (6–) 7–9 (–10) μm, (1–)3–4(–5) septate *Coniocarpon fallax*
Orange–red pruina absent; ascospores (15–) 16–18 (–20) × (6–) 7–8 (–9) μm, (2–)3(–4) septate *Coniocarpon cuspidans*
- 23(20) On rock 24
On bark, bryophytes or wood 28
- 24(23) Thallus C+ red [Opegraphaceae] *Sparria endlicheri*
Thallus C– 25
- 25(24) Hypothecium brown; ascospores <17 μm long 26
Hypothecium colourless or pale brown; ascospores >17 μm long 27
- 26(25) Ascospores 4–5 (–7) μm diam.; thallus rather thick, often pinkish when fresh, with photobiont cells in distinct filaments (trentepohlioid) *arthonioides*
Ascospores 2.8–3.8 μm diam.; thallus thin, never pinkish, photobiont cells single (not trentepohlioid) *mediella*
- 27(25) Thallus brown, thin, smooth; apothecia round, not pruinose *phaeobaea*
Thallus pale to slate grey, thick or arachnoid; apothecia rounded to substellate, often pruinose *Reichlingia dendritica*
- 28(23) Ascospores with the apical cell enlarged 29
Ascospores without an enlarged apical cell 37
- 29(28) Hypothecium >90 μm tall, dark brown *arthonioides*
Hypothecium <50 μm tall, colourless or pale 30
- 30(29) Ascospores 26–36 × 10–13 μm *ilicina*
Ascospores mostly <26 μm long, <10 μm diam. 31

31(30)	Ascospores 12–14 (–16) μm long	32
	Ascospores >17 μm long	33
32(31)	Apothecia pruinose, sub-stellate.....	<i>Reichlingia anombrophila</i>
	Apothecia not pruinose, strongly stellate	<i>Arthonia invadens</i>
33(31)	Apothecia white-pruinose	34
	Apothecia not pruinose	35
34(33)	Thallus and especially apothecial pruina UV+ orange-yellow; never lichenicolous	<i>Synarthonia astroidestera</i>
	Thallus and apothecia UV– ; often invading <i>Phlyctis</i> spp.....	<i>Reichlingia zwackhii</i>
35(33)	Apothecial sections C+ red	<i>anglica</i>
	Apothecial sections C–	36
36(35)	Apothecia irregularly rounded to elongate; old ascospores brown and \pm smooth ($\times 1000$)	<i>ilicinella</i>
	Apothecia linear to stellate; old ascospores brown and distinctly warted (even at $\times 400$)	<i>stellaris</i>
37(28)	Thallus and apothecia C+ red	<i>Pachnolepia pruinata</i>
	Thallus and apothecia C–	38
38(37)	Hypothecium >30 μm , pale red to dark brown	39
	Hypothecium <30 μm tall, colourless or pale	40
39(38)	Photobiont trentepohlioid; on acid bark of mature trees or <i>Calluna</i>[Arthoniales, uncertain position]	<i>Felipes leucopellaeus</i>
	Photobiont chlorococcoid or not obvious; on bryophytes or bark	<i>mediella</i>
40(38)	Thallus usually distinct, with trentepohlioid algae; apothecia 70–100 μm tall, rounded to stellate	<i>radiata</i>
	Thallus usually inconspicuous, without trentepohlioid algae; apothecia 40–60 μm tall, rounded to linear, rarely branched	41
41(40)	Ascomata 0.2–1.4 \times 0.1–0.4mm, not pruinose; ascospores 13–23 \times 5–7 μm	<i>Naevia punctiformis</i>
	Ascomata 0.12–0.30 mm diam., white-pruinose; ascospores (8–) 9–12 \times 3.0–3.5 (–4.0) μm	<i>thoriana</i>

Lichenicolous species

42(1)	Associated with Arthoniaceae (<i>Arthothelium</i>)	<i>cohabitans</i>
	Associated with Caliciaceae (<i>Diploicia</i> , <i>Diplotomma</i>).....	43
	Associated with Cladoniaceae (<i>Cladonia</i>)	44
	Associated with Graphidaceae (<i>Graphis</i> , <i>Schizotrema</i> , <i>Thelotrema</i>).....	46
	Associated with Lecanoraceae (<i>Lecanora</i> , <i>Lecidella</i> , <i>Myriolecis</i> , <i>Protoparmeliopsis</i>).....	48
	Associated with Lecideaceae (<i>Amygdalaria</i> , <i>Porpidia</i>)	54
	Associated with Pannariaceae (<i>Nevesia</i> , <i>Psoroma</i>).....	55
	Associated with Parmeliaceae (<i>Protoparmelia</i>).....	<i>protoparmeliae</i>
	Associated with Peltigeraceae (<i>Peltigera</i>).....	56
	Associated with Phlyctidaceae (<i>Phlyctis</i>).....	<i>Reichlingia zwackhii</i>
	Associated with Physciaceae (<i>Phaeophyscia</i> , <i>Physcia</i>)	57
	Associated with Stereocaulaceae (<i>Lepraria</i> , <i>Stereocaulon</i>)	59
	Associated with Teloschistaceae (<i>Calogaya</i> , <i>Variospora</i> , <i>Xanthoria</i>)	60
	Associated with Trapeliaceae (<i>Placopsis</i>).....	<i>gelidae</i>

- 43(42) Apothecia in large clusters; asci 4-spored; ascospores remaining colourless and smooth;
on *Diploicia canescens* *diploiciae*
Apothecia scattered; asci 8-spored; ascospores soon brown and warted; on *Diplotomma*
alboatrum and *D. chlorophaeum*..... *punctella*
- 44(42) Apothecia with 0- or 1-septate dark brown surface hairs *coronata*
Apothecia without surface hairs 45
- 45(44) Apothecial sections at least partly K⁺ purple; ascospores 12–15 × 4.5–5.5 μm *colombiana*
Apothecial sections not K⁺ purple; ascospores 9–11 × 3–4.5 μm..... *digitatae*
- 46(42) Apothecia stellate-dendritic; on *Schizotrema quercicola* with soralia Pd⁺ red [these are
often suppressed]..... *invadens*
Apothecia rounded to elongate, rarely branched 47
(compare also with *Reichlingia zwackhii* which is usually lichenicolous on *Phlyctis* spp.
and has apothecia rounded to stellate; thallus Pd[±] yellow)
- 47(45) Ascospores (13–) 14–17 μm long; hypothecium colourless; on *Graphis*..... *graphidicola*
Ascospores 11–14 μm long; hypothecium red-brown; on *Thelotrema*..... *thelotrematis*
- 48(42) Ascospores 1-septate 49
Ascospores at least mostly 2- or 3-septate 50
- 49(48) Ascospores 10–12 μm long; epithecium greenish; on *Lecanora varia* *caerulescens*
Ascospores 11–15 μm long; epithecium dark brown; on *Myriolecis* species *apotheciorum*
- 50(48) Apothecia diffuse, with asci and paraphyses intermixed with those of the host; on
Lecidella spp. *intexta*
Apothecia discrete; on *Lecanora* or *Protoparmeliopsis* species 51
- 51(50) Ascospores colourless, (1–) 2- to 3-septate 52
Ascospores tinted brown, consistently 3-septate; on *Lecanora albella* or *L. carpinea* *subfuscicola*
- 52(51) Ascospores 13–18 × 4–7 μm; on *Lecanora rupicola* *varians*
Ascospores 10–15 μm long; on *Myriolecis* or *Protoparmeliopsis* 53
- 53(52) Ascospores 10–14.5 (–15) × (3.5–) 4–6.5 μm; hymenium K/I⁺ blue; paraphysis apices
entirely dark brown; on *Protoparmeliopsis*..... *protoparmeliopsisidis*
Ascospores 11–13 × 4–4.5 (–5) μm; hymenium K/I⁺ red; paraphysis apices with
dark brown caps; on *Myriolecis populicola* *lecanoricola*
- 54(42) Ascospores 10.5–15 × 4.5–5 (–6) μm; on *Amygdalaria* and *Porpidia soredizodes* *almquistii*
Ascospores (13–) 16–21 × (5–) 6–8 μm; on *Porpidia rugosa*..... *amylospora*
- 55(42) Ascospores 1-septate, 9.5–12.5 × 3.5–4.5 μm; on *Psoroma hypnorum*, not gall-forming *pannariae*
Ascospores 3-septate, 20–26 × 6–8 μm; forming galls on *Nevesia sampaiana*..... *sampaianae*
- 56(42) Ascospores 15–20 × (5–) 6–7 μm; on *Peltigera rufescens* (? also on *Solorina bispora*) *peltigerea*
Ascospores 9–15 × ca 3.5 μm; on *Peltigera hymenina*..... *fuscopurpurea*
- 57(42) Hypothecium dark red- to black-brown; on *Physcia* spp. 58
Hypothecium colourless to pale red; on *Phaeophyscia orbicularis* *phaeophysciae*
- 58(57) Hymenium not yellowish; asci 8-spored; ascospores 10–14 × (3–) 3.5–5 μm *epiphyscia*
Hymenium yellowish, K⁺ purple-lilac; asci at least mostly 4-spored; ascospores
10.5–17 × 5–7 μm *destruens*

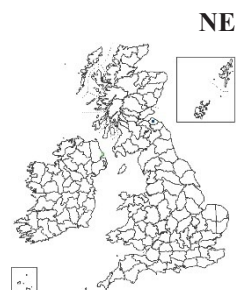
- 59(42) Apothecial sections K+ purple; ascospores $7\text{--}10 \times 3\text{--}4 \mu\text{m}$; on *Lepraria lobificans**neglectula*
 Apothecial sections not K+ purple; ascospores $11.5\text{--}14.5 \times 4\text{--}5 \mu\text{m}$; on
Stereocaulon spp.*stereocaulina*
- 60(42) Apothecia scattered or in small clusters; hymenium brownish; epithecium with olive
 tinge, K-*molendoi*
 Apothecia strongly aggregated; hymenium pale grey-blue; epithecium dark brown
 with bluish tinge, K+ chestnut brown*parietinaria*

Arthonia almquistii Vain. (1883)

Thallus absent, lichenicolous. Apothecia convex, rounded, $0.1\text{--}0.25$ (-0.4) mm diam., black, immersed to erumpent, crowded, partly confluent, with a rough surface; exciple poorly developed, dark brown, $8\text{--}10 \mu\text{m}$ thick; hypothecium $40\text{--}70 \mu\text{m}$ tall, I+ red, with colourless to pale brown subhymenial layer and brown to dark brown (carbonaceous) basal zone; hymenium (30--) $40\text{--}45 \mu\text{m}$ tall, colourless to pale brown; hamatecium with short-celled, strongly branched and anastomosing pale brown, apically agglutinated paraphysoids $2\text{--}2.5 \mu\text{m}$ diam., apical cells irregularly shaped, dark brown pigmented, $3\text{--}4.5$ (-5.5) μm diam., forming a dark brown epithecium $10\text{--}15 \mu\text{m}$ thick; asci broadly clavate, stalked, $28\text{--}38 \times (15\text{--}) 17\text{--}20 \mu\text{m}$, 8-spored; ascospores $10.5\text{--}15 \times 4.5\text{--}5$ (-6) μm , clavate, 1-septate, colourless, with an I+ red gelatinous sheath. Lichen products not detected by TLC. **BLS 0771.**

Lichenicolous, recorded on various species of Porpidiaceae, Pertusariaceae and Trapeliaceae. In Britain and Ireland known only on *Amygdalaria pelobotryon* and *Porpidia soledizodes*; rare. Scotland (E. Lothian) and Ireland (Antrim, Island Magee).

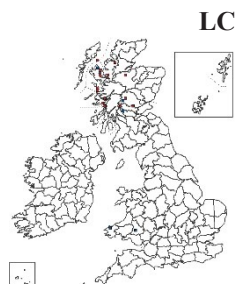
The identity of GB and Irish specimens needs confirmation; current thought is that lichenicolous species of *Arthonia* are normally host-specific and there may be several species involved.



Arthonia amylospora Almq. (1880)

Thallus absent, lichenicolous. Apothecia $0.1\text{--}0.35$ mm diam., immersed in the host thallus, rarely emergent, usually in small clusters, black, rounded, flat to convex; epithecium dark brown, K+ olive; hymenium $40\text{--}55 \mu\text{m}$ tall, pale brown, I+ pale red; hypothecium medium to dark brown, K+ olive; paraphysoids $1.7\text{--}2.5 \mu\text{m}$ diam., the apices with dark brown apical caps $4\text{--}6 \mu\text{m}$ diam. Ascospores (13--) $16\text{--}21 \times (5\text{--}) 6\text{--}8 \mu\text{m}$, 1-septate, ellipsoidal to cylindric-obovoid, colourless, the episore distinct and K/I+ blue. Lichen products not detected by TLC. **BLS 1930.**

On thallus of *Porpidia rugosa*, commensalistic, scarcely damaging the host; occasional. Scottish Highlands and Wales (Breconshire).



Arthonia anglica Coppins (1989)

Thallus immersed, delimited by a dark brown line, to 6×3 cm, grey-white to pale fawn. Apothecia mostly irregularly stellate, rays $80\text{--}160 \mu\text{m}$ broad, pale to dark red-brown, not pruinose, in section $80\text{--}130 \mu\text{m}$ tall; epithecium pale to dark red-brown, K+ olive; hymenium $50\text{--}70 \mu\text{m}$ tall, colourless; hypothecium $20\text{--}50 \mu\text{m}$ tall, colourless; paraphysoids 1 (-1.5) μm diam., sometimes thickened and $1.5\text{--}2.5 \mu\text{m}$ diam. in the epithecium, a few with dark caps $2\text{--}3 \mu\text{m}$ diam. Asci $50\text{--}55 \times 21\text{--}24 \mu\text{m}$. Ascospores (16--) $17\text{--}24 \times 6\text{--}7$ (-8) μm , obovoid to cylindric-obovoid, (2--) 3- or 4-septate, the apical cells enlarged; old ascospores brown and warted. Pycnidia absent. Thallus C-, K-, KC-, Pd-, UV- (apothecial sections C+ red, gyrophoric acid). **BLS 1686.**

On smooth bark of *Ilex*, also *Corylus* and *Fraxinus* in ancient woodlands; rare. S.W. England and the New Forest (formerly on *Fagus* in Sussex).

Like *Synarthonia astroideastera*, but differing in the non-pruinose apothecia, C+ red apothecial sections and



the absence of the unidentified substances detected by TLC in that species. Ertz & Tehler (2011) and Van den Broeck *et al.* (2018) found that African material identified as this species clustered away from the main *Arthonia* clade, and close to *Reichlingia*; however, insufficient recent European material has been located to confirm that European populations are also placed there.

Arthonia apatetica (A. Massal.) Th. Fr. (1866)

Thallus smooth to granular, green, with chlorococcoid photobiont. Apothecia brown to black, convex, 0.2–0.4 mm diam.; epithecium brown; hymenium 40–60 μm tall, colourless to pale red, I+ red; hypothecium colourless to straw-coloured; paraphysoids usually with distinct dark brown, 3.0–4 (–4.5) diam. apical tips, extending periclinally along the surface of the hymenium. Ascospores 12–15 \times 4.5–5 μm , colourless, 1-septate. Lichen products not detected by TLC. **BLS 2418.**

On twigs of *Populus tremula*; rare. Mid-Perthshire.

A. apatetica is mostly confused with *Bryostigma lapidicola*, with which it shares the paraphysoid apices that extend periclinally along the surface of the hymenium, a feature that distinguishes them from *A. patellulata* in which the apices are erect and not or only faintly pigmented. Frisch *et al.* (2015) confirmed the relationship between *A. apatetica* and *B. lapidicola*, but the species is not transferred for the present, pending further research into the inter-relationships of species within the *Bryostigma* clade.

DD



Arthonia apotheciorum (A. Massal.) Almq. (1880)

Bryostigma apotheciorum (A. Massal.) S. Y. Kondr. & J.-S. Hur (2020)

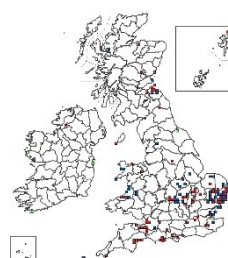
Thallus absent, lichenicolous. Apothecia developing in the host hymenium and blackening the disc, 0.1–0.4 mm diam., black, rounded, flat to slightly convex; epithecium dark brown, K+ olive; hymenium 40–50 μm tall, colourless, I+ blue; hypothecium colourless or very pale brown; paraphysoids 1.5–2 μm diam., apices with dark pigmented caps 2–4 μm diam. Ascospores 9–15 \times 3–5 μm , 1-septate, obovoid to clavate, colourless. Lichen substances unknown. **BLS 1501.**

In apothecia of *Myriolecis* species; common. Probably throughout most of Britain and Ireland, but under-recorded.

Like *A. varians* but the ascospores are narrower and 1-septate. A similar, unidentified species in the apothecia of *Lecanora leptacina* from the Cairngorms differs in having a dark brown, K+ olive hypothecium.

A. apotheciorum belongs in the main *Arthonia* clade along with *A. radiata*, and appears to be close in phylogenetic terms to *A. subfuscolica* which has 3-septate ascospores (Thiyagaraja *et al.* 2020). There are no data to support its placement in *Bryostigma*, and the transfer appears to be a mistake.

LC NS



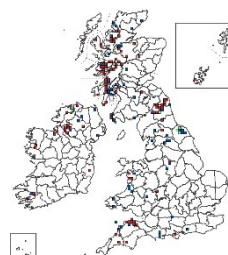
Arthonia arthonioides (Ach.) A.L. Sm. (1911)

Thallus off-white (or pale pink when fresh), usually effuse; when on rock, usually thick (to 1 mm), soft and scurfy, sometimes dispersed into soft verrucae to 0.8 mm diam.; when on bark, mostly immersed; hyphae K/I–, loosely entwined around distinct filaments of trentepohlioid algae. Apothecia 0.15–0.6 mm diam., rounded and \pm convex, or (especially on bark) somewhat elongate to 1.2 \times 0.2–0.5 mm, black, not pruinose; in section 140–350 μm tall; epithecium dark brown, K+ pale green; hymenium 30–40 μm tall, pale red-brown; hypothecium 100–300 μm tall, dark brown, K– or dulling; paraphysoids 1–1.5 μm diam., thickened in the epithecium by pigment, often with brown apical caps. Ascospores 12–14 (–16) \times 4–5 (–6) μm , (1–) 3(–4)-septate, obovoid-cylindrical, the apical cell enlarged. Pycnidia rare, black, immersed, 0.1–0.15 mm diam., walls brown, K+ green; conidia straight, 5–7 \times 1.5–2 μm . Thallus C–, K \pm faint pale yellow, KC–, Pd–, (lichen products not detected by TLC). **BLS 0051.**

On siliceous rocks and tree roots below dry overhangs, also on the dry sides of acid-barked trees (*Alnus*, *Betula*, *Ilex*, *Larix*, *Quercus*, *Sorbus*, *Pinus*) in humid woodlands; local. W. & N. Britain, rare in lowland England. In Ireland, locally frequent in the Fermanagh Scarplands, rare beyond.

Apothecia are usually without asci in corticolous thalli. Diminutive morphs on rocks have been confused with *A. mediella*. Parasitised by *Chaenothecopsis lecanactidis*.

Nb NS



Arthonia atra (Pers.) A. Schneid. (1898)

LC

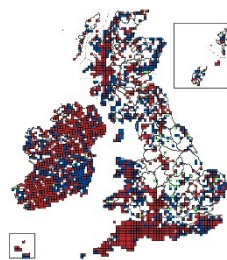
Opegrapha atra Pers. (1794)

Thallus thin, smooth, effuse or delimited, cream- to silver-white, sometimes tinged olivaceous, smooth, often immersed, usually in small, clearly defined patches, occasionally mosaic-forming; prothallus ± distinct, grey to black. Apothecia (0.3–) 0.7–1.5 (–2) × (0.09) 0.12–0.2 (–0.3) mm, 0.10–0.13 mm high, abundant, randomly distributed or in parallel lines or stellate clusters, variable, simple or frequently branched, sometimes forming dense contiguous black patches, sessile; disc a slit, rarely opening; exciple K+ olive-green; hymenium 60–90 µm tall, I+ blue; epithecium brown or green-brown, K+ olive-green. Asci *Arthonia*-type. Ascospores 13–18 (–20) × 2.5–4 (–5) µm, 3-septate, ellipsoidal or often ± clavate. Pycnidia immersed, rare; conidia 4–5 × 0.7–1 µm, straight or slightly curved, ends blunt, rounded, bacilliform. Thallus C–, K–, KC–, Pd–, UV– (no lichen products detected by TLC). **BLS 0938**.

On smooth bark of young or old trees, more rarely on wood, especially on *Corylus*, *Fraxinus* and *Ilex*; often abundant, especially near the west coast. Throughout Britain and Ireland.

The carbonized black exciple and slit-like opening is not at all typical of *Arthonia*, but Ertz *et al.* (2009) showed that this and *A. calcarea* belong in the Arthoniaceae rather than the Opegraphaceae. Further studies may justify a separate genus for these two taxa, but no suitable placement is currently available.

Although normally superficial, the lirellae may become almost totally immersed when on *Sambucus niger*. This common species often forms small, neat thalli on smooth bark of young trees. It is distinguished by the numerous, often contiguous, apothecia, the 3-septate ascospores and K+ olivaceous tinge of the epithecium and edge of the exciple. Similar to *Melaspilea atroides* which has 1-septate ascospores.

**Arthonia caerulea** (Almq.) Arnold (1881)

LC NR

Similar to *A. apotheciorum*, which grows mainly on *Myriolecis albescens*, but distinguished by a stronger greenish pigmentation in the epithecium, and smaller ascospores (10–12 vs. 11–15 µm long). It has rounded black apothecia with a dark blue-green epithecium, pale hypothecium, 1-septate colourless spores and an I+ blue hymenium. **BLS 2563**.

Lichenicolous in apothecia of *Lecanora varia*, Scotland (E. Lothian). A record on *Amandinea pelidna* may well refer to a different species.

**Arthonia calcarea** (Turner ex Sm.) Ertz & Diederich (2009)

LC

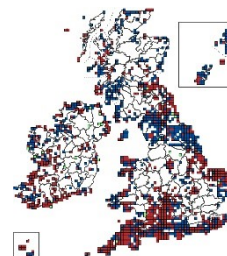
Opegrapha calcarea Turn. ex Sm. (1807)

Thallus thin, finely rimose-cracked or smooth, sometimes totally immersed, white, grey, pale green-pink or rusty ochraceous, often with abundant lipid-rich cells which stain in Sudan Black, 5–10 µm diam. Apothecia variable, 0.6–1.2 (–2) × (0.1–) 0.15–0.3 mm, 40–120 µm tall, sessile or rarely semi-immersed, scattered or contiguous, simple, sometimes branched or stellate; disc a slit, sometimes partially exposed with age; exciple K+ olive-green; epithecium brown, K+ greenish; hymenium 80–100 µm tall. Asci *Arthonia*-type. Ascospores 16–20 (–24) × 4–5 (–6.5) µm, 3-septate, clavate. Conidia 4.2–7 × 0.5–1.4 µm, straight, bacilliform, or rarely ellipsoidal, 4–5 × 1–1.5 µm in large pycnidia, to 0.3 mm diam. Thallus C–, K–, KC–, Pd–, UV– (no lichen products detected by TLC). **BLS 0959**.

On damp shaded limestone, mortar, bone or base-enriched rock; frequent. Throughout Britain and Ireland, particularly near the coast.

Close to *Arthonia atra*, which also has apothecia with carbonized exciple and opening by a narrow slit; see that species for more information. Also similar to *Opegrapha dolomitica*, but with smaller ascospores and a greenish exciple, epithecium and hypothecium in K.

The wide circumscription of *Arthonia calcarea* adopted here encompasses several morphotypes, not all of which have suitable combinations into the genus from *Opegrapha*. The most distinctive of these have been named as: *Opegrapha conferta* auct., the commonest, has a thin and inconspicuous to evanescent pale grey thallus, often confined to minute fissures in neutral to siliceous rocks, especially near the coast; the lirellae are variable in form, sometimes scattered, irregularly nodular or deformed or often forming knot-like heaps to 7 mm across. *O. chevallieri* Leight. (1854) resembles *O. conferta* auct. but has a conspicuous superficial pure white chalk-like



thallus with conspicuous, loose to compact heaps of lirellae, sometimes to 5 mm diam.; it is widespread on cement, mortar and plaster walls, especially in churchyards and on derelict buildings. These morphotypes appear to intergrade with the typical state of the species and confusing intermediates occur; a detailed study of this complex is required.

Arthonia cohabitans Coppins (1989)

Thallus absent, lichenicolous. Apothecia scattered to clustered, developing below the surface of the bark but soon erumpent, fleck-like, brown-black, not pruinose, rounded and 0.06–0.16 mm diam., or elongate and to 0.3 (–0.4) × 0.08–1 mm; in section (50–) 60–70 µm tall, K+ purple due to yellow-orange pigment; epithecium often discontinuous, of pale yellow-orange pigment mixed with the dark brown walls of the paraphyses; hymenium 35–38 µm tall, pale yellow-orange, I+ blue; hypothecium 16–23 µm tall, mottled dark brown with yellow-orange background; paraphysoids rather scanty, sparingly branched, 1–1.5 µm diam., the apices more richly branched, brown-walled, 1.5–2 µm diam., sometimes with dark brown caps to 3.5 µm diam. Ascospores 10.5–14 × 4–5 µm, 1-septate, the upper cell broader and longer than the lower, cylindric-obovoid to cylindric-ellipsoidal or clavate, at first colourless with a thin perispore, later becoming brown and warted. Lichen products not detected by TLC. **BLS 0027.**

On thallus of *Arthothelium macounii*, commensalistic or weakly parasitic, rarely forming necrotic patches. C. Scotland (Argyll, W. Inverness). Endemic.

The non-lichenicolous *A. didyma* is distinguished by the larger ascospores.

VU D2



Arthonia colombiana Etayo (2002)

Apothecia convex, black, 0.1–0.22 mm diam., the exciple indistinct. Epithecium and upper hymenium with orange crystals, K+ purple. Ascospores 1-septate, clavate, 12–15 × 4.5–5.5 µm, becoming grey-brown and warted when old. **BLS 2463.**

On 'bleached' squamules and podetia of *Cladonia* species (including *C. pyxidata* and *C. squamosa*) on trees and on soil on boulders. Rare. W. Scotland (Argyll, Skye, W. Ross, Sutherland) and England (Dartmoor).

Reminiscent of the corticolous (or occasionally lignicolous) *A. vinosa*, but the apothecia are much smaller. Microscopical examination of the host tissue in some of the Scottish collections revealed cells of trentepohlioid algae within the chlorotic tissue, and it seems likely that *A. colombiana* is a lichenicolous lichen.

NE NR



Arthonia coronata Etayo (1996)

Thallus absent, lichenicolous. Apothecia brown-black, 50–100 µm diam., arising among the rather loose soredia of the hosts, with a roughened appearance under the dissecting microscope (at ×50), caused by the dark brown aseptate (or occasionally 1-septate) surface hairs, 10–35 × 3–3.5 µm; hymenium I–, K/I–; asci with a K/I– tholus (without an amyloid ring), but the cytoplasm within the ascus K/I+ pale red; paraphysoids compacted, branched, and irregular in diam. (2–3 µm). Ascospores colourless to pale brown, 1-septate, 10–14 × 3.5–4.5 µm. **BLS 2415.**

Lichenicolous on podetia of *Cladonia ochrochlora* and *C. subulata*; rare. Scotland (Moray, E. Sutherland).

Originally described as a parasite in the soralia of *Flavoparmelia caperata*, but apparently widespread on *Cladonia* species in northern Europe and North America (Zhurbenko & Pino-Bodas 2017).

LC NR



Arthonia destruens Rehm (1868)

Thallus absent, lichenicolous. Apothecia scattered to crowded, then often confluent, irregularly shaped but usually ± round, 0.1–0.25 (–0.4) mm diam., cushion-like, blackish, with a rough surface, in section 50–100 µm tall; epithelial layer brownish with a yellowish tinge, 5–15 µm tall, composed of dense but not interwoven ± anticlinal cells, covered by a colourless gelatinous coat; hymenium streaked brown-yellow; hypothecium brown-yellow; paraphysoids scanty, occasionally branched and anastomosed; asci clavate, 29–43 × 11–15 µm, 4- to 8-spored, with a K/I– tholus; ascospores cylindric-obovoid (soleiform), becoming brown and verrucose, 10.5–17

NE NR

× 5–7 µm, 1-septate, slightly constricted at the septum and with a slightly larger upper cell. Chemistry: Epithecium and ascigerous layer I+ dark blue; hypothecium I+ reddish brown; all parts KI+ deep blue; yellowish pigments K+ turning purplish violet and dissolving. **BLS 2564**.

On a moribund thallus of *Physcia tenella* on a branch of *Fraxinus excelsior*, Wales (Cardiganshire). Only known from a single GBI collection.

Superficially similar to *A. epiphyscia*, which also grows on *Physcia* spp., but distinguished by having an internal yellowish, K+ purple-lilac pigment and longer ascospores (10.5–17 vs. 10–14 µm).

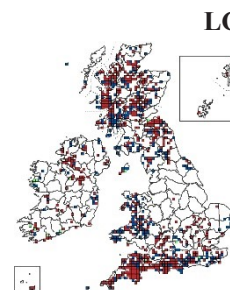


Arthonia didyma Körb. (1853)

Thallus immersed, effuse, wide-spreading or in tiny patches (especially around lenticels and scars), inconspicuous, pale fawn or olive-grey, sometimes pale pink when fresh. Apothecia 0.06–0.6 × 0.06–0.3 mm, rounded to shortly linear, flat, dark brown to brown-black, matt, not pruinose; in section 45–70 (–100) µm tall; epithecium red-brown or indistinct; hymenium 33–50 µm tall, colourless or pale orange-red-brown in parts; hypothecium 5–30 µm tall, red-brown; red-brown pigment K+ grey or olive, but epithecium, hymenium and sometimes hypothecium with additional orange-red, K+ purple-violet pigment; paraphysoids 0.5–1 (–1.5) µm diam., rather scanty, or (especially in epithecium) brown-walled and to 2.5 µm diam., a few with apical caps. Ascospores (12–) 14–17 × 4.7–7 µm, 1-septate, obovoid, colourless, but soon brown and warted. Pycnidia 40–60 µm diam., rare, immersed, the wall red-brown, K+ olive-grey; conidia 3.5–4 × ca 0.7 µm, bacilliform. No lichen products or anthraquinone(s) detected by TLC. **BLS 0056**.

Usually on smooth bark of deciduous trees and shrubs, especially *Corylus*, mainly in woodlands; common in unpolluted areas. Throughout Britain and Ireland.

Usually recognized by the tiny fleck-like apothecia. The K+ pale purple morph is separated from small morphs of *Diarthonia spadicea* by its larger ascospores, and from *A. vinosa* by the flat, shallower apothecia. The lichenicolous *A. cohabitans*, on *Arthothelium macounii*, has ascospores 10.5–14 × 4–5 µm. Morphs without any K+ pale purple pigment have been recognized as *Arthonia aspersella* Leight. (1872), but both types of apothecia are often found on the same thallus. *A. excipienda* differs from the K– form in its more elongated apothecia, well-developed lateral ‘exciple’, and absence of trentepohlioid algae.



LC

Arthonia digitatae Hafellner (1999)

Thallus absent, lichenicolous, discolouring the host squamules to white or pale red-brown. Apothecia minute, 0.10–0.20 mm diam., irregularly rounded, usually aggregated and sometimes ± confluent, dark brown to black, innate; epithecium dull olive; hymenium varied in pigmentation, the epithecium and hymenium sometimes including scattered granules, hymenial gel I+ pale red, K/I+ blue; hypothecium colourless to straw-coloured; asci broadly clavate, 8-spored, with a K/I+ blue apical ring; paraphysoids anastomosing, olive-brown at the ± thickened and capitate tips. Ascospores colourless, narrowly clavate, 1-septate, 9–11 × 3–4.5 µm, sometimes with a gelatinous perispore. Lichen products not known. **BLS 2416**.

Parasitic on *Cladonia macilenta* and *C. polydactyla* on old stumps; previously known only on *C. digitata* squamules; rare. England (Somerset), Scotland (Highlands and S.E. Scotland), Wales (Radnor).

Reported on a broad range of *Cladonia* species and with a broad geographical range by Zhurbenko & Pino-Bodas (2017). It appears to be rather variable, and a species complex might be involved. The same authors investigated an *Arthonia* species similar to *A. digitatae* but with a proportion of ascospores developing more than one septum. It was compared with *Abrothallus lepidophilus* Anzi (1868) (= *Arthonia lepidophila* (Anzi) Clauzade, Diederich & Cl. Roux (1989, *comb. inval.*) but appears to be distinct from that species by its (0-) 2-septate rather than 1- to 3-septate spores, much shorter asci and ascogmata without a green pruina. There appears to be no appropriate species placement for *A. cf. lepidophila* as treated by Zhurbenko & Pino-Bodas, but similar material has been recorded on degraded *Cladonia cf. cervicornis* from Scotland (W. Inverness, Morvern).



LC NR

Arthonia diploiciae Calat. & Diederich (1995)

Thallus absent, lichenicolous. Apothecia very numerous, black, sessile, convex, 0.07–0.13 mm diam., producing ± circular, pale brown infection spots on the surface of the host lichen; hymenium colourless to pale brown, 25–35 µm tall, K/I+ blue, I+ red; epihymenium brown, K–, N–; hypothecium pale brown to brown, 25–35 µm tall; hamathecium of paraphysoids, 2–3 µm diam., branched and anastomosed, septate, thickened at the apices, which are 4–5 µm thick; asci clavate to subglobose, 15–22 × 7–12 µm, 4-spored, apical part thickened, with the ocular chamber surrounded by an amyloid ring; ascospores 1-septate, lower cell slightly attenuated, apices rounded, colourless, smooth-walled, 8–11 (–14) × 3.5–4 (–5) µm. **BLS 2009.**

Parasitic on *Diploicia canescens* on church walls and coastal rocks; rare. E. Anglia & S.W. England, W. Ireland.

Easily distinguished from other *Arthonia* species by the very small ascomata, arising in groups of up to 125, inducing brown spots on the host thallus, by the 4-spored asci, ascospore size, and by its host. The species may belong in the broad *Bryostigma* clade close to *A. epiphyscia*, from which it differs in the much smaller ascomata, and especially the 4-spored asci.

DD NR

**Arthonia epiphyscia** Nyl. (1875)

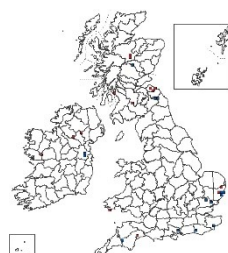
Bryostigma epiphyscium (Nyl.) S. Y. Kondr. & J.-S. Hur (2020)

Thallus absent, lichenicolous. Apothecia 0.1–0.35 mm diam., often in clusters, black, rounded, convex; epithecium brown, K+ olive; hymenium 30–35 µm tall, I+ red; hypothecium red-brown (K+ olive); paraphysoids 1.5–2.5 µm diam., apices thickened with dark pigment, to 4 µm diam. Ascospores 10–14 × (3–) 3.5–5 µm, 1-septate, cylindrical to clavate, colourless. Lichen products not known. **BLS 0122.**

On thalli of a range of *Physcia* spp., commensalistic or weakly parasitic; occasional. Scattered throughout Britain and Ireland.

Earlier reports on other hosts belong to *A. molendoi* or *A. phaeophysciae*. See also *Arthonia diploiciae*, which is probably closely related to this species. Molecular data suggest that this species belongs within the *Bryostigma* clade, but further study is needed to confirm its position.

LC

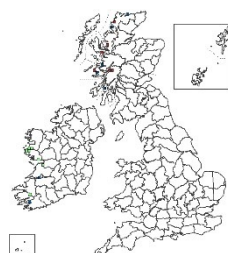
**Arthonia excipienda** (Nyl.) Leight. (1871)

Thallus immersed, often scarcely visible, effuse or sometimes delimited from adjacent crusts by a brown line; photobiont absent, but a few adventitious protococcoid or trentepohlioid cells are sometimes present. Apothecia 0.3–1.5 × 0.1–0.14 mm, often curved or flexuose, occasionally a few branched; ‘margins’ slightly raised towards a slit-like disc that sometimes expands in old apothecia. In section 40–50 µm tall, with a well-developed lateral dark brown (K+ pale green) exciple-like zone 12–18 µm thick; epithecium pale brown or olive; hymenium 30–40 µm tall, colourless; hypothecium indistinct, rarely over 5 µm tall, colourless; paraphysoids 1–1.5 µm diam., numerous, only rarely thickened by pigment above, apical caps not seen. Ascospores 15–17 (–18) × 5–7 µm, 1-septate, obovoid, colourless. Pycnidia not found. Lichen products not known. **BLS 1599.**

On smooth bark (e.g. *Corylus*) or the smooth surface of fissured bark; rather rare. W. Scotland, W. Ireland.

Distinguished from superficially similar *Arthonia* spp. by the well-developed exciple-like margin. It is easily overlooked for *Naevia punctiformis*, which has 3-septate ascospores, but appears not to belong in that genus. *Melaspilea atroides* has a true black exciple and smaller, dark brown ascospores.

NT

**Arthonia fusca** (A. Massal.) Hepp (1860)

Arthonia lapidicola auct., non (Taylor) Branth & Rostr. (1869)

Thallus thin and partly immersed to irregularly scurfy granular-verrucose, verrucae to 0.15–0.3 mm diam., pale fawn to dull grey or olive-brown; photobiont cells 6–17 (–21) µm diam., green (not trentepohlioid), mostly ± globose, but rarely irregularly globose to ellipsoidal and 4–10 × 4–6 µm in size. Apothecia (0.1–) 0.2–0.4 (–0.5) mm diam., convex, dark brown to black; in section 70–190 µm tall; epithecium to 15 µm tall, ± red-brown, K+ dull- or olive-brown; hymenium 35–60 µm tall, colourless or pale pale green in upper part; hypothecium dark, ± red-brown, K+ dull- or olive brown; paraphysoids (1–) 1.5–2 µm diam., numerous, the apices mostly swollen to

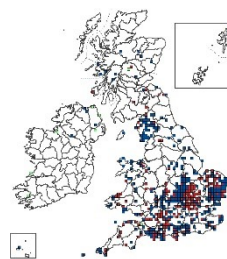
LC

3.5 μm diam. with dark apical caps. Ascospores 11–15 (–18) \times 4–7 μm , 1-septate, obovoid, or constricted at the septum and slipper-shaped with the apical cell \pm rounded and elongated, the other narrower, colourless. Pycnidia 40–50 μm diam., few to numerous, immersed, the wall red-brown, K+ dull brown; conidia 4.5–6 \times ca 1 μm , bacilliform. Lichen products not detected by TLC. **BLS 0064.**

On calcareous rocks and mortar, including loose stones, mostly in open habitats, also \pm base-rich stone window sills of churches below metal grilles; widespread. Throughout Britain but with fewer records from Scotland, rarely recorded in Ireland.

Referred to in Coppins & Aptroot (2009) and numerous other works as *Arthonia lapidicola*, but the type of that name has recently been shown to be a saxicolous morph of the species referred to as *Bryostigma muscigenum* (Alan Fryday, *pers. comm.*). *A. fusca* belongs to the broad *Bryostigma* clade based on sequences of Frisch *et al.* (2014) labelled as *A. lapidicola*, but it may not be congeneric with *Bryostigma sensu stricto* and could be placed in its own genus along with *A. apatetica* which has similar paraphysoids.

Easily mistaken in the field for a small member of Lecideaceae s. lat. Morphs of *Bryostigma lapidicola* (syn. *B. muscigenum*) on rock differ in the smaller ascospores, scanty, narrower paraphyses, and epithecium of compacted periclinal hyphae.



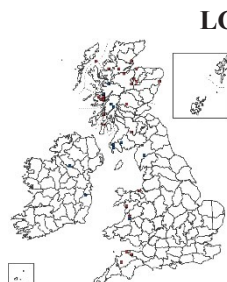
Arthonia fuscopurpurea (Tul.) R. Sant. (1960)

Thallus absent, lichenicolous. Apothecia (0.2–) 0.5–1.5 (–2) mm diam., red-brown to brown-black, often surrounded by a ring of white bleached host tissue, rounded, flat to convex, often with the central part convex and surrounded by a flat maculate zone of individual patches of developing hymenia and sometimes also pycnidia; epithecium orange- to red-brown, K+ dull brown, sometimes with an olive tinge; hymenium 25–30

μm tall, pale brown-orange, K+ dull brown, I+ red; hypothecium 40–100 μm tall, pale brown-orange, \pm with red-brown mottling, K+ dull brown; paraphysoids 1.5–2.5 (–3) μm diam., extending periclinally above the asci to form the epithecium in which the colourless apical walls are embedded in a pigmented matrix. Ascospores 9–15 \times 3–4 μm , 1-septate, obovoid to cylindrical-obovoid or clavate, the upper cell shorter and broader than the lower, colourless. Pycnidia grouped in apothecium-like clusters, or in the outer edge of the apothecia, 25–40 μm diam., red-brown, wall red-brown, K+ dull brown; conidia 3.5–5 \times 0.8–1 μm , bacilliform. Lichen products not known. **BLS 0775.**

On thallus of *Peltigera hymenina*, probably parasitic; outside Britain and Ireland on other hosts; rather common. W. and N. Britain, rarely recorded in Ireland.

Can be confused with *A. peltigerea* (q.v.).



Arthonia galactites (DC.) Dufour (1818)

Thallus to 0.08 mm thick, chalk-white, usually in \pm circular patches without a dark, prothalline margin, immersed, of scattered hyphae and abundant, minute crystals among loose bark cells; photobiont absent. Apothecia 0.16–0.8 (–1) \times 0.14–0.6 (–0.7) mm, flat, black, not pruinose; in section 35–55 μm tall; epithecium dark brown; hymenium 20–35 μm tall, pale green-yellow; hypothecium 5–10 μm tall, pale green-yellow or brown; brown pigment K–, pale green-yellow pigment K+ violet; paraphysoids 1–2 μm diam., brown-walled and to 3 μm diam. in the epithecium, a few with dark apical caps. Ascospores 12–14 \times 4–5 μm , 1-septate, obovoid, colourless. Pycnidia 40–80 μm diam., often numerous, black, the wall brown, K \pm olive; conidia 10–14 \times ca 0.5 μm , curved. Thallus C–, K+ faint yellow, KC–, Pd–, UV– (lichen products not detected by TLC). **BLS 0061.**

On smooth bark of *Populus*; probably extinct in Britain and Ireland. Formerly recorded from S. England and S. Ireland.



Arthonia gelidae R. Sant. (1986)

Thallus absent, lichenicolous. Apothecia 0.2–0.5 mm diam., black, round or slightly elongate, solitary, erumpent,

NE NR

convex to almost hemispherical; epithecium dark brown; hymenium *ca* 50 μm high, colourless, I+ red, K/I+ blue; hypothecium colourless; paraphysoids with apices 4–6 μm diam., dark brown. Ascospores 11.5–16 \times (4–) 5–6 μm , 1-septate, cylindrical-obovoid, colourless. Pycnidia immersed, rare, *ca* 30 μm diam., the wall colourless; conidia *ca* 5 \times 1 μm , bacilliform. Lichen products not known. **BLS 1961.**

On thalli of *Placopsis gelida* and/or *P. lambii*, commensalistic. S. Wales, Scotland.

Arthonia granitophila Th. Fr. (1865)

Melaspilea granitophila (Th. Fr.) Coppins (1989)

Thallus evanescent, dull green- or yellowish brown, often visible only near the apothecia. Apothecia 0.1–0.3 (–0.4) mm diam., immersed to sessile, rounded to somewhat elongate, rarely branched, sometimes curved; disc exposed; true exciple well-developed, raised, extended below into a stipe-like structure; hymenium pale brown, I+ blue; hypothecium dark brown; paraphysoids unbranched or branched and anastomosed below. Asci 25–45 \times 14–20 μm , 8-spored, clavate, with an internal apical beak. Ascospores (9.5–) 11–14 (–19) \times (3.5–) 4.5–5.5 (–6.5) μm , cylindrical-ovoid to slipper-shaped, colourless and smooth at first, becoming pale brown and verrucose. **BLS 0868.**

On shaded siliceous rocks in upland areas (once found spreading onto *Quercus* roots), often associated with *Enterographa zonata*, *Gyrographa gyrocarpa* or *Porina lectissima*; occasional. Scotland and Wales, also a few sites in the north or Ireland.

Arthonia graphidicola Coppins (1989)

Thallus absent, lichenicolous. Apothecia scattered, developing below the surface of the host thallus but soon erumpent, fleck-like, rounded or \pm polygonal and 60–160 μm diam. or elongate with \pm pointed ends, to *ca* 420 \times 60–100 μm , red- to dark brown, not pruinose; in section 60–85 μm tall; epithecium indistinct or pale red-brown, K+ dull olive; hymenium 40–50 μm tall, pale red-brown, K+ pale olive, I+ red; hypothecium 10–28 μm tall, colourless, I+ blue; paraphysoids rather scanty, sparingly branched, 1–1.5 μm diam., the apices more richly branched, brown-walled, 1.5–2 μm diam., occasionally with dark brown caps to *ca* 3.5 μm diam. Ascospores (13–) 14–17 \times 4.5–5.5 μm , 2- or 3-septate, the apical cells enlarged, cylindrical-obovoid, at first colourless and smooth but often with a thin perispore, later covered in dark brown granular warts. Pycnidia rare, immersed, *ca* 40 μm diam., the wall red-brown, K+ pale green; conidia colourless, bacilliform, 4.5–5 \times *ca* 0.8 μm . Lichen products not known. **BLS 0735.**

On thallus of *Graphis scripta* and more rarely *G. inustuloides*, frequent in W. Scotland, scattered and rare in S. & S.W. England, W. Wales and Ireland.

Similar to *A. thelotrematis* but the ascospores are longer and the hypothecium paler. A similar taxon has been found on *Phaeographis smithii* in north Cornwall with shorter and broader spores.

Arthonia ilicina T. Taylor (1836)

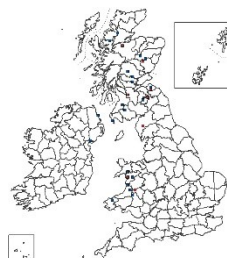
Thallus immersed, effuse or delimited by a brown line, white to cream-yellow. Apothecia irregularly rounded and 0.2–1 mm diam., or a few elongated to *ca* 2 \times 0.2–0.6 mm, flat to slightly convex, dark red-brown to black, not pruinose, in section 95–105 μm tall; epithecium red-brown, K+ pale green; hymenium 60–85 μm tall, colourless or pale red-brown, K+ pale green; hypothecium 20–30 μm tall, concolorous with the hymenium or darker in places; paraphysoids numerous, *ca* 1 μm diam., brown-walled and 1.5–2 μm diam. in the epithecium. Ascospores 26–36 \times 10–13 μm , obovoid-cylindrical, often slightly curved, (4–) 5–6 (–7)-septate, the apical cells enlarged, old spores brown, smooth or very faintly warted (\times 1000 lens). Pycnidia rare, 60–80 μm diam., brown, the wall red-brown, K+ pale green; conidia 7–9 \times *ca* 1 μm , bacilliform. No lichen products detected by TLC. **BLS 0094.**

On smooth, more rarely rough, bark of deciduous trees in old woodlands; locally common in western Scotland, scarce beyond in S. & W. Britain, W. Ireland.

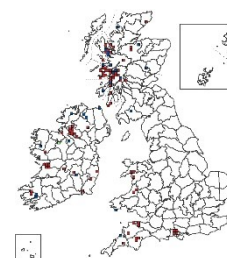
A. ilicinella has smaller ascospores and generally smaller apothecia; *Arthothelium dictyosporum* and *A.*



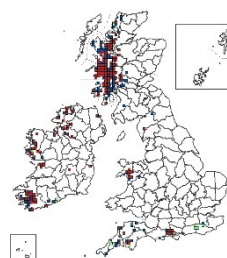
Nb



Nb IR



Nb IR



macounii are superficially similar but have muriform ascospores.

Frisch *et al.* (2014) found that an American collection identified as this species clustered within the cryptothecoid clade of the Arthoniaceae close to *Briancoppinsia* and *Tylophoron*, but it is retained here pending molecular studies of European material.

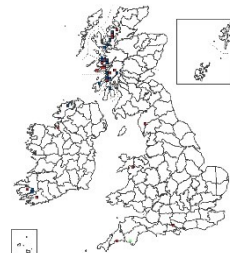
Arthonia ilicinella Nyl. (1867)

Thallus immersed, effuse or delimited by a brown line, white-grey or cream-white. Apothecia 0.1–0.6 mm diam., or elongated to *ca* 0.8 × 0.15–0.3 mm, irregularly rounded, ± flat, black, not pruinose, 80–95 µm tall; epithecium red-brown, K+ pale green; hymenium 40–60 µm tall, pale red-brown, K+ pale green; hypothecium 10–25 µm tall, concolorous with the hymenium; paraphysoids *ca* 1 µm diam., brown-walled and 1.5–2 µm diam. in the epithecium, sometimes a few with apical caps. Ascospores (16–) 18–23 × 7–9 µm, cylindrical-obovoid, 3- or 4(–5)-septate, the apical cells enlarged; when old becoming brown, smooth or very faintly warty (×1000). Pycnidia often present but usually few, 60–80 µm diam., the wall red-brown, K+ pale green; conidia 7–9 × *ca* 1 µm. Lichen products not detected by TLC. **BLS 0062.**

On smooth bark, especially of *Corylus* & *Ilex*; rare, once observed as being parasitic on *A. ilicina*. W. Scotland (Argyll to Skye, W. Ross), W. Ireland, N. Wales, W. & S. England (Lake District, Cornwall & New Forest).

Closely related to *A. ilicina*, but distinguished by the smaller apothecia and ascospores. *A. stellaris* has ± stellate apothecia, and ascospores that become distinctly warty (×400) when brown.

NT IR



Arthonia intexta Almq. (1880)

Thallus absent, lichenicolous. Apothecia developing in the hymenium of the host, poorly delimited, with asci and paraphysoids intermixed with those of the host; paraphysoids 1.5–3 µm diam.; apices thickened by olive-brown pigment to 5.5 µm diam. Ascospores (11–) 12.5–17 (–20) × (3–) 3.5–5 (–6) µm, (1–)2(–3)-septate, cylindrical-obovoid, colourless. Pycnidia immersed in the host hymenium, 50–70 (–90) µm diam., the wall olive-brown above, becoming colourless below; conidia 5–5.5 × *ca* 1 µm. Lichen products not known. **BLS 1933.**

In apothecia of *Lecidella* species, slightly discolouring the discs; rare or overlooked. Thinly scattered throughout Britain (W. Cornwall, Shropshire, N.E. Yorkshire, W. Inverness, Shetland). An unidentified *Arthonia* sp. with 1-septate ascospores 11–12 × 3–4 µm in size is known on the thallus and apothecia of *Lecidella elaeochroma* from N.W. Scotland.

NE NR



Arthonia invadens Coppins (1989)

Thallus absent, lichenicolous; weakly parasitic in the thallus of the host, suppressing or sometimes eliminating production of soralia. Apothecia evenly and mostly densely scattered, developing below the surface of the bark but soon erumpent, dark brown, not pruinose, linear to more usually stellate or stellate-dendritic, 0.2–0.8 (–1) mm diam., linear apothecia or stellate-rays very narrow, 30–80 (–100) µm broad; in section 54–60 µm tall, I+ blue; epithecium 7–12 µm tall, red-brown, K+ olive; hymenium 30–40 µm tall, colourless or pale red-brown in places; hypothecium indistinct, less than 10 µm tall, colourless; paraphysoids rather scanty, branched, 1(–1.5) µm diam.; apices often brown-walled and to 2 µm diam., without dark caps. Ascospores 11–15 (–17) × (4–) 4.5–5.5 (–6) µm, 2- or 3-septate, the apical cells enlarged, cylindrical-obovoid, at first colourless and often with a thin perispore, later covered in brown, granular warts. Pycnidia few, immersed, 40–50 µm diam., the wall red-brown, K+ pale green; conidia bacilliform, 3.8–5 × *ca* 0.8 µm. Lichen products not known. **BLS 0729.**

On thallus of *Schizotrema quercicola* in ancient woodland; rare. S.W. England, New Forest, Ireland, Scotland (Kintyre), Wales (Merionethshire). Endemic.

Recently sequenced and shown to be in the *Coniocarpon-Reichlingia* clade (see Ertz *et al.* 2019), but its systematic position needs to be fully established. In circumstances where the lichenicolous nature is not recognized (see Ertz *et al.* 2019), the stellate non-pruinose apothecia distinguish this species from *Reichlingia anombrophila*.

NT



Arthonia lecanoricola Alstrup & Olech (1996)

Similar to *Arthonia protoparmeliopsidis* but with broader 2(–3)-septate ascospores, 11–12.5 × 6–6.5 μm in size, the apical cells of the paraphysoids have a brown cap (in *A. protoparmeliopsidis* the apices are entirely dark), and the hymenium is K/I+ wine red rather than K/I+ blue. **BLS 2630**.

Lichenicolous, in apothecia of *Myriolecis* (*Lecanora*) *populicola*, E. Inverness.

NE

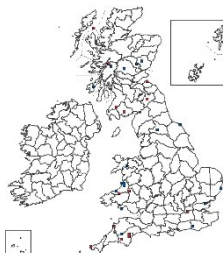
**Arthonia ligniaria** Hellb. (1884)

LC NS

Thallus inconspicuous, immersed, or apothecia associated with subgelatinous mixed-algal films. Apothecia rounded, flat to convex, 0.1–0.3 mm diam., black; in section 95–100 μm tall, all parts K/I–; epithecium 7–10 μm tall, dark brown, K+ olive-brown; hymenium 40–50 μm tall, colourless to pale yellow-brown, K+ pale yellow-olive; hypothecium 45–55 μm tall, pale to dark brown, K+ olive tinge; paraphysoids numerous, dense, much-branched, 1.7–2 μm diam.; apices branched and knobby, to 5 μm diam., with dark caps. Ascospores 17–22 (–26) × 6.5–9.5 μm, 1-septate, ellipsoidal to cylindrical-obovoid, constricted at the septum, colourless or becoming brown when old. Pycnidia not found. Lichen products not detected by TLC. **BLS 1536**.

On bark of mature *Quercus*; also reported from moist acid soil on mossy roadside and woodland banks, and on ± acid soil of a coastal landslip; rare but probably overlooked. Throughout Britain.

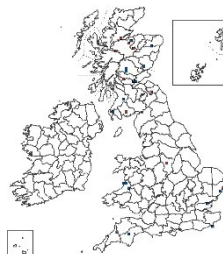
Distinguished from *A. fusca* and *Bryostigma lapidicola* by the large ascospores and K/I– tissues, but no molecular data are available to support this morphological similarity. *A. ligniariella* has smaller ascospores but is otherwise similar.

**Arthonia ligniariella** Coppins (1989)

LC NS

Like *A. ligniaria* in appearance, general anatomy and pigmentation. Hymenium 25–30 μm tall. Ascospores 10.5–14 × 3–3.8 μm, 1-septate, narrowly clavate, constricted at the septum, colourless, the upper cell usually shorter and broader than the lower cell. Lichen products not known. **BLS 1742**.

Mostly on rotting wood of stumps of fallen trees, also on *Quercus* bark, weathered hardboard and moribund *Leucobryum* cushions, and terricolous on moist soil on disused metal mine sites. Scattered records throughout Britain.

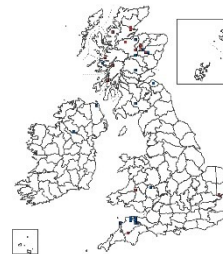
**Arthonia mediella** Nyl. (1859)

LC NS

Thallus pale, dull yellowish to grey, thin, smooth to rimose. Apothecia 0.12–0.3 mm diam., round, elongate to irregular, single, never in groups; disc brown-black to black, shiny to matt; hypothecium reddish brown, 30–70 μm tall; hymenium colourless to pale yellow, I+ red-orange, 30–50 μm tall; epihymenium dark to brown-black; paraphysoids strongly agglutinated, infrequently branched, terminal cells markedly swollen, 3–5 μm diam., with dark brown caps; ascospores 3-septate, cylindrical to obovoid, often tapered at one end, slightly constricted at the septa, 10–17 × 2.5–3 (–4) μm. Pycnidia brown-black, immersed in the thallus to sessile, 40–60 μm diam.; conidia bacilliform, 4–5.5 × 0.8–1 μm. Lichen products not detected by TLC. **BLS 0413**.

Most often found on slightly bleached leaves and stems of pleurocarpous mosses, especially *Hypnum cupressiforme* agg., also on *Salix* bark and rarely on schistose rock; occasional. Scattered throughout Britain and Ireland.

The species superficially resembles *Bryostigma lapidicola* and sometimes grows with it, but has erect, capitate apices to the paraphyses, and 3-septate ascospores. Despite literature reports to the contrary, this species does not have trentepohlioid algae as photobiont. The type of *A. myriocarpella* is a saxicolous morph of this species. Frisch *et al.* (2014) found that the species clusters within the Chrysotrichaceae, but the necessary new combination was not made due to uncertainties regarding generic limits in that family.



Arthonia meridionalis Zahlbr. (1914)

Thallus chalky-white, forming slightly raised, irregularly rounded patches, continuous to rimose-cracked; photobiont trentepohlioid. Apothecia numerous, round to slightly elongate, 0.1–0.6 × 0.1–0.5 mm, black but thinly white-pruinose, immersed and ± level with the thallus. Epithecium brown, K–; hymenium colourless or becoming patchily brown; hypothecium 45–55 µm tall, dark brown, K–; paraphysoids numerous with swollen apices and dark brown caps, 3.5–4.5 µm diam. Ascospores 1-septate, colourless, 12–15 × 4.5–6 µm. Pycnidia not seen. Lichen products not detected by TLC. **BLS 2450.**

On limestone rocks and stones in sheltered, but well-illuminated hollows below large boulders; very rare. England (Dorset).

In the field most easily mistaken for *Diplotomma albostratum*, but distinguished by its trentepohlioid photobiont and 1-septate ascospores. There are no recent studies of the species, and its affinities are unclear.

VU D2

**Arthonia molendoi** (Heufl. ex Frauenf.) R. Sant. (1986)

Bryostigma molendoi (Heufl. ex Arnold) S. Y. Kondr. & J.-S. Hur (2020)

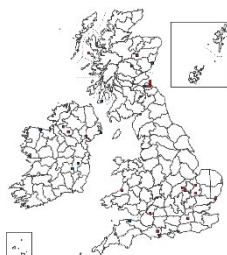
Thallus absent, lichenicolous. Apothecia usually 1–5 per infection spot, 0.1–0.3 mm diam., convex, glossy black; epithecium blackish brown with a dark olive tinge, K–; hypothecium pale straw-coloured to medium brown; hymenium to 40 µm tall, colourless to pale brownish; paraphysoids distinct, apical cells to 4 µm diam. Ascospores 4–8 per ascus, 1-septate, 10–13 × 4–6 µm, with unequal cells, constricted at the septum. **BLS 1934.**

On the thallus of various species of *Calogaya* (*Caloplaca* s.l.); scattered. Throughout Britain and Ireland.

At one time included within *A. epiphyscia* (q.v.). Frisch *et al.* (2015) found that *A. molendoi* clustered with *Bryostigma lapidicola* (as *B. muscigenum*), and that genus may need to be expanded to include this species as well as *A. apatetica*. The transfer by Kondratyuk *et al.* (2020) is premature, due to a poor understanding of the limits of the genus *Bryostigma* and the probable need to transfer further lichenicolous species from *Arthonia*.

The type of *A. molendoi* was collected from thalli of *Rusavskia* (*Xanthoria*) *elegans*, but it has not been reported from this lichen in Britain and Ireland. *A. parietinaria* occurs on *Xanthoria parietina*, and British and Irish records on this host may well need redetermination. *A. parietinaria* has larger infection spots and numbers of ascomata per infection spot, and matt black rather than glossy black ascomata. The species are compared and contrasted by Fleischhacker *et al.* (2016).

LC NR

**Arthonia neglectula** Nyl. (1874)

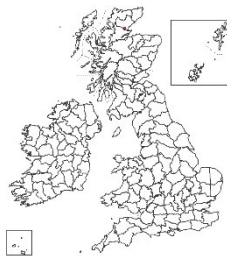
Bryostigma neglectulum (Nyl.) S.Y. Kondr. & Hur (2020)

Thallus absent, lichenicolous. Ascomata scattered, ± rounded, 90–200 µm diam., sessile, cushion-like, black (not translucent when moist), with rough surface; epithecium strongly carbonized with dark brown pigments (K+ olive-black), 5–15 µm tall; cells 4–5 µm diam.; parathecioid layer formed by strongly carbonized hyphae, forming a transition from the hypothecium to the epithecium; texture as in epithecium; hymenium colourless to pale yellow-brown, sometimes with orange-brown inclusions, 20–30 µm tall; gel I+ wine red, KI+ pale blue; hypothecium brown, 20–30 µm tall, cells rounded, ca 3 µm diam.; intercellular gels with inclusions of brown pigments. Asci clavate, 25–32 × 11–15 µm, 8-spored, I–, K/I+ with an inconspicuous, slightly elongated ring in the tholus; paraphysoids scanty and inconspicuous, cells 3–4 × 0.5–1 µm. Ascospores cylindrical-obovoid, persistently colourless, with a faint gelatinous sheath (conspicuous in K), 7–10 × 3–4 µm, 1-septate, not or slightly constricted at the septum. Pigments in lower parts of the ascigerous layers K+ lilac (slowly) and dissolving. Lichen products not known. **BLS 2323.**

On thallus of *Lepraria lobificans* (in Finland on *L. cf. neglecta*) on the side of a granite outcrop, apparently not damaging the host. Scotland (East Sutherland).

Molecular data suggest that this species belongs in the broader *Bryostigma* clade, but its transfer is premature.

NE NR



Arthonia pannariae Zhurb. & Grube (2010)

Thallus absent, lichenicolous. Ascomata black, rarely with a brown tinge, matt to slightly glossy, single or usually merging in large numbers into composite structures to 2 mm diam., moderately convex to tuberclose. Epithecium distinct, medium grey- or brown-olive, *ca* 10 µm tall, K⁻, I⁺ red, with numerous small granules in KI. Hymenium pale grey- or brown-olive (particularly above) to almost colourless, 40–50 µm tall, I⁺ red, K/I⁺ blue. Hypothecium to 150 µm tall, pale yellow-brown to almost colourless, I⁺ and K/I⁺ blue. Paraphyses ± unbranched below, 2–3 µm diam., often branched above, sinuous and 3–5 (–8) µm thick; the apical cells slightly to strongly inflated, sometimes constricted at the septa, clearly pigmented, but without a pigment cap. Asci clavate, often with a stipe, 8-spored, wall I⁺ reddish, K/I⁺ pale blue, no K/I⁺ blue ring observed in the tholus. Ascospores persistently colourless, smooth, 1-septate, sometimes slightly constricted at the septum, soleiform with the upper cell wider, (7.5–) 9.5–12.5 (–15) × (3–) 3.5–4.5 (–5) µm, no gelatinous sheath observed. **BLS 2576.**

On apothecia of *Psoroma hypnorum*, Scotland (Moray).

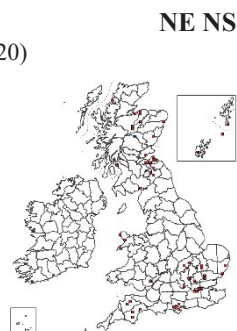
**Arthonia parietinaria** Hafellner & Fleischhacker (2016)

Bryostigma parietinarium (Hafellner & Fleischhacker) S. Y. Kondr. & J.-S. Hur (2020)

Thallus absent, lichenicolous. Ascomata matt black, often with a slight brownish tinge, to 0.25 mm diam., arranged in groups of up to 30 (–50), convex, ± roundish, distributed over the surface of the host thallus including apothecial margins and hymenia. Hymenium pale greyish, with K/I⁺ blue hymenial gel, 30–45 µm tall. Epithecium dark brown (due to the pigmented paraphysoidal tips) with a bluish tinge, K⁺ chestnut-brown. Hypothecium pale brownish with some brown agglomerations, K/I⁻, the hyphae directly underneath K/I⁺ blue. Paraphysoids 1–1.5 µm thick, with only slightly thickened terminal cells, apically *ca* 2.5 µm thick, with pigmented caps. Asci clavate, 8-spored, with a hemiamyloid (K/I⁺ blue) ring structure, 26–35 (–37) × (11–) 12–15.5 (–16.5) µm. Ascospores colourless, K/I⁻, 1-septate, the upper cell somewhat broader and mostly shorter, with a thin colourless epispore, (9–) 10–12 (–13.5) × (3–) 4–5 (–6) µm. Conidiomata subglobose to pyriform, with ellipsoidal conidia. Lichen products not known. **BLS 2683.**

On *Xanthoria parietina*, widely distributed.

Recently segregated from *A. molendoi* (q.v.), which itself was originally confused with *A. epiphyscia*. The three species were studied by Fleischhacker *et al.* (2016).

**Arthonia patellulata** Nyl. (1853)

Thallus very thin, grey-white; photobiont chlorococcoid. Apothecia rounded, black, 0.3–0.7 mm diam.; epithecium grey-green to pale brown; hymenium 40–60 µm tall, grey to yellow-green, I⁺ red; hypothecium black. Ascospores 1-septate, 9–15 × 3–5 µm, colourless. Lichen products not known. **BLS 0066.**

On smooth bark of branches of *Populus tremula* and often closely associated with *Myriolecis populicola*; locally frequent. Scottish Highlands (Cairngorms, N.E. Scotland). Probably a member of the *Bryostigma* clade according to Frisch *et al.* (2014).

**Arthonia peltigerea** Th. Fr. (1866)

Thallus absent, lichenicolous. Apothecia 0.3–1.5 mm diam., black, convex to hemispherical, sometimes with a flat outer rim; epithecium brown, K⁺ olive; hymenium 45–50 µm tall, pale brown ± with olive tinge, K⁺ olive, I⁺ red; hypothecium to 250 µm tall, dark mottled red-brown, K⁺ olive; paraphysoids 1.5–2.5 µm diam., branched but erect and ± parallel, apices wider, to 3.5 µm, often coated with dark pigment. Ascospores 15–20 × (5–) 6–7 µm, 1-septate, cylindrical to bluntly slipper-shaped, the upper cell slightly broader than the lower, colourless. Lichen products not known. **BLS 1935.**

NE NR

On thallus of *Peltigera rufescens* in coastal heath; weakly parasitic; rare. N. Scotland (E. Sutherland). There is also a record on *Solorina bispora* from Mid Perth. (Ben Lawers).

Differs from *A. fuscopurpurea* in the darker coloured apothecia and hypothecium, larger ascospores, and erect paraphysoid apices that do not extend periclinally above the asci.

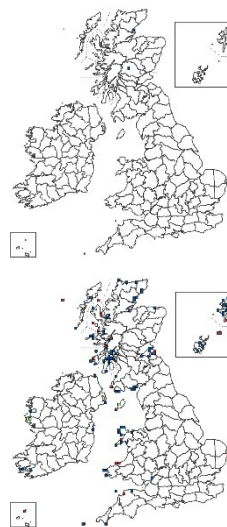
Arthonia phaeobaea (Norman) Norman (1869)

Nb NS

Thallus brown with faint mauve tinge, thin, smooth or slightly cracked, usually forming delimited patches but without any bordering line, to 0.1 mm thick, cortex of \pm globose brown-walled cells 3–4 μm diam.; photobiont cells 7–12 μm diam., chlorococcoid. Apothecia 0.16–0.3 mm diam., rounded, flat to slightly convex, brown-black or black; in section 90–120 μm tall; epithecium dark red-brown, K⁻; hymenium 35–50 μm tall, colourless; hypothecium 48–85 μm tall, pale straw-brown or colourless, K⁻; paraphysoids 1 (–1.5) μm diam.; apices brown-capped, coherent. Ascospores 17–30 \times 5–7 μm , 3- to 5-septate, \pm cylindrical, constricted at the mid-septum and the upper half slightly broader than the lower, colourless; epispore usually distinct, ca 2 μm thick in K. Pycnidia 40–80 μm diam., numerous, black, immersed; wall brown, K⁺ olive-brown; conidia 4–5.5 \times 1.5–2 μm , cylindrical. Lichen products not detected by TLC. **BLS 0067.**

On hard siliceous coastal rocks, mesic-supralittoral zone; common. N. and W. Britain and Ireland.

Easily overlooked, especially when sterile, but then recognized by the characteristic thallus colour and the numerous punctiform pycnidia.



Arthonia phaeophysciae Grube & Matzer (1997)

Bryostigma phaeophysciae (Grube & Matzer) S.Y. Kondr. & J.-S. Hur (2020)

Thallus absent, lichenicolous. Apothecia numerous, breaking through the cortex of the host, parts of the epinecral layer of the host sometimes remaining on the ascomata, rounded, 0.12–0.25 mm diam., flat, black; epithecium 10–25 μm tall, pale olive brown; cells ca 7 \times 4 μm , in the uppermost layer collapsed; hymenium 30–35 μm tall, colourless; hypothecium 20–25 μm tall, colourless to pale brown, K⁺ grey; paraphysoids vertically oriented, cells 7–10 \times 2–3 μm . Asci 35–45 \times 16–20 μm , clavate, 8-spored. Ascospores 12–14 \times 4–6 μm , obovoid, 1-septate, indistinctly constricted at the septum, colourless, smooth, with a gelatinous sheath; ascomatal gel I⁺ red, K/I⁺ first pale blue, becoming red, gel of vegetative hyphae I⁺ red; asci with K/I⁺ blue ring structure. Lichen products not known. **BLS 1982.**

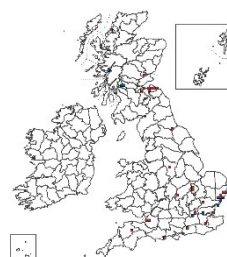
On *Phaeophyscia orbicularis*, less frequently on *P. endophoenicea*, and *P. sciastra*, causing considerable damage to the host lichens; frequent but under-recorded. Strongly infected parts of the hosts become necrotic and blackened and, in these parts, vegetative propagules of the parasite may be present on the upper thallus surface. Throughout Britain.

The characters found in *A. phaeophysciae* indicate that it belongs to the broader *Bryostigma* clade, but further work is needed before its transfer can be justified. *A. epiphyscia*, confined to *Physcia*, differs by its superficial, more convex ascomata. Additionally, the epithecium of *A. phaeophysciae* is composed of more distinctly vertical and parallel elements.

Arthonia protoparmeliae Etayo (2010)

Thallus absent, lichenicolous. Apothecia in clusters but not confluent, 100–250 μm diam., \pm globose, the upper part domed, shining black, at first immersed but becoming sessile or partially erumpent, the lower part cupulate and deeply immersed in the host thallus. Outer wall thin, dark brown, composed of hyphae similar to the interascal tissue, not staining in K or N. Hymenium ca 50 μm thick, subhyaline to orange-brown, I⁺ red, N⁻, K⁻, KI⁺ blue. Hypothecium 200–230 μm thick, penetrating deeply into host tissue, dark brown. Interascal tissue of branched and anastomosing paraphyses 1.5–2 μm diam., the apical part not swollen or pigmented. Asci 37–42 \times 10–14 μm , clavate, broadened at the apex, without a definite apical structure, 8-spored. Ascospores 12–

LC NR



NE NR



14.5 × 4–5 µm, ellipsoidal, colourless, 1-septate, with a narrow KI+ blue gelatinous sheath. **BLS 2655**.
On thallus of *Protoparmelia badia*, Shetland.

Arthonia protoparmeliopsis Etayo & Diederich (2009)

Thallus absent, lichenicolous. Apothecia 0.1–1 mm diam., often in small groups, blackish, flat or slightly convex, ± round or rarely irregular in shape, immersed in the apothecial disc or sometimes the thallus of the host lichen, often filling the entire apothecium. Exciple poorly developed. Hymenium 40–50 µm tall, colourless or pale brown, I+ red, K/I+ blue. Epithymenium brownish to olivaceous brown, intracellular pigment not granulose, K– or K+ more intense olivaceous green, N–, covered by a colourless gelatinous sheet 2–8 µm thick. Subhymenium and hypothecium well-developed, to more than 100 µm tall, colourless, I+ blue, K/I+ blue. Interascal tissue of branched and anastomosed paraphyses with short and wide cells, erect, septate, capitate (to 3–5 µm thick) at the apex, brownish to olivaceous green in the upper 3–9(–15) µm. Asci 22–42 × 10–15 µm, broadly clavate to elongate ellipsoidal, the wall strongly thickened in the upper part with a long ocular chamber, hemiamyloid ring present, but often poorly visible, (5–) 8-spored. Ascospores 10–14.5 (–15) × (3.5–) 4–5.5 (–6.5) µm, ellipsoidal, colourless, thin-walled, (1–)2- or 3-septate, not or slightly constricted at the septa, I–, KI–, 1-septate ascospores with a median to submedian septum, perispore absent or very thin. **BLS 2631**.

In apothecia (and sometimes on the thallus) of *Protoparmeliopsis muralis*, E. Lothian.

Similar to *Arthonia varians*, which occurs on *Lecanora rupicola* and has longer ascospores (13–18 × 4–7 µm). See also *Arthonia lecanoricola*, also recently reported from GB&I on *Lecanora populicola*. The species epithet has been corrected from the original “*protoparmeliopseos*”.

NE NR



Arthonia punctella Nyl. (1859)

Thallus absent, lichenicolous. Apothecia 0.07–0.22 mm diam., black, rounded, convex; epithecium dark red- brown, K+ dull red or olive; hymenium 30–60 µm tall., colourless, I+ blue; hypothecium 30–70 µm tall, dark red-brown, K+ dull or olive; paraphysoids 1.5–3 µm diam.; apices thickened with pigment, to 4 (–5) µm diam. Ascospores 12–17 × 5–6.5 (–7.5) µm, 1-septate, obovoid to cylindrical-ellipsoidal, colourless at first but soon brown and warted. Lichen products not known. **BLS 1929**.

On thalli of *Diplotomma alboatrum* and *D. chlorophaeum* on rocks and walls; occasional records throughout Britain and Ireland.

LC NR



Arthonia punctilliformis Leight. (1876)

Thallus absent, non-lichenized. Apothecia scattered, minute (*ca* 0.10 mm diam.), blackish, cushion-like; asci pyriform to subglobose, thick-walled; hymenium poorly defined, red-brown throughout, I–, K/I–; paraphysoids richly branched, short-celled, *ca* 1 µm diam. Ascospores 1-septate, thin-walled, pale brown, 29–33 × *ca* 12 µm. Lichen products not known. **BLS 2010**.

On bark of *Ilex*. Wales (Caernarvon, Trefriw). Endemic, no recent records.

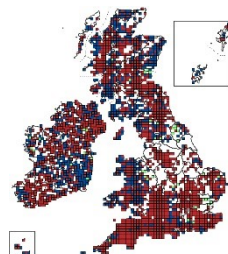
There is no indication that this species is either lichenized or lichenicolous, and it may prove not to be referable to *Arthonia* even in the previous broad concept for this genus. The general appearance of *A. punctilliformis* might suggest the lichenicolous genus *Lichenostigma* Hafellner, but the ascomata in that genus are constructed of ± globose cells.

NE NR

Arthonia radiata (Pers.) Ach. (1808)

Thallus immersed, usually delimited by a brown line and often mosaic-forming, white, pale grey, sometimes with a brown or olive tinge. Apothecia variably shaped, rounded to substellate and 0.15–0.8 mm diam., linear or sparingly branched and to 1.4 × 0.1–0.2 mm, or stellate and to 1.5 (–2.2) mm diam., flat or slightly convex, black, not pruinose; in section 70–100 µm tall; epithecium brown or olive-brown, K+ pale green; hymenium 35–50 µm tall, colourless; hypothecium 10–25 µm tall, colourless to pale olive-brown, K+ pale green; paraphysoids numerous, 1–2 µm diam., often to 3 µm diam. and brown-walled in the epithecium, often with dark apical caps. Ascospores 15–20 × 4.5–6 µm, cylindric-obovoid to cylindrical, 3-septate; the apical cell not

LC



enlarged. Pycnidia 60–85 μm diam., rare, immersed, black, the wall brown, K+ pale green; conidia 4–5 \times ca 1 μm , bacilliform. Lichen products not detected by TLC. **BLS 0069.**

Mostly on smooth bark of many trees and shrubs; widespread and common even in formerly air-polluted areas. Throughout Britain and Ireland.

A common and very variable species, often confused with *Naevia punctiformis* (q.v.). Host to *Muellerella polyspora* Hepp ex Müll. Arg. (1862), *Stigmidium arthoniae* (Arnold) Hafellner (1994) and an undescribed *Opegrapha*.

Arthonia sampaianae (Diederich & Etayo) Ertz & Diederich (2005) **NT**

Thallus absent, lichenicolous. Apothecia single or in groups of 2–5, 0.2–0.5 mm diam., immersed in galls 0.5–1 mm diam., dark brown to black, rounded, flat; epithecium brown, K+ olive; hymenium 100–140 μm tall, brownish, K+ olive, I+ red; hypothecium colourless; paraphysoids 2–4 μm diam., the apices pigmented but not enlarged. Asci clavate, 4- to 8-spored, 60–90 \times 17–21 μm . Ascospores 20–26 \times 6–8 μm , 3-septate, colourless, with a 0.5–4 μm thick perispore which becomes dark brown at maturity, slightly constricted at the septa. Lichen substances unknown. **BLS 2154.**

In galls on thallus of *Nevesia sampaiana*; rare. Scotland (Argyll & Westernness).



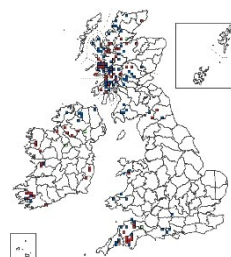
Arthonia stellaris Kremp. (1861)

Thallus immersed, often delimited by a brown line and usually 1–2 cm diam., sometimes larger on tree trunks, white with a green or grey tinge, or pale fawn. Apothecia linear or more usually irregularly branched to stellate and to 2 mm diam., with ‘arms’ 0.08–0.15 mm wide, red-brown to brown-black, not pruinose but sometimes covered by a thin layer of bark cells; in section 60–95 μm tall; epithecium red-brown, K+ pale green; hymenium 40–50 μm tall, colourless or pale red-brown above; hypothecium indistinct or to 20 μm tall, colourless or pale red-brown, K+ pale green in patches; paraphysoids 1 (–1.5) μm diam., brown-walled and to ca 2 μm wide in the epithecium, sometimes with dark apical caps. Ascospores (13–) 16–22 (–24) \times (5–) 6–7 (–9) μm , obovoid to cylindric-obovoid, (2–) 3- or 4-septate; apical cells enlarged; old ascospores brown and warted. Pycnidia rare, immersed, 40–60 μm diam., the wall red-brown, K+ pale green; conidia 4.5–5.5 \times 0.5–1 μm . Thallus C–, K–, KC–, Pd–, UV– (unidentified substance in TLC). **BLS 0071.**

On smooth bark, especially of *Corylus*, *Ilex*, *Quercus* and *Sorbus*, in old woodland. Widespread in W. Britain and Ireland, locally frequent in Scotland, scarce elsewhere.

Often confused with other species with ascospores with enlarged apical cells such as *A. anglica*, *Reichlingia anomobrophila*, *A. ilicinella*, *R. zwackhii* or weakly pigmented morphs of *A. elegans*, and the lichenicolous *A. invadens*.

LC NS



Arthonia stereocaulina (Ohlert) R. Sant. (1993)

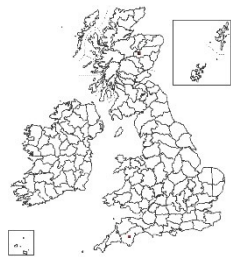
Nb NR

Bryostigma stereocaulinum (Ohlert) S. Y. Kondr. & J.-S. Hur (2020)

Thallus absent, lichenicolous. Apothecia black when dry, 0.1–0.3 mm diam.; epithecium pale green brown; hymenium pale brown, I+ wine-red; hypothecium colourless or pale red; asci broadly clavate to saccate; paraphyses distinct. Ascospores 1-septate, 11.5–14.5 \times 4–5 μm , cells unequal. Lichen products not known. **BLS 2406.**

On phyllocladia of *Stereocaulon evolutum*; elsewhere also on other *Stereocaulon* species; very rare. Scotland (South Aberdeenshire).

More research is needed before the transfer proposed by Kondratyuk *et al.* (2020) can be confirmed.

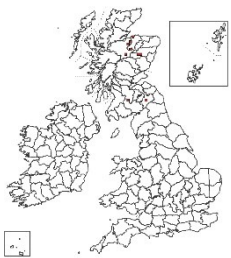


Arthonia subfuscicola (Linds.) Triebel (1991)

NE NR

Thallus absent, lichenicolous. Apothecia to 0.25 mm diam., round, black; ephymenium dark brown; hypothecium dark brown. Ascospores consistently 3-septate, pale brown, 15–16.5 \times 5–7 μm . Lichen products not known. **BLS 1936.**

On apothecia and rarely also on thalli of *Lecanora carpinea* on twigs of mature *Populus tremula*; rare. Scotland (S. Aberdeenshire, E. Inverness-shire). Found on *L.*



albella in Sweden.

Similar to *A. varians*, which is restricted to the apothecia of the saxicolous *Lecanora rupicola* group.

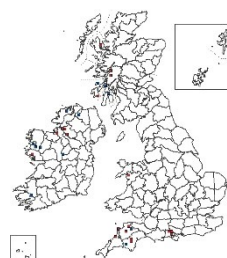
Arthonia thelotrematis Coppins (1989)

Thallus absent, lichenicolous, forming circular to elliptical necrotic patches 3–7 × 1.5–5 mm. Apothecia crowded, developing below the surface of the bark (i.e. with an endophloeodal thallus) but soon erumpent, fleck-like, rounded to ± polygonal and 0.06–0.2 mm diam., or elongate and to 0.4 × 0.06–0.12 mm, sometimes slightly branched or bluntly stellate, dark red-brown to black, not pruinose; in section 55–60 µm tall; epithecium 12–15 µm tall, reddish brown, K+ olive; hymenium 33–35 µm tall, pale red-brown, K+ pale green, I+ red; hypothecium 5–15 µm tall, red-brown, K+ olive, I+ blue; paraphysoids rather scanty, sparingly branched, ca 1 µm diam., the apices often branched, brown-walled, 1.5–2.5 µm diam., a few sometimes with a dark brown cap 3–3.5 µm diam. Ascospores 11–14 × 4.5–5 µm, (2–) 3-septate, the apical cells enlarged, cylindric-obovoid, at first colourless and often with a thin perispore, later covered in dark brown granular warts. Lichen products not known. **BLS 1937**.

On thallus of *Thelotrema lepadinum* on *Corylus*, *Ilex* and *Betula*; parasitic; rare. W. Scotland, Wales (Merionethshire), S.W. England, New Forest, W. Ireland.

Similar to *A. graphidicola*, but differs in shorter ascospores and a brown hypothecium.

Nb IR



Arthonia thoriana Ertz & Sanderson (2018)

Thallus to 3 cm diam. and 60 µm thick, white, cracked, scurfy in places, non-lichenized. Apothecia scattered, abundant, solitary or rarely 2–3 contiguous, sessile, rounded, emarginate, 0.12–0.30 mm diam.; disc flat to convex, pallid brown, with a thin layer of white pruina covering at least some parts of the surface. Exciple inconspicuous. Hymenium colourless to very pale brown, 35–45 µm tall. Epithecium to 5 µm thick, brown, K+ becoming greyish, covered by crystals of calcium oxalate. Paraphysoids abundant, richly anastomosing, ca 1 µm thick, not or slightly enlarged at the apex. Subhymenium colourless to pale brown, 10–22 µm thick. Asci 8-spored but sometimes with one or two spores remaining immature, (22–) 23–30 (–35) × 10–13 µm, the wall slightly or distinctly thickened at the apex. Ascospores ± clavate, colourless, (1–2–) 3-septate, (8–) 9–12 × 3–3.5 (–4) µm, without a gelatinous sheath. Pycnidia not seen. Chemistry: Thallus surface K–, C–, PD–, UV–; hymenium I+ dark red with small parts I+ persistently dark blue, KI+ blue; ascus wall I– and KI– (KI blue ring structure not observed), but with a thin I+ orange layer on its surface. **BLS 2714**.

In crevices in dry bark of veteran *Quercus petraea*, Somerset. Endemic.

Of non-lichenized *Arthonia* species with pale “thalli”, *Naevia punctiformis* differs notably by much larger and non-pruinose ascumata (0.2–1.4 × 0.1–0.4 mm) and larger ascospores (13–23 × 5–7 µm).

NE NR



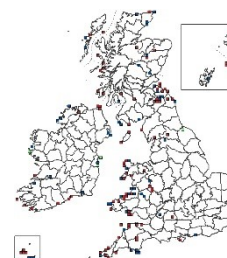
Arthonia varians (Davies) Nyl. (1861)

Thallus absent, lichenicolous. Apothecia developing in the hymenium of the host and blackening the disc, 0.3–1 mm diam., black, level with the host disc or slightly more convex; epithecium brown to olive-brown, K+ pale green; hymenium 45–60 µm tall, colourless, I+ blue; hypothecium colourless; paraphysoids 1.5–2 (–2.5) µm diam.; apices cemented together by dark pigment. Ascospores 13–18 × 4–7 µm, (1–) 2- to 3-septate, obovoid to cylindric-ellipsoidal, colourless. Lichen products not known. **BLS 0714**.

In apothecia of *Lecanora rupicola*, blackening the disc, rather common in most of the host’s localities. Throughout upland Britain, coastal in Ireland. Some collections inhabiting the apothecia of *Myriolecis helicopsis* have been provisionally placed here.

See also *A. apotheciorum*, which has 1-septate spores.

LC NS

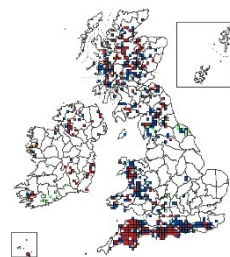


Arthonia vinosa Leight. (1856)

Thallus immersed or thinly powdery to scurfy-granular, effuse, white to pale fawn, or more usually stained orange-yellow, sometimes pink when fresh, often with dull pale yellow to orange-yellow patches, K+ purple.

LC

Apothecia 0.2–0.5 (–0.6) mm diam., rounded, convex, orange-red-brown to brown-black, usually matt, not pruinose; in section 85–140 µm tall, yellow-orange-red throughout or brown-red in upper hypothecium, K+ magenta and K+ purple with pigments dissolving; epithecium indistinct; hymenium 33–40 µm tall; hypothecium 45–100 µm tall; paraphysoids 0.5–1 (–1.5) µm diam., mostly neither swollen nor dark-walled above, a few sometimes with dark walls and apical caps. Ascospores 11–15 × 4–5 µm, obovoid-ellipsoidal to clavate, 1-septate, colourless but old ascospores are brown and warted. Pycnidia frequent, 40–60 µm diam., the wall red-brown, K+ purple; conidia (3.5–) 4–6 × ca 1 µm, bacilliform or slightly curved. Thallus C–, K± pale purple (pigment), Pd–, UV– (unidentified orange anthraquinone). **BLS 0073.**



On bark or lignum of old trees, especially *Quercus* but often also *Alnus*, confined to old woodland and ancient parklands. Common in S. W. & N. Britain, scattered in Ireland, absent from the central plain.

See also *Diarthonia spadicea*, with its smaller ascospores and pigment not dissolving in K. According to Frisch *et al.* (2018), however, the two species are not closely related and *A. vinosa* is phylogenetically close to *A. didyma*.

There are several collections of an unidentified *Chaenothecopsis* on *A. vinosa*.

ARTHOTHELIUM A. Massal. (1852)

Thallus crustose, immersed or superficial, effuse or delimited. **Photobiont** trentepohlioid, chlorococcoid or absent. **Ascomata** apothecium-like, variously shaped, flat to convex, elongate or stellate. **Disc** red-brown to black, sometimes pruinose. **Thalline margin** absent. **True exciple** absent. **Epithecium** colourless to red-brown or dark brown. **Hymenium** usually I+ blue. **Hypothecium** poorly- to well-developed and dark red-brown to dark brown. **Hamathecium** of sparsely to richly branched and anastomosed paraphysoids, the apices usually swollen and red-brown, often capitate. **Asci** usually 8-spored, clavate, ellipsoidal or subglobose, semi-fissitunicate, with a large apical dome and usually distinct ocular chamber; apical dome K/I–, or K/I+ bluish in the lower part near the apex of the ocular chamber, *Arthonia*-type. **Ascospores** obovoid to ellipsoidal, colourless, one end sometimes enlarged, muriform. **Conidiomata** *Arthonia*-like. **Chemistry**: lichen products absent (in all species in Britain and Ireland), or with various substances (incl. xanthenes and anthraquinones). **Ecology**: on bark, especially when smooth, in humid, little-disturbed habitats, rarely on rock. **Distribution**: ca 50 species, cosmopolitan, but mostly tropical.

Separated from *Arthonia* in morphological terms only by the muriform, not persistently transversely septate ascospores. The genus is certainly polyphyletic, and its type species (*A. tremellosum* A. Massal.) has not been studied in recent years. Some of the species treated here are misplaced, but are retained pending a more detailed revision of the European species.

Literature

Coppins (2009), Ertz & Tehler (2011), Frisch *et al.* (2014, 2015, 2017), Grube & Giralt (1996), Ihlen & Coppins (1999), Sundin & Tehler (1998), Thiyagaraja *et al.* (2020).

1	Ascospores with an undivided enlarged apical cell	2
	Ascospores without an undivided enlarged apical cell	3
2(1)	Apothecial sections K+ purple-violet or magenta	<i>macounii</i>
	Apothecial sections K+ greenish	<i>dictyosporum</i>
3(1)	Photobiont absent or chlorococcoid	4
	Photobiont trentepohlioid	5

- 4(3) Ascospores oblong-obovoid, the transverse cells with 0–1 longitudinal septa*lirellans*
 Ascospores obovoid-ellipsoid, the four central transverse cells with 2–3 longitudinal septa
 *orbilliferum*
- 5(3) Ascospores $>25 \times 10 \mu\text{m}$ 6
 Ascospores $(15\text{--})17\text{--}25$ (-26) \times $7\text{--}9.5$ (-10.5) μm *ruanum*
- 6(5) Apothecia mostly 0.3–0.6 mm at widest or longest point; epithecium reddish brown,
 K+ green; paraphysoid apices with dark caps*norvegicum*
 Apothecia mostly 0.5–1(–2) mm at widest or longest point; epithecium red-brown,
 K± reddish; paraphysoid apices without dark caps*spectabile*

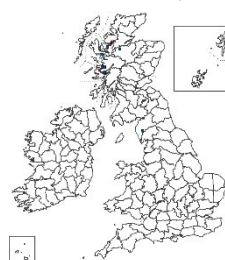
Arthothelium dictyosporum (Coppins & P. James) Coppins (1989)

Thallus immersed, often delimited by a brown line, whitish, brown-grey or fawn; photobiont trentepohlioid. Apothecia 0.3–0.8 \times 0.14–0.3 mm, irregularly rounded, polygonal or shortly elongate, flat or slightly convex, sometimes disintegrating at the centre, blackish, not pruinose, 80–190 μm tall; epithecium brown, K+ greenish; hymenium 60–90 μm tall, colourless; hypothecium 10–85 μm tall, colourless or pale brownish (K+ greenish) in parts; paraphysoids 1–1.5 (–1.8) μm diam., numerous, mostly thickened by pigment to 2.5 μm diam. in the epithecium and a few with apical caps. Ascospores 28–33 \times 9–12 μm , obovoid-cylindrical, muriform, the apical cell enlarged, the lower part with 5 to 7 transverse septa and most cells with 1 or 2 longitudinal septa, when old brown and warted. Pycnidia 50–60 μm diam., few, the wall reddish brown, K+ greenish; conidia 4.5–6.5 \times 0.6–0.8 μm , bacilliform. **BLS 0095.**

On smooth (*Corylus*, *Ilex* and especially *Sorbus*) or roughish bark (*Salix*) in old woodlands; rare. Scotland (W. & C. Highlands), Cumbria.

Similar in appearance to *Arthonia ilicina*, but ascospores have a muriform ‘tail’ and are distinctly warted when brown, and to *Arthothelium macounii* which has K+ purplish and magenta pigments in the epithecium and hypothecium.

NT IR



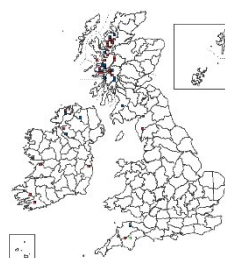
Arthothelium lirellans (Almq.) Coppins (1979)

Thallus immersed, usually delimited by a brown line, indistinct but discolouring bark whitish, dull yellowish, fawn or pale grey to grey-brown; photobiont absent. Apothecia to 0.8 mm diam., or 0.3–1.2 \times 0.1–0.3 (–0.5) mm, shortly elongate, irregularly rounded or polygonal, sometimes slightly branched or bluntly stellate, in section 45–60 μm tall; epithecium green-brown, K+ greenish; hymenium 35–40 μm tall, colourless; hypothecium indistinct or to 15 μm tall, colourless; paraphysoids 1–2 μm diam., but pigmented and to 3 μm diam. in the epithecium, apices often with dark caps. Ascospores 17–27 (–30) \times 8–12 μm , cylindric-obovoid, muriform with (4–) 5 to 8 transverse septa and 0–4 transverse cells with a single longitudinal septum. Pycnidia 60–80 μm diam., rare, the wall brown, K+ greenish; conidia 3.5–5 \times 0.5–0.7 μm , bacilliform. **BLS 1569.**

On smooth bark (*Corylus*, *Ilex*, *Quercus*, *Sorbus*), often on branches, in old woodlands (especially in ravines). W. Britain and Ireland, frequent in Scotland.

Easily overlooked in the field for *Naevia punctiformis*. Close (in morphological terms at least) to *A. orbilliferum*.

Nb IR



Arthothelium macounii (G. Merr.) W.J. Noble (1987)

VU D2 IR

Like *A. dictyosporum*, but apothecia with a brownish purple tinge; thallus around the apothecia often reddish orange; epithecium purplish, K+ purple-violet; epithecium, hymenium and hypothecium with orange-red oily inclusions that are K+ magenta. Ascospores 20–38 \times 10–14 μm , the lower part with 4–6 transverse septa and at



maturity most transverse cells with 1 or 2 longitudinal septa, when old brown and distinctly warted. **BLS 0096.**

On smooth bark of *Corylus*, rarely *Fraxinus*, in old hazel woods; rare. W. Scotland (Argyll to Skye).

Sometimes parasitized by *Arthonia cohabitans*.

Arthothelium norvegicum Coppins & Tønsberg (1984)

Thallus immersed, white or greenish grey, usually forming small (<3 cm diam.) patches; photobiont trentepohlioid. Apothecia 0.3–0.6 mm diam., ± rounded, slightly convex, black, not pruinose, in section 90–130 µm tall; epithecium reddish brown, K+ greenish; hymenium 70–100 µm tall, colourless or pale straw, K+ greenish yellow; hypothecium 10–30 µm tall, colourless or patchily reddish-brown (K+ greenish); paraphysoids 0.7–1.5 µm diam., numerous, pigmented and to 2.5 µm diam. in the epithecium; apices often with a dark hood or cap. Ascospores 29–36 × 12–15 µm, obovoid-ellipsoidal to obovoid-cylindrical, muriform with 7 to 8 (–9) transverse septa, at maturity most transverse cells with 2 or 3 longitudinal septa, when old brown and warted. **BLS 1743.**

On *Calluna* stems in coastal heath and on *Corylus* and *Sorbus* bark; rare. W. Scotland (Mull to Torriddon), W. Ireland (Mayo, Donegal).

Norwegian material has ascospores 31–42 µm, with mostly 9 transverse septa. Distinguished from *A. spectabile* by the smaller apothecia and K+ greenish epithecium.

Frisch *et al.* (2014) found that sequences identified as this species clustered with *Diarthonia spadicea* in a clade quite distinct from that occupied by *Arthonia* sensu stricto; however relationships between the two species need further investigation before a new combination would be appropriate.

NT



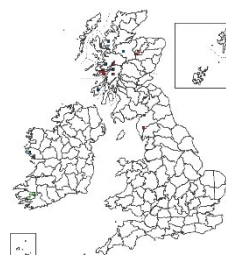
Arthothelium orbilliferum (Almq.) Hasse (1913)

Thallus immersed, grey-white or creamy-white, usually delimited by a brown line; photobiont absent. Apothecia to 0.7 mm diam., rounded, rarely elongate or bluntly stellate, usually soon disintegrating at the centre, black, not pruinose, in section 45–65 µm tall; epithecium greenish brown, K+ greenish; hymenium 30–50 µm tall, colourless or pale greenish; hypothecium to 10 µm tall, indistinct, colourless; paraphysoids 1–1.5 µm diam., pigmented and to 3 µm diam. in the epithecium; apices often with a dark hood or cap. Ascospores (16–) 19–26 × (9–) 10–14 µm, obovoid-ellipsoidal, muriform, with 5–6 transverse septa, the 4 central cells with 2–3 longitudinal septa. Pycnidia 50–80 µm diam., rare, black, the wall greenish in K; conidia 3.7–4.7 × 0.5–0.8 µm. **BLS 1711.**

On smooth bark (*Corylus*, *Ilex*, *Quercus*, *Sorbus*) in old (especially ravine) woodlands; rare. W. Scotland, Cairngorms, Cumbria, W. Ireland.

Very close in morphological terms to *A. livellans* but the thallus is usually whiter, the apothecia more rounded and with a greater tendency to disintegrate at the centre, and ascospores that are relatively broader and with more longitudinal septa. According to Frisch *et al.* (2017), this species occupies an isolated clade basal to the main *Arthonia* cluster. Thiyagaraja *et al.* (2020) suggested a possible relationship with the genus *Mycoporum* because of morphological similarities with the type of this genus; it should be noted that probably none of the species assigned to *Mycoporum* by Sanderson & Coppins (2009) are congeneric with that type.

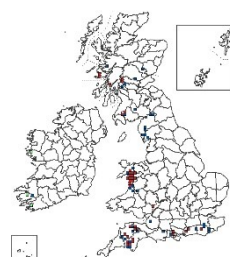
LC NS IR



Arthothelium ruanum (A. Massal.) Körb. (1861)

Thallus immersed, effuse or delimited by a brown line, creamy white, pale grey, brown-grey or olive-grey; photobiont trentepohlioid. Apothecia to 1.6 (–2) mm diam., irregularly rounded to bluntly stellate, often disintegrating in places and regenerating to give the appearance of a crowded swarm of punctiform apothecia, black, not pruinose (but often long remaining covered by bark cells), in section 70–95 µm tall; epithecium dark red-brown, K+ green; hymenium 35–50 µm tall, colourless or pale brown (K+ greenish); hypothecium 10–30 µm tall, dark red-brown, K+ dark green; paraphysoids 1–1.5 diam., numerous, the apices obscured by dense pigment. Ascospores (15–) 17–24 (–26) × 7–9.5 (–10.5) µm, obovoid-cylindrical, muriform, with 5–8 transverse septa and (2–) 3 to 7 transverse cells with 1 to 3 longitudinal septa,

Nb NS



when old brown and warted. Pycnidia 60–80 µm diam., scarce, the wall red-brown, K+ green; conidia 4–6 × ca 1 µm, bacilliform. **BLS 0097**.

On smooth bark (*Castanea*, *Corylus*, *Fraxinus*, *Sorbus*), usually by streams in sheltered woodland; rare, though locally frequent in parts of NW Wales. S. England, W. England (Lake District), Wales, Scotland (north to Mull and E. Perthshire), very rare in S. Ireland. There are some enigmatic specimens from S.W. Ireland which have larger ascospores, 20–31 × 9.5–11.5 µm, with 6–9 (–10) transverse septa, earlier mentioned by Coppins & James (1979).

Arthothelium spectabile Flot. ex A. Massal. (1852)

Thallus immersed, creamy- or grey-white, usually delimited by a brown line; photobiont trentepohlioid. Apothecia to 1.2 mm diam., or somewhat elongate to 2 mm long, irregularly rounded or polygonal, black, not pruinose, in section 120–150 µm tall; epithecium red-brown, K+ reddish; hymenium and hypothecium pale reddish-brown, K± faintly greenish; paraphysoids 0.5–1 µm diam., numerous, the apices usually not pigmented and without caps. Ascospores 26–36 × 12–15 µm, ellipsoidal to cylindrical-ellipsoidal, muriform, with 5–7 transverse septa, most transverse cells with 1–3 longitudinal septa. **BLS 0098**.

On ± smooth bark; probably extinct in Britain and Ireland (not reported since 19th century).

See also *A. norvegicum*. According to Frisch *et al.* (2015), this species clusters with *Pachnolepia pruinata*, but its relationships need confirmation.



BRIANCOPPINSIA Diederich, Ertz, Lawrey & van den Boom (2012)

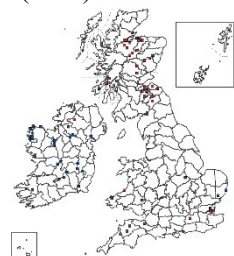
This is a monotypic genus, so the description of *B. cytospora* below constitutes that of the genus.

Literature

Diederich *et al.* (2012).

Briancoppinsia cytospora (Vouaux) Diederich, Ertz, Lawrey & van den Boom (2012) **LC NS**

Thallus absent (lichenicolous). Ascomata not known. Conidiomata pycnidial, (40–) 50–80 (–120) µm diam., partly immersed in the host thallus or apothecia, dark brown to black, ± spherical, the base somewhat flattened, initially with a punctiform ostiole, when overmature with an enlarged opening that can reach the diameter of the conidioma and exposing the white conidial matrix (the matrix never extruding from the pycnidial cavity in the form of a white drop, as seen in other coelomycetous genera); setae absent. Pycnidial wall 5–7 µm thick, composed of a few layers of brown to olivaceous cells, K+ dark olivaceous, composed of compacted entwined short-celled hyphae. Pycnidial gel I+ and K/I+ red. Conidiophores absent. Conidiogenous cells lining the inner wall of the pycnidial cavity, (4.0–) 4.8–6.9 (–7.5) × (2.0–) 2.9–5.1 (–6.6) µm, short-ampulliform, not proliferating, colourless, smooth-walled. Conidia abundantly produced, (4.5–) 5.8–6.8 (–8.0) × (1.2–) 1.6–2.0 (–2.6) µm, arising singly, narrowly ellipsoidal, straight or more frequently slightly curved, the apex rounded and the base truncate, colourless, aseptate, smooth- and thin-walled, lipid guttules absent or indistinct.



On thalli of various species of Parmeliaceae, most frequently *Evernia*, *Hypogymnia* and *Parmelia* spp., also occasionally on *Lecanora* spp., often associated with some degree of necrosis; southern England, west Wales, Scotland and Ireland.

Colonies on *Evernia* might be confused with *Phoma everniae* D. Hawksw. (1994) which has smaller pycnidia and conidia (the latter 4.5–5 × 1–1.5 µm), or *Everniicola flexispora* D. Hawksw. (1982) with strongly curved 1-septate conidia. Neither of these species are well known, and their affinities are unclear.

BRYOSTIGMA Poelt & Döbbeler (1979)

Thallus thin, effuse and partly immersed to irregularly scurfy granular-verrucose. **Photobiont** chlorococcoid. **Apothecia** convex, dark brown to black, not pruinose. **Epithecium** pale green or ± red-brown, K+ green, dull- or olive-brown. **Hymenium** colourless or pale green in the upper part. **Hypothecium** dark, ± red-brown, K+ dull- or olive brown. **Hamathecium** of paraphysoids, the apices mostly swollen with dark apical caps. **Asci** *Arthonia*-type. **Ascospores** 1-septate, obovoid (the upper cell distinctly broader), colourless. **Pycnidia** immersed, the wall red-brown, K+ dull brown. **Conidia** bacilliform. Lichen products not detected by TLC.

The chlorococcoid rather than trentepohlioid photobiont is distinctive within the Arthoniales. Frisch *et al.* (2014) established that *Bryostigma* occupied a sister clade to the Arthoniaceae, but the combined taxon is monophyletic so it is treated here for convenience. They considered that members of the clade have blackish, adnate, moderately to strongly convex ascomata reminiscent of *Micarea*, in combination with *Arthonia*-type asci with or without amyloid ring structures, small colourless, 2-celled spores with an enlarged upper cell, and a dark brown epithecium formed of the tips of the paraphysoids.

Frisch *et al.* (2014, 2015), Fleischhacker *et al.* (2016) and Thiyagaraja *et al.* (2020) have published phylogenetic trees that suggest that *Bryostigma* might need to be expanded to include *Arthonia apatetica* (also with a chlorococcoid photobiont), and several lichenicolous species including *A. molendoi* and *A. parietinaria*. More detailed studies are needed of the extent of the *Bryostigma* clade and the inter-relationships of its constituent species.

Literature

Coppins, B.J. & Aptroot, A. (2009). *Arthonia*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolselsey, P.A. eds): 153-171. London: British Lichen Society.

Fleischhacker, A., Grube, M., Frisch, A., Obermayer, W. & Hafellner, J. (2016). *Arthonia parietinaria* - a common but frequently misunderstood lichenicolous fungus on species of the *Xanthoria parietina* group. *Fungal Biology* **120**: 1341-1353.

Frisch, A., Ohmura, Y., Ertz, D. & Thor, G. (2015). *Inoderma* and related genera in Arthoniaceae with elevated white pruinose pycnidia or sporodochia. *Lichenologist* **47**: 233-256.

Frisch, A., Thor, G., Ertz, D. & Grube, M. (2014). The Arthonialean challenge: restructuring Arthoniaceae. *Taxon* **63**: 727-744.

Bryostigma lapidicola (Taylor) S.Y. Kondr. & J.-S. Hur (2020)

Arthonia lapidicola (Taylor) Branth & Rostr. (1869)

Bryostigma muscigenum (Th. Fr.) Frisch & G. Thor (2014)

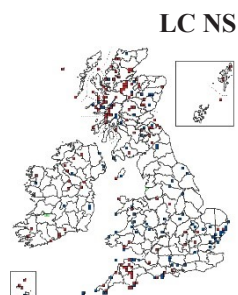
Arthonia muscigena Th. Fr. (1865)

Thallus effuse, dull olive-grey, olive- or grey-brown, thin, minutely scurfy-granular; granules when discrete ca 20-50 µm diam.; photobiont 6-14 (-17) µm diam.; cells chlorococcoid. Apothecia 0.05-0.25 (-0.3) mm diam., convex, black, not pruinose; in section 60-100 µm tall; epithecium 5-7 µm tall, pale green or red-brown, K+ pale green, composed of 2-3 rows of periclinally arranged, dark-walled hyphae ca 1.5-2 µm diam.; hymenium 25-30 µm tall, colourless or pale green; hypothecium 30-70 µm tall, reddish brown, K+ dull olive-brown; paraphysoids 0.5-1 µm diam., very scanty.

Ascospores 8-12 (-14) × 2.5-4 µm, 1-septate, obovoid, the upper cell broader and shorter than the lower but often with a slightly pointed apex. Pycnidia occasional, ca 40 µm diam., the wall pale brown, K+ olive; conidia bacilliform, 3-4 × ca 0.5 µm. Lichen products not detected by TLC. **BLS 1700.**

On twigs, especially of *Sambucus*, or tree trunks (e.g. *Acer*, *Ulmus*), sometimes over bryophytes, less often on *Abies* needles, fence posts and shaded, ± siliceous rocks; apparently common but overlooked and tolerant of suburban conditions. Throughout the British Isles.

Morphs on rock need to be carefully distinguished from *Arthonia fusca* (referred to incorrectly as *A. lapidicola* in Coppins & Aptroot 2009), and the species has also been confused with *A. apatetica* in the past.



The type of *B. lapidicola* has recently been found to represent an earlier name for *A. muscigena* (Alan Fryday, pers. comm.). The combination of *A. lapidicola* into *Bryostigma* made by Kondratyuk *et al.* was based on sequences identified as *A. lapidicola* by Frisch *et al.* (2014), but which are actually referable to *Arthonia fusca*.

CONIOCARPON DC. (1805)

Thallus smooth, immersed or erumpent, usually pale brown, continuous, sometimes delimited by a dark line. **Photobiont** trentepohlioid. **Apothecia** irregularly rounded to weakly lobed, lirellate or stellate, emergent, solitary or forming loose to dense aggregations. **True exciple** brown, composed of compressed and vertically oriented paraphysoidal hyphae, often forming short hairs at the outer margin; old bark cells often attached to the exciple. **Disc** dark, flat to weakly convex, sometimes white-pruinose and with a layer of orange–red pruina sometimes present above the white pruina, margins level with the disc, sometimes conspicuously orange–red pruinose and containing crystals. **Epithecium** brown, composed of branched tips of the paraphysoidal hyphae extending horizontally above the asci. **Hymenium** colourless, strongly conglutinated. **Hamathecium** of densely branched and netted paraphysoids. **Hypothecium** colourless. **Asci** *Arthonia*-type, obpyriform to clavate, 8-spored. **Ascospores** colourless, obovoid, with an enlarged apical cell, becoming pale brown with granular ornamentation in the epispore at late maturity. **Chemistry**: exciple and epithecium I+ blue, KI+ blue, hymenium and hypothecium I+ red, KI+ blue; the orange-red crystals dissolving in K to form a clear, fleeting, purplish solution.

An old genus, resurrected by Frisch *et al.* (2014) to include *Arthonia cinnabarina* and related species. It is characterized by crystalline orange, red and purple quinoid pigments in the ascomata that dissolve in K to form a purple solution, by colourless transversely septate ascospores with large apical cells, and by rounded to lirellate ascomata.

Literature

Coppins & Aptroot (2009), Frisch *et al.* (2020a), Moen (2019).

- | | | |
|------|--|---------------------|
| 1 | Ascospores mostly > 20 µm long; ascomata typically rounded to weakly lobate, rarely lirellate; orange–red pruina present | <i>cinnabarinum</i> |
| | Ascospores mostly ≤ 20 µm long; ascomata typically irregularly lirellate; orange–red pruina present or absent..... | 2 |
| 2(1) | Orange–red pruina present; ascospores (15–) 17–20 (–22) × (6–) 7–9 (–10) µm, (1–) 3–4 (–5) transversely septate | <i>fallax</i> |
| | Orange–red pruina absent; ascospores (15–) 16–18 (–20) × (6–) 7–8 (–9) µm, (2–)3(–4) transversely septate | <i>cuspidans</i> |

Coniocarpon cinnabarinum DC. (1805)

LC

Arthonia cinnabarina (DC.) Wallr. (1831)

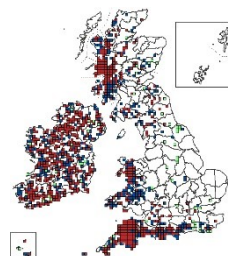
Thallus immersed, often mosaic-forming and delimited by a brown line, off-white, pale grey, pale fawn or sometimes tinged dull orange in parts, surface smooth or (especially on thick bark) finely powdery. Apothecia (0.2–) 0.3–1 × 0.2–0.5 (–0.7) mm, flat to slightly convex, rounded, ± polygonal or linear, occasionally branched but rarely stellate (to 1.5 mm diam); white-pruinose with (usually) marginal rose-red to cinnabar-red pruina, old apothecia often not pruinose and dark pale purple-brown; in section 110–140 µm tall; epithecium brown with patches of purple-red pigment (K+ red or purple, dissolving) especially at the outer edge, often also with numerous minute granules (pruina); hymenium 60–70 µm tall, colourless or pale orange-red; hypothecium 25–

40 µm tall, ± colourless; paraphysoids 1–1.5 µm diam., but often brown-walled and to 2.5 µm diam. in the epithecium, a few with apical caps. Ascospores (18–) 20–28 × 7–9.5 µm, (2–) 4- to 5 (–6)-septate, cylindrical-obovoid, old ascospores brown, wrinkled but not warted. Pycnidia immersed, *ca* 60 µm diam., the walls red-brown, K+ olive-grey; conidia 3.5–5.5 × *ca* 0.8 µm, bacilliform. At least three unidentified anthraquinones (orange, lilac and red) by TLC. **BLS 0072**.

On smooth bark of small or young trees (e.g. of *Corylus*), sometimes on somewhat rough bark of large trees (especially *Fagus* and *Fraxinus*), in sheltered situations, mainly in old woodlands; common. W. Britain, extending locally to unpolluted eastern areas, throughout Ireland.

Often confused with *C. fallax* but distinguished by generally larger, more rounded apothecia, taller hymenium, and larger ascospores.

Host to an undescribed *Opegrapha* species, so far found in Ireland (Clare and Kerry) and W. Scotland.



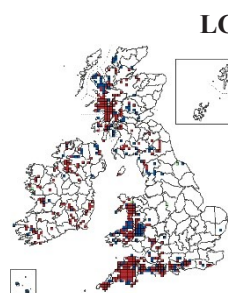
Coniocarpon cuspidans (Nyl.) Moen, Frisch & Grube (2020)

Arthonia elegans auct. brit. non (Ach.) Almq. (1880)

Similar to *C. fallax*, but orange-red pruina on the apothecial margins is lacking, though red and purple pigment crystals and a weak amorphous red to purple pigmentation is present in the exciple and epithecium. Additionally, the ascospores are marginally smaller and predominantly 3-septate, though these features are unreliable for identification on their own. **BLS 0058**.

On smooth bark, especially of *Corylus* and young *Quercus*, in sheltered woodland. Common in W. Britain, confined to old woodlands further east, widespread in Ireland.

Sometimes confused in the past with *C. fallax* but the latter species was generally lumped with *C. cinnabarinum* in the field due to the presence of red pruina, and almost all records of *Arthonia elegans* refer to *C. cuspidans*.



LC

Coniocarpon fallax (Ach.) Grube (2014)

Arthonia elegans (Ach.) Almq. (1880)

Thallus pale fawn to grey-brown, weakly glossy to matt, smooth, prothallus line dark grey to brown, sometimes present when in contact with other lichens; ascomata weakly elongate to irregularly lirellate, with steep flanks, emergent from the thallus, 0.2–0.4 mm × 0.1–0.2 mm, 65–110 µm tall, typically forming weakly elongate to irregularly lirellate or stellate aggregations of 3–15 ascomata; disc black to dark purple-black, flat to weakly convex, weakly glossy to matt, sometimes with a thin layer of white pruina; margins level with the disc, orange-red pruinose, sometimes with additional patches of white pruina; exciple brown, 7–20 µm thick; epithecium brown, 10–20 µm tall, conglutinated only in the lower parts, composed of branched tips of the paraphysoidal hyphae extending horizontally above the asci; the tips slightly widened to 3 (–4) µm; hymenium colourless, strongly conglutinated, 35–70 µm tall, paraphysoids densely branched and netted, 1–2 µm diam.; hypothecium colourless; orange, red or purple granular crystals common in epithecium and exciple; asci *Arthonia*-type, long obpyriform to clavate, 50–75 × 20–32 µm, 8-spored; ascospores colourless, (1–) 3–4 (–5) septate, (15–) 17–20 (–22) × (6–) 7–9 (–10) µm, obovoid, with an enlarged apical cell, becoming pale brown with granular ornamentation at late maturity; development macrocephalic. **BLS 2760**.

On smooth bark, especially of *Corylus*, less often on rough bark (*Fraxinus*), in sheltered woodland. Apparently rare, with a confirmed record from N. Wales (Caernarvonshire).

Often confused with *C. cinnabarinum*. Species of *Arthonia* with similarly shaped apothecia and ascospores with enlarged apical cell lack K+ pale purple or violet pigments.

NE

DIARTHONIS Clem. (1909)

The genus as currently circumscribed is monotypic, so the description of *D. spadicea* below constitutes that of the species.

Phylogenetic trees constructed by Frisch *et al.* (2014) showed that *Arthonia spadicea* fell outside of the main *Arthonia* clade, with indications that it (along with *Arthothelium norvegicum*) formed a sister group with the Arthoniaceae as a whole. The branch was referred to as the *Coniangium* clade by Thiyagaraja *et al.* (2020), based on the long-forgotten genus *Coniangium* Fr. (1821). However, the type is *C. vulgare* Fr., which is a synonym of *Arthonia vinosa*. According to work by Frisch *et al.* (2018), *A. vinosa* is not congeneric with *A. spadicea*, and it belongs within a clade that includes *A. didyma* within the Arthoniaceae *sensu stricto*. However, the generic name *Diarthonis* Clem. (1909) is available for use; it was introduced (with a minimal but nomenclaturally acceptable diagnosis) for the single species *D. lurida* (Ach.) Clem., basionym *Arthonia lurida* Ach. (1803). That name was formally rejected following acceptance of a nomenclatural proposal by Hawksworth & Sherwood (1981) to protect the later name *Arthonia spadicea* Leight. (1854). The Code states that names using a rejected name as a basionym are similarly rejected, but that generic names with the rejected name as type are allowable. Therefore, *Diarthonis* can be used for a genus including *A. spadicea*, and that epithet can be retained in the newly recognized genus. The formal combination needed is given at the end of this publication.

Frisch *et al.* (2014) and Thiyagaraja *et al.* (2020) reported that DNA of *D. spadicea* clustered in a distinct clade with that of *Arthothelium norvegicum*, and that name may need to be transferred as a second species of *Diarthonis*. However, the phylogenetic branch lengths are quite long and more data are required to confirm the relationship.

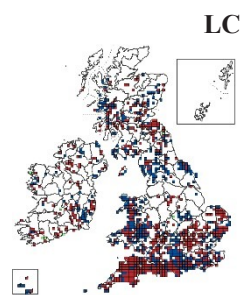
***Diarthonis spadicea* (Leight.) Frisch, Ertz, Coppins & P.F. Cannon (2020)**

Arthonia spadicea Leight. (1854)

Thallus immersed, occasionally superficial, to 35 μm thick, effuse, pale to dark grey, often tinged green; hyphae K/I-. Apothecia (0.1–) 0.2–1.5 mm diam., rounded, flat to slightly convex, red-brown to brown-black, often slightly glossy, resembling spots of tar; in section 55–70 μm tall, \pm uniformly orange-brown, K+ dull pale purple; epithecium indistinct; hymenium 25–35 μm tall; hypothecium 30–40 μm tall; paraphysoids 0.5–1 (–1.5) μm diam., not swollen or pigmented at the apices; apices often embedded in a thin, clear gel-like layer. Ascospores 7–11 \times 3–4 μm , 1-septate, obovoid or slipper-shaped, colourless. Pycnidia frequent, 80–100 μm diam., brown, the wall orange- to red-brown, K+ pale purple; conidia 3–4.5 \times 0.5–1 μm , bacilliform to narrowly ellipsoidal, straight or slightly curved. Lichen products not detected by TLC. **BLS 0070.**

On very shaded bark of trunks (usually at or near the base) of deciduous trees, in moist woodland; rather common except in very air-polluted areas, rare in N. Scotland. Throughout Britain except for N. Scotland, widespread in Ireland.

Distinguished from *Arthonia vinosa* by the usually less convex apothecia, smaller ascospores, and apothecial pigment that turns pale purple, but does not dissolve in K.



INODERMA (Ach.) Gray (1821)

Thallus extensive, bright whitish to pale olive grey, continuous, rimose to fissured-areolate but sometimes evanescent, with an ecorticate, weakly felty, scurfy or (sub-) granular to powdery-mealy surface. **Photobiont** trentepohlioid. **Apothecia** present or absent, immersed to adnate, rounded to indistinctly lobed, \pm convex, thinly to thickly white-pruinose. **True exciple** not well differentiated. **Hymenium** colourless to pale yellowish brown, with dense pale granular crystals in the epithecium. **Hypothecium** colourless to pale yellowish brown or dark brown, of intertwined hyphae embedded in a gelatinous matrix. **Hamathecium** of paraphysoids, only slightly widened and

not pigmented in the tips. **Asci** *Arthonia*-type, 8-spored, without KI+ blue tholus structures. **Ascospores** cylindrical-obovoid to soleiform, colourless, transversely (1–) 2–4-septate, sometimes with slightly enlarged apical cells, not constricted at the septa. **Conidiomata** elevated pycnidia with dark brown to black walls covered by a thick whitish pruina. **Conidia** bacilliform to cylindrical. **Chemistry**: lepralic acid, confluent acid, byssaceum unknowns. The dark brown pigment in the apothecia and pycnidia turns greenish black in K and slowly changes to orange-brown in nitric acid.

The genus was reintroduced by Frisch *et al.* for a small group of species with elevated, white-pruinose pycnidia, immersed to adnate white pruinose apothecia and a weakly gelatinized hymenium. Two of the four accepted species are found in our region.

Literature

Frisch *et al.* (2015), Wolseley *et al.* (2009).

- | | | |
|---|--------------------------------------|---------------------|
| 1 | Thallus and pycnidia K– | <i>byssaceum</i> |
| | Thallus and pycnidia K+ yellow | <i>subabietinum</i> |

Inoderma byssaceum (Weigel) Gray (1821)

Arthonia byssacea (Weigel) Alm. (1880)

Thallus extensive, bright whitish grey to pale fawn, continuous, rimose or evanescent, largely immersed, the surface corticate, matt, scurfy to weakly felted-arachnoid, sometimes patchily granulose; prothallus absent. Apothecia (not known in British material) adnate, rounded to slightly undulate in outline, weakly to strongly convex, densely white-pruinose, 0.4–1 mm diam. and 110–200 µm tall; epithecium 10–25 µm tall, greyish to brown, interspersed with pale granular crystals 1–3 µm diam.; hymenium colourless to pale yellowish brown, 45–65 µm tall, only moderately gelatinized; hypothecium dark brown, 50–120 µm tall; paraphysoids 1–1.5 µm diam., the apices slightly widened to ca 2 µm diam., with sparse dark brown pigment attached to the outer wall; asci clavate to broadly clavate, 37–46 × 15–19 µm; ascospores obovoid, (11–) 13.5–16.5 (–19) × (4–) 4.5–5.5 (–6) µm, (2–) 3–4 (–5)-septate, with a slightly enlarged apical cell. Pycnidia emergent, 0.15–0.4 mm diam., dark brown to black but covered by a thick whitish pruina; conidia bacilliform, (4–) 4.5–6 × 1–1.5 µm. Thallus, apothecia and pycnidial pruina K–, C–, KC–, Pd–, thallus hyphae I+ pale blue, KI+ pale blue. **BLS 2604**.

On dry bark of veteran *Quercus*, England (Shropshire), Wales (Cardiganshire), sterile.

Recognized by its thin whitish thallus with scattered black urceolate pycnidia, the pruinose walls giving the impression of a neat white cuff-like thalline rim to the conidiomata.

VU D1



Inoderma subabietinum (Coppins & P. James) Ertz & Frisch (2015)

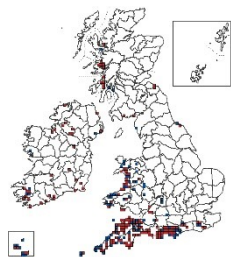
Lecanactis subabietina Coppins & P. James (1979)

Thallus 20–80 µm thick, effuse, thin, whitish grey, ± continuous, scurfy, cracked. Apothecia unknown. Pycnidia 0.18–0.5 mm diam, numerous, crowded, sessile, globose, cylindrical or widened above, black (K+ dark greenish) but densely white-pruinose and often with a pale yellowish conidial mass extruded from the wide ostiole; conidia cylindrical to ellipsoidal, 3.7–5 × 1.2–1.7 µm. Pycnidial pruina C–, K+ lemon-yellow; thallus C–, K+ lemon-yellow, K/UV+ mauve, KC–, Pd–, UV+ bluish or yellowish white (confluent, 2'-O-methylmicrophyllinic and lepralic acids, and 'byssaceum-unknowns' [in pycnidia]). **BLS 0606**.

Often forming extensive patches on dry, usually shaded, acid bark of (mostly) old *Quercus*, less often *Betula* and *Pinus*, usually low down on the trunk; also on *Hedera* stems and decaying fern fronds under dry overhangs and old *Calluna* stems. Very rarely on rock. S. & W. Britain from Hampshire & Cornwall, Wales, to W. Scotland, very rare on the E. coast (N.E. Yorkshire, Suffolk, Berwickshire, E. Lothian), occasional in Ireland, absent from the central plain.

Can be confused with sterile morphs of *Lecanactis abietina* which has larger conidia and K–, C+ red pycnidial pruina and with *Opographa vermicellifera*, which has K– pycnidial pruina, K– (not ± greenish) pycnidial walls and slightly longer conidia. The K/UV+ mauve (confluent acid) spot test is diagnostic.

Nb IR



NAEVIA Fr. (1824)

Non-lichenized, but often forming thallus-like, whitish to greyish patches on the substrate (presumably due to disruption of the phorophyte epidermis or cuticle by fungal hyphae). **Photobiont** absent. **Ascomata** apothecia, black, rounded to irregular or almost stellate in outline, adnate, not pruinose. **Hymenium** colourless, gel I+ blue, KI+ blue. **Hamathecium** of paraphysoids, the apices thickened with dark brown walls. **Epithecium** olive-brown, K+ pale to olive-green. **Hypothecium** colourless to pale yellowish. **Asci** ovoid to clavate, *Arthonia*-type, I-, with a KI+ ring-shaped structure in the tholus, 4–8-spored. **Ascospores** colourless, 1–5-septate, cylindric-clavate, the apical cell not enlarged. **Conidiomata** pycnidia, black, semi-immersed to immersed. **Conidia** aseptate, bacilliform. **Chemistry**: lichen products not detected by TLC. **Ecology**: on twigs and smooth bark, perhaps gaining nutrition from cuticular waxes.

Recognized as a separate clade within the Arthoniaceae by Frisch *et al.* (2014), and linked with the generic name *Naevia* by Thiyagaraja *et al.* (2020). There has been confusion between *Naevia* Fr. (1824) and an unrelated group of fungi that was named as a later homonym by the same author (Fries 1849). The species treated here has long been accepted as a species of *Arthonia*, but is phylogenetically distinct and is unusual for the Arthoniaceae in being neither lichenized or lichenicolous. The hemiamyloid reaction of the ascus contents may also be diagnostic, though the coloration can be a factor of the concentration of the Lugol's reagent.

Literature

Moen (2019), Thiyagaraja *et al.* (2020).

Naevia punctiformis (Ach.) A. Massal. (1855)

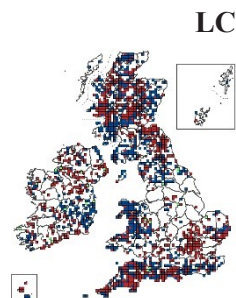
Arthonia punctiformis Ach. (1808)

Thallus immersed, usually effuse, indistinct or slightly 'bleaching' the bark; photobiont absent. Apothecia 0.2–1.4 × 0.1–0.4 mm, rounded or elliptical to linear, rarely branched or substellate, black, not pruinose, usually immersed then erumpent and often with a thin 'margin' of bark tissue; in section 40–60 µm tall; epithecium brown or olive-brown, K+ pale green; hymenium 26–50 µm tall, colourless; hypothecium indistinct, to 10 µm thick, colourless; paraphysoids 1–1.5 µm diam., numerous, apices thickened to 3.5 µm diam. with dark brown walls. Ascospores 13–23 × (4–) 5–7 µm, 3(–5)-septate, cylindric-obovoid to cylindrical; the apical cell not enlarged, colourless. Pycnidia not found. Lichen products not detected by TLC. **BLS 0068**.

On smooth bark of a wide variety of trees and shrubs; often a primary colonizer of twigs along with *Arthopyrenia punctiformis*; common except in heavily air-polluted areas. Throughout Britain and Ireland.

A species complex according to Moen (2019), who detected four separate taxa in material from Norway. More work is needed to understand this aggregate, and to find names for the clades.

Distinguished from *Arthonia radiata* by the less conspicuous, non-lichenized thallus, and rarely branched, shallower apothecia. *Arthothelium lirellans* looks similar in the field.



PACHNOLEPIA A. Massal. (1855)

The genus contains a single species, so the description below constitutes that of the genus. *Pachnolepia* is included in the *Cryptothecia* clade of the Arthoniaceae (Frisch *et al.* 2014, 2015), and appears to occupy a sister clade to *Arthothelium spectabile* (Frisch *et al.* 2015, Thiyagaraja *et al.* 2020).

Literature

Coppins & Aptroot (2009), Frisch *et al.* (2014, 2015)

Pachnolepia pruinata ((Pers.) Frisch & G.Thor (2014)

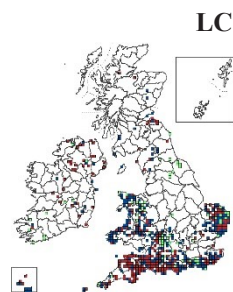
Arthonia pruinata (Pers.) Steud. ex A.L. Sm. (1911)

Thallus effuse and often wide-spreading, white to pale grey or pale brown, matt or powdery, rimose-cracked and 0.1–0.3 mm thick but sometimes warty and to 1 mm thick. Apothecia to 1 mm diam., rounded or angular, sometimes elongate or substellate, immersed, pink to dark brown but usually thickly white-pruinose and hence inconspicuous when dry; in section 100–250 (–250) μm tall; epithecium red-brown, K+ grey or pale green; hymenium 40–60 μm tall, colourless; hypothecium 45–85 (–170) μm tall, colourless; paraphysoids numerous, 1–1.8 μm diam., in the epithecium often with brown walls and to 2.5 μm diam. Ascospores 13–22 \times 4.5–7 μm , (3–) 4–5-septate, cylindric-obovoid, the apical cell not enlarged, colourless, old ascospores apparently never brown. Pycnidia 100–200 μm diam., rare, \pm immersed, pale or red-brown, internally convoluted, the wall colourless or pale red-brown (K+ pale green); conidia 10–16 \times 0.5 μm , short thread-like, usually curved. Thallus and apothecia pruina C+ red, K–, Pd–, UV– (arthoniaic acid). **BLS 0063**.

On rain-sheltered, dry bark of tree trunks in nutrient-enriched situations, especially *Acer*, *Fraxinus* and *Quercus*, often dominating the side of the tree, rarely on wooden boards and dry stonework; frequent. S. Britain extending locally to S. Aberdeenshire. Uncommon and eastern in Ireland.

Distinguished from species of *Arthonia* on bark with pruinose apothecia by the C+ red reaction. *A. anglica* apothecia are not pruinose, stellate and only C+ red in section, and the ascospores have enlarged apical cells. *P. pruinata* has been claimed to resemble and often grows with *Dendrographa decolorans* in the field, but that species is always sterile in Britain, soresiate and C–. It has also been misidentified as *Lecanographa lyncea*, which can look similar when in poor condition, but this is C–.

Sometimes acts as a host for *Milospium graphideorum*.



REICHLINGIA Diederich & Scheid. (1996)

Thallus white, pale grey or greyish green, compact and felty to byssoid and granular. **Prothallus** whitish, fibrillose, thin, replaced by a dark brown prothallus line in contact with other lichens. **Photobiont** trentepohlioid. **Apothecia** rounded to polygonal or short lirelliform, lobed or forming irregular stellate clusters, with individual hymenia separated by deep but often incomplete fissures, immersed in the thallus or adnate, pale brown to brown below a thin whitish pruina. **Thalline margin** absent or thin and patchily developed. **True exciple** usually constricted towards the base, composed of \pm parallel, hyphae with colourless or dark brown walls; pale granular crystals present or absent. **Epithecium** greyish with pale granular crystals or dark brown, composed of the largely free, densely branched and intertwined tips of the paraphysoids. **Hymenium** colourless. **Hypothecium** colourless or pale brownish. **Hamathecium** of loosely branched and anastomosed paraphysoids, embedded in a dense gelatinous matrix, the apices broadened, without or with dark brown pigment in the walls. **Asci** clavate, *Arthonia*-type, 8-spored, without KI+ tholus structures. **Ascospores** persistently colourless or becoming pale brown with granular ornamentation in the epispore at late maturity, cylindric-obovoid, 3- to 5- transversely septate with enlarged apical cells or submuriform. Hymenial gel I+/KI+ deep blue or I+ pale yellowish brown/ KI+ pale blue. **Pycnidia** unknown. **Sporodochia** (in *R. leopoldii*) reddish to dark chocolate brown, confluent into large irregular patches. **Conidiophores** dark brown, with thick verrucose walls. **Conidia** irregularly branched with one to several branches, constricted at the septa, dark brown, strongly verrucose, with a dark brown granulose pigmentation.

Frisch *et al.* (2013) found that *Arthonia zwackhii* (with apothecia but no sporodochia) was congeneric with *Reichlingia leopoldii*. Diagnostic features for the genus include the pale grey-olive byssoid to loosely felty thallus (not so in *R. anombrophila*) and a chemistry of 2'-O-methylperlatolic acid and perlatolic acid.

Literature

Coppins & Aptroot (2009), Diederich & Coppins (2009), Diederich & Scheidegger (1996), Ertz *et al.* (2020), Frisch *et al.* (2013, 2015, 2020).

- | | | |
|------|--|---------------------|
| 1 | Apothecia absent, sporodochia present | <i>leopoldii</i> |
| | Apothecia present, sporodochia absent | 2 |
| 2(1) | Ascospores 12–14 (–16) × 4–5 (–6) μm, (1–) 3-septate | <i>anombrophila</i> |
| | Ascospores 16–24 × 5–7 μm, at least mostly 3- or 4-septate | 3 |
| 3(2) | On hard siliceous rock, often coastal | <i>dendritica</i> |
| | On dry bark in ancient woodlands | <i>zwackhii</i> |

Reichlingia anombrophila (Coppins & P. James) Frisch (2020)

Arthonia anombrophila Coppins & P. James (1989)

Thallus effuse or delimited by a brown line, usually in small patches, immersed or (when on rough bark) partly superficial, to 70 μm thick, white to pale grey, matt. Apothecia 0.15–0.3 mm diam., numerous and often crowded, irregularly rounded or usually elongate, 0.2–1 × 0.05–0.2 mm, often irregularly branched or substellate, red-brown but usually white-pruinose, in section 45–100 μm tall; epithecium pale to dark red-brown, K+ pale green; hymenium 35–55 μm tall, colourless or pale red-brown above; hypothecium 25–35 μm tall, colourless or pale red-straw; paraphysoids ca 1 μm diam., numerous, often pigmented in the epithecium and to 2.5 μm diam., sometimes with brown apical caps. Ascospores 12–14 (–16) × 4–5 (–6) μm, obovoid, (1–) 3-septate, the apical cell enlarged, old ascospores brown and finely warted. Pycnidia 40–80 μm diam., few, immersed; wall red-brown, K+ pale green; conidia 3–5 × 0.7–1 μm, bacilliform. Thallus C–, K–, KC–, Pd–, UV– (2'-O-methylperlatolic acid). **BLS 1588.**

On dry shaded, usually rough bark, towards the bases of old trees (esp. *Quercus*), more rarely on smooth bark (*Betula*, *Corylus*, *Sorbus*), in old woodland and parkland; rare overall but very locally frequent in W. & N. Britain, rare in lowland England, occasional in Ireland but absent from the central plain. Increasing in W. Wales perhaps due to climate change and nitrogen pollution. Similar material has been found lichenicolous on *Lecanora exallens* in Ireland, which needs further investigation.

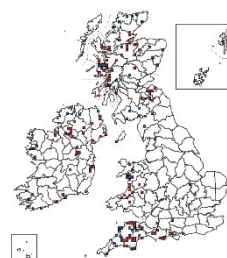
Distinguished from *Pachnolepia pruinata*, *Reichlingia zwackhii*, and (when not pruinose) *Arthonia anglica* and *A. stellaris*, by the smaller ascospores and chemistry. *A. invadens* is distinguished by the Pd+ red soralia of the host.

Reichlingia dendritica (Leight.) Ertz & Sanderson (2020)

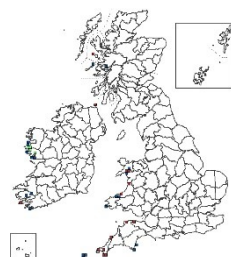
Arthonia atlantica P. James (1970)

Thallus effuse or forming mosaics with other species, white to pale grey, matt, often thin (to 0.5 mm thick) and cracked-areolate, sometimes thinly arachnoid in places; medulla white, densely packed with minute crystals. Apothecia ± immersed, irregularly rounded (to 0.2 mm diam.) but more usually elongate (to 1.2 × 0.08–0.16 mm) or ± stellate, often joining to form an irregular reticulum, brown-black, but often thinly white-pruinose; epithecium red-brown, K+ grey-brown; hymenium 40–50 μm tall, ± colourless; hypothecium sometimes extending down to the substratum, pale red-straw or sometimes with red-brown patches (especially at the outer edge); paraphysoids 1–1.8 μm diam.; apices with dark caps. Ascospores 16–24 × 6–7 μm, (2–) 3- or 4-septate, cylindric-obovoid, the apical cell enlarged; old ascospores brown and warted. Pycnidia not seen. Thallus C–, K+ yellow, KC–, Pd– or Pd+ pale yellow or red, UV– (confluent acid, and either atranorin

Nb IR



NT IR



with one or two unidentified compounds [var. *atlantica*] or stictic acid and unidentified compound [var. *positiva* P. James (1978)]. **BLS 0053**.

On hard siliceous rocks below dry overhangs and sheltered sides of old walls, usually on or near the coast but also on rock faces in subcoastal woodlands; rare. S.W. England (Cornwall, Devon, Somerset), W. Scotland (Coll), S.W. & N.W. Ireland (Killarney, Mayo, West Cork), N. & W. Wales.

Confirmed as a species of *Reichlingia* by Ertz & Sanderson (2020). Superficially like *Enterographa*, but distinguished by the shape of the ascospores. *Roccellographa circumscripta* differs in the Pd⁺ deep yellow thallus and dark brown, 4- to 7-septate ascospores.

Reichlingia leopoldii Diederich & Scheid. (1996)

Thallus greyish green, continuous, delimited but sometimes confluent, roundish, not or indistinctly lobed, 0.5–2 mm thick, 1–5 (–40) cm diam; prothallus indistinct or well-developed, of loose whitish hyphae, best developed on the lower surface, rarely present on the upper surface and then brownish; lower surface often indistinct, formed by the whitish prothallus that fixes the thallus to the substrate, smooth, pale to ochraceous, similar to that of *Lepraria crassissima*, but even; upper surface in young and well-developed thalli sometimes ± granulose, with granules of 200–300 μm which soon disintegrate into soredia of 30–60 μm or consoredia of 75–125 μm, with no or few projecting hyphae; in older thalli, the soredia disintegrate or disappear, leaving a more or less byssoid thallus with a very loose upper surface, composed of whitish, free hyphae; hyphae colourless, 2–4 μm diam., often covered by minuscule granules; photobiont trentepohlioid, of roundish (12–15 μm diam.) or elongate (12–18 × 8–10 μm), often catenate cells, contents yellowish, densely surrounded by hyphae. Ascomata unknown. Conidia produced on the upper surface of the thallus, except at the margin, in irregular sporodochium-like conidiomata that are reddish to chocolate brown, irregular, 0.1–0.4 mm diam., sometimes confluent; conidiophores dark brown, with a thick, verrucose wall; conidiogenous cells not clearly defined, the terminal cells acting in turn as conidiogenous cells; conidia dry, irregularly branched, with one or several branches, 17–35 μm long, septate, distinctly constricted at the septa, individual cells subspherical to ellipsoidal, dark brown, 4–6 μm long, 3.5–5.5 μm diam., the wall strongly verrucose, with a granulose dark brown pigmentation. Thallus K[–], C and KC⁺ reddish (sometimes indistinct), Pd[–], UV[–] (2'-O-methylperlatolic acid). **BLS 2386**.

On basalt and conglomerate cliffs, sometimes in dry crevices in underhangs; associated with *Sparria endlicheri*, *Dirina massiliensis* and *Dendrographa latebrarum*. Scotland (Angus, E. Inverness, E. Lothian). In Europe it occurs on bark as well as rock.

Although originally described as a lichenicolous fungus on an unidentified, trentepohlioid-containing host, it is now generally considered to be a lichenized hyphomycete. Distinguished from other lichenized or lichenicolous hyphomycetes with dark brown, verrucose conidia by the greyish green, often byssoid thallus that is irregularly covered (except at the margin) by chocolate brown, multicellular, branched conidia. Conidiomata of the facultatively lichenized *Milospium graphideorum* (Nyl.) D. Hawksw. (1975) are always delimited and roundish, and conidia are aseptate, irregularly lobed with an irregularly swollen wall. Conidiomata of *Sclerococcum s. lat.* (with lichenicolous and lichenized species) are also always delimited and roundish, but the conidia are aseptate to multicellular and always more or less spherical in shape.

Reichlingia zwackhii (Sandst.) Frisch & G. Thor (2013)

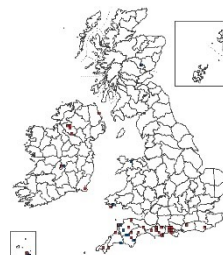
Arthonia zwackhii Sandst. (1903)

Thallus to 80 μm thick, effuse, white to pale grey, matt, slightly rimose; photobiont trentepohlioid. Apothecia numerous and often crowded, typically irregularly stellate and to 1.2 mm diam, rarely rounded to polygonal and 0.2–0.3 mm diam., red-brown but mostly thinly white-pruinose; in section 65–95 μm tall; epithecium red-brown, K⁺ pale green; hymenium 40–50 μm tall, colourless or pale red-brown above; hypothecium 15–35 μm tall, colourless to pale straw-coloured; paraphysoids 1–2 μm diam., but brown-walled and to 2.5 μm diam. in the epithecium, a few with apical caps. Ascospores 16–22 (–24) × 5–7 μm, cylindric-obovoid, 3- or 4-septate, the apical cell enlarged; old ascospores brown and warted. Pycnidia not seen. Thallus C[–], K[±] yellow→red (crystals; reaction patchy), KC[–], Pd[–], or Pd⁺ yellow in places, UV[–] (unidentified substance 'A' of Coppins & James (1978); ± norstictic acid, probably from the host). **BLS 0074**.

DD NR



NT



On flushed mesic bark of mature *Fagus*, *Fraxinus* and *Quercus* in ancient woodlands, usually visibly invading *Phlyctis argena* and rarely *P. agelaea* thalli (hence the patchy norstictic acid), but does occasionally appear to become a fully independent lichen; rare. Widespread in S. & S.W. England (Cornwall to Sussex), very rare in Scotland (E. Perthshire), S.W. & N.W. Wales, Ireland.

Distinguished from the similarly stellate pruinose apothecia of *Synarthonia astroidestera* by the UV– pruina, and from other species with stellate apothecia by their lack of pruina. Poor specimens might be confused with species with more rounded apothecia, but distinguished from *Pachnolepia pruinata* by the C– thallus and apothecia, and ascospores with apical cells enlarged, and from *R. anombrophila* by the longer ascospores. Most thalli are surrounded by surviving uninfected *Phlyctis* thallus but this can be difficult to differentiate from that of *R. zwackhii*.

SNIPPOCIA Ertz, Kukwa & Sanderson (2018)

The genus contains a single species, *S. nivea*, so the description below constitutes that of the genus.

Previously contained in *Schismatomma* (Roccellaceae), molecular data demonstrate that *S. nivea* belongs in the Arthoniaceae. It occupies a basal clade and its closest relative is not clear.

Literature

Ertz *et al.* (2018b), Wolseley & Hawksworth (2009)

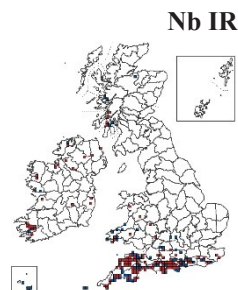
Snippocia nivea (D. Hawksw. & P. James) Ertz & Sanderson (2018)

Schismatomma niveum D. Hawksw. & P. James (1971)

Thallus usually rather thick and sometimes ± tartareous, rarely thin and evanescent, wide-spreading, pale pink when fresh, soon becoming creamy white to glaucous green-grey in dried collections, cortex absent or poorly developed. Photobiont trentepohlioid, cells single or in short chains, individual cells 12–27 × 10–15 µm, ± spherical or short-elongate. Surface matt or rarely slightly shining, continuous, rarely weakly rimose-cracked, sometimes entirely non-sorediate, especially on *Ilex*, but usually with soralia developing from small tubercles, at first punctiform, to 1 mm diam but then spreading and becoming confluent to form irregular patches, rarely covering more than half the thallus, concolorous with the thallus. Prothallus often not obvious, when present white to dull purple-black in colour, smooth or obscurely fibrous. Apothecia unknown. Pycnidia occasional, black, immersed, mainly circular and *ca* 125 µm diam., some elongated and lobed to 250 µm and exceptionally to 500 µm long, conidia 5.7 – 6.7 × ca 1 µm, straight to curved, the pycnidia often apparently empty. Thallus C–, K–, KC–, Pd+ bright yellow, UV± dull pale grey ± tinged orange (psoromic and 2-*O*-demethylpsoromic acids and ± an unidentified xanthone). **BLS 1317.**

On bark on the dry sides of ancient trees, but also on moister acid bark where frequent, often forming extensive pale pink patches, especially on *Quercus* and *Ilex* in old woodlands; frequent to rare. Frequent in southern England, rare beyond, Wales, W. Scotland, scattered and rare in Ireland, Channel Islands.

Haematomma ochroleucum var. *porphyrium* is separated by its distinct white and fibrous prothallus, greenish glaucous colour, presence of *Trebouxia* and the Pd– thallus. *Schizotrema quercicola* has a Pd+ orange-red reaction confined to the persistently punctiform soralia. *Sporodophoron cretaceum* is Pd– and starkly white.



SPORODOPHORON Frisch, Y. Ohmura, Ertz & G. Thor (2015)

Similar to *Inoderma* but forming sporodochia instead of pycnidia. **Photobiont** trentepohlioid. **Apothecia** (known only from the Japanese species *S. gossypinum*) densely white-pruinose, adnate. **True exciple** poorly differentiated, composed of paraphysoidal hyphae. **Epithecium** greyish,

inspersed with granular crystals. **Hymenium** colourless to pale yellowish brown and only moderately gelatinized. **Hypothecium** pale yellowish brown. **Hamathecium** of paraphysoids with only slightly broadened, unpigmented, horizontally extending apices. **Asci** *Arthonia*-type, without KI+ blue tholus structures. **Ascospores** 1–2(–3)-septate, with a slightly enlarged apical cell. **Sporodochia** whitish, convex, discrete or confluent in the thallus centre. **Conidia** formed apically in zigzag-shaped and occasionally branched chains, rounded angular to ellipsoidal or short-cylindrical, 0–2-septate, constricted at the septa, with unevenly thickened walls; in *S. cretaceum* to 6-septate, often appearing ± submuriform.

The genus forms a sister group to *Inoderma*, separated in morphological terms by the conidia being produced in sporodochia rather than pycnidia. Only one of the four currently accepted species occurs in Great Britain and Ireland.

Literature

Frisch *et al.* (2015), Wolseley & Hawksworth (2009)

Sporodophoron cretaceum (Hue) Ertz & Frisch (2015)

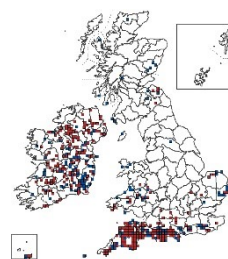
Schismatomma cretaceum (Hue) J. R. Laundon (1984)

Thallus wide-spreading, thick and ± tartareous, whitish grey at first, becoming pure chalk-white due to the confluence of sporodochia, continuous to rimose, rarely areolate with the areoles flat, angular, 0.5–2 (–3) mm diam.; photobiont trentepohlioid; cells subglobose or ellipsoidal, 10–18 × 6–15 μm, in short chains or single-celled; thallus surface not corticate, powdery-mealy; medulla whitish; prothallus not observed; hyphae covered by numerous tiny colourless crystals that dissolve in K (polarized light). Apothecia and pycnidia unknown. Sporodochia at first delimited but becoming irregular and erose, then covering most of the thallus surface. Conidia formed from colourless hyphae ca 2 μm diam. disintegrating into 1–6-septate fragments of irregular shape, often with a ±submuriform appearance; rounded angular to ellipsoidal, ± constricted at the septa, and often wavy in outline, bent or indistinctly branched, (10–) 11.5–16.5 (–20) × (6–) 7.5–11 (–14) μm, with individual cells rounded to ellipsoidal, rarely short-cylindrical, often ± bent, (4–) 4.5–6.5 (–8) × (3.5–) 4–5.5 (–6) μm, the walls colourless, irregularly thickened, with a distinct gelatinous coating 0.5–1 μm diam., covered by numerous pale granular crystals (polarized light). Chemistry: thallus C–, K+ yellow, KC–, Pd–, UV± dull pale grey, tinged orange (unidentified substances related to lepranic and 2'-O-methylperlatolic acids). **BLS 1318**.

On well-lit, dry sides of old wayside and woodland trees, especially with some slight nutrient enrichment, forming extensive patches. S. & E. Britain, extending locally to E. & N. Scotland, Ireland & the Channel Islands.

Distinguished from *Snippocia nivea* by the starkly white, Pd– thallus. Rarely parasitized by *Chaenothecopsis retinens*.

Nb IR



SYNARTHONIA Müll. Arg. (1891)

Thallus crustose, rarely absent (then lichenicolous), whitish to greenish-grey to green, with or without white striae or spots, continuous to cracked, smooth to verrucose or farinose, sorediate or not, not corticate. **Prothallus** not observed, but forming a black to brown line in contact with other lichens. **Photobiont** trentepohlioid. **Apothecia** solitary or forming irregular clusters, immersed to ± sessile; disc white, greyish or orange-pruinose, pale brown and almost translucent or blackish-brown with remnants of thallus. **True exciple** colourless to pale brownish or straw-coloured, non-carbonized. **Epithecium** pale brownish, formed by agglutinated paraphysoid tips inspersed with colourless or red-brown to orange granular crystals. **Hymenium** colourless, I+ directly red, I+ blue rapidly turning into red or I+ persistently blue, K/I+ blue. **Hypothecium** colourless, yellowish or brownish.

Hamatecium of colourless branched and anastomosing paraphysoids, forming a dense or loose mesh around the asci. **Asci** *Arthonia*-type, 8-spored, with or without K/

I+ blue ring like structures in the tholus. **Ascospores** persistently colourless, or brownish and ornamented with small brown (K+ olivaceous) warts at late maturity, ellipsoidal to cylindrical-obovoid, transversely septate with an enlarged apical cell or muriform, with or without a gelatinous sheath.

Conidiomata pycnidia, black, walls brown. **Conidia** colourless, bacilliform, aseptate, straight to slightly curved. **Chemistry**: parietin, evernic acid, psoromic acid, unidentified xanthenes.

Synarthonia forms a monophyletic lineage closely related to *Coniocarpon* and *Reichlingia*. It includes both corticolous lichens with a trentepohlioid photobiont and non-lichenized lichenicolous fungi. The core group is characterized by white-pruinose ascomata, but species producing orange-pruinose or non-pruinose ascomata are also included. Ascospores are transversely septate with an enlarged apical cell or are muriform. Around 20 species are known, but only two definitely occur in Great Britain and Ireland.

Literature

Coppins & Aptroot (2009), Ertz *et al.* (2020), Van den Broeck *et al.* (2018)

- 1 Ascomata thickly white-pruinose; ascospores $17\text{--}27 \times 6\text{--}7 \mu\text{m}$, (3-) 4-septate *astroidestera*
 Ascomata with orange pruina; ascospores $11.5\text{--}17 \times 4\text{--}7.5 \mu\text{m}$, mostly 3-septate *ochracea*

Synarthonia astroidestera (Nyl.) Ertz & Van den Broeck (2018)

Arthonia astroidestera Nyl. (1874)

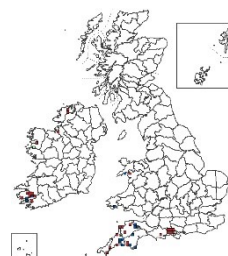
Thallus immersed, usually delimited by a brown line, cream-white to cream-yellow. Apothecia linear (to 1.2 mm long), irregularly branched or stellate (to 1.2 mm diam.) with rays 0.06–0.2 mm broad, pale to dark brown but usually thickly white-pruinose and in dried collections often developing a waxy bloom of minute needle-shaped crystals ($\times 50$ lens); in section 45–85 μm tall; epithecium colourless to red-brown (K+ pale green), often with dense minute granular crystals dissolving in K; hymenium 35–50 μm tall, colourless; hypothecium indistinct or to 25 μm tall, colourless; paraphysoids 1 (–1.5) μm diam., numerous, sometimes pigmented in the epithecium and 1.5–2.5 μm diam., sometimes with apical caps. Ascospores (17–) 18–24 (–27) \times 6–7 μm , (3–) 4-septate, cylindrical-obovoid, the apical cell enlarged; old spores brown and warted. Pycnidia not seen. Thallus C–, K–, KC–, Pd–, UV+ orange; pruinose apothecia UV+ bright orange-yellow (lichexanthone).

BLS 1687.

On smooth bark, especially *Ilex*, in ancient woodlands; rare. S.W. England (S. Hampshire, New Forest to Cornwall), Wales, Ireland.

Distinguished from *Arthonia anglica* and *A. stellaris* by the UV+ orange apothecial pruina, and chemistry (TLC). With UV light even small amounts of pruina can be detected, allowing even poor material to be detected.

NT IR



Synarthonia ochracea (Dufour) Van den Broeck & Ertz (2018)

NE

Thallus thin, whitish, smooth to cracked. Ascomata solitary, 0.1–0.5 \times 0.1–0.5 mm, or in clusters of 2–4 ascomata of 0.6–0.8 \times 0.3–0.5 mm, lirellate, often stellate to lobed, numerous, at first immersed, becoming semi-sessile, scattered \pm evenly over the thallus; disc heavily orange-pruinose, blackish below the pruina when dry, reddish when wet, flat, all layers \pm interspersed with clusters of granular orange-brown crystals which are K+ purplish to reddish and partly dissolving; exciple 10–25 μm wide, brownish; epithecium 20–25 μm tall, orange-brown; hymenium 40–60 μm tall, brownish to slightly reddish, I+ deep blue, K/I+ deep blue with purplish patches. Paraphysoids 1.5–2.2 μm diam., the tips colourless; hypothecium orange-brown. Asci 30–54 \times 14–21 μm , ellipsoidal to obovoid, stipitate; a KI+ ring-like structure in the tholus and an ocular chamber observed in young asci. Ascospores 11.5–17.0 \times 4.0–7.5 μm , colourless, becoming brown and ornamented with brown warts at late maturity, slightly constricted at the septa, with an enlarged apical cell, cylindrical-obovoid, (2–)3(–4)-septate; gelatinous sheath distinct, granular, ca 0.7 μm thick. Pycnidia immersed to erumpent, pale, round, concentrated on small patches of the thallus; the wall composed of brown-walled hyphae. Conidia 4.2–5.3 \times 0.8–1.3 μm , bacilliform, colourless, aseptate.

Apparently initially lichenicolous on *Graphis scripta* s. lat. but sometimes forming an independent thallus with

age. Scotland (Argyll), Ireland.

In the past, sometimes considered a synonym of *Coniocarpon fallax* (syn. *Arthonia elegans*), which has a red, not orange, pruina and a purplish pigment in the ascomata, especially at the margin.

TYLOPHORON Nyl. (1862)

Thallus crustose, thin, not corticate, effuse, thin, often farinose or felty, and encrusted with crystals. **Prothallus** often well-developed, of medium-brown radiating hyphae. **Photobiont** trentepohlioid. **Apothecia** sessile, short-cylindrical to conical, mazaediate (not known in British species). **Thalline margin** well-developed, interspersed by minute granular crystals and often thickened at the base. **True exciple** of dark brown sclerotized hyphae. **Asci** cylindrical, with spores uniseriately arranged, evanescent and forming a black mazaedium. **Ascospores** dark brown, 1-septate, with thick walls and septum. **Conidiomata** sporodochia, convex-hemispherical to subglobose, scattered or in small groups, pale creamy yellow to black. **Conidiophores** not well delimited. **Conidiogenous cells** terminal, forming catenate conidia. **Conidia** colourless or dark brown, mostly aseptate, cylindrical-ellipsoidal to fusiform. **Chemistry**: thallus K⁻, C⁺ red or C⁻, Pd⁻, UV⁺ brilliant yellow or UV⁻. Most species contain lecanoric acid, some with 2'-*O*-methylperlatolic acid or lichexanthone.

Tylophoron is one of only two genera of the Arthoniales with mazaedial ascomata. Most species are tropical in distribution; only one of the eight currently recognized occurs in our area. This was originally described as a lichenized species with sporodochial conidiomata, as *Blarneya* D. Hawksw., Coppins & P. James (1980).

Literature

Chambers & Purvis (2009), Ertz *et al.* (2011), Hawksworth *et al.* (1980), Lumbsch *et al.* (2009), Tibell (1996).

Tylophoron hibernicum (D. Hawksw., Coppins & P. James) Ertz, Diederich, Bungartz & Tibell (2011) NT IR

Blarneya hibernica D. Hawksw., Coppins & P. James (1980)

Thallus crustose, ecorticate, pale rose or pinkish, fading to white in dried collections, effuse, thin, soft and cotton-like, often encrusted with crystals (dissolving in C), the margin delimited by brownish arachnoid-fasciculate threads radiating outwards over the host thallus which is killed in advance of the hyphal threads; hyphae 1.5–2 µm diam.; photobiont trentepohlioid; cells arranged in filaments or separating, invested by hyphae of the fungus without penetration of the protoplast. Ascomata rare (only found in material from Hawaii and the Galapagos Is); sessile, short-cylindrical to conical, 0.5–1 mm diam., 0.4–0.6 mm high (excluding the mass of ascospores); thalline margin well-developed, 50–60 µm wide, of colourless hyphae 1.5–2 µm diam. densely interspersed with minute colourless crystals dissolving in K; true exciple of dark brown hyphae; mazaedium well-developed, black; paraphyses branched, anastomosing, 1.5 µm diam.; asci dissolving at an early stage, cylindrical, with eight uniseriate ascospores, 35–45 × 4–5 µm; ascospores 1-septate, dark brown, with a heavily pigmented band around the central part, ellipsoidal, sometimes constricted at the septum, occasionally with slightly pointed ends, wall thick, (9–) 10.5–13.5 (–17) × (5.5–) 6.5–8.0 (–9) µm. Conidiomata sporodochia, 0.3–0.6 (–1) mm diam., convex-hemispherical to subglobose, scattered or in small groups, pale creamy yellow, fading and concolorous with the thallus in dried material, often forming over old apothecia or pycnidia of the host; conidiogenous cells 2–3 µm diam., terminal or lateral; conidia forming in acropetal chains, 8–13 × 3–4.5 µm, bacilliform, mostly 1-septate, apices rounded or truncate, guttulate, with wrinkled walls. Thallus and sporodochia C[±] red (fleeting), K⁻, KC[±] red, Pd⁻, UV⁺ glaucous (lecanoric acid). **BLS 0185**.

Initially lichenicolous, establishing on and spreading over a range of lichens belonging to the Arthoniales.



These include *Cresponea premnea*, *Dendrographa decolorans*, *Enterographa crassa*, *Inoderma subabietinum*, *Lecanactis abietina*, *Snippocia nivea* and *Sporodophoron cretaceum*. The parasite apparently takes over their photobionts, finally becoming independent and forming discrete or diffuse thalli to several cm diam., on dry, sheltered bark on bases of old trees in ancient woodland (often *Quercus* and *Ilex*), predominantly in warm, oceanic, coastal sites in the extreme S.W. of Britain; rare but locally frequent. S. & S.W. England (Cornwall to S. Hampshire), Wales (Cardiganshire, Radnorshire), Ireland (Kerry, Waterford, Donegal, Antrim).

A highly distinctive species, only really confusable in the field with fertile morphs of *Lecanactis abietina* with heavily pruinose, yellowish convex discs. In *T. hibernicum* the sporodochia, which resemble soralia, react C+ strong red colour (fleeting) whereas the apothecia of *L. abietina* are C-. Previously reported as also containing schizopeltic acid by TLC but this was probably due to contamination from the underlying host lichen in the tested material.

Nomenclature

Diarthonis spadicea (Leight.) Frisch, Ertz, Coppins & P.F. Cannon, **comb. nov.** **IF557849**

Basionym: *Arthonia spadicea* Leight., *Ann. Mag. nat. Hist.* ser. 2, **13**: 442 (1854).

Typification: [England]: On the smooth bark of hazel and hawthorn, close to the ground. Shelton Rough near Shrewsbury, Shropshire. *Leighton, Lich. Brit. Exs.* no. 97 (1852).

Acknowledgements

Alan Fryday is acknowledged for information on the identity of the type of *Arthonia lapidicola*, and Linda in Arcadia and Paul Kirk for nomenclatural advice. Nicola Bacciu, Nigel Chadwick, Peter Lambley, Ivan Pedley and Sue Knight are thanked for their review of the first draft of this document.

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