Revisions of British and Irish Lichens



British Lichen Society

Volume 53

May 2025



Various Arthoniales

Cover image: Ingaderia vandenboomii on a chapel wall, Llanfihangel-y-pennant, Merioneth.

Revisions of British and Irish Lichens is a free-to-access serial publication under the auspices of the British Lichen Society, that charts changes in our understanding of the lichens and lichenicolous fungi of Great Britain and Ireland. Each volume will be devoted to a particular family (or group of families), and will include descriptions, keys, habitat and distribution data for all the species included. The maps are based on information from the BLS Lichen Database, that also includes data from the historical Mapping Scheme and the *Lichen Ireland* database. However, these are not comprehensive and there are many further records that have not yet been digitized. 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to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published.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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ISSN 2634-7768

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Revisions of British and Irish Lichens vol. 53

Various Arthoniales

including *Andreiomyces* (Andreiomycetaceae), *Chrysothrix* (Chrysotrichaceae), *Ingaderia* (Opegraphaceae), *Roccellographa* (Roccellographaceae) and *Bactrospora*, *Bryostigma*, *Felipes*, *Mixtoconidium*, *Perigrapha* and *Phacothecium* (family unassigned).

by

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This publication can be cited as:

Cannon, P., Coppins, B., Sanderson, N. & Simkin, J. (2025). Various Arthoniales, including Andreiomyces (Andreiomycetaceae), *Chrysothrix* (Chrysotrichaceae), *Ingaderia* (Opegraphaceae), *Roccellographa* (Roccellographaceae) and *Bactrospora*, *Bryostigma*, *Felipes*, *Mixtoconidium*, *Perigrapha* and *Phacothecium* (family unassigned). *Revisions of British and Irish Lichens* **53**: 1–15.

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Various ARTHONIALES

This volume contains the species not treated in other volumes of the *Revisions*, namely those of the Arthoniaceae (vol. 1, 2020), Lecanographaceae (vol. 14, 2021), Opegraphaceae (vol. 13, 2021) and the revised Roccellaceae (vol. 32, 2023).

ANDREIOMYCETACEAE B.P. Hodk. & Lendemer (2013)

The fanily contains a single genus *Andreiomyces* B.P. Hodk. & Lendemer (2013), that in turn contains two *Lepraria*-like species that differ in chemistry and phylogeny. A more detailed phylogenetic study would be helpful, in order to establish its closest relatives.

ANDREIOMYCES B.P. Hodk. & Lendemer (2013)

Andreiomyces obtusaticus (Tønsberg) B.P. Hodk. & Lendemer (2013)

Thallus leprose throughout, or composed of soredia mixed with colourless medullary hyphae, pale green with a grey-yellow tinge, becoming more distinctly grey-yellow in dried collections, diffuse, not lobed, discontinuous to partly continuous, forming irregular patches to several cm diam., usually unstratified, rarely in thickish parts of the thallus with an indistinct white medulla, frequently with flecks of yellow-orange pigment at the base of the thallus. Soredia fine, to 25 (-35) µm diam., sometimes in loosely packed, more or less irregular consoredia to 50 µm diam., very fragile; wall poorly developed. Photobiont green, coccoid, to 10 µm diam. Chemistry: Obtusatic acid, \pm an unidentified yellow-orange pigment. Thallus K–, except for the yellow-orange pigment patches that are K+ violet, K/UV(wet)–, C–, UV– but patchily UV+

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pale orange where the pigment occurs, PD- (Tønsberg (1992) reports it as PD+ yellow, but this has not been observed in British material).

In dry bark crevices of mature to ancient *Quercus*, typically in crevices with *Lecanactis abietina*, S. England, also scattered through N. England, mid Wales, Scottish Highlands and E. Ireland. Probably under-recorded, and the current known distribution reflects recorder bias.

The description has been adapted from Tønsberg (1992) with additions from Alan Orange (in litt.), and the species has been included in the key to *Lepraria* s.l. in vol. 51 of the *Revisions*. It can easily be overlooked as *Lecanora expallens*, that can also occur in dry bark, but usually in slightly more flushed habitats. That species is typically C+ orange, but this can be difficult to see in material in this habitat, but the uniform UV+ orange fluorescence and the strong K/UV(wet)+ bright yellow-green fluorescence of *L. expallens* is diagnostic. Previously misidentified as *Lithocalla ecorticata*, but that is confined to rock and has a different chemistry.

CHRYSOTRICHACEAE Zahlbr. (1905)

Thallus leprose to granular, often sparse or discontinuous, pale green to bright lemon-yellow or yellow-green, non-corticate. **Photobiont** protococcoid. **Ascomata** apothecia, resembling *Micarea*, immersed or superficial, convex-globose, yellow-green, orange, brown or black, rarely pruinose, surrounded by a thin, non-corticate margin or emarginate. **Thalline margin** absent. **Exciple** poorly

developed, of anastomosing hyphae, \pm colourless or rarely dark brown. **Epithecium** colourless or rarely dark brown, granular. **Hymenium** colourless, conglutinated. **Hamathecium** of paraphysoids, richly anastomosed above, the apices not swollen, rarely with dark pigment above. **Asci** *Arthonia*-type, rarely almost tubular, 8-spored, the inner wall usually extending to form a K/I+ blue tube within the tholus. **Ascospores** narrow, ovoid to ellipsoidal, colourless, usually 3-septate. **Conidiomata** unknown.

The family contains only three genera, *Chrysothrix* and the two monotypic Japanese genera *Melarthonis* and *Galbinothrix*. Frisch *et al.* (2014) found that the species *Arthonia mediella* (Arthoniaceae, q.v.) clusters within the Chrysotrichaceae, but the necessary new combination was not made due to uncertainties regarding generic limits in that family.

Literature:

Frisch et al. (2014, 2018).

CHRYSOTHRIX Mont. (1852)

Thallus leprose, inconspicuous and stain-like, rarely within the outer layers of bark, bright lemonyellow to bright yellow-green, non-corticate, unstratified and coloured throughout, comprising a mass of powdery globose granules and anastomosing hyphae, often interspersed with granular crystals, the thallus edge effuse or determinate, without lobes, sometimes sorediate; prothallus not conspicuous. **Photobiont** protococcoid. **Ascomata** apothecia, resembling *Micarea*, immersed or superficial, convex to \pm globose, surrounded by a thin, non-corticate margin or emarginate; disc greenyellow to pale orange to brown, sometimes pale yellow-pruinose. **Exciple** poorly developed, of anastomosing hyphae. **Hymenium** and **epithecium** colourless, \pm granular above. **Hamathecium** of paraphysoids, septate, richly anastomosed above, the apices not swollen. **Asci** *Arthonia*-type, 8spored, the inner wall extending to form a K/I+ blue tube tube within the tholus. **Ascospores** narrowly ovoid to ellipsoidal, colourless, mostly 3-septate. **Conidiomata** unknown. **Chemistry**: pulvinic acid derivatives. **Ecology**: on trees, wood, and shaded acid rocks.

Many species resemble saxicolous *Leproplaca* species (which are K+ purple), or *Psilolechia*. The genus seems heterogeneous, and may well be subdivided in future. *C. candelaris and C. chlorina* are clearly distinct from *C. chrysophthalma* and *C. flavovirens* in having bright golden yellow, woolly-textured, sorediate thalli. The soredia appear to grow from infinitesimally small to about 0.1 mm diam. at which point they disperse and appear scattered around the main thallus. *C. chrysophthalma* and *C. flavovirens* appear to be a species pair, the first fertile and the second sorediate and sterile (Frisch *et al.* 2014).

Literature:

Fletcher & Purvis (2009), Harris & Ladd (2008), Laundon (1981), Olszewska et al. (2014), Tønsberg (1994).

1	Thallus immersed, inconspicuous or a grey stain on bark or decorticated wood; soredia absent: often richly fertile	ophthalma
	Thallus superficial, strikingly and completely green- or golden-yellow sorediate; sterile or rarely sparingly fertile	
2 (1)	Soredia dull yellow-green, finely farinose, \pm evenly sized, 20–25 µm diam.; rhizocarpic acid present, mainly on bark, rarely sparingly fertile	flavovirens
	Soredia bright golden yellow, irregular in size, 10–300 μ m diam.; on bark or rocks; rhizocarpic acid absent: unknown fertile in Britain	

Chrysothrix candelaris (L.) J.R. Laundon (1981)

Thallus leprose, thin, diffuse (rarely delimited), of scattered tiny granular soredia, or producing a continuous non-areolate vivid bright yellow crust, often with a golden or green tinge; prothallus conspicuous; soredia 10–300 μ m diam., minutely convex to globose, woolly textured. Apothecia absent in British material; minute, to 0.5 mm diam., \pm superficial, rounded or distorted-angular, flat to slightly convex, at first surrounded by a very thin, non-corticate margin; disc smooth, pale orange, often yellow-pruinose; exciple poorly developed, to 10 μ m thick, entire, smooth, concolorous and sometimes obscured by the thallus, becoming excluded as the apothecia mature. Ascospores narrowly obvoid to narrowly ellipsoidal, mostly 3-septate, 9–14 × *ca* 3 μ m. Thallus C–, K and KC± orange, darkening to red-black, Pd± orange, UV– (calycin or pinastric acid, rarely both). **BLS 0354**.

On the dry shaded sides of trees, often in crevices or forming extensive sheets in well-lit humid woodland, rarely on shaded siliceous rocks and walls. Throughout Britain and Ireland.

Characterized by the bright yellow diffuse leprose thallus, it could only be confused with *Psilolechia lucida* which inhabits shaded rock crevices. See also *C. chlorina*.

The facultatively lichenicolous Monodictys cellulosa S. Hughes (1958) has been found on this host.

Chrysothrix chlorina (Ach.) J.R. Laundon (1981)

Thallus leprose, diffuse, of scattered granules or forming a thick continuous nonareolate to strongly cracked crust, bright golden-yellow; prothallus inconspicuous; thallus coarsely granular-sorediate, soredia very irregular, $10-300 \mu m$ diam., woolly in texture. Apothecia unknown. Thallus C–, K± faintly orange, KC± red, Pd–, UV+ orange (calycin and vulpinic acid). **BLS 0355**.

On siliceous rocks in very shaded, dry habitats beneath overhangs and in crevices, where it forms the species-poor association *Leprarietum chlorinae*, very rarely on the highly acid trunks of conifers and on man-made substrata; uplands; rare. W. and N. Britain, scattered elsewhere.

Characterized by its thick bright yellow, almost luminous woolly thallus of irregular granules growing on rock. May be difficult to separate from *C. candelaris*, which has a thinner, yellow to orange-yellow thallus, grows on bark and has a different chemistry. *Psilolechia lucida* has a yellow-green, completely powdery thallus, which is slightly less brightly coloured, due to the presence of rhizocarpic acid. *Leproplaca xantholyta* is on calcareous rocks and is K+ purple.

Chrysothrix chrysophthalma (P. James) P. James & J.R. Laundon (1981)

Thallus entirely immersed, effuse or rarely visible as scattered minute grey warts, prothallus absent; soredia absent; photobiont sparse, algal cells scattered, densely surrounded by an envelope of hyphae. Apothecia numerous, discrete, <0.2 mm diam., flattened to convex-globose, rounded or somewhat tuberculate, yellow or orange, densely lemon yellow-pruinose; exciple almost absent, reduced to a few wisp-like hyphae, hypothecium colourless, of densely compacted interwoven hyphae; hymenium 20–38 (–45) µm tall, colourless, I+ blue, composed of intricately interwoven paraphysoids in a gelatinous matrix, the apices not swollen, together with the epithecium wholly and densely interspersed with granules, K+ dissolving and subsequently recrystallizing. Asci 20–27 \times 9–13 µm, apex K/I+ blue; ascospores (0-)

1- to 3-septate, ellipsoidal to shortly elongate, (8–) 10–13 (–15) \times 2.7–3.5 µm. Chemistry C–, K–, Pd–, UV+ orange, K/UV(wet & dry)+ bright yellow (rhizocarpic acid, + unknown). **BLS 0356**.

On dry acid conifer bark in Caledonian pinewoods, or old broad-leaved tree bark; rare. Scottish Highlands, occasional records in Wales and a 19th century record from NE Yorkshire. Records from Cumbria, Yorkshire and S.W. England (see map) are probably *C. flavovirens*.





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The tiny yellow-pruinose apothecia resemble some *Thelocarpon* species. Most previous reports of *C. chrysophthalma* were sorediate and are now referred to *C. flavovirens*. Sterile, saxicolous *Psilolechia lucida* may be confused with the epiphyte *C. chrysophthalma*, which differs in containing an additional unidentified substance with rhizocarpic acid and prefers more exposed situations.

Apothecia are sometimes seen with the tiny black dots of Minutophoma chrysophthalmae D. Hawksw. (1981).

Chrysothrix flavovirens Tønsberg (1994)

Thallus superficial, of continuous, extensive patches of \pm evenly sized soredia to 20–25 µm diam., thin to thick and cracked, dull yellow-green; prothallus inconspicuous. Apothecia rare, when present few and scattered and generally on wood rather than bark, <0.3 mm diam., \pm flattened, the margin often \pm obscured by soredia, internal anatomy similar to *C. chrysophthalma*, perhaps less densely interspersed with granules. Chemistry C–, K–, Pd–, UV+ orange, K/UV(wet & dry)+ bright yellow (rhizocarpic acid, chrysophthalma unknown). **BLS 1925**.

On well-lit, rather dry, non-nutrient-enriched wood and bark of mature broad-leaved and coniferous trees, very rarely on shaded rocks near trees supporting the lichen; frequent, has increased considerably in response to past acidifying pollution. Throughout Britain and Ireland.



Separated as a sorediate counterpart of *C. chrysophthalma*. Distinguished from *C. candelaris* by its dull green colour and granular soredia, forming extensive effuse sheets on wood or bark of a wide variety of trees.

C. flavovirens closely resembles the predominantly rock-growing *Psilolechia lucida*, which may occasionally occur on tree bases and exposed roots but which lacks the chrysophthalma unknown. It can resemble a dull coloured *Lecanora expallens* which is C+ orange. Populations of *Lecanora expallens* where the C+ orange reaction is weak still have a strong K/UV(wet)+ bright yellow-green fluorescence. *Chrysothrix flavovirens* in contrast has a K/UV(wet)+ clear yellow fluorescence.

The apothecia can be parasitised by Minutophoma chrysophthalmae.

OPEGRAPHACEAE Stizenb. (1862)

The family was included in vol. 13 of *Revisions of British and Irish Lichens* (Cannon *et al.* 2021), with the four genera *Llimonaea*, *Opegrapha*, *Paralecanographa* and *Sparria*. *Llimonaea* is transferred to *Ingaderia* below.

INGADERIA Darb. (1897)

Thallus crustose, placodioid with subfruticose outgrowths or fruticose, pale creamish or white, sometimes pinkish when fresh or greyish brown, matt, sometimes sorediate, usually rich in crystals notably of calcium oxalate, corticate or not. **Photobiont** trentepohlioid. **Ascomata** often numerous, elongate to lirellate, rarely punctiform or roundish, immersed or elevated above the thallus, often with a thalline cover, unbranched to densely branched, straight or flexuose; hymenial disc remaining slit-like or exposed, pruinose or not. **Exciple** thick, black, K+ becoming slightly darker or olivaceous. **Hymenium** clear, colourless to pale fawn, usually hemiamyloid. **Epithecium** colourless or brown, rarely with an olivaceous tinge. **Hamathecium** of branched and anastomosing paraphysoids. **Hypothecium** dark brown to black. **Asci** (4–)8-spored, narrowly clavate, not thickened near the apex, with a tiny ocular chamber, KI+ blue and usually with an apical KI+ blue ring. **Ascospores** ± fusiform,

1- to multiseptate, thick-walled, often becoming dark brown and with a gelatinous perispore. **Conidiomata** pycnidia, immersed in the thallus, wall dark brown. **Conidia** colourless, filiform, slightly curved to sickle-shaped. **Chemistry**: often with erythrin, gyrophoric acid and/or lecanoric acid, rarely with psoromic acid, as major secondary metabolites. **Ecology**: mostly saxicolous, rarely corticolous.

The genus currently includes five species, two of which occur in our region, and was assigned to the Opegraphaceae by Ertz *et al.* (2023). The genera *Llimonaea* Egea & Torrente is placed into synonymy with *Ingaderia*. Compare also with *Roccellographa* J. Steiner (Roccellographaceae).

Literature:

Ertz & Tehler (2011, 2023), Sparrius et al. (2005), Tehler (2017).

 1
 Thallus C-, Pd+ yellow.....sorediata

 Thallus C+ red, Pd-.....vandenboomii

Ingaderia sorediata (Sparrius, P. James & M.A. Allen) Ertz (2023)

Fulvophyton sorediatum (Sparrius, P. James & M.A. Allen) Tehler & Van den Boom (2017) *Peterjamesia sorediata* (Sparrius, P. James & M.A. Allen) D. Hawksw. (2006) *Roccellographa sorediata* (Sparrius, P. James & M.A. Allen) Coppins & Fryday (2012)

Thallus to 5 cm diam., mosaic-forming, finely vertucose, milk-white to grey, 200–300 μ m thick, without pruina or densely white-pruinose, soralia 0.5–2.5 mm diam., irregular in shape, blue-grey or white, often becoming widely confluent, soredia 20–40 μ m diam.; prothallus usually present, conspicuous, black, to 2 mm broad; cortex not differentiated but cortical gel present, 20–30 μ m thick; medulla chalky, milk white, densely filled with calcium oxalate crystals 10–15 μ m diam. Ascomata unknown. Thallus C–, K± pale yellow, KC–, Pd+ yellow, UV± pale cream (psoromic, ± conpsoromic acids). **BLS 2439**.

Widespread under sheltered overhangs of acid coastal rock faces, often with *Roccellographa circumscripta* and *Dirina fallax*. Common on W. coasts of British Isles (N. to Westerness) & Channel Islands.

Very similar to *R. circumscripta* but ± entirely sorediate. The sorediate *Sparria endlicheri*, *D. fallax* and *Ingaderia vandenboomii* (syn. *Llimonea sorediata*) are all C+ red, Pd–.

Ingaderia vandenboomii Ertz (2023)

Llimonaea sorediata van den Boom, Brand & Elix (2007)

Thallus on siliceous rock, crustose, to 3.5 cm diam., usually delimited by a conspicuous dark brown to blackish prothallus, corticate but the cortex poorly developed with intertwined colourless hyphae, containing crystals (erythrin), areolate at the edge, rimose-polygonal in the centre; rimose-areoles angular, 0.1–0.5 mm diam., or elongate, sometimes somewhat radiating, thin, to 0.25 (–0.3) mm thick, smooth to slightly uneven, pale cream-white, white-pink when fresh; soralia white, punctiform, becoming confluent, forming a granular covering in the thallus centre, granules 25–35 μ m diam. Apothecia very rare (not seen in British material), immersed to semi-immersed, rounded-ellipsoidal, 0.8–1.2 \times 0.4–0.7 mm diam.; disc flat, dark brown to black, white-pruinose; thalline margin concolorous with the thallus, thin,

often flexuose and deformed, soon excluded, containing crystals; true exciple to 80 μ m thick, continuous with the hypothecium, dark brown to black, hyphal walls strongly gelatinized, the inner part pigmented brown-olive; epithecium brown to olive, K+ green intensifying, containing colourless crystals; hymenium colourless, 110–140 μ m high; hypothecium dark brown, to 25 μ m thick, continuous with the exciple; paraphysoids richly branched and anastomosing, 1.5–2.0 μ m diam., apical cells not widened or pigmented. Ascospores elongate-fusiform, rarely slightly curved, 35–50 × 4.5–5.5 (–6) μ m, 8- to 14-septate, with a gelatinous sheath *ca* 2 μ m thick, becoming brown with age. Pycnidia unknown. Thallus C+ red, K–, KC–, Pd– (erythrin, isoerythrin, traces of lecanoric and placodiolic acids and atranorin). **BLS 2466**.

On vertical or overhanging siliceous rocks on sea coasts, and N. walls of churches, associated with other

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commonly sterile crusts such as *Dirina* and *Roccellographa* spp.; also occasionally on bark of veteran *Quercus*. Possibly mistaken for the sorediate morph of *Dirina massiliensis* in the past. N.W. Scotland, S. England, Ireland (Connemara), Wales (widespread), Channel Islands, Isles of Scilly.

The change of epithet to *I. vandenboomii* was necessary due to the existence of *I. sorediata*, the basionym of which was published the previous year to *Llimonaea sorediata*; see Ertz & Tehler (2023) for more information.

ROCCELLOGRAPHACEAE Ertz & Tehler (2011)

Thallus crustose or subfruticose. **Photobiont** *Trentepohlia*. **Ascomata** apothecia, punctiform or lirellate. **Thalline margin** absent. **Exciple** brown above and pale below, or sometimes carbonized. **Hypothecium** colourless or pale brown. **Hamathecium** of paraphysoids, branched or anastomosed. **Asci** cylindrical to clavate. **Ascospores** colourless or rarely brown, fusiform or cylindrical, with a macrocephalic septation pattern, with distosepta or rarely muriform when mature, often with a gelatinous sheath.

The family occupies a sister clade to the Opegraphaceae, according to Ertz & Tehler (2011). There are only three genera, including *Fulvophyton* and *Roccellographa* (syn. *Peterjamesia*). *Ingaderia sorediata* (Sparrius, P. James & M.A. Allen) Ertz was formerly placed in both genera, but is now known to belong to the Opegraphaceae (Ertz & Tehler 2023).

Literature:

Ertz & Tehler (2011, 2023).

ROCCELLOGRAPHA J. Steiner (1902)

Thallus crustose, thin, uniform. **Prothallus** \pm well-developed, dark, mosaic-forming. **Photobiont** *Trentepohlia*, revealed when fresh by the orange colour when scratched. **Ascomata** apothecia, dotlike, immersed, often forming groups or lines. **Thalline margin** absent. **True exciple** narrow, brown above, pale below. **Hamathecium** of paraphysoids, thick, richly anastomosing. **Hypothecium** colourless. **Asci** 8-spored, fissitunicate; *Opegrapha*-type. **Ascospores** to 7-septate, elongate-fusiform or long and clavate, macrocephalic, ends rounded, dark grey to brown. **Conidiomata** unknown. **Chemistry**: psoromic and conpsoromic acids. **Ecology**: saxicolous.

Originally included in *Sclerophyton*, an otherwise totally corticolous, tropical genus with a brown hypothecium. *R. circumscripta*, the single British species, has been included in several genera including *Sclerophytonomyces* and *Peterjamesia* (Hawksworth 2006), but is now included in *Roccellographa* (Ertz & Tehler 2011), and a sorediate morph initially treated as a variety of this species is now accepted as *Ingaderia sorediata* (see above). *Enterographa* differs in having colourless ascospores and a hypothecium densely filled with calcium oxalate crystals.

Literature:

Ertz & Tehler (2011), Fletcher (2009), Hawksworth (2006), Sparrius (2004), Sparrius et al. (2005).

Roccellographa circumscripta (Leight.) Ertz & Tehler (2011)

Peterjamesia circumscripta (Taylor) D. Hawksw. (2006)

Thallus <5 cm diam., but often forming extensive angular mosaics composed of small thalli, 200-250 μ m thick, the surface continuous, tartareous, \pm finely scurfy, finely irregularly rimose-cracked, areoles 1-2 mm diam. with saw-tooth edges, white, glaucous or mottled grey, the surface with densely compacted calcium oxalate crystals, often surrounded by a conspicuous dark grey-black prothallus. Apothecia to 0.1 mm diam., dot-like, often very numerous, immersed, rounded or oval in surface view, sometimes contiguous, often in groups or dispersed in flexuose or radiating lines; disc flat, black, often densely white- or grey-pruinose. Ascospores 17-26 × 5-6 μ m, (4-)5-(7)-septate, \pm constricted at each septum when mature, dark grey to dark brown, the outer and cross-walls somewhat thickened. Thallus C–, K–, KC \pm pale yellow, Pd+ yellow-orange, UV– (psoromic, conpsoromic acids). **BLS 1319**.



In dry crevices and beneath sheltered overhangs of siliceous coastal rocks, intolerant of direct wetting by rain or sea spray; locally frequent. W. coasts of the Britain from S.W. England (Dorset) to Scotland (Westerness) and on the E. coast in Berwickshire and East Lothian (also an unconfirmed record from Shetland), Ireland.

Easily recognizable in the field as, with *Ingaderia sorediata*, the only species growing in dry, sheltered crevices or under overhangs with a thin white even mosaic-forming thallus which, when scratched, is orange- yellow due to the photobiont. When fertile the thallus becomes pale grey, due to the numerous tiny dot-like apothecia which become more apparent (black) when wet. It is the characteristic member of the *Sclerophytetum circumscriptae* community which includes *Sparria endlicheri*, *Cliostomum tenerum*, *Dirina fallax* and, in S. England and S. Wales, *Ingaderia vandenboomii*, *Lecanora praepostera* and *Roccella* spp. It superficially resembles an *Enterographa*, which has colourless ascospores. See also *Arthonia atlantica*.

ARTHONIALES, family unassigned

BACTROSPORA A. Massal. (1852)

Thallus crustose, immersed or superficial, thin, continuous, scurfy, uniform or rimose. **Prothallus** indistinct. **Cortex** absent. **Photobiont** *Trentepohlia*. **Ascomata** apothecia, mostly sessile, black or black-brown. **Thalline margin** absent. **Exciple** persistent, dark red-brown at the outer edge, paler within, pigment K+ blackish olive. **Epithecium** pale to dark red-brown. **Hymenium** colourless, I± blue. **Hypothecium** colourless. **Hamathecium** of sparingly, dichotomously branched, rarely anastomosed paraphysoids, the apices not swollen, but richly branched to form an epithecium. **Asci** initially 8-spored, narrowly clavate or ± cylindrical, fissitunicate, the apex with a narrow K/I± pale blue apical dome penetrated by a small ocular chamber that is sometimes surrounded by a small K/I+ dark blue ring-like zone. **Ascospores** ± acicular, colourless, multiseptate, often fragmenting into spherical, cuboid or shortly cylindrical part-spores. **Conidiomata** pycnidia; apical wall around the ostiole dark brown, K+ green-black, pale below. **Conidia** aseptate, bacilliform or narrowly ellipsoidal, with rounded ends. **Chemistry**: lichen products not detected by TLC. **Ecology**: mostly corticolous.

Differs from *Lecanactis* and *Cresponea* primarily in the multiseptate (at least 50 septa) spores which have a tendency to fragment into part-spores so that mature asci are multispored. The genus has been placed in the Roccellaceae by e.g. Sobreira *et al.* (2015), but the molecular data available are insufficient to confirm this placement.

LC

Egea & Torrente (1993), Sobreira et al. (2015), Wolseley et al. (2009).

1	Ascospores fragmenting into part-spores within the ascus	2
	Ascospores entire when mature, or fragmenting into multicellar fragments outside the ascus	
		omalotropa
2 (1)	Ascospore part-spores \pm rounded or cuboid, 2–3.5 µm long	corticola
. ,	Ascospore part-spores shortly cylindrical, 3–8 µm long	dryina

Bactrospora corticola (Nyl.) Almq. (1869)

Thallus immersed or superficial, grey-white, scurfy, diffuse or weakly rimose, not sorediate. Apothecia 0.2-0.5 (-0.6) mm diam., round, brown-black, deep red-brown when wet, at first flat, becoming \pm convex, not pruinose; exciple pale within, dark redbrown, particularly towards the outer edge; epithecium dark brown, of congealed granules, K+ blackish olive, not dissolving (including the exciple); hymenium 70-100 μ m tall, I+ reddish; hypothecium I \pm pale blue. Asci 60–90 × 9–11 μ m. Ascospores $50-100 \times (1.5-) 2$ (-2.5) µm, at first indistinctly long and very narrow, faintly spiralled, soon fragmenting into numerous rounded or cuboid individual segments 2- $3.5 \times (1.5-) 2 (-2.5) \mu m$. Pycnidia 0.1–0.2 (-0.3) mm diam, frequent, although few in thalli with abundant apothecia, brown-black, ostiole often gaping and torn; conidia $3.5-4 \times 1-1.5 \,\mu$ m, aseptate, bacilliform or narrowly ellipsoidal, straight or slightly curved. BLS 0172.

In deep fissures on the sides of old Quercus trunks, more rarely of Alnus and Betula, in rather sheltered situations in ancient parklands and old-growth woodlands; rather rare and scattered. Throughout much of Britain and Ireland, most frequent in less oceanic areas and absent from areas impacted by past acidifying pollution.

Occasionally found as a sterile crust with pycnidia which are C-, cf. Inoderma subabietinum and Opegrapha vermicellifera.

Bactrospora dryina (Ach.) A. Massal. (1852)

Like B. corticola, but apothecia more irregular and slightly larger, 0.2–0.7 mm diam., flat with a shallow margin but soon becoming convex and immarginate, not pruinose; hymenium 75–110 μ m tall, I+ blue; hypothecium I+ reddish or blue. Asci 70–100 × 10-13 µm. Ascospores filiform, but soon breaking down within the ascus into cylindrical part-spores $3-8 \times 2-3 \,\mu\text{m}$ in size. Pycnidia *ca* 0.14 mm diam.; conidia 3- $5 \times 1-1.5 \,\mu m$, straight. **BLS 0173**.

On bark of Quercus trunks. Known only from three sites in W. Scotland (Knapdale in Kintyre and Loch Sunart in Westerness).

Bactrospora homalotropa (Nyl.) Egea & Torrente (1989)

Thallus thin, smooth, greyish-white. Apothecia 0.2-0.6 mm diam., round, black, roughened, not pruinose, at first immersed, later sessile and raised 0.1-0.2 mm above the thallus, with a thick, often ragged margin and concave to flat disc; exciple dark red-brown; hymenium 140-160 µm tall, I+ reddish; hypothecium I+ reddish. Asci $125-160 \times 15-17 \mu m$, with 8 parallel ascospores. Ascospores to ca 50-septate, cylindric-acicular, blunt-ended, (80-) 110-140 × 3-5 µm. Pycnidia unknown. BLS 0599.

Mainly on Corylus, Quercus, Salix, Sorbus and Ulmus, in humid, sheltered oceanic woodlands, often with Crutarndina petractoides, etc., in a hyperoceanic Graphidion community; locally frequent. W. Scotland (Argyll to W. Ross), W. Ireland.

The ragged margin of the apothecia, and *Trentepohlia* in the thallus (scratching orange), usually serve to distinguish it from other Graphidion species with similar appearance (e.g. Buellia disciformis and Lecidella elaeochroma). Microscopically, easily identified by the entire, multiseptate, acicular-cylindrical ascospores.









BRYOSTIGMA Poelt & Döbbeler (1979)

The genus contains around fifteen species, some of which are lichenicolous (Etayo *et al.* 2023) and not all have been formally transferred from *Arthonia* s.l. When lichenized, the chlorococcoid rather than trentepohlioid photomorph is distinctive within the Arthoniales.

Frisch *et al.* (2014) recognized a *Bryostigma* clade as a sister group to the Arthoniaceae. Frisch *et al.* (2014, 2015) and Fleischhacker *et al.* (2016) published phylogenetic trees that suggest that *Bryostigma* might need to be expanded to include *Arthonia apatetica*, *A. molendoi* and *A. parietinaria*, as well as several other lichenicolous species. More detailed studies are needed. The lichenized taxa from this clade in their studies include *A. apatetica*, *A. lapidicola* and (probably) *A. patellulata*; all have chlorococcoid photobionts. In addition, Frisch *et al.* (2014) found 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 hyaline, 2-celled spores with an enlarged upper cell, and a dark brown epithecium formed of the tips of the paraphysoids.

Literature:

Coppins & Aptroot (2009), Etayo et al. (2023), Fleischhacker et al. (2016), Frisch et al. (2014, 2015).

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

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

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

Arthonia muscigena Th. Fr. (1865)

Thallus effuse, usually forming small patches (<5 mm diam.) among other crusts, dull olive-grey, olive- or grey-brown, thin, minutely scurfy-granular; granules when discrete *ca* 20–50 μ m diam.; photobiont 6–14 (–17) μ m diam.; cells chlorococcoid. Apothecia 0.05–0.25 (–0.3) mm diam., convex, black, not pruinose; in section 60–100 μ m tall; epithecium 5–7 μ m tall, pale green or red-brown, K+ pale green, composed of 2-3 rows of periclinally arranged, dark-walled hyphae (paraphysoid apices) *ca* 1.5–2 μ m diam.; hymenium 25–30 μ m tall, colourless or pale green; hypothecium 30–70 μ m tall, reddish brown, K+ dull olive-brown; paraphysoids 0.5–1 μ m diam., very scanty. Ascospores 8–12 (–14) × 2.5–4 μ m, 1-septate, ovoid, the upper cell broader and shorter than the lower but often with a slightly pointed apex.



Pycnidia occasional, *ca* 40 μ m diam., the wall pale brown, K+ olive; conidia bacilliform, 3–4 × *ca* 0.5 μ m. Lichen products not detected by TLC. **BLS 1700**.

On twigs, especially of *Sambucus*, or tree trunks (e.g. *Acer*, *Ulmus*), sometimes over bryophytes or other lichens (e.g. *Lobaria pulmonaria*), less often on *Abies* needles, fence posts and shaded, \pm siliceous rocks; apparently common but overlooked and tolerant of suburban conditions. Scattered throughout Britain and Ireland.

Morphs on rock need to be carefully distinguished from *Arthonia.fusca*. Often confused with *A. apatetica* (q.v.) in the past.

FELIPES Frisch & G. Thor (2014)

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

According to Frisch et al. (2014), *Felipes* is easily distinguished from *Arthonia* and other genera of Arthoniales by its loosely organized thallus with large, thick-walled photobiont cells which are loosely surrounded by mycobiont hyphae, the characteristic ascomata with a thin and sometimes indistinct margin of byssoid hyphae. The genus occupies a sister clade to the Chrysotrichaceae.

LC NS

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

Felipes leucopellaeus (Ach.) Frisch & G. Thor (2014)

Arthonia leucopellaea (Ach.) Almq. (1880)

Thallus mostly effuse, sometimes thinly scurfy, arachnoid or minutely granularleprose, white to pale fawn but often with a pink tinge when fresh; thallus hyphae K/I–, loosely woven around distinct filaments of *Trentepohlia*. Apothecia adnate and loosely attached, irregularly rounded to bluntly stellate or lobate, dark brown to black but usually thinly white-pruinose and with a white, arachnoid margin, the centre appressed but the margin often ascending, in section 70–90 µm tall; exciple dark brown, of densely intertwined hyphae; epithecium brown, K+ yellow-pale green tinge; hymenium 25–36 µm tall, colourless or pale brown; hypothecium 35–70 µm tall, dark brown, K+ yellow-pale green tinge; paraphysoids 1–1.5 µm diam., scanty, brown-walled and to 2.5 µm diam. in the epithecium. Ascentaria-type, 40–50 × 2.5



13–17 μ m, 8-spored, tholus structures not observed. Ascospores 10–15 (–17) × 3.5–5 μ m, (1-) 3- or 4-septate, cylindric-ovoid, the upper cell not enlarged, colourless but old ascospores brown and warted. Pycnidia not found. Thallus C–, K± faint pale yellow, KC–, PD ± orange, UV– (two unidentified substances). **BLS 0065**.

On acid bark of older trees (especially *Betula, Ilex, Quercus, Pinus*), also on old *Calluna* stems; locally frequent in ancient birch, pine and oak woodlands. S. & S.W. England (Hampshire, New Forest), Wales, Scotland (Highlands), S.W. Ireland.

Frisch *et al.* (2014) note that the species is initially parasitic on other lichens (*Loxospora elatina* in Sweden) which has also been observed rarely in the New Forest, and that older ascomata of *F. leucopellaeus* die off in the central parts while expanding marginally, thus forming the typical marginal lobes. *Chaenothecopsis vainioana* is occasionally associated with this species.

MIXTOCONIDIUM Etayo (1995)

Conidiomata pycnidia, scattered or in small clusters, sometimes associated with galls, erumpent, subglobose, dark brown to black. **Conidiomatal wall** composed of angular cells with brown verrucose walls, sometimes with a gelatinous outer layer. **Conidiophores** absent. **Conidiogenous cells** cylindrical to cylindric-clavate, with annellidic proliferation. **Conidia** dimorphic; macroconidia cylindrical to allantoid-clavate, colourless, 1-septate, not constricted at the septum; microconidia smaller, bacilliform, aseptate.

Ascomata apothecia, convex, black, the disc with orange pruina. **Exciple** thin-walled laterally but thicker at the base, not carbonized below, composed of intertwined hyphae interspersed with brown granules, K+ purple. **Epithecium** brown with many orange crystals, K+ purple. **Hypothecium** dark. **Hymenium** KI+ blue. **Hamathecium** composed of branched and anastomosed pseudoparaphyses. **Asci** 8-spored. **Ascospores** ellipsoidal, 3-septate, one central cell swollen, with a narrow gelatinous sheath.

The genus was originally characterized largely by its dimorphic conidia, which can be found mixed within the same conidioma (Etayo 1995). A description of the sexual morph was published the following year (Etayo 1996), and further information was added by van den Boom & Etayo (2017). Two species are known, *M. insidens* on *Ramalina* species from Europe and the North American *M. nashii* on the related host genus *Niebla*. No molecular data are available, but an uncertain placement within the Arthoniales was proposed by Diederich *et al.* (2018).

Nb

Diederich et al. (2018), Etayo (1995, 1996), van den Boom & Etayo (2017).

Mixtoconidium insidens (Vouaux) Etayo & van den Boom (2017)

Conidiomata pycnidia, 100–300 µm diam., \pm spherical, immersed in galls (200–500 µm diam.) of the host, similar in appearance to apothecia with a black "disk" and a conspicuous paler surround composed of degraded host tissue; the galls each contain one well-developed conidioma and sometimes a few small less-developed conidiomata. Conidiomatal wall dark brown, composed of intertwined hyphae, the cells dark brown with a distinctively verrucose outer layer. Conidiophores not present, or reduced to short undifferentiated cells. Conidiogenous cells and conidia of two types, mixed within the same conidioma. Macroconidiogenous cells often dominating, 8–11 (-13.5) × 2.5–3 (-3.5) µm at the base, \pm cylindrical or slightly tapering, percurrently proliferating with several to numerous very conspicuous annellations and persistent collarettes. Macroconidia 12–14.5 × (4–) 4.5–5 µm, rather variable in shape, cylindrical to cylindric-ellipsoidal or rarely cylindric-ovoid, sometimes slightly curved, colourless, (0-) 1-septate, the septum \pm median and hardly to moderately constricted, the apex obtuse to rounded and the base rounded to truncate, thin-walled, smooth, without a gelatinous sheath. Microconidiogenous cells 9–12 × 1.5–2 µm, similar to the macroconidiogenous cells but narrower and more tapering, with less conspicuous annellations. Microconidia 5–6.5 × 1.5–2 µm, cylindrical, aseptate, colourless, smooth- and thin-walled.

Ascomata 250–550 μ m diam., first flat, soon convex, in groups of two to six emerging from the same point and forming roundish compound structures to 1.5 mm diam., dark brown, covered by orange pruina, K+ purple. Exciple orange-brown, K+ olivaceous brown, 20–30 μ m thick laterally and to 60 μ m thick in the base, composed of hyphae covered by small brown granules. Epithecium brown with many orange crystals, K+ purple. Hypothecium brownish. Hymenium 60–90 μ m thick, yellowish, I+ red, KI+ blue, with strongly branched and anastomosed paraphyses. Asci 55–67 × 12–19 μ m, clavate, not blueing in iodine, 8-spored. Ascospores 16–21 × 6–8 μ m, at first hyaline, soon brownish, 3-septate, the second cell larger, containing small guttules, with a sheath 0.5–1 μ m thick. **BLS 2749**.

In thalli of Ramalina lacera, S.W. Ireland (Limerick).

Known only from a single collection in our region that did not contain ascomata; the description of apothecia is adapted from van den Boom & Etayo (2017). Most lichenicolous fungi are under-recorded, but this is quite a conspicuous species and could well be rare.

PERIGRAPHA Hafellner (1996)

Thallus absent (lichenicolous), sometimes gall-forming. **Stromata** superficial, scattered or in small clusters, convex, round to elongate, dark brown to black, the surface often roughened but not lirellate, reddish to dark brown, multiloculate, the locules \pm globose to vertically oriented and without a distinct wall. **Hymenium** colourless to pale orange or brown above, without a distinct epithecium, hymenial gel K/I+ blue. **Hamathecium** of branched and occasionally anastomosed paraphyses, not or little enlarged at the apex. **Asci** *Opegrapha*-type, narrowly clavate to subcylindrical, endoascus somewhat thickened above, wall I–, K/I– except for a faint apical K/I+ blue ring, 4- to 8-spored. **Ascospores** fusiform with rather acute apices, mostly 3-septate, sometimes with a basal appendage, colourless, sometimes becoming yellowish and slightly ornamented following degradation of a gelatinous sheath. **Conidiomata** known for one species, formed as locules in the stromata. **Conidiogenous cells** ampulliform. **Conidia** bacillar, colourless, aseptate.

The genus is characterized mostly by the multiloculate, often pruinose stromata with punctiform openings that may be elongate but not lirellate, *Opegrapha*-like asci and elongated multiseptate ascospores with a gelatinous sheath. Currently five species are known, all appearing to be host-specific (Zhurbenko & Ohmura 2017). Only one is known from our region. No molecular data are available so the genus cannot be assigned to a family within the Arthoniales, but there are some morphological similarities with *Plectocarpon* (Lecanographaceae).

NE

Ertz et al. (2005), Hafellner (1996), Pérez-Vargas et al. (2013), Zhurbenko et al. (2017).

Perigrapha superveniens Hafellner (1996)

Thallus absent (lichenicolous), forming galls. Stromata in small clusters, black, with around 5–10 locules 200–300 μ m diam. with slightly depressed punctiform openings, surrounded by a collar of host tissue and appearing like lecanorine apothecia, the stromatic tissue reduced to a common clypeus-like layer composed of dark brown intertwined hyphae and granular above. Hamathecium of branched and anastomosed paraphyses, not thickened and pigmented only at the apex in the ostiolar region. Asci *Opegrapha*-type, clavate to cylindrical, 80–100 × 12–15 μ m, 4-, 6- or 8-spored. Ascospores 30–35 × 4.5–6 μ m, narrowly fusiform, 3-septate, surrounded by a thin perispore that degenerates into a pale fine-grained ornamentation, attentuated at the base into a tail-like extension to 50 μ m in length and *ca* 1 μ m diam. Conidiomata not known. **BLS 2021**.

On thalli of Parmelia sulcata, Scotland (Raasay, W. Ross, W. Sutherland), S.W. Ireland.

This is the type species of the genus. It is characterized by melanized stromatic tissue restricted to a clypeuslike layer and ascospores that were reported to have elongate, mostly basal appendages. It is possible that these are hyphae resulting from germination within the ascus; it would be useful to study further material.

PHACOTHECIUM Trevis. (1856)

The genus is monotypic, so the description below constitutes that of the genus. *P. varium* is a lichenicolous taxon, treated as a species of *Opegrapha* in the second edition of this publication. The two genera may be distinguished by the closely clustered apothecia in *Phacothecium* (dispersed in *Opegrapha*) and the hemiamyloid ring that is absent in asci of *Phacothecium* but present in *Opegrapha*.

Literature

Atienza (1992), Hafellner (2009).

Phacothecium varium (Tul.) Trevis. (1856)

Opegrapha physciaria (Nyl.) D. Hawksw. & Coppins (1992)

Ascomata black, 0.2–0.3 mm diam., 0.15–0.21 mm tall; \pm round when young and still closed, becoming lobed to divided with age, resulting in dense clusters of 1–5 discs divided by sharp excipular margins; exciple narrow, 20–30 µm thick, extending under the hymenium, dark brown, K+ brown-red throughout; epithecium brownish, K–; hymenium colourless, 70–80 µm high, K–; hymenial gel I+ blue then red, K/I+ blue; hypothecium colourless to pale brownish, 30–50 µm thick; asci broadly subcylindrical to subclavate, tapering towards the base and distinctly stipitate, (4- to 6-) 8-spored, 45–60 × 16–20 µm, ocular chamber reduced, wall I-, K/I-, hemiamyloid apical ring structure lacking; ascospores colourless, 3-septate, cylindrical or slightly tapering



towards the lower end, (12–) $14-16 \times 5-7 \mu m$, with a thin but distinct gelatinous sheath which degenerates to form a pale brown vertuculose ornamentation with age. Pycnidia frequently present, conidia rod-shaped, (4–) 6– $7.5 \times 0.7-1 \mu m$. **BLS 1953**.

On the thallus of *Xanthoria parietina*; occasional but probably overlooked. Scattered records throughout Britain, with a few records from Ireland.

NE



- Atienza, V. (1992). Peridothelia oleae (Körber) D. Hawksw. and Opegrapha physciaria (Nyl.) D. Hawksw. & Coppins, two poorly known west mediterranean fungal taxa. Anales del Jardín Botánico de Madrid 50: 159–162.
- 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. & Wolseley, P.A. eds): 153–171. London: British Lichen Society.
- Diederich, P., Lawrey, J.D. & Ertz, D. (2018). The 2018 classification and checklist of lichenicolous fungi, with 2000 nonlichenized, obligately lichenicolous taxa. *Bryologist* 121: 340–425.
- Egea, J.M. & Torrente, P. (1993). The lichen genus Bactrospora. Lichenologist 25: 211-255.
- Ertz, D. & Tehler, A. (2011). The phylogeny of Arthoniales (Pezizomycotina) inferred from nucLSU and RPB2 sequences. *Fungal Diversity* 49: 47–71.
- Ertz, D. & Tehler, A. (2023). New species of Arthoniales from Cape Verde with an enlarged concept of the genus *Ingaderia*. *Lichenologist* 55: 1–15.
- Ertz, D., Christnach, C., Wedin, M. & Diederich, P. (2005). A world monograph of the genus *Plectocarpon* (Roccellaceae, Arthoniales). *Bibliotheca Lichenologica* 91: 155 pp.
- Etayo, J. (1995). *Mixtoconidium canariense*, a new genus and species of lichenicolous coelomycetes with dimorphic conidia. *Mycotaxon* **53**: 425–432.
- **Etayo, J.** (1996). Contribución al conocimiento de los líquenes y hongos liquenícolas de Mallorca (Islas Baleares, España). *Bulletin de la Société linnéenne de Provence* **47**: 111–121.
- Etayo, J., Sancho, L.G. & Pino-Bodas, R. (2023). Taxonomic and phylogenetic approach to some Antarctic lichenicolous fungi. *Mycological Progress* 22: 9.
- 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.
- Fletcher, A. (2009). Peterjamesia. In Lichens of Great Britain and Ireland (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 688–689. London: British Lichen Society.
- Fletcher, A. & Purvis, O.W. (2009). Chrysothrix. In Lichens of Great Britain and Ireland (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 307–309. London: British Lichen Society.
- Frisch, A., Thor, G., Ertz, D. & Grube, M. (2014). The Arthonialean challenge: restructuring Arthoniaceae. *Taxon* 63: 727–744.
- 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., Moon, K.H. & Ohmura, Y. (2018). Galbinothrix, a new monotypic genus of Chrysotrichaceae (Arthoniomycetes) lacking pulvinic acid derivatives. *Plant and Fungal Systematics* 63: 31– 37.
- Hafellner, J. (1996). Studien an lichenicolen Pilzen und Flechten VIII. *Perigrapha*, eine neue Ascomycetengattung für "*Melanotheca*" superveniens Nyl. (Arthoniales). *Nova Hedwigia* 63: 173–181.
- Hafellner, J. (2009). *Phacothecium* resurrected and the new genus *Phacographa* (Arthoniales) proposed. *Bibliotheca Lichenologica* **100**: 85–121.
- Harris, R.C. & Ladd, D. (2008). The lichen genus *Chrysothrix* in the Ozark Ecoregion, including a preliminary treatment for eastern and central North America. *Opuscula Philolichenum* **5**: 29–42.
- Hawksworth, D.L. (2006). Misunderstanding the status of Ciferri & Tomaselli's generic names necessitates *Peterjamesia* gen. nov. for *Sclerophyton circumscriptum* and an additional species. *Lichenologist* 38: 187–190.
- Hodkinson, B.P. & Lendemer, J. (2013). Next-generation sequencing reveals sterile crustose lichen phylogeny. *Mycosphere* 4: 1028–1039.
- Laundon, J.R. (1981). The species of Chrysothrix. Lichenologist 13: 101–121.
- **Olszewska, S., Zwolicki, A. & Kukwa, M.** (2014). Chemistry and morphology of *Chrysothrix candelaris* in Poland, with notes on the taxonomy of *C. xanthina. Mycotaxon* **128**: 165–172.
- Pérez-Vargas, I., Etayo, J. & Hernández-Padrón, C. (2013). New species of lichenicolous fungi from the Canary Islands. *Phytotaxa* 99: 58–64.
- Sobreira, P.N. Bezerra, Aptroot, A. & Cáceres, M.E. da Silva (2015). A world key to species of the genus *Bactrospora* (Roccellaceae) with a new species from Brazil. *Lichenologist* 47: 131–136.

Sparrius, L.B. (2004). A monograph of Enterographa and Sclerophyton. Bibliotheca lich. 89: 1-141.

- Sparrius, L.B., James, P.W. & Allen, M.A. (2005). The sorediate variety of Sclerophytonomyces circumscriptus. Lichenologist 37: 285–289.
- **Tehler, A.** (2017). Three new combinations in the genus *Fulvophyton* (Roccellographaceae, Arthoniales). *Lichenologist* **49**: 171–173.
- Tønsberg, T. (1992). The sorediate and isidiate, corticolous, crustose lichens in Norway. *Sommerfeltia* 14: 1–331.
- Tønsberg, T. (1994). *Chrysothrix flavovirens* sp. nov. the sorediate counterpart of *C. chrysophthalma*. *Graphis Scripta* **6**: 31–33.
- Van den Boom, P.P.G. & Etayo, J. (2017). Further interesting lichens and lichenicolous fungi from Fuerteventura, Canary Islands (Spain), with three new species and notes on *Mixtoconidium. Ascomycete.org* 9 (4): 124–134.
- Wolseley, P.A., James, P.W. & Purvis, O.W. (2009). *Bactrospora*. In *Lichens of Great Britain and Ireland* (Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. eds): 207–208. London: British Lichen Society.
- Zhurbenko, M.P. & Ohmura, Y. (2018). *Perigrapha cetrariae*, a new lichenicolous ascomycete on *Cetraria* from Japan. *Folia Cryptogamica Estonica* **55**: 17–19.

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