

Revisions of British and Irish Lichens



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Caliciales: Caliciaceae

Cover image: *Calicium notarisii*, on a wooden bench, Royal Botanic Gardens, Kew, Surrey.

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.

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to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published.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

including the genera *Acolium*, *Amandinea*, *Buellia*, *Calicium*, *Diploicia*, *Diplotomma*, *Endohyalina*, *Monerolechia*, *Orcularia*, *Pseudothelomma*, *Rinodina* and *Tetramelas*

by

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CALICIACEAE Chevall. (1826)

Thallus crustose, sometimes reduced or immersed; verrucose, rimose-areolate or granular. **Photobiont** chlorococcoid. **Ascomata** apothecial, sometimes mazaedial, immersed, sessile or long-stalked, with a flat to lens-shaped or \pm spherical disc. **Thalline margin** absent or much reduced, **true exciple** usually well-developed, the **stalk** where present often melanized. **Hamathecium** of paraphyses, often branched above with the apices swollen and pigmented; absent in mazaedial species. **Asci** cylindrical to broadly clavate, formed from croziers, either thick-walled (*Bacidia*-type or *Lecanora*-type) or thin-walled, without apical structures, evanescent and releasing spores passively. **Ascospores** 1- (to 3-) septate, rarely submuriform, dark brown, usually thick-walled, smooth or ornamented and sometimes with ornamentation formed from rupturing of the outer wall layers, sometimes with a gelatinous coat. **Conidiomata** pycnidial, sessile or partially immersed, dark-walled at least in the upper part. **Conidiogenous cells** formed on short branched conidiophores, \pm cylindrical, proliferating percurrently. **Conidia** ellipsoidal to cylindrical, hyaline, aseptate.

For many years, it was assumed that the mazaedial developmental form, seen in *Calicium* and similar genera, represented a fundamental division between those lichens and those with thick-walled, actively discharging asci. Various phylogenetic studies have challenged this assumption (Prieto *et al.* 2012, Prieto & Wedin 2016) and it is now clear that the mazaedial form has evolved on a number of occasions in the Ascomycota, and twice within the Caliciaceae. That family therefore includes both mazaedial and non-mazaedial genera.

Molecular data have also demonstrated that stalked, immersed and sessile mazaedial forms are not monophyletic units. That has led to the abandonment of *Cyphelium* as an accepted genus, with species placed in that group by Giavarini & Purvis (2009a, b) being divided between *Calicium* and the newly resurrected genus *Acolium* by Prieto & Wedin (2016). The genus *Pseudothelomma* was also described to accommodate some diverging *Thelomma* species.

The varied morphology shown by members of the Caliciaceae makes it difficult to identify diagnostic characters, and to identify features that distinguish it from the Physciaceae. Rambold *et al.* (1994) found that non-mazaedial members of the Caliciaceae (referred to by them as the *Buellia* lineage) had asci of the *Bacidia*-type, while those of the Physciaceae sensu stricto had *Lecanora*-type asci. However, the distinction does not appear to be absolute, and the interpretation of ascus types has varied with the author; for example Coppins *et al.* (2009) and Scheidegger (2009) described the asci of *Buellia* and *Amandinea* respectively as *Lecanora*-type. In addition, segregates from *Rinodina* (Physciaceae) such as *Endohyalina* and *Orcularia* have been transferred to the Caliciaceae (Lücking *et al.* 2016), though molecular data for these moves are lacking.

Literature

Coppins *et al.* (2009), Gaya *et al.* (2012), Elix (2018a), Giavarini & Purvis (2009), Lücking *et al.* (2016), Marbach (2000), Prieto *et al.* (2012), Prieto & Wedin (2016), Rambold *et al.* (1994), Scheidegger (2009), van den Boom *et al.* (2021), Wedin *et al.* (2000, 2002).

1	Apothecia mazaedial	2
	Apothecia not mazaedial	5
2(1)	Apothecia stalked	<i>Calicium</i>
	Apothecia \pm sessile or partially immersed in the thallus (a few species lichenicolous).....	3
3(2)	Thallus verrucose, greyish; true exciple thin and colourless throughout.....	<i>Pseudothelomma</i>
	Thallus various, true exciple pigmented, at least in part	4

- 4(3) Ascospores smooth-walled; apothecia immersed with a dark and narrow rim-like true exciple *Calicium* ("Cyphelium" *tigillare* group; Prieto & Wedin 2016)
Ascospores ornamented, with ridges or surface cracks; apothecia immersed or sessile with a distinct dark exciple which is thick, at least at the base *Acolium*
- 5(1) Ascospores 1-septate 6
Ascospores 2- to 8-septate or muriform (if sorediate see *Buellia griseovirens*) *Diplotomma*
- 6(5) Thallus placodioid, with distinct lobes closely contiguous for most of their length *Diploicia*
Thallus crustose (to squamulose), rimose-areolate or granular 7
- 7(6) Thalline margin absent or inconspicuous; hypothecium usually strongly pigmented; asci *Bacidia*-type; ascospores septate with thin walls, at least near the apices 8
Thalline margin present; hypothecium \pm colourless; asci *Lecanora*-type; ascospores polarilocular or septate with thickened walls *Rinodina*
- 8(7) Ascospores with thin walls in the apical region, strongly thickened around the septum (*Orcularia*-type; Fig. 1F) *Orcularia*
Ascospores varied, either with thickened apices or \pm uniformly thickened 9
- 9(8) Apothecia small, \pm immersed within the thallus or host lichen tissue with a poorly developed true exciple; ascospore walls with both thickened apices and septal region (*Dirinaria*-type; Fig. 1D) *Endohyalina*
Apothecia mostly large, sessile, with a well-developed true exciple; ascospores varied 10
- 10(9) Thallus bullate to squamulose; initially lichenicolous but developing an independent thallus; ascus *Dimelaena*-type, the apex with a wide central I- cone *Monerolechia*
Thallus crustose, rimose-areolate; ascus *Bacidia*-type, with a narrow central I- cone 11
- 11(10) Conidia filiform, to ca 30 μm long *Amandinea*
Conidia bacilliform to ellipsoidal, <10 μm long 12
- 12(11) Corticolous or saxicolous (a few species initially parasitic on saxicolous lichens) *Buellia*
Overgrowing mosses, or lichenicolous (rare, montane) *Tetramelas*

ACOLIUM (Ach.) Gray (1821)

Thallus crustose, verrucose to rimose-areolate, thick or thin, superficial or \pm immersed, grey to brownish; absent in lichenicolous species. **Cortex** formed by interwoven hyphae. **Photobiont** trebouxiod. **Ascomata** apothecia, black, sessile or \pm immersed. **True exciple** thick throughout, strongly thickened at the base, blackish brown, sometimes white- or grey-pruinose. **Hamathecium** inconspicuous, of unbranched paraphyses. **Asci** formed singly from ascogenous hyphae with croziers, cylindrical, with a single functional wall layer, disintegrating at an early stage, the spores being released into a dry black powdery mass (mazaedium). **Ascospores** 1-septate, broadly cylindrical to ellipsoidal, with a slight or pronounced constriction at the septum; wall thick, dark brown, with a distinctive ornamentation of irregular cracks, verrucae or parallel ridges. **Conidiomata** pycnidia, spherical or slightly compressed, 50–200 μm diam., initially semi-immersed in the thallus. **Conidiophores** branched. **Conidia** aseptate, hyaline, of two kinds: cylindrical, tapering towards one end, 3-4 \times ca 1 μm and ellipsoidal, 3-4 \times ca 1.5 μm , often occurring together. **Chemistry**: pulvinic acid derivatives (yellow pigments), together with unidentified compounds. **Ecology**: on bark and wood, rarely on rocks, or lichenicolous.

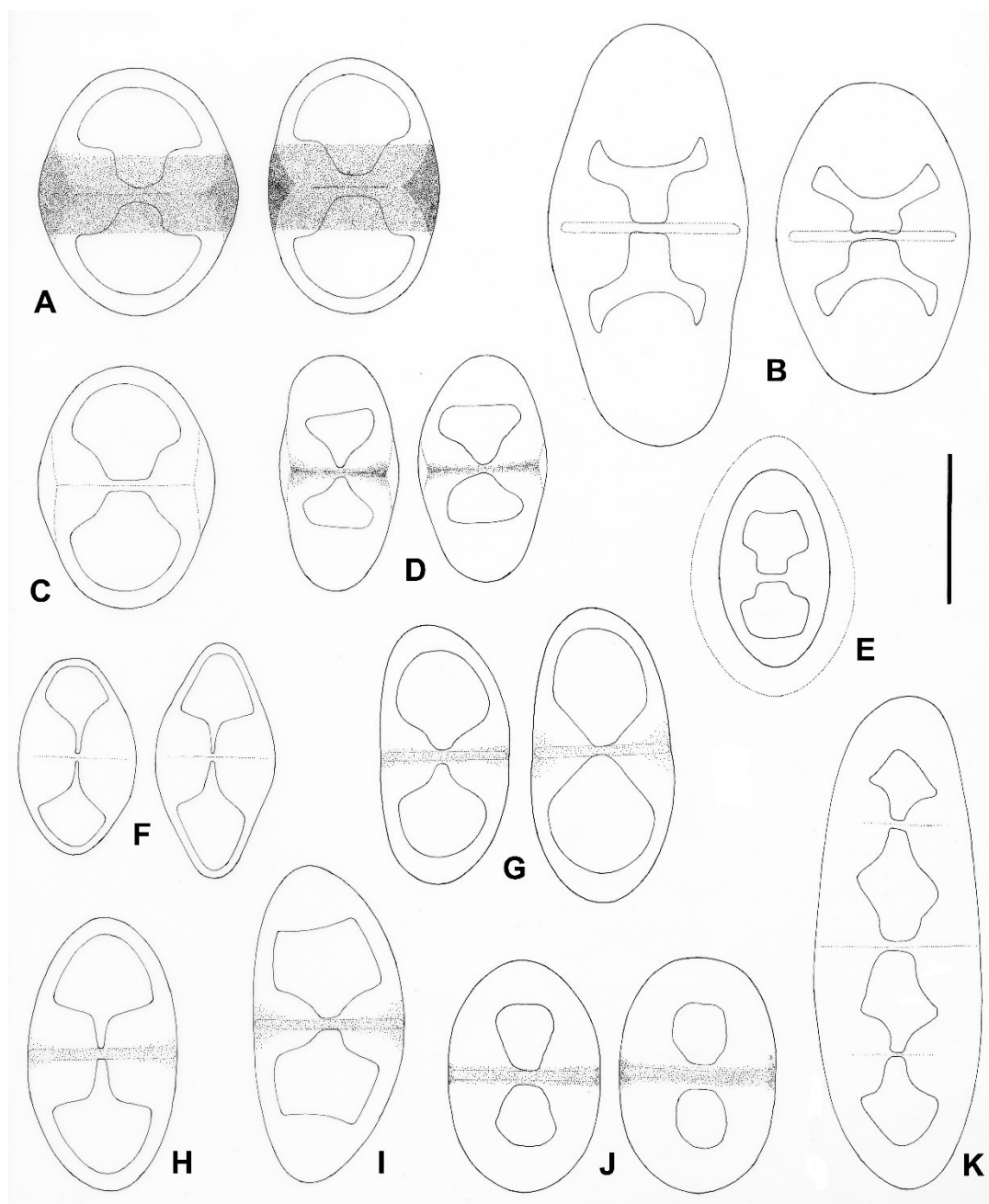


Fig. 1. Ascospores of selected members of the Caliciaceae and Physciaceae; mounted in 10% K. **A.** *Rinodina bischoffii* (*Bischoffii*-type). **B.** *Mischoblastia oxydata* (*Mischoblastia*-type). **C.** *Rinodina dubyana* (*Dubyana*-type; not a British species). **D.** *Rinodina oleae* (*Dirinaria*-type). **E.** *Rinodina pityrea* (*Tunicata*-type). **F.** *Orcularia insperata* (*Orcularia*-type). **G.** *Rinodina sophodes* (*Milvina*-type). **H.** *Rinodina sicula* (*Physconia*-type). **I.** *Rinodina luridescens* (*Physcia*-type). **J.** *Rinodina atrocinerea* (*Pachysporaria*-type). **K.** *Rinodina conradii* (*Conradii*-type). Scale bar = 10 μ m.

Acolium as treated by Prieto & Wedin (2016) contains species with a distinct grey-brown thallus (or are lichenicolous and do not form an independent thallus), with sessile to somewhat immersed ascomata, a dark exciple that is strongly thickened at the base and often a grey pruina on the rim of the exciple. *Cyphelium* as treated by Giavarini & Purvis (2009) contained the species now assigned to *Acolium*, and several species with smooth ascospores that are now included in a more broadly circumscribed *Calicium*. *Acolium* species are additionally keyed out in the account of *Calicium* below.

The ascomata (not yet found in the British Isles) of *Pseudothelomma ocellatum* differ from those of *Acolium* in having a thin, pale lateral exciple.

Literature

Giavarini & Purvis (2009b), Prieto & Wedin (2016), Tibell (1971).

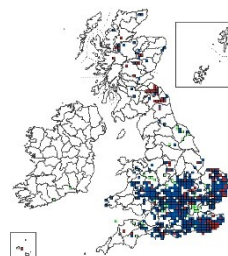
- 1 Lichenicolous on *Pertusaria* or *Lepra* spp.; thallus absent 2
 Not lichenicolous, with a pale to dark grey thallus *inquinans*
- 2(1) Apothecia sessile; ascospores at first coarsely spirally striate, later with irregular ridges and cracks; usually on *Pertusaria coccodes* on bark, rarely on *Lepra* spp. *sessile*
 Apothecia immersed; ascospores irregularly verrucose with a few shallow fissures; on *Pertusaria pseudocorallina* on rock *marcianum*

Acolium inquinans (Sm.) A. Massal. (1853)

LC

Cyphelium inquinans (Sm.) Trevis. (1862)

Thallus verrucose to cracked-areolate, pale to dark grey, usually rather thick, sometimes almost immersed. Apothecia 0.4–1.6 (–2.5) mm diam., black, sessile; true exciple thick, strongly thickened at the base, frequently with faint white or grey pruina. Asci cylindrical; ascospores 14–19 (–21) × 8–11 μm, uniseriately arranged, broadly ellipsoidal, dark brown, with a finely striate surface and a few irregular cracks when mature. Pycnidia 80–140 × 55–70 μm; conidia ± cylindrical, colourless, 3–4 × ca 1 μm, tapering at one end. Thallus C–, K+ yellow to reddish brown, Pd± pale yellow (placodiolic acid and sometimes an unidentified yellow pigment, by TLC), UV–. **BLS 0474.**



Frequent on wood and acid bark (*Pinus*, *Quercus*, *Larix*, *Betula*), particularly old fence posts, gates and rails; also very rarely on dry siliceous rocks below overhangs. S.E., C. and N.E. England, Wales, E. & C. Scotland. Characteristic of and largely confined to old growth native pinewoods in the Highlands but spread widely in the 20th century in southern England in response to sulphur dioxide pollution, it is now apparently in retreat in the south, especially in the west.

Characterized by the usually well-developed pale grey thallus, the abundant sessile apothecia with the true exciple strongly thickened at the base and the medium-sized ascospores with a minute ornamentation of parallel ridges. When on bark, distinguished from the lichenicolous *A. sessile* by its larger apothecia and larger ascospores. Lignicolous forms with ± immersed thalli may resemble short-stalked morphs of *Calicium victorianum*, which has smaller apothecia and ascospores. In the field *A. inquinans* may be confused with black-fruited species of *Lecidea*, *Lecidella* or *Mycoblastus sanguinarius*, but can readily be distinguished by the loose spore mass which leaves a black trace on finger or paper. Relatively tolerant of SO₂ air pollution, often occurring with *Lecanora conizaeoides*.

Acolium marcianum (de Lesd.) M. Prieto & Wedin (2016)

Nb

Cyphelium marcianum de Lesd. (1908)

Thallus absent. Apothecia in small clusters, 0.3–0.5 mm diam., immersed in the host thallus, the disc black, not pruinose; true exciple thick throughout, distinctly thickened at the base and often forming a stalk immersed in the host thallus. Asci cylindrical. Ascospores (9–) 12–15 (–19.5) × (6–) 7–9.5 (–11) μm, very thick-walled, slightly constricted at the septum, dark greenish brown in water, mid to dark brown in K; surface irregularly verrucose, occasionally cracking irregularly. Lichen products only



those of the host (norstictic acid). **BLS 1865.**

On *Pertusaria pseudocorallina*; very rare. Scotland (Argyll), mid and N. Wales, N. Devon, Ireland (Mayo).

Like *A. sessile*, but with immersed apothecia and ascospores with an irregular verrucose ornamentation and fewer, shallower wall fissures. The spores are very variable in size (partially due to the degree of maturity) and the walls appear to swell in K.

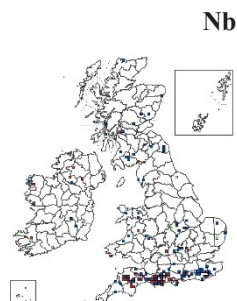
Acolium sessile (Pers.) Arnold (1885)

Cyphelium sessile (Pers.) Trevis. (1862)

Thallus absent. Apothecia 0.25–0.6 mm diam., sessile, not pruinose; true exciple thick throughout, distinctly thickened at the base, and often forming a stalk immersed in the host thallus. Asci narrowly clavate. Ascospores (10–) 12–15 × 6–9 μm, slightly constricted at the septum; surface coarsely helically striated, finally cracking irregularly, to give a complex pattern of helical ridges and irregular cracks. Lichen products only those of the host (norstictic acid in *Pertusaria coccodes*). **BLS 1545.**

On *Pertusaria coccodes*, more rarely *Lepra amara* and *L. albescens*, commensalistic to mildly pathogenic, on trunks of old oaks; local. Throughout Britain and Ireland, but commoner in the south.

A. sessile causes considerable modification of the host thallus; it is usually darker in colour and the production of isidia and soredia of the host is partly suppressed. Specimens of *A. inquinans* on bark have larger apothecia and ascospores. For differences from *A. marcianum*, also parasitic on *Pertusaria*, see above.



AMANDINEA Choisy ex Scheid. & H. Mayrhofer (1993)

Thallus crustose, rimose to bullate. **Medulla** I–, not amyloid. **Photobiont** chlorococcoid. **Ascomata** apothecia, lecanorine or lecideine, immersed to sessile with a broad or constricted base; disc ± black. **Hypothecium** pale or more usually dark brown, sometimes olivaceous in part. **Hamathecium** of paraphyses, septate, unbranched or branched in the upper third, the apices swollen and pigmented, many with a dark brown cap. **Asci** (4–) 8 (-multi)-spored, clavate, *Lecanora*-type. **Ascospores** brown, 1-septate, with or without median spore wall thickenings, often with rugose ornamentation (electron microscopy required for reliable observation of ornamentation). **Conidiomata** pycnidia, often present. **Conidia** filiform, curved, to 30 μm long. **Chemistry**: rarely norstictic acid (taxa outside the British Isles), more often no chemical compounds detectable by TLC. **Ecology**: widely distributed on rocks, bark, soil and artificial substrata.

As defined here, *Amandinea* can only be distinguished reliably as a genus from *Buellia* by its filiform rather than bacillar conidia, and the two genera are combined by Bungartz *et al.* (2007). While conidial morphology is less than ideal as a distinguishing character for identification, both genera are considered to be heterogenous (Bungartz *et al.* 2007, Giralta *et al.* 2015, Prieto & Wedin 2016) and it is likely that both will be remodelled in future. The genus is retained here until its status has been clarified, and *Amandinea* species are keyed out in addition with *Buellia*.

Literature:

Bungartz *et al.* (2007), Fryday & Arcadia (2012), Giralta *et al.* (2015), Prieto & Wedin (2016), Scheidegger (1993, 2009), Sheard & May (1997), van den Boom *et al.* (2021).

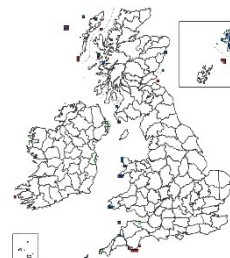
- | | | |
|----------|--|----------------|
| 1 | Thallus of scattered or more often aggregated brown areoles that are often warty or ± lobed; ascospores mostly 7.5–9 μm diam. | coniops |
| | Thallus smooth, cracked, warty, or of unlobed areoles, white, grey or brown; ascospores mostly 6–8 μm diam. | 2 |

- 2(1) Ascospores with internal wall thickenings near the septum; usually on coastal rocks*pelidna*
 Ascospores uniformly thin-walled; corticolous, less frequently saxicolous*punctata*

Amandinea conioips (Wahlenb.) M. Choisy ex Scheid. & H. Mayrhofer (1993)

Nb

Thallus areolate; areoles 0.1–0.3 mm diam., pale grey-brown to dark brown, convex, sometimes becoming shortly lobed, often aggregating to form a secondary bullate, warted or subsquamulose crust to 1–2 mm thick in the thallus centre; a dark prothallus sometimes evident when areoles are dispersed; medulla I–. Apothecia 0.3–0.6 (–0.8) mm diam., superficial; disc flat to slightly convex; true exciple usually persistent but may be excluded in older convex apothecia; epithecium brown, N–; hymenium without oil droplets; paraphyses ca 1.5 µm diam., apices to 4–5 µm diam. Ascospores 13–18 × (7–) 7.5–9 (–10) µm, wall uniformly thickened, minutely warted. Conidia 15–30 × 0.8–1 µm, thread-like, curved. **BLS 0203.**



On coastal rocks, especially those manured by birds; nationally scarce but locally common. Mainly N. & W. Scotland, extending to S.W. England (Cornwall), W. Wales, Ireland.

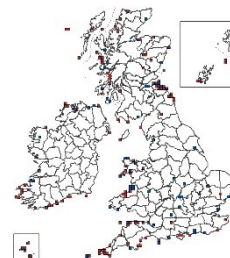
Distinguished from *A. punctata* by the thicker, more warted (becoming sublobulate) thallus, and generally larger ascospores and from *A. pelidna* by the thicker thallus, the larger apothecia and slightly longer and broader spores. In most cases *A. conioips* is easily recognizable by its bullate thallus and thread-like conidia.

Amandinea pelidna (Ach.) Fryday & Arcadia (2012)

LC

Amandinea lecideina (H. Mayrhofer & Poelt) Scheid. & H. Mayrhofer (1993)

Thallus rimose, whitish to brownish, a dark prothallus often evident; medulla I–. Apothecia lecideine, 0.3–0.6 mm diam., broadly sessile, disc flat, the margin thin, persistent; true exciple usually persistent; epithecium brown, N–; hymenium without oil droplets; paraphyses ca 1.5 µm diam., apices to 4–5 µm diam. Ascospores 10–15 × 6.5–8.5 µm, wall with median thickening (*Physconia*-type initially, *Buellia*-type when mature), minutely warted. Conidia 15–30 × 0.8–1 µm, thread-like, curved. **BLS 1292.**



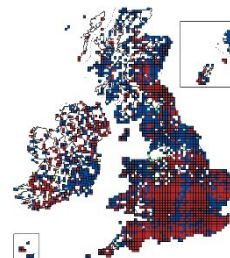
On coastal rocks often in ± sheltered aspects; uncommon. Also very rarely encountered inland. Mainly S.W. England, W. Wales, Ireland, Scotland.

Distinguished from *A. punctata* by its restriction to coastal rock habitats, the rimose thallus, median spore wall thickening, and the frequent presence of pycnidia. *A. conioips* has a thicker, bullate thallus. *Buellia excelsa* resembles *A. pelidna* but has a white, K+ yellow (atranorin) thallus, and numerous hymenial oil droplets.

Amandinea punctata (Hoffm.) Coppins & Scheid. (1993)

LC

Thallus thin or inconspicuous to thickish, rarely more than 0.5 mm thick at the centre, smooth to rimose and often warted, pale to dark grey, rarely brown; a dark or grey prothallus rarely present; medulla I–. Apothecia numerous, 0.2–0.6 mm diam., superficial; disc flat to slightly convex, rarely strongly so; true exciple thin, persistent, sometimes later excluded; epithecium brown, N–; hypothecium pale to dark brown; hymenium without oil droplets. Ascospores (8.5–) 11.5–16 (–19.5) × (4.5–) 6–8 (–10.5) µm, usually slightly curved; wall scarcely thickened near the septum (*Buellia*-type when mature, may tend towards *Physconia*-type initially), smooth. Pycnidia sparse; conidia 14–20 × 0.5–1 µm, curved, thread-like. **BLS 0212.**



On nutrient-rich or -enriched bark, wood (including fence posts), rocky substrata and debris, bird-perching rocks (including gravestones); tolerant of SO₂ pollution and inorganic fertilizers; abundant. Throughout the British Isles.

Common and very variable. Many records on coastal rocks refer to *Amandinea pelidna* (q.v.). Similar, but rarer, species on rocks include *A. conioips*, *Buellia excelsa* and *B. spuria*; and on bark or wood, *B. pulverea* and *B. schaeereri*. *Lecidella elaeochroma* which grows in similar habitats differs in the C+ orange reaction of the thallus, the broad true exciple, particularly in young apothecia, and the unicellular spores.

Host to *Skyttea buelliae* Sherwood, D. Hawksw. & Coppins (1981).

BUELLIA De Not. (1846)

Thallus crustose, smooth, rimose, areolate, granular or slightly placodioid, sometimes immersed, white to grey, yellow or brown, often delimited by a dark prothallus and mosaic-forming, corticate or not, epinecral layer present, often pronounced. **Photobiont** chlorococcoid. **Ascomata** apothecia, immersed, emergent or superficial from the beginning, black, sometimes white-pruinose. **Thalline margin** absent, or in immersed apothecia not distinguishable from the thallus. **True exciple** thin, pale and inconspicuous to well-developed and dark-pigmented. **Epithecium** brown to olive-green, K⁻, N[±] red. **Hymenium** colourless or green in the upper part, I⁺ blue, with or without numerous oil droplets that do not dissolve in K. **Hypothecium** pale or more usually dark brown, sometimes olive in part. **Hamathecium** of paraphyses, septate, unbranched or branched in the upper third, apices swollen and pigmented, often with a dark brown cap. **Asci** (4-)8(-many)-spored, clavate, *Lecanora*-type. **Ascospores** brown, 1(-3)-septate or rarely submuriform, ellipsoidal, cylindrical or fusiform, straight or slightly curved; wall of uniform thickness, or thickened at the septum (rarely also subapically), sometimes thinner and paler at the apices, surface smooth or finely ornamented (use ×1000, oil immersion). **Conidiomata** pycnidia, immersed; wall dark brown at least in the upper part. **Conidia** aseptate, colourless, ellipsoidal to cylindrical, bacilliform or fusiform-cylindrical. **Chemistry**: β-orcinol *p*-depsides, tridepsides, and depsidones, orcinol *p*-depsides, usnic acid- related compounds, and xanthones. **Ecology**: on a wide range of substrata, especially siliceous rocks and acid stonework, bark, wood, occasionally parasitic on lichens.

The genus as presented here is heterogeneous. The *Buellia disciformis* aggregate contains the type species, and is characterized by irregularly thickened ascospore walls, thalli often with norstictic acid and occurring mostly on trees.

The fragmentation of *Buellia* following phylogenetic studies is still incomplete, and it is likely that further changes will occur. Segregates to date include *Amandinea*, distinguished in morphological terms primarily by conidia that are curved and filiform rather than ± bacillar. *Monerolechia* contains the species formerly known as *Buellia badia*, a squamulose saxicolous species frequently found overgrowing other lichens. Three species that are lichenicolous or overgrow mosses have been transferred to *Tetramelas*, which appears to be monophyletic (Nordin & Tibell 2005, Prieto & Wedin 2016) and have some common characters of ascospore morphology or chemistry. *Melanaspicilia* Vain. (1909) is the oldest genus name applicable for the group around *B. aethalea*, which also appears to be phylogenetically distinct, although this was not taken up by Lücking *et al.* (2016) and is not adopted here.

Rinodina differs from *Buellia* in having a distinct thalline margin, although in some species this is concolorous with the disc and so evident only in section. Species of *Rinodina* have a pale (usually colourless) hypothecium and usually much pronounced, often diagnostic, thickening of the ascospore wall. *Diplotomma* differs in the 3-septate to muriform and distoseptate ascospores, and the apothecia are also often densely pruinose. *Diploicia* is distinguished by the distinctly placodioid thallus, but seems to be related to *Diplotomma*. Similar, but unrelated crustose genera containing species with discoid apothecia and brown, 1- to 3-septate or submuriform ascospores are *Arthonia*, *Catolechia*, *Epilichen*, *Melaspilea*, *Orphniospora* and *Rhizocarpon*, as well as the lichenicolous or non-lichenized *Abrothallus*, *Dactylospora* and *Rhizodiscina*; all these genera have different ascus structures.

Ertz *et al.* (2018) discovered that the sterile soreciate species *Buellia violaceofusca* is a photomorph of the fertile *Lecanographa amylacea* (Lecanographaceae, Arthoniales) with a chlorococcoid rather than trentepohlioid photobiont.

Literature:

Bungartz *et al.* (2004, 2007), Coppins *et al.* (2009), Ertz *et al.* (2018), Giralt *et al.* (2000, 2011), Lücking *et al.* (2016), Marbach (2000), Nordin (2000), Nordin & Tibell (2005), Prieto & Wedin (2016), Scheidegger (1993).

Key to species of *Amandinea*, *Buellia* and similar genera

- 1 Thallus inconspicuous, immersed in *Physcia* and *Physconia* species *Tetramelas pulverulentus*
Thallus obvious, sometimes overgrowing crustose species.....2
- 2(1) Thallus with soredia3
Thallus without soredia6
- 3(2) Thallus of diffuse, powdery-granular soredia; KC+ red (alectorialic acid) *pulverea*
Thallus with delimited, occasionally confluent, soralia; KC-4
- 4(3) Soredia dark brown to black, with violet tinge; K-
.....[Arthoniales, Lecanographaceae] *Lecanographa amylacea*
Soredia grey/green, at most with blue tinge; K+ yellow to red5
- 5(4) Thallus K+ yellow→red (norstictic acid), often C+ yellow; ascospores submuriform *griseovirens*
Thallus K+ yellow (atranorin), C-; ascospores 1(-3)-septate *arborea*
- 6(2) On bark, woody stems, wood, or old leather7
On rock, soil, or on bryophytes over soil or rock13
- 7(6) Hymenium with numerous oil droplets; ascospore wall thinner and paler at the apices8
Hymenium without numerous oil droplets; ascospore wall not thinner at the apices10
- 8(7) Ascospores (13-) 17-26 (-30) × (6.5-) 7-10 (-13) μm; hymenium <100 μm high *disciformis*
Ascospores 25-32 × (9-) 10-14 μm; hymenium 100-130 μm high9
- 9(8) Thallus K+ yellow (atranorin); paraphysis apices 3-4.5 μm diam. *arnoldii*
Thallus K+ yellow→red (crystals); paraphysis apices 2-3 μm diam. *sanguinolenta*
- 10(7) Thallus K+ yellow or K+ yellow→red; apothecia 0.4-1.6 mm diam. *erubescens*
Thallus K± yellow-brown; apothecia 0.2-0.6 mm diam.11
- 11(10) Ascospores (19-) 21-24 (-29) × (7.5-) 8-9.5 (-11) μm *hyperbolica*
Ascospores <19 μm long12
- 12(11) Ascospores 6-10 (-12) × 2.5-4 (-4.5) μm..... *schaereri*
Ascospores (8.5-) 11.5-16 (-19.5) × (4.5-) 6-8 (-10.5) μm..... *Amandinea punctata*
- 13(6) Apothecia remaining immersed in the thallus, not emergent14
Apothecia superficial at maturity20
- 14(13) Thallus pale yellow or yellow-grey; C+ persistent orange15
Thallus white, grey or grey-brown; C± fleeting red16
- 15(14) Conidia 4-6 μm long; thallus rimose to areolate, marginal areoles uniform, not elongate;
widely distributed lowland species *ocellata*
Conidia 6-9 μm long; thallus of scattered areoles or ± continuously areolate, marginal
areoles enlarged, elongate; a rare northern species *jugorum*
- 16(14) Thallus C+ red (in sections) (gyrophoric acid); ascospore surface striate *uberior*
Thallus C-; ascospore surface smooth or faintly warted17

- 17(16) Thallus K⁺ yellow→red (crystals) 18
 Thallus K[±] yellow 19
- 18(17) Apothecia immersed in the thallus, 0.2–0.4 mm diam., not pruinose; ascospores finely warted;
 medulla I[±] blue *aethalea*
 Apothecia sessile, constricted at the base, 0.3–0.7 mm diam., often pruinose; ascospores
 smooth; medulla I[–] *abstracta*
- 19(17) Thallus white to pale grey; K⁺ yellow (atranorin); medulla I[–]; ascospores (8–) 10–13 (–15) ×
 5–7 (–8.5) μm; principally coastal *stellulata*
 Thallus pale to dark grey; K[±] yellow→red (crystals) (norstictic acid); medulla I[±] blue;
 ascospores (9.5–) 12–18 (–20) × (4.5–) 6–10 (–12) μm; throughout the British Isles *aethalea*
- 20(13) On soil, turf, or on bryophytes over rocks 21
 On rock 23
- 21(20) Thallus with marginal lobes; asci 4-spored, rarely more; lowland, rare *asterella*
 Thallus without marginal lobes; asci 8-spored; montane 22
- 22(21) Thallus convex-areolate to bullate; C[–] *Tetramelas papillatus*
 Thallus granulose; C⁺ yellow, at least in section under the microscope *Tetramelas insignis*
- 23(20) Thallus C[–] 24
 Thallus C⁺ red (gyrophoric acid) *saxorum*
- 24(23) Thallus K⁺ yellow→red (crystals) (norstictic acid) *subdisciformis*
 Thallus K[–], K⁺ yellow or K⁺ yellow-orange (no crystals) 25
- 25(24) Hymenium with numerous oil droplets 26
 Hymenium without numerous oil droplets 27
- 26(25) Ascospores 14.5–23.5 × 6.5–11.5 μm *leptoclinoides*
 Ascospores (10–) 11.5–15 × 5–8 μm *excelsa*
- 27(25) Thallus well-developed, K⁺ yellow or yellow-orange; medulla I⁺ blue 28
 Thallus K[–], well-developed or inconspicuous; medulla I[–] 29
- 28(27) Thallus K⁺ yellow (atranorin); exciple K⁺ orange *leptocline*
 Thallus K⁺ yellow-orange (stictic acid) ; exciple not reacting *spuria*
- 29(27) Thallus bullate to squamulose, brown *Monerolechia badia*
 Thallus smooth to areolate or inconspicuous 30
- 30(29) Ascospores 4.5–5.5 μm diam.; thallus inconspicuous; conidia bacilliform *abstracta*
 Ascospores ≥5.5 μm diam.; thallus usually conspicuous; conidia filiform 31
- 31(30) Thallus of scattered to often aggregated, brown areoles that are often warty or ± lobed;
 ascospores mostly 7.5–9 μm diam. *Amandinea coniois*
 Thallus smooth, cracked, warty, or of unlobed areoles, white, grey or brown; ascospores
 mostly 6–8 μm diam. 32
- 32(31) Ascospores with internal wall thickenings near the septum; on coastal rocks *Amandinea pelidna*
 Ascospores uniformly thin-walled; on bark, wood, rock etc., widespread *Amandinea punctata*

Buellia abstracta (Nyl.) H. Olivier (1903)*Buellia sequax* auct., non (Nyl.) Zahlbr. (1931)

Thallus usually immersed and inconspicuous, rarely rimose-cracked, white; medulla I-. Apothecia 0.2–0.3 (–0.7) mm diam., immersed to sessile, often forming lines or irregular clusters; disc often pruinose; exciple thin, persistent, often raised; epithecium brown; hymenium without oil droplets; hypothecium dark brown. Ascospores 11–13.5 × 4.5–5.5 μm, 1-septate, slightly constricted at the septum, wall smooth. Pycnidia rare; conidia 2.5–4 μm, bacilliform. Thallus C–, K+ yellow→red (crystals), Pd+ orange-red, UV– (norstictic acid), or reaction negative and no lichen substances found by TLC. **BLS 1744.**

On coastal rocks, mostly siliceous sandstones, granite pebbles and small stones, often growing over other lichens; rare. Isles of Scilly, S. England, Channel Islands, Isle of Man, Scotland (Wigtown, Mull of Galloway), Wales (Pembrokeshire, Cardiganshire).

Resembles a *Sarcogyne* or *Lecidea sarcogynoides* in habit. Included in Coppins *et al.* (2009) as *B. sequax*, but Giralt *et al.* (2011) showed that this name refers to the species previously known as *B. excelsa*.

Nb

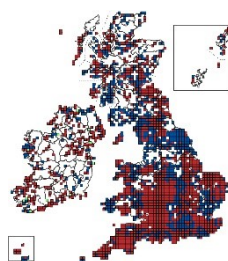
**Buellia aethalea** (Ach.) Th. Fr. (1874)

Thallus thin to rather thick, distinctly areolate, often less than 2 cm diam. and mosaic-forming; areoles 0.2–0.6 (–1.2) mm diam., ± angular, flat or rarely convex, pale to dark grey, sometimes discoloured brown; delimited by a narrow, black prothallus, sometimes visible between the areoles; medulla I± blue. Apothecia 0.2–0.4 (–0.7) mm diam., immersed, sometimes surrounded by a thalline collar; disc flat; true exciple thin or inconspicuous, usually dark olive, distinctly pigmented only in the outermost part; epithecium brown to olive, N± red; hypothecium pale to dark brown. Ascospores (9.5–) 12–18 (–20) × (4.5–) 6–10 (–12) μm, 1-septate, minutely warted. Pycnidia rare; conidia 5–7 (–8.5) × ca 1 μm, bacilliform. Thallus C–, K± yellow→red (crystals), Pd± yellow-orange, UV– (usually norstictic, and ± stictic acid; sometimes no lichen substances detected by TLC). **BLS 0200.**

On siliceous rocks, pebbles and stonework, often a pioneer species, sometimes in nutrient-rich situations, rarely on timberwork or plastic-coated surfaces; common. Throughout Britain and Ireland.

Specimens with an I– medulla are sometimes referred to as *B. sororia* Th. Fr. (1874) but a broad concept of *B. aethalea* is used here pending a critical revision. Specimens with a weak K reaction have often been mistaken for *B. stellulata*, but that species has a different chemistry (K+ yellow), smaller apothecia and ascospores, usually a paler thallus, and a coastal distribution. Also similar are *B. ocellata* – thallus yellow, C+ persistent orange and *B. uberior*, thallus C+ red (fading).

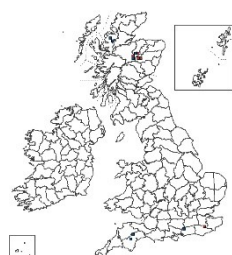
LC

**Buellia arborea** Coppins & Tønsberg (1992)

Thallus crustose, mostly within the bark in non-sorediate parts, forming rounded patches to ca 4 cm diam., areolate, sorediate; prothallus white, mostly not evident; areoles sparse, white, discrete or ± contiguous, slightly convex, to 0.5 mm diam.; medulla I–; soralia erumpent, to 0.4 mm diam., sometimes encircled by a white ± lacerate margin; blue, green, sometimes brownish or dark green, ± rounded or, in lignicolous material, elliptical to linear, flat to crateriform; soredia fine, <30 μm diam., single or loosely aggregated, heavily incrusting with crystals dissolving in K, revealing an olive, N– pigment in the external hyphae of exposed soredia. Apothecia rare, erumpent, ± immersed to sessile, black, rounded to broadly elliptical, to 0.5 mm diam., the margin distinct, persistent; disc mostly concave, more rarely ± flat; exciple brown along the outermost edge and below the subhymenium, otherwise olive; epithecium olive; hymenium colourless to dilute olive, with oil droplets, <120 μm high; hypothecium brown to ± olive; paraphyses branched in the upper part, 1.5–2 μm diam., apical cell to 4 μm diam., with sharply delimited brown pigment in the wall of the upper half of the cell. Asci clavate, with up to 8 spores. Ascospores brown, often with pale apices, smooth, mostly pointedly ellipsoidal with thin-walled apices, sometimes bluntly ellipsoidal, 1(–3)-septate, (17.5–) 19–25 (–28) × (7.5–) 8.5–10 (–12) μm. Pycnidia not observed. Thallus C–, K+ yellow, KC–, Pd± yellow, UV–, (atranorin, placodiolic acid). **BLS 1853.**

On decorticated trunks of *Pinus sylvestris*; uncommon, local. Scotland, (Easterness, Abernethy Forest) &

Nb



England (Devon and Sussex).

TLC is sometimes required to separate sterile specimens of *Xylographa vitiligo* from *Buellia arborea* and *B. griseovirens*, especially when on lignum.

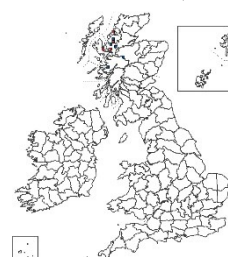
Buellia arnoldii Servit (1931)

Thallus thin to moderately thick, smooth, wrinkled or rimose; medulla I-. Apothecia 0.4–1 mm diam.; disc flat; true exciple persistent, shiny; epithecium brown to olive-brown; hymenium 100–130 µm tall, with numerous oil droplets; hypothecium dark brown; paraphyses 1.5–2 µm diam., apices (3–) 4–4.5 µm diam. Ascospores 25–32 × (9–) 12–15 µm, 1-septate, smooth, often strongly curved; apices pointed, thin-walled and pale; wall internally much thickened at the septum. Conidia 3–3.5 × 1–1.5 µm, narrowly ellipsoidal to cylindrical. Thallus C-, K+ yellow, Pd± yellow, UV- (atranorin). **BLS 1854**.

On smooth conifer bark; rare. N. Scotland (Westernness, W. Ross).

Differs from *B. disciformis* in the larger ascospores and shorter conidia, and from *B. sanguinolenta* in the K reaction and broader paraphyses.

NT IR



Buellia asterella Poelt & M. Sulzer (1974)

Thallus white, matt, containing numerous crystals, with short marginal lobes to 2 mm long and 0.4–1 mm wide, forming rosettes when young but often becoming irregular and fragmented when older; medulla I-. Apothecia 0.4–0.8 mm diam., at first immersed with a thalline collar, later superficial; disc flat to strongly convex, ± pruinose when young; true exciple narrow or excluded, composed of radiating hyphae; epithecium brown; hymenium 50–70 µm tall, without oil droplets; hypothecium brown. Asci 4-spored (rarely more). Ascospores 10–17 × 5–8 µm, 1-septate, nearly smooth, the apices rounded. Thallus C-, K± yellow→red (crystals), Pd± yellow-orange, UV- (± norstictic acid). **BLS 0202**.

On dry basic soil, often with *Gyalolechia fulgens*; very local and decreasing, possibly extinct in the UK. Formerly found in E. England (E. Anglia, Breckland).

CR A, C2, D



Buellia disciformis (Fr.) Mudd (1861)

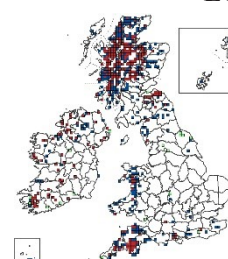
Thallus superficial or sometimes immersed, thin and almost smooth to thick, rimose-cracked and somewhat warted, white to yellow-grey, often delimited by a black prothallus; medulla I-. Apothecia 0.3–1.3 mm diam., superficial; disc flat to slightly convex; true exciple usually persistent, of radial hyphae, the rim more distinctly pigmented than the inner part; epithecium brown, N-; hymenium <100 µm high, with numerous oil droplets; hypothecium brown. Ascospores (13–) 17–26 (–30) × (6.5–) 7–10 (–13) µm, 1(-3)-septate, sometimes slightly curved, wall thinner and paler at the pointed apices; wall internally much thickened at the septum. Conidia 5.5–8.5 × 0.7–1 µm, straight. Thallus C-, K+ yellow, Pd± yellow, UV- (atranorin, traces of two or more unidentified lichen substances). **BLS 0204**.

On smooth bark; frequent. N. & W. Britain, Ireland; extending locally elsewhere, where it may be a relic of a wider pre-industrial distribution.

See also *B. arnoldii*, *B. erubescens*, and *B. sanguinolenta*. Often confused with morphs of *Lecidella elaeochroma* with a pale thallus. *B. arborea* has similar apothecia to *B. subdisciformis* but differs in having a sorediate thallus.

Occasionally parasitized by *Lichenodiplis pertusariicola* Dyko & D. Hawksw. (1979) and more rarely *Muellerella lichenicola* (Sommerf.) D. Hawksw. (1979).

LC



Buellia erubescens Arnold (1875)

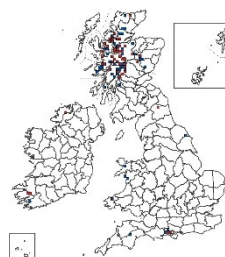
Thallus immersed to thin and superficial, white to pale grey, smooth to rimose-cracked or slightly wrinkled, usually delimited by a black prothallus; medulla I-. Apothecia 0.4–1.6 mm diam., sessile; disc flat to slightly convex, usually pruinose at least when young; margin prominent and usually persistent; epithecium brown;

LC NS

hymenium without oil droplets; hypothecium dark brown. Ascospores $14\text{--}20 \times 6\text{--}9 \mu\text{m}$, 1-septate, apices rounded, wall evenly pigmented, finely warted. Conidia $6\text{--}8 \times 0.5\text{--}1 \mu\text{m}$, straight. Thallus C⁻, K⁺ yellow → red (crystals), Pd⁺ yellow-orange, UV⁻ (atranorin, norstictic acid and traces of stictic acid complex); rarely K⁺ yellow, Pd[±] yellow, UV⁻ (lacking norstictic acid). **BLS 0205**.

On ± smooth bark, rarely on lignum, mainly confined to ancient woodlands; widespread in the Scottish Highlands but very rare in the rest of Britain and W. Ireland.

Distinguished from *B. disciformis* by the absence of hymenial oil droplets, the rounded, evenly pigmented ascospore apices, and the normally K⁺ red (crystals) thallus.



Buellia excelsa (Leight.) A.L. Smith (1911)

NE

Thallus white, areolate; areoles variable in size, dispersed or forming a continuous, warted crust; prothallus inconspicuous; medulla I⁻. Apothecia superficial; disc flat to slightly convex; true exciple persistent; epithecium brown, N⁻; epithecium brown; hymenium with numerous oil droplets; hypothecium dark brown. Ascospores (10⁻) $11.5\text{--}15 \times 5\text{--}8 \mu\text{m}$, 1-septate; wall faintly roughened. Thallus C⁻, K⁺ yellow, Pd⁻, UV⁻ (atranorin, chloratranorin, diploicin and isofulgidin). **BLS 0213**.

On siliceous rocks; rare. W. Ireland (W. Galway, Mt. Doughruagh, Connemara), S.W. England (Lizard Peninsula).

Resembles a tiny *B. subdisciformis*, but is distinguished from this and *Amandinea lecideina* by the white, K⁺ yellow thallus and numerous hymenial oil droplets. Giralt *et al.* (2011) placed this into synonymy with *B. sequax* (Nyl.) Zahlbr. (1931), but the type of that species is in poor condition and Scheidegger (1993) considered that they are separate taxa. *B. sequax* sensu Coppins *et al.* (2009) should now be referred to as *B. abstracta* (Giralt *et al.* 2011).

Buellia griseovirens (Turner & Borrer ex Sm.) Almb. (1952)

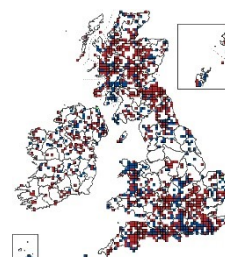
LC

Thallus ± immersed and thin to thick, smooth to wrinkled or ± rimose-cracked; a grey-black prothallus sometimes evident (especially on smooth bark); soralia mostly discrete, 0.15–0.4 mm diam., often crowded, a few becoming confluent, pale green-grey to ash-grey, often with a blue tinge but pale yellow when abraded; soredia 15–26 μm diam., pigmented hyphae brown, K⁻, N⁻; medulla I⁻. Apothecia very rare, 0.4–1 mm diam., superficial; disc flat to convex, black, not pruinose; exciple K⁺ yellow; epithecium brown; hymenium 110–120 μm tall, without oil droplets; hypothecium brown. Ascospores (13⁻) $15\text{--}28 \times 7\text{--}13 \mu\text{m}$, submuriform, grey to brown. Thallus and soralia C[±] yellow, K⁺ yellow → red (crystals), KC⁻, Pd⁺ yellow or yellow-orange, UV⁻ (atranorin, norstictic acid and traces of other substances of the stictic acid complex). **BLS 0207**.

On ± smooth bark of deciduous trees and shrubs, less often on conifers, wood, and rarely on brick, usually in well-lit situations, tolerant of moderately polluted areas and often a pioneer species; frequent. Throughout the British Isles.

A common and variable species. The K reaction is often weak and production of red crystals should be checked in microscope preparations. The C⁺ yellow reaction is unexplained but often characteristic. Often confused with *Mycoblastus caesius*, *Violella fucata* and *Xylographa vitiligo*. *B. arborea* is similar when sterile (q.v.).

Nectriopsis physciicola D. Hawksw. & Earl.-Benn. (2006) has been reported on this host.



Buellia hyperbolica Bagl. (1871)

VU D1

Thallus of white, pale grey to yellow-green granules, ± continuous, usually covering a wide area. Apothecia lecideine, rapidly becoming biatorine, 0.2–0.3 (–0.4) mm diam., adnate, abundant and confluent; disc flat at first, soon hemispherical; thalline margin very thin, and even when juvenile becoming almost totally excluded; true exciple poorly developed, to 20 μm thick; hymenium without oil droplets, 70–90 (–100) μm high; hypothecium interspersed with abundant oil droplets, 100–120 μm tall; apical cells of the paraphyses markedly swollen, to (3.5–) 4–5 μm diam., pigmented dark brown. Ascospores (19⁻) $21\text{--}24$ (–29) × (7.5–) 8–9.5 (–11) μm, when young with the inner



wall thickened at the septum; when mature walls uniformly thin; apices pointed, often slightly curved, roughly ornamented. Pycnidia unknown. Thallus C-, K+ yellow-brown, Pd+ orange-red, UV- (\pm atranorin, fumarprotocetraric, protocetraric, confumarprotocetraric and \pm conviresnic acids). **BLS 2286.**

On acid bark and lignum, mainly on old *Quercus* but also *Castanea* and ornamental conifers, in parks and pasture woodlands; rare. S. England (Berkshire, Devon, Hampshire, Herefordshire, Oxfordshire) & central and N. Wales (Carmarthenshire & Merionethshire).

Buellia jugorum (Arnold) Arnold (1884)

Thallus areolate, margins slightly placodioid, the peripheral areoles to 1.8 mm diam., white to yellow with a smooth surface, medulla not amyloid. Apothecia 0.3–0.6 mm diam., immersed or broadly sessile, exciple black in the outer part, pale in the inner part; hymenium without oil droplets, green in the lower part; epithecium greenish brown, N+ reddish; hypothecium dark brown. Ascospores minutely rugulose, 11–15 \times 6–8.5 μ m. Conidia bacilliform, 6–9 \times ca 1 μ m. Thallus C+ persistent orange, UV+ orange (arthonelin). **BLS 2456.**

Only a single record from coastal shingle in N.E. Scotland (Morayshire).

Very similar to *B. ocellata* but differs by its alpine/northern distribution and longer conidia. Furthermore, the areoles are a little larger with a smooth surface and slightly placodioid at the margin.

Nb



Buellia leptocline (Flot.) A. Massal. (1854)

Thallus very thin, to thick and rimose, grey; areoles \pm angular, 0.2–1 mm diam.; prothallus indistinct; medulla I+ blue. Apothecia 0.4–1.2 (–1.5) mm diam., superficial; disc flat to slightly convex; margin prominent and persistent; exciple orange-brown, effusing an orange solution with K; epithecium brown, N-; hymenium 80–100 μ m tall, without oil droplets; hypothecium dark brown. Ascospores 12–16 (–18) \times (6–) 7–8.5 (–11) μ m, 1-septate; wall faintly warted, pigmentation often thickened at the septum. Pycnidia few; conidia 4–5 \times ca 1 μ m. Thallus C-, K+ yellow, Pd-, UV- (atranorin). **BLS 0209.**

On hard exposed siliceous rocks, upland; uncommon. England (Devon, Lake District), N. and C. Wales, N. Scotland (Highlands).

Easily mistaken superficially for species of *Lecidea* or *Porpidia*. *B. saxorum* and *B. subdisciformis* have different chemistries and usually more abundant pycnidia.

Nb

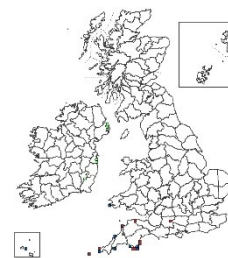


Buellia leptoclinoides (Nyl.) J. Steiner (1907)

Thallus rimose, whitish to pale yellow-grey, often >5 cm diam.; medulla I-. Apothecia 0.45–0.8 (–1.0) mm diam., superficial; disc flat to slightly convex; exciple with K-crystal complexes; epithecium brown, N-; hymenium with numerous oil droplets; hypothecium dark brown. Ascospores 14.5–23.5 \times 6.5–11.5 μ m, 1(-3)-septate, sometimes slightly curved, faintly warted; wall thinner and paler at the apices, internally much thickened at the septum. Conidia bacilliform, 5–6 μ m long. Thallus C-, K+ yellow, Pd+ yellow, UV- (atranorin, placodiolic acid). **BLS 0210.**

On coastal siliceous rocks in the xeric supralittoral zone, often in recesses; locally abundant; outside Britain and Ireland also on bark. S.W. England, E. Ireland, Wales (Pembrokeshire). There are also records from Salisbury Plain (Stonehenge).

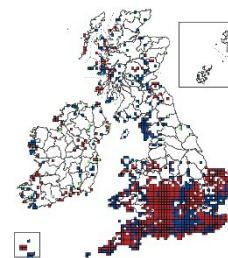
Nb



Buellia ocellata (Flot.) Körb. (1855)

LC

Thallus forming small patches 1–2 (–5) cm diam., thin to thickish, yellow-grey, areolate, sometimes delimited by a black prothallus; areoles 0.3–1.3 mm diam., flat to convex; medulla I-. Apothecia 0.15–0.5 mm diam., immersed, sometimes surrounded by a thalline collar; disc concave to flat; true exciple thin or inconspicuous; epithecium brown to usually olive, N+ red; hymenium without oil droplets; hypothecium brown but green in the upper part. Ascospores (11–) 13–17 (–21.5) \times 6.5–9 (–11.5) μ m, 1-septate; apices rounded; wall uniformly thickened, finely warted. Pycnidia common;



conidia $4-6 \times 0.8-1 \mu\text{m}$. Thallus C+ persistent orange, K-, Pd-, UV- (xanthonones, especially arthothelin). **BLS 0219**.

On exposed siliceous rocks, pebbles and stonework; occasional. Throughout Britain and Ireland.

Similar in habit to, and often occurring with, *B. aethalea*, but distinguished by the yellowish, C+ orange thallus due to the presence of xanthonones.

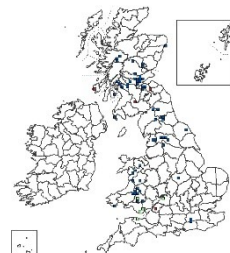
Buellia pulverea Coppins & P. James (1978)

LC NS

Thallus effuse, powdery-granular, thin to thick, dull grey-green to dark brown-grey, often with irregular patches of soredia; soredia $12-22 \mu\text{m}$ diam.; medulla I-. Apothecia $0.2-0.4 (-0.5)$ mm diam., usually at least a few present, immersed among the granules or sometimes emergent; disc flat to slightly convex; true exciple thin, \pm persistent; epithecium brown, N-. Ascospores $12-14 (-17) \times (5-6) 6-7 (-8) \mu\text{m}$, 1-septate, straight or slightly curved; wall uniformly thickened, smooth. Thallus C+ pink, K-, KC+ red, Pd+ yellow, UV+ yellow (alectorialic acid). **BLS 0211**.

On exposed acid bark, wood and *Calluna* stems, often associated with *Lecanora conizaeoides* and *Scoliciosporum chlorococcum*, tolerant of sulphur dioxide and particularly fluoride pollution; widespread but uncommon, with very few recent records. N. & W. Britain, not recorded from Ireland.

B. pulverea resembles *Amandinea punctata*, but differs in the powdery soresiate thallus and chemical reactions. The presence of alectorialic acid is indicated in time (3-5 years) by the pink-brown staining of chlorine-bleached herbarium paper.



Buellia sanguinolenta T. Schauer (1965)

NT

Thallus thin, continuous, somewhat immersed, white-grey, sometimes delimited by a black prothallus; medulla I-. Apothecia $(0.3-0.4) 0.4-0.8$ mm diam., superficial; disc flat to convex; true exciple thin, mostly persistent; hymenium *ca* $120 \mu\text{m}$ tall, with numerous oil droplets; paraphyses $1-1.4 \mu\text{m}$ diam., apices to $2-3 \mu\text{m}$ diam. Ascospores $25-32 \times 10-14 \mu\text{m}$, 1-septate, often curved, thin-walled and paler at the pointed apices; inner wall thickened at the septum. Pycnidia usually few; conidia $3.5-4 \times 1-1.5 \mu\text{m}$, cylindrical-ellipsoidal. Thallus C-, K+ yellow \rightarrow red (crystals), Pd+ yellow-orange, UV- (norstictic acid). **BLS 1856**.

On smooth bark of *Sorbus*; rare. Scottish Highlands (Easternness, Mid-Perthshire & W. Ross).

Distinguished from *B. arnoldii* and *B. disciformis* by the K reaction, and from the latter also by the larger ascospores. Differs from *B. erubescens* by the presence of numerous oil droplets in the hymenium.



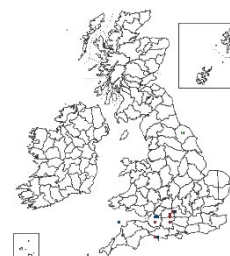
Buellia saxorum A. Massal. (1852)

NT

Thallus moderately thick, rimose-cracked, white to pale yellow-grey, delimited by a black prothallus and often mosaic-forming; medulla I+ blue. Apothecia $0.3-1$ mm diam., superficial; disc flat to slightly convex; true exciple prominent; epithecium brown, N-; hymenium without oil droplets. Ascospores $10-18 \times 5-9 \mu\text{m}$, 1-septate, wall uniformly thickened, smooth. Pycnidia numerous; conidia $4-7 (-9) \times ca 1 \mu\text{m}$; fusiform-cylindrical. Thallus C+ red, K+ yellow, Pd \pm yellow, UV- (atranorin, gyrophoric acid). **BLS 0214**.

On exposed, hard siliceous rock of standing stones and sarsens; local. S. England (Berkshire, Wiltshire, Somerset, Dorset, Lundy).

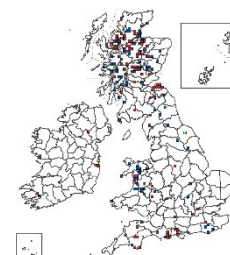
Similar to *B. subdisciformis* but differing in chemistry and ecology. *B. leptocline* is C-, has few pycnidia and shorter conidia.



Buellia schaeferi De Not. (1846)

LC

Thallus thin, continuous to slightly rimose-cracked or wrinkled, pale grey, effuse; medulla I-. Apothecia $0.2-0.3 (-0.5)$ mm diam., superficial; disc flat to convex; true exciple thin to excluded; epithecium brown, N-; hymenium $35-60 \mu\text{m}$ tall, without oil droplets; hypothecium brown. Ascospores $6-10 (-12) \times 2.5-4 (-4.5) \mu\text{m}$, 1-septate, uniformly thin-walled, smooth. Pycnidia often numerous, $50-70 \mu\text{m}$ diam.; conidia $2-$



$3 \times 1-1.4 \mu\text{m}$, shortly cylindrical to ellipsoidal. Lichen substances not detected by TLC. **BLS 0215**.

On acid bark and wood, especially of conifers and *Quercus*. Scattered throughout Britain, common in Scotland; a few records from Ireland.

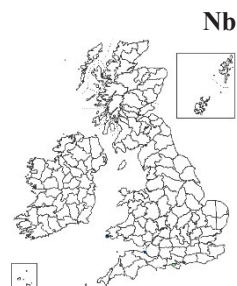
Distinguished from *Amandinea punctata* by the notably smaller, thinner-walled ascospores, paler thallus and shorter, \pm cylindrical conidia.

Buellia spuria (Schaer.) Anzi (1860)

Thallus moderately thick to 1 mm thick, rimose-cracked, white; prothallus indistinct; medulla I+ violet. Apothecia 0.4–1 mm diam., immersed to broadly sessile; disc flat to convex; exciple thin, mostly persistent; epithecium green to olive, N+ pale red; hymenium without oil droplets; hypothecium dark brown. Ascospores $9-15 \times 4.5-6.5 \mu\text{m}$, finely warted. Pycnidia usually few; conidia $4.5-6 \times 1-1.5 \mu\text{m}$. Thallus C–, K+ yellow-orange, Pd+ yellow-orange, UV– (atranorin, stictic acid and traces of accessory substances). **BLS 1857**.

On sandstone; rare. Wales (Pembrokeshire) and S.W. England (Somerset).

Distinguished from *B. stellulata* by the I+ violet medulla. Closely resembles *Lecidella carpathica* in habit.



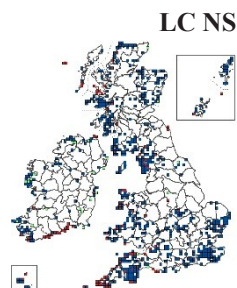
Buellia stellulata (Taylor) Mudd (1861)

Thallus thin, white to pale grey, rimose-cracked, mostly 1–2 cm diam., delimited by a black prothallus and often forming mosaics; areoles 0.2–0.5 mm diam., flat; medulla I–. Apothecia 0.2–0.35 mm diam., immersed; exciple thin, evident at least when young; epithecium dark olive to olive-brown, N+ red; hymenium without oil droplets; hypothecium dark brown. Ascospores $(8-10-13 (-15) \times 5-7 (-8.5) \mu\text{m}$, wall evenly thickened, minutely roughened. Pycnidia rare; conidia $3.5-5 \times 1-1.5 \mu\text{m}$. Thallus C–, K+ yellow, Pd \pm yellow, UV– (atranorin, confluent and 2'-O-methylperlatolic acids). **BLS 0216**.

On hard siliceous rocks and pebbles, mainly coastal in the xeric supralittoral zone; locally common. N. & W. British Isles.

This species has been much over-recorded, especially in inland localities (as is evident from the map), owing to confusion with *B. aethalea* (q.v.); that has a K+ yellow→red reaction, though it is sometimes weak.

The lichenicolous *Polycoccum stellulatae* (Vouaux) Hafellner (2015) has been found on this host in Scotland (Ayrshire).

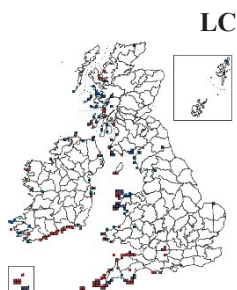


Buellia subdisciformis (Leight.) Vain. (1890)

Thallus thin to thick, rimose-cracked, areoles 0.2–1.2 mm diam., sometimes becoming warted, pale to medium grey, sometimes with a yellow tinge, usually delimited by a black prothallus, often mosaic-forming; medulla I–. Apothecia 0.4–1 (–1.8) mm diam., superficial; disc flat to slightly convex; disc and margin grey-white pruinose at least when young; exciple prominent, mostly persistent, uniformly pigmented throughout; epithecium brown, N–; hymenium without oil droplets; hypothecium dark red-brown. Ascospores $9.5-19.5 \times 5.5-10 \mu\text{m}$, 1-septate; apices rounded; wall uniformly thickened, finely warted. Pycnidia numerous; conidia $(6-) 9-13 \times 0.8-1 \mu\text{m}$, straight. Thallus C–, K+ yellow→red (crystals), Pd+ yellow-orange, UV– (atranorin, norstictic acid, traces of other substances of the stictic acid complex). **BLS 0217**.

On hard siliceous, mainly coastal rocks in the xeric supralittoral zone; locally abundant. S.W. & W. Britain, maritime sites throughout Ireland.

Differs from *B. saxorum* in the K+ yellow→red, C– thallus.



Buellia uberior Anzi (1866)

Thallus areolate, grey, mostly 1–5 cm diam., usually delimited by a black prothallus; areoles 0.35–0.8 mm diam.; medulla I+ blue. Apothecia 0.25–0.8 (–1) mm diam., immersed; epithecium olive to olive-brown, N+ red; hymenium without oil droplets; hypothecium colourless to pale brown. Ascospores $8-11.5 \times 4.5-6.5 \mu\text{m}$, outer wall striate. Pycnidia usually present; conidia $3.5-4 \times 1-1.5 \mu\text{m}$, cylindrical. Thallus C+ red, K \pm yellow-orange,

Nb

Pd± orange, UV– (gyrophoric and ± stictic acids). **BLS 1549.**

On hard siliceous rocks, at least when young growing on *Schaereria fuscocinerea*; uncommon. England (Devon, Northumberland), N. Wales, Scotland (Argyll, Mid-Perthshire, S. Aberdeenshire, Sutherland).

Distinguished from *B. aethalea* by the C+ red thallus (best seen in sections) and striate ascospores.



CALICIUM Pers. (1794)

Thallus crustose, verrucose-granular or immersed, grey to green-grey, pale yellow or dark green.

Photobiont trebouxioid. **Ascomata** apothecia, often elevated, either with a long, distinct stalk and globose to lens-shaped head or ± sessile; stalk of thickened brown to greenish black irregularly interwoven hyphae. **True exciple** well-developed, supporting the dry spore mass. **Asci** cylindrical to clavate, formed singly from ascogenous hyphae with croziers, dissolving at an early age. **Ascospores** 1-septate, rarely submuriform, forming a well-developed dry black spore mass (mazaedium); wall thick, dark brown, often with a distinctive ornamentation. **Conidiomata** pycnidia, sessile or slightly immersed, globose, the ostiole punctiform. **Conidiophores** branched. **Conidiogenous cells** subcylindrical. **Conidia** broadly ellipsoidal to short-cylindrical, colourless, non-septate. **Chemistry**: orcinol and β-orcinol depsides and depsidones, dibenzofurans, anthraquinones, xanthonones, and pulvinic acid derivatives variously present. **Ecology**: usually on dry bark and wood, very rarely on siliceous rocks in rather humid and sheltered situations.

Cyphelium was formerly distinguished by its sessile rather than stalked apothecia, but the genus is no longer recognized (Prieto & Wedin 2016) and the species included by Giavarini & Purvis (2009b) have been divided between *Calicium* and a newly re-adopted genus, *Acolium*. *Chaenotheca* and other stalked mazaedial lichens have non-septate ascospores, except for *Microcalicium*, whose ascospores have greenish (never dark brown) walls.

C. corynellum was listed as a British species with a conservation assessment of Critically Endangered, and was considered to be a lichenicolous fungus by Hawksworth (1975). However, British material identified as *C. corynellum* has been shown to be saxicolous morphs of *C. viride* (Yahr 2015). Results from Prieto *et al.* (2020) support the distinction of *Calicium corynellum* from *C. viride*, by both morphological and genetic characters.

References

Aguirre-Hudson *et al.* (2007), Giavarini & Purvis (2009a, b), Prieto *et al.* (2012, 2020), Prieto & Wedin (2016), Tibell (1999), Yahr (2015).

1	Ascomata long-stalked (length at least twice the diameter of the head)	2
	Ascomata short-stalked to sessile or immersed	13
2(1)	Stalk and exciple in squash I+ dark blue to black	<i>lenticulare</i>
	Stalk and exciple in squash I± reddish blue	3
3(2)	Ascomata with yellow pruina	4
	Ascomata without yellow pruina	5
4(3)	Thallus immersed, Pd–; asci cylindrical	<i>trabinellum</i>
	Thallus verrucose, Pd+ yellow-red; asci clavate	<i>adspersum</i>

5(3)	Lower side of head brown	6
	Lower side of head not brown, with or without white pruina	7
6(5)	Thallus well-developed, yellow-green; asci clavate; ascospores $13-14 \times 6-7 \mu\text{m}$	<i>viride</i>
	Thallus immersed or just visible as a grey stain; asci cylindrical; ascospores $8-11 \times 4-5 \mu\text{m}$	<i>salicinum</i>
7(5)	Mature asci clavate	8
	Mature asci cylindrical	9
8(7)	Ascospores $8-11 \times 3.5-5 \mu\text{m}$; thallus thin, verrucose or immersed, grey-green, slightly glossy	<i>parvum</i>
	Ascospores $13-14 \times 6-7 \mu\text{m}$; thallus usually thick, granular, bright yellow-green, matt	<i>viride</i>
9(7)	Apothecial stalk often tinged brown; mature ascospores with ornamentation of minute warts	<i>abietinum</i>
	Apothecial stalk black; ascospores cracked or ridged	10
10(9)	Thallus immersed, K ⁻ , C ⁻	11
	Thallus superficial, green or grey, K ⁺ yellow or red, C [±] orange	12
11(10)	Apothecia 0.5–0.9 mm tall, usually with a ± pruinose rim; ascospores with ornamentation of minute ± longitudinal ridges or cracks; asci $34-41 \times 3.5-4.5 \mu\text{m}$	<i>glaucellum</i>
	Apothecia (0.2–) 0.3–0.4 mm tall, not pruinose; ascospores with ornamentation of irregular cracks; asci $30-35 \times 4-5 \mu\text{m}$	<i>pinastri</i>
12(10)	Thallus thick, grey, granular, K ⁺ yellow→red, C ⁻	<i>quercinum</i>
	Thallus minutely verrucose, yellow-green, K ⁺ dull yellow, C ⁺ orange	<i>hyperelloides</i>
13(1)	Ascomata short-stalked to ± sessile, height and diameter approximately equal.....	14
	Ascomata entirely sessile, ± immersed within thallus (or host thallus).....	17
14(13)	Ascomata always without yellow pruina; ascospores finely verrucose	<i>victorianum</i>
	Ascomata, at least when young, with yellow or greenish pruina; ascospores longitudinally or helically ridged	15
15(14)	Apothecia 0.1–0.2 mm tall	<i>diploellum</i>
	Apothecia >0.5 mm tall	16
16(15)	A thick yellow pruina covering both head and exciple	<i>adpersum</i>
	Faint yellow pruina at the edge of the exciple only	<i>trabinellum</i>
17(13)	Thallus bright yellow-green	18
	Thallus pale to dark grey or greyish brown	19
18(17)	Ascospores 1-septate	<i>tigillare</i>
	Ascospores submuriform	<i>notarisii</i>
19(17)	Lichenicolous on <i>Pertusaria</i> sp. and relatives.....	20
	Not lichenicolous	21

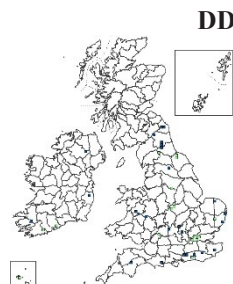
- 20(19) Apothecia sessile; ascospores at first coarsely helically striate, later with irregular ridges and cracks; usually on *Pertusaria coccodes* on bark *Acolium sessile*
 Apothecia immersed; ascospores with a few shallow fissures; on *Pertusaria pseudocorallina* on rock *Acolium marcianum*
- 21(19) Apothecia immersed; true exciple thin *trachylioides*
 Apothecia sessile; true exciple thick 22
- 22(21) Thallus immersed; ascospores 11–13 µm long *victorianum*
 Thallus superficial; ascospores 14–19 (–21) × 8–11 µm *Acolium inquinans*

Calicium abietinum Pers. (1797)

Thallus immersed. Apothecia 0.6–0.9 mm tall, 6–11 times as high as the width of the stalk, shiny black or dark brown, pruina absent, I–; head 210–280 µm diam., lens- or slightly bell-shaped; stalk 80–130 µm diam. Asci 44–52 × 4–5 µm, cylindrical. Ascospores 11.5–15 × 5–7 µm, uniseriately arranged, minutely warted to minutely cracked-areolate. C–, K–, KC–, Pd–; lichen products not detected by TLC. **BLS 0222**.

On wood, especially *Quercus* and conifers, also decaying stumps and logs; local. S. & C. England, N. England (Northumberland), C. Wales, Ireland.

Characterized by the non-pruinose apothecia, the black to frequently brownish or olivaceous stalks and the large, minutely warted ascospores. Formerly often incorrectly recorded for *C. glaucellum*, which has smaller, often faintly white-pruinose apothecia, shorter asci and smaller ascospores with minute, irregular ridges and cracks.



Calicium adpersum Pers. (1800)

Thallus granular, grey. Apothecia 0.6–1 mm tall, normally 3–5 times as high as the width of the stalk, black, I–, a very thin outermost layer I+ blue; yellow pruina present on head and exciple margin; head 0.3–0.6 mm diam., broadly lenticular; stalk 0.1–0.3 mm diam. Asci clavate-cylindrical. Ascospores 13–16 × 5.5–6.5 µm, with helically arranged ridges. Thallus K+ yellow→red, Pd+ yellow-red (norstictic acid); the pruina contains vulpinic acid. **BLS 0223**.

On dry, old *Quercus* bark; rare. S. England (Oxford), C. Wales (Montgomery), Scotland (E. Ross).

Characterized by the yellow pruina which is best developed on the heads of young apothecia. In *C. trabinellum* the yellow pruina is restricted to the lower surface of the head.



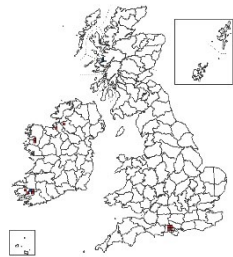
Calicium diploellum Nyl. (1868)

CR D IR

Thallus very thin, grey-white to green, finely granular. Apothecia 0.1–0.2 mm tall, black, top-shaped; head 80–120 µm diam., often green-pruinose when young. Ascospores 6–9 × 3–4 (–4.5) µm, often remaining aseptate, with helically arranged ridges. The pruina contains vulpinic acid; no other lichen products reported. **BLS 1649**.

Usually inside the lenticels of dry *Ilex* bark, more rarely on the bark, mainly found surrounded by *Mycoporum lacteum*, which does not overgrow the lenticels unlike *Lecanactis abietina*; very rare. N.W. Scotland (W. Inverness, Loch Sunart), S. England (Hampshire, New Forest), W. Ireland.

A minute, poorly understood species; the ascospore ornamentation is particularly well developed. This species is difficult to spot due to its small size, it is best detected by looking for the green thallus coloration within lenticels and then searching for apothecia.



Calicium glaucellum Ach. (1803)

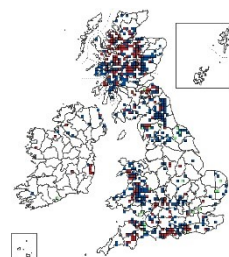
LC

Thallus usually immersed, rarely superficial, with an indistinct dark grey-green granular thallus. Apothecia 0.5–0.9 mm tall, 4–8 times as high as the width of the stalk, shiny black, usually with a faint white pruinose region

at the edge and below the head, I-; head 0.23–0.34 mm diam., obovoid to lens-shaped; stalk 0.11–0.17 mm diam. Asci 34–41 × 3.5–4.5 μm, cylindrical. Ascospores 9–13 × 5–6.5 μm, uniseriately arranged, with irregular cracks and ± longitudinal ridges on the surface. Pycnidia frequent; conidia 4–5 × ca 0.8 μm, narrowly cylindrical. Thallus C–, K± dull yellow, KC–, Pd– (sekikaic, 2-O-methylsekikaic, 4-O-methylhypocetraric and physodic (±) acids by TLC). **BLS 0225**.

On old stumps or standing or fallen wood of coniferous and deciduous trees, more rarely on bark; common. Throughout Britain, less common in formerly polluted central and eastern areas; rare in Ireland.

Characterized by the rather short-stalked black apothecia that frequently have a white rim of pruina on the upper part of the exciple, the immersed or rarely superficial thallus and the medium-sized ascospores that have distinctive irregular cracks and ridge fragments at maturity. Formerly often misidentified as *C. abietinum*, which has black-brown apothecia, lacks white pruina and has longer asci and larger ascospores with an irregular warty surface. Also resembles *C. trabinellum* (see below). *Chaetothecopsis pusilla* is sometimes commensal on the thallus.



Calicium hyperelloides Nyl. (1860)

Thallus minutely verrucose to almost immersed, greenish to yellowish green. Ascomata 0.48–0.65 mm tall, not pruinose or sometimes with a white pruina of minute crystals on the lower side of the head, 4–5.5 times as tall as the diameter of the stalk, all parts of the ascomata I-; head 0.17–0.27 mm diam., the exciple formed by dark brown, elongate and interwoven hyphae with thickened walls, or of almost isodiametric cells; hypothecium dark brown, with convex upper surface; inner surface of the exciple sometimes lined by a layer of minute crystals that appears as a yellow lining of the border of the mazaedium; stalk 90–150 μm diam., not pruinose, shining black. Asci cylindrical with uniseriate spores, 41–45 × 4.7–5.7 μm. Ascospores ellipsoidal, with a minutely uneven and cracked surface, 10.9–12.7 × 5.2–6 μm. Thallus usually C+ orange, K+ dull yellow, KC+ orange-red, Pd-, UV+ dark orange. Some specimens contain arthothelin, thiophanic acid, and thuringione, others arthothelin and thiophanic acid only. In addition, smaller amounts of unidentified xanthonines occur. Several specimens contain only traces of unidentified compounds or have no detectable amounts of secondary substances. **BLS 2407**.

On partly shaded, easily wetted *Quercus* bark. S. England (Cornwall, New Forest), Isles of Scilly, N. Ireland (Fermanagh); rare.

The colour and C+ orange reaction of the thallus separate this species from *C. glaucellum* which has similar ascomata.

CR D



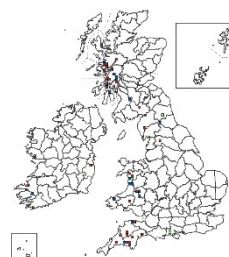
Calicium lenticulare Ach. (1816)

Thallus granular to verrucose or almost immersed, greenish to yellowish grey or with a bluish tinge. Apothecia 0.6–1.3 mm tall, 4–8 times as high as the width of the stalk, black, mostly with a distinct white pruina on the lower surface of the head; stalk and exciple I+ dark blue (in squash); head 0.2–0.55 mm diam., obconical to lens-shaped; stalk 80–220 μm diam., black or with a reddish tinge. Asci narrowly clavate to ± cylindrical. Ascospores 9–11 × 4–5 μm, remaining non-septate while in the asci, then 1-septate, broadly ellipsoidal, minutely verrucose to areolate. C± faint yellow, K-, KC-, Pd-, UV+ orange. Placodiolic and 4-O-methylhypocetraric (±) acids by TLC. **BLS 0229**.

On wood, often decaying stumps, or bark, especially of *Quercus*; scarce. W. England, Wales, W. Scotland, S.W. Ireland.

Recognized by the obconical head with an often slightly reddish brown stalk, strong I+ blue reaction of the stalk and exciple, narrowly clavate asci and late formation of the ascospore septum. The previously unrecorded UV+ orange fluorescence of the thallus has caused confusion with *Calicium hyperelloides*, but this also has a strong C+ orange reaction. The *Calicium* species most tolerant of high humidity.

Nb IR



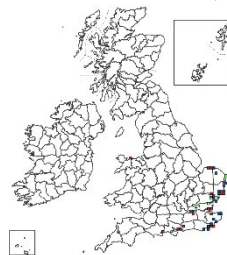
Calicium notarisii (Tul.) M. Prieto & Wedin (2016)*Cyphelium notarisii* (Tul.) Blomb. & Forssell (1880)

Thallus verrucose to almost totally immersed, bright yellow-green. Apothecia 0.2–0.5 (–0.8) mm diam., produced singly on thalline warts, immersed, not pruinose; true exciple brown, thin, rim-like, not thickened at the base. Asci evanescent at a very early stage. Ascospores 2- to 3-seriate, $13\text{--}32 \times 11\text{--}19 \mu\text{m}$, irregular in shape, 1-septate to submuriform. Pycnidia black, $50\text{--}100 \mu\text{m}$ diam., but often forming irregular clusters to 0.26 mm diam.; conidia ellipsoidal, colourless, $3.8\text{--}4.2 \times 1.5\text{--}1.8 \mu\text{m}$. Thallus C–, K–, KC–, Pd– (rhizocarpic acid). **BLS 0475.**

On wood, particularly weathered fence rails, old garden seats and gates, especially near the sea; rare. S.E. and E. England, N. Wales.

Characterized by the vivid yellow-green, verrucose thallus, immersed apothecia and submuriform ascospores. In external morphology it is identical with *C. tigillare*, which, however, has only 1-septate ascospores and is restricted to ancient woodlands.

NT

**Calicium parvum** Tibell (1975)

Thallus thin, grey to greenish grey, verrucose or ± immersed. Apothecia 0.5–0.8 mm, 6–8 times as high as the width of the stalk, black, shiny, I–, sometimes with a thin white pruina at the base of the exciple; head 0.12–0.4 mm diam., lens-shaped; stalk $80\text{--}120 \mu\text{m}$ diam. Asci clavate, persistent until the spores are nearly mature. Ascospores $8\text{--}11 \times 3.5\text{--}5 \mu\text{m}$, biseriate or fasciculately arranged, constricted at the septum and with irregular cracks on the surface. Pycnidia frequent; conidia $2\text{--}3 \times 1\text{--}1.5 \mu\text{m}$, ellipsoidal. Thallus C–, K± dull yellow, Pd+ pale yellow, UV+ white (diffractaic acid). **BLS 0226.**

On wood and bark, mostly on old *Pinus*; rare, possibly overlooked. C. & E. Scotland in native pinewoods, and S. England (New Forest) on introduced *Pinus* in humid glades within pasture woodlands.

Resembles *C. glaucellum*, which is most usually found on wood; also distinguished from this species by the smaller apothecia, which are usually not pruinose, the superficial thallus, clavate asci, and smaller, narrower ascospores. The UV+ white and Pd+ yellow reactions of the thallus are useful for field identification.

NT

**Calicium pinastri** Tibell (1999)

Thallus very thin, grey and sometimes with a greenish tinge, or ± immersed. Apothecia (0.2–) 0.33–0.4 mm, 2–3 times as high as the width of the stalk, not pruinose, I–; head 0.14–0.2 mm diam., obconical to lenticular, with a flat or slightly convex upper surface. Stalk often rather short, glossy black, not pruinose, $0.09\text{--}0.15 \text{ mm}$ diam., consisting of dark brown interwoven strongly sclerotized hyphae, the surface layer paler and forming a ± distinct colourless coat. Asci when mature cylindrical with uniseriately arranged spores, $30\text{--}35 \times 3.7\text{--}5.4 \mu\text{m}$. Ascospores when young smooth, when mature with an ornamentation of irregular cracks, broadly ellipsoidal, $9.5\text{--}13.5 \times 5.1\text{--}6.4 \mu\text{m}$. Thallus C–, K–, KC–, Pd–. **BLS 2740.**

On bark of *Pinus sylvestris*, recorded once on *Quercus* lignum. England (Hampshire, New Forest) and Scotland (Moray); rarely recorded but probably overlooked.

Close to *Calicium glaucellum*, but the apothecia lack pruina at the edge of the exciple, the ascospores have an ornamentation of irregular cracks rather than minute longitudinal ridges, and the asci are shorter and relatively broader.

NE

**Calicium quercinum** Pers. (1797)

Thallus verrucose-granular, distinct, greyish green, thick. Apothecia 0.5–1 mm tall, 5–7 times as high as the diameter of the stalk, black, matt, with white pruina on the lower surface of the head, I–; head 0.16–0.54 mm diam., lens-shaped, stalk $80\text{--}240 \mu\text{m}$ diam. Asci cylindrical. Ascospores $9\text{--}11 \times 4\text{--}5 \mu\text{m}$, uniseriately or sometimes biseriately arranged, with helically arranged ridges and irregular cracks. Thallus C–, K+

Ex



yellow→red, Pd+ yellow (norstictic acid). **BLS 0227**.

On oak trunks and timber; not recorded since the 19th century and possibly extinct in the British Isles. Formerly scattered throughout England and Wales, S.E. Scotland (Lanark, Falls of Clyde).

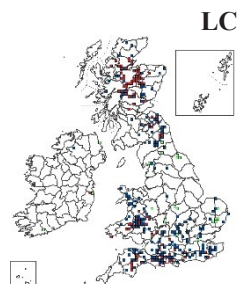
Characterized by the well-developed thallus, pruinose apothecia, cylindrical asci and ascospores with helically arranged ridges.

Calicium salicinum Pers. (1794)

Thallus immersed, often staining the substratum grey. Apothecia 0.4–1.5 mm tall, 10–15 times as high as the width of the stalk, brown-black, with brown pruina on the lower side of the exciple and sometimes the upper part of the stalk, I–; head 0.18–0.4 (–0.6) mm diam., lens-shaped; stalk 50–120 µm diam. Asci cylindrical. Ascospores 8–11 × 4–5 µm, uniseriately arranged, ellipsoidal, with helically arranged ridges. Thallus C–, Pd+ yellow-orange, K+ yellow→red (norstictic acid). **BLS 0228**.

On dry, less acid bark and wood, especially on bark on the dry sides of old *Quercus* and on lignum on *Fagus*. Sometimes apparently parasitic on *Cliostomum griffithii*. Throughout Britain, but absent from formerly polluted areas and from the most oceanic areas in the west, rare in Ireland.

Characterized by the brown pruina on the lower side of the head, the small, helically striate spores and the K+ yellow→red thallus. *C. viride* has a bright green, rather than grey thallus, clavate asci and larger ascospores. *C. lenticulare* sometimes has a reddish brown tinge on the lower side of the head but differs in the head being obconical, the smooth to minutely verrucose ascospores, I+ blue apothecial stalk and exciple and K– thallus.



Calicium tigillare (Ach.) Pers. (1811)

Cyphelium tigillare (Ach.) Ach. (1815)

Thallus verrucose, of variable thickness, bright yellow-green. Apothecia 0.2–0.6 (–0.8) mm diam., immersed, not pruinose; true exciple thin, rim-like, brown. Ascospores 17–21 × 9–11 µm, 1-septate, broadly ellipsoidal, the surface smooth, without cracks. Pycnidia scarce, 160–190 × 105–125 µm, forming irregular clusters to 0.4 mm diam.; conidia ellipsoidal, colourless, 3–4 × ca 1.5 µm. Thallus C–, K–, KC–, Pd– (rhizocarpic acid, epanorin and two unidentified compounds by TLC). **BLS 0476**.

On wood, especially of conifers, and gate posts in old forests; very rare. England (Sussex, New Forest, Herefordshire), Scotland (E. Highlands).

Characterized by the yellow-green verrucose thallus, immersed apothecia and 1-septate ascospores. Morphologically very similar to *C. notarisii* which has submuriform ascospores and more frequently occurring pycnidia.



Calicium trabinellum (Ach.) Ach. (1803)

Ex

Like *C. glaucellum*, but apothecia with greenish yellow pruina on the lower surface of the head, and ascospores ornamented with irregular cracks. The pruina contains vulpinic acid. **BLS 0230**.

On wood, e.g. old fence posts; possibly extinct in Britain and Ireland. E. & C. Scotland (Perth).

Characterized by the yellow pruina which is restricted to the lower surface of the head. In *C. adpersum* the yellow pruina occurs over the head and the ascospores have helically arranged ornamentation.



Calicium trachylioides (Nyl. ex Branth & Rostr.) M. Prieto & Wedin (2016)

Cyphelium trachylioides (Nyl. ex Branth. & Rostr.) Erichsen (1938) **CR D IR**

Like *C. tigillare* but pale green to greyish fawn, not yellow-green. Ascospores slightly larger, 20–23 × 10–13 µm. Apothecia are immersed in discrete thalline warts. They differ from those of *C. inquinans* (0.4–1.6 mm diam.) in being smaller (0.5–0.7 mm diam.), and in producing ± smooth-walled ascospores. No lichen products detected by TLC. **BLS 1900**.



On peeled (not sawn) surface of a roadside fence post, and wood paneling. E. Scotland (Angus and Berwickshire).

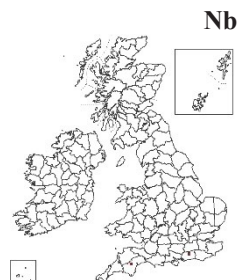
Rhizocarpic acid-deficient populations of *C. tigillare*, noted from Continental Europe, can resemble this species.

Calicium victorianum (F. Wilson) Tibell (1987)

Thallus immersed, inconspicuous. Apothecia to 0.1 mm tall, short-stalked and often appearing to be ± sessile, black, the mazaedium dark brown, not pruinose, I-; head inverted bell-shaped, 0.2–0.5 mm diam. Asci cylindrical. Ascospores (9–) 11–13 × 4–6 μm, uniseriately arranged, only slightly constricted at the septum, with fine, irregular warts at maturity. The thallus contains physodalic acid. **BLS 2471.**

Recorded once on a wooden fence-post (W. Sussex) and once on an old *Ilex* in pasture woodland (S. Devon); very rare.

Very similar to *C. glaucellum*, which has taller apothecia and often a white pruina at the edge of the head. The almost sessile apothecia are likely to cause confusion with *C. inquinans*, which has larger ascospores and a usually well-developed, superficial thallus.



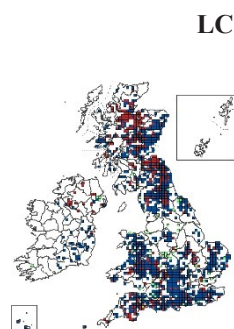
Calicium viride Pers. (1794)

Calicium corynellum sensu auct. br., non (Ach.) Ach. (1803)

Thallus granular, usually well-developed, bright green. Apothecia (0.3–) 0.6–1.9 mm tall, mostly 9–16 times as high as the width of the stalk, black, I-; head 0.14–0.7 mm diam., often with a brown pruina on the lower surface; stalk 40–160 μm diam. Asci clavate. Ascospores 11–13.5 × 6–7 μm, biseriately arranged, commonly constricted at the septum when mature, with deep, irregular cracks. Contains rhizocarpic acid and epanorin. **BLS 0231.**

On wood and dry, acid bark, rarely on siliceous rocks below overhangs when the apothecial stalks tend to be shorter; was very common, but appears to have strongly declined in the south in formerly acidified areas as the levels of pollution reduced, always rarer in the west. Throughout Britain and eastern Ireland.

Recognized by the bright green thallus. Some specimens with an immersed thallus and well-developed brown pruina on the lower side of the head may resemble *C. salicinum*, which has cylindrical asci and smaller ascospores with spirally arranged ridges.



DIPLOICIA A. Massal. (1852)

Thallus crustose, placodioid, forming rosettes, pale glaucous green, covered with pruina that is particularly evident when dry; prothallus absent. **Upper cortex** pseudoparenchymatous, packed with minute diamond-shaped crystals which grow and form chains in K. **Soralia** present in some species.

Photobiont chlorococcoid. **Ascomata** apothecia, at first immersed in the thallus, emergent; disc medium-sized, black, usually with a covering of crystalline granules; flat to convex. **Thalline margin** absent (present in some non-British species). **True exciple** thin, becoming excluded, concolorous with the disc. **Epithecium** dark brown. **Hamathecium** of unbranched or forked septate paraphyses with 2-3 brownish swollen cells at the top and a dark brown cap. **Hymenium** colourless, I+ blue. **Hypothecium** dark brown. **Asci** 8-spored, *Lecanora* type. **Ascospores** 1-septate, ellipsoidal, brown. **Conidiomata** pycnidia, immersed, brown-black. **Conidiogenous cells** pleurogenous, branched. **Conidia** rod-shaped, colourless. **Chemistry**: depsides and xanthenes. **Ecology**: on rock and bark.

Preliminary molecular work (Molina *et al.* 2002) suggested that *Diploicia* is related to *Diplolemma* but subsequent studies indicate that they are phylogenetically distinct (e.g. Miądlikowska *et al.* 2014).

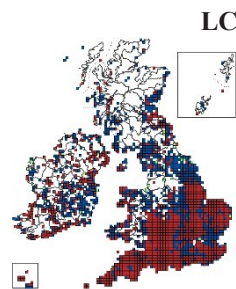
Bungartz *et al.* (2016) noted similarities of chemistry with *Endohyalina* (q.v.). There is only one British species.

Literature

Benfield & Purvis (2009), Bungartz *et al.* (2016), Gaya *et al.* (2012), Miądlukowska *et al.* (2014), Molina *et al.* (2002).

Diploicia canescens (Dicks.) A. Massal. (1852)

Thallus to 6 cm diam, often smaller and coalescing, outer lobes radiating, thickly pruinose, closely contiguous, convex, pleated, 0.5–1 mm broad, wider at the margins, glaucous white; lobe ends incurved, white-grey, verruculose and cracked-areolate towards the centre; soralia mainly laminal, effigurate at first then coalescing; soredia green-white, sometimes developing grey tips, finely granular. Apothecia 0.3–1 mm diam. locally common near the coast, rare inland; true exciple black with a marginal zone of crystals. Ascospores (8.5–) 9–12 (–15) × (4–) 5.5–7 (–7.5) μm. Pycnidia more common on new lobes of fertile specimens, narrowly ‘U’-shaped in section, ca 0.24 mm tall, 60–70 μm diam., the wall colourless; dark brown or green-black around the ostiole only; conidia aseptate, rod-shaped, 5–8 × ca 0.7 μm. Thallus C–, K+ yellow, KC+ yellow, Pd–, UV± dull orange (atranorin, chloroatranorin, diploicin and a xanthone). **BLS 0491.**



On dry rocks and stonework, and dry bark in nutrient-enriched or calcareous habitats. Very common throughout lowland Britain and Ireland, but rarer and increasingly restricted to coastal districts in N. Britain.

Resembles *Solenopsora candicans*, which is not sorediate, has a thalline margin, 1-septate colourless ascospores, different chemistry and is restricted to hard limestone. The black apothecia of *Arthonia diploiciae* (q.v.) and *Rhymbocarpus cruciatus* (Sherwood, D. Hawksw. & Coppins) Etayo & Diederich (2000) are occasionally found on the thallus.

DIPLATOMMA Flot. (1849)

Thallus crustose, superficial, delimited, rarely effuse, pale to dark grey, continuous or ± rimose, or absent to immersed if lichenicolous. **Cortex** densely packed with minute crystals, not dissolving in K. **Photobiont** chlorococcoid. **Ascomata** apothecia, immersed at first, emergent. **Thalline margin** sometimes present, pale, thin, crenate. **Disc** black, sometimes white-grey pruinose. **True exciple** poorly developed, continuous with the hypothecium. **Epithecium** brown. **Hymenium** colourless, I+ blue. **Hypothecium** pale to dark brown, semi-opaque. **Hamathecium** of unbranched paraphyses with enlarged, pigmented apical cells. **Asci** 8-spored, ± ellipsoidal-clavate, *Lecanora*-type. **Ascospores** septate to submuriform, distoseptate, brown ascospores with rounded lumina. **Conidiomata** pycnidia, pale to dark brown above, colourless below. **Conidia** ellipsoidal, colourless, aseptate. **Chemistry**: depsides. **Ecology**: on basic or nutrient-enriched bark, also calcareous rocks, mortar and walls, more rarely asbestos-cement, or parasitic on lichens.

The circumscription of species in this genus is somewhat unsatisfactory, as there is little correlation between life-form, thallus morphology, ascospore characters and chemistry. The lichenicolous taxa were subsumed in *D. alboatrum* by Nordin (2000), but were kept separate by Duke & Purvis (2009). The systematics of the buellioid genera is in a state of flux and we have taken a conservative approach in the present treatment pending further study. *Diplotomma* differs from *Buellia* in the crystalline-granular thallus cortex, immersed apothecia, septate to submuriform, and red-brown ascospores with rounded lumina. *Rhizocarpon* may have rather similar ascospores but the asci are of a distinctive type. *D. venustum* Körb. is incorrectly recorded for the British Isles.

Literature

Bungartz *et al.* (2016), Duke & Purvis (2009), Gaya *et al.* (2012), Molina *et al.* (2002), Nordin (1996, 2000).

1	Thallus K ⁻ , Pd ⁻	2
	Thallus K ⁺ yellow→red (crystals), Pd ⁺ orange	<i>chlorophaeum</i>
2(1)	Lichenicolous	3
	Not on lichens	5
3(2)	On <i>Pyrenodesmia</i> (<i>Caloplaca</i>) <i>teicholyta</i> ; ascospores 20–22 µm long	<i>murorum</i>
	Ascospores 12–16 (–19) µm long	4
4(3)	On <i>Polycauliona</i> (<i>Caloplaca</i>) <i>verruculifera</i> ; ascospores 7–9 µm diam., 4–6 (–8) septate, submuriform, smooth	<i>vezdanum</i>
	On <i>Myriolecis</i> (<i>Lecanora</i>) <i>dispersa</i> agg.; ascospores 5.5–7.5 µm diam., 3-septate, minutely warted.....	<i>parasiticum</i>
5(2)	Ascospores never submuriform; on calcareous rocks	<i>hedinii</i>
	Ascospores soon becoming submuriform; on nutrient-rich bark or calcareous rocks	6
6(5)	True exciple prominent; always corticolous	<i>pharcidium</i>
	True exciple inconspicuous; corticolous and saxicolous	<i>alboatrum</i>

Diplotomma alboatrum (Hoffm.) Flot. (1849)

Thallus thin to thick, often wide-spreading, white or pale to dark grey, smooth or rimose-cracked or granular, ± determinate; dark prothallus absent. Apothecia 0.3–0.8 (–1.5) mm diam.; disc at first flat, later ± convex, often pruinose; thalline margin sometimes present, white, sometimes ± crenulate; true exciple inconspicuous; epithecium brown; hymenium 45–75 µm tall, colourless; hypothecium brown. Asci (40–) 55–70 × (10.5–) 17–25 µm. Ascospores (11–) 15–20 (–30) × (5.5–) 8–10 (–17) µm, at first (1–)3-septate, mostly submuriform at maturity. Thallus C⁻, K⁻, KC⁻, Pd⁻, UV⁻ (no lichen substances detected by TLC). **BLS 0496**.

On basic or calcareous rocks, mortar and stonework, and occasionally on nutrient-rich bark, especially *Ulmus* and *Fraxinus*, and worked timber. Frequent, throughout Britain and Ireland.

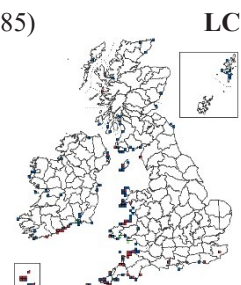
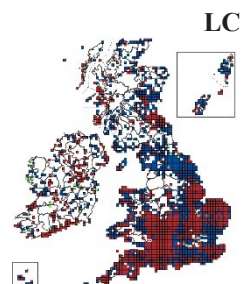
D. alboatrum is an extremely variable species in need of a comprehensive revision. *D. murorum* and *D. vezdanum* may be lichenicolous forms of this species; their characters fall within the range of *D. alboatrum*. *D. pharcidium* is very closely related if not synonymous. *D. chlorophaeum* is also considered synonymous with *D. alboatrum* by some but is retained here because of its unique chemistry and ecology.

Host to *Arthonia punctella* (q.v.) and scattered or contiguous, grey-green, grey-brown or brown areoles of *Verrucula latericola* s.l., rare but probably overlooked.

Diplotomma chlorophaeum (Hepp ex Leight.) Kr.P. Singh & S.R. Singh (1985)

Thallus thick, white to ochraceous, regularly rimose or warted, or thin and pale grey, cracked-areolate or disappearing, ± determinate; dark prothallus absent. Apothecia 0.2–0.6 mm diam.; disc flat, later becoming convex, non-pruinose; thalline margin disappearing; true exciple indistinct; epithecium brown; hymenium 80–115 µm tall; hypothecium brown. Asci 40–80 × 13–20 µm. Ascospores (14.5–) 18.5–27.5 × (7.0–) 10–12.5 µm, 3-septate to submuriform. Medulla C⁻, I⁺ blue, K⁺ yellow→red (crystals), KC⁻, Pd⁺ yellow-orange (norstictic acid). **BLS 0497**.

On coastal rocks, sea walls, sandy mortar; locally frequent. W. Britain and coastal Ireland.

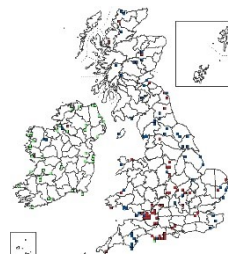


Distinguished by the reactions with Pd and K. It has been suggested that it is merely a form of *D. alboatrum*, but is maintained as a separate species in this treatment because of its different chemistry and very specialized ecology.

Diplotomma hedinii (H. Magn.) P. Clerc & Cl. Roux (2004) **LC NS**

Like *D. alboatrum*, but the thallus sometimes pale brownish and the ascospores (1-) 3-septate, lacking longitudinal septa, and more frequently curved. Thallus C-, K-, KC-, Pd-, UV- (no lichen substances detected by TLC). **BLS 0498**.

On calcareous rocks; local. Scattered throughout Britain and Ireland.

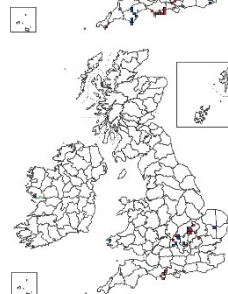


Diplotomma murorum (A. Massal.) Coppins (1980) **NE NR**

Like *D. alboatrum*, but the thallus inconspicuous to ± continuous and powdery-superficial. Apothecia ± prominent, soon becoming convex, very pruinose. Ascospores 20–22 × 7.5–9 µm. Thallus C-, K-, KC-, Pd-, UV- (no lichen substances detected by TLC). **BLS 0317**.

Parasitic on *Pyrenodesmia* (*Caloplaca*) *teicholyta*. Rare. S.E. England and E. Anglia, Wales (Pembrokeshire), W. Ireland (Galway).

The lichenicolous habit and the host seem to be the only distinguishing characters from *D. alboatrum*; not accepted by (Nordin 1996), where it is synonymized with that species.



Diplotomma parasiticum (B. de Lesd.) Diederich, Cl. Roux & van Haluwyn (2014) **NE NR**

Thallus inconspicuous or absent (lichenicolous). Apothecia 0.2–0.3 mm diam. Asci 6- to 8-spored. Ascospores 12.5–16 × (5.5–) 6.5–7.5 µm, 3-septate (rarely with a single longitudinal septum), brown and minutely warted. **BLS 2673**.

Developing in apothecia of *Myriolecis* (*Lecanora*) *antiqua* and the *M. dispersa* agg. (parasitic on other *Myriolecis* species elsewhere).

Known from single collections in S. England (Surrey) and S. Scotland (E. Lothian).

Diplotomma pharcidium (Ach.) M. Choisy (1950)

Thallus whitish to dark grey, smooth or rimose, continuous; a dark brown prothallus usually present. Apothecia 0.5–1 mm diam., abundant, at first immersed, later ± sessile, disc usually remaining flat for a long time, eventually ± convex, sometimes pruinose; the margin thin or with thalline granules in young apothecia; exciple <80 µm thick, pale in the inner part, dark brown in the outermost rim, usually well-developed and extending below the hypothecium; hymenium 75–100 µm tall, without oil droplets; asci 50–68 × 14–22 µm; ascospores (15.5–) 16.5–19.5 (–23) × (6.5–) 6.8–8.4 (–9.5) µm, ellipsoidal, 3-septate or submuriform, often slightly curved. Pycnidia rare; conidia 7–10 × ca 1 µm, bacilliform. Thallus C-, K-, KC-, Pd-, UV- (no lichen substances detected by TLC). **BLS 2316**.

On rather smooth, nutrient-rich bark, mainly of *Populus* spp. and *Fraxinus* (sometimes with *D. alboatrum*) on old deciduous trees, seldom on lignum. Locally frequent in N.E. Scotland and recently found in Ireland (Westmeath); historic records from Shropshire, Yorkshire, Roscommon & Cork.

When typically developed, *D. pharcidium* is recognizable in the field by its relatively large and flattened apothecia with a prominent, thick margin, bordered with a thalline veil. May resemble *Buellia disciformis* or *Lecidella elaeochroma* with a whitish thallus. It is sometimes mistaken for *D. alboatrum*, which has smaller apothecia with a thinner and less conspicuous margin. The submuriform and usually 8-celled ascospores of *D. alboatrum* are distinctive; longitudinal septa occurring in the ascospores of *D. pharcidium* are restricted to the central part of the ascospores, on either side of the middle, transverse septum.



Diplotomma vezdanum (P. Scholz & Knoph) Coppins (2002)

Apparently lichenicolous, modifying the surface structure of the host thallus and changing its colour from orange to white. Apothecia irregularly round, dispersed, appressed, occasionally constricted at the base, *ca* 0.3 (–0.5) mm diam., disc flat to convex, black, shiny to matt; margin distinct from the beginning, mostly persistent, black, shiny; true exciple partly interspersed with crystals, 30–50 (–60) μ m thick; hypothecium hyaline, partly interspersed with crystals, *ca* 200 μ m thick; hymenium (60–) 65–80 μ m thick, hyaline, I+ blue; epithecium brown; paraphyses mainly branched in the apical part; asci *ca* 50 \times 16–18 μ m; ascospores ellipsoidal to ovoid, 4–6 (–8)-septate, submuriform, 12–16 (–19) \times 7–9 μ m. Pycnidia not observed. Thallus C–, K–, KC–, Pd–, UV– (no lichen substances detected by TLC). **BLS 2339.**

On the thallus of *Polycauliona* (*Caloplaca*) *verruculifera*, coastal; rare. Wales (Cardiganshire and Pembrokeshire). Endemic.

Diplotomma murorum has longer ascospores, prominent, often pruinose apothecia which soon become convex, and is only known on *Pyrenodesmia* (*Caloplaca*) *teicholyta*. The lichenicolous habit and the host seem to be the only distinguishing characters and *D. vezdanum* was not accepted by Nordin (1996), where it was considered a synonym of *D. alboatrum*.

**ENDOXYALINA** Marbach (2000)

Thallus crustose, or lichenicolous with an absent or inconspicuous thallus. **Photobiont** (when present) chlorococcoid. **Apothecia** lecideine, immersed to sessile, black, small. **Thalline margin** absent or inconspicuous, becoming excluded. **True exciple** poorly developed, with a dark outer part with hyphae with \pm swollen cells and a paler to colourless inner part with hyphae similar in structure and orientation to the paraphyses. **Hymenium** \pm interspersed with oil droplets or not. **Hypothecium** pale to dark brown. **Asci** *Bacidia*-type. **Hamathecium** of paraphyses with apical cells \pm enlarged, with brown caps. **Ascospores** brown at maturity but with the ends paler, always one-septate and small, ellipsoidal or fusiform, with internal wall thickenings mostly of the *Dirinaria*-type, but also grading into the *Milvina*-, *Physconia*- or *Pachysporaria*-type; ontogeny of type B (Giralt 2001), with apical internal wall thickenings appearing before the septum develops; surface smooth to minutely rugulose. **Conidiomata** pycnidia, **conidia** bacilliform. **Chemistry**: diploicin, fulgidin and isofulgidin; dechlorodiploicin, caloploicin, brialmontin 1, atranorin, or secalononic acids present. **Ecology**: corticolous or rarely lignicolous, or lichenicolous on siliceous substrata.

A segregate from *Rinodina* taken up by Giralt *et al.* (2010), differing from that genus by its \pm lecideine apothecia, *Bacidia*-type asci and distinct spore ontogeny. Molecular data are sparse with only basic data available for a single species, but that appears to cluster outside of the main *Rinodina* clade and the genus was assigned to the Caliciaceae by Lücking *et al.* (2016). The British species are also included in the *Rinodina* key in the current publication.

Literature

Giavarini *et al.* (2009), Giralt (2001, 2010), Giralt *et al.* (2010), Lücking *et al.* (2016), Marbach (2000), Nadyeina *et al.*, (2010).

- 1 Thallus crustose, K+ yellow; hymenium containing numerous oil droplets..... *ericina*
Thallus absent, lichenicolous on *Lecanora rupicola* agg.; hymenium without oil droplets *insularis*

Endohyalina ericina (Nyl.) Giralt, van den Boom & Elix (2010)*Rinodina ericina* (Nyl.) Giralt (2000)

Thallus crustose, of discrete whitish convex warts, rarely continuous. Apothecia lecideine, 0.2–0.5 (–0.7) mm diam., sessile; true exciple thick, entire and persistent; disc black, flat to subconvex; epithecium dark brown; hymenium 50–70 µm high, containing numerous oil droplets; hypothecium brown with a greenish tinge. Ascospores fusiform, smooth, (10–) 11–15 (–18) × 4.5–6.5 µm, *Dirinaria*-type (Fig. 1D). Thallus K⁺ yellow (atranorin, diploicin and an additional unknown lichen substance). **BLS 1922.**

In coastal habitats on *Calluna*, Ireland (Sybil Point, Kerry) and *Larix* (Ulva, Inner Hebrides); also recently reported on granite from Penwith Moor (Cornwall).

Recognised by the discrete and subconvex thalline warts, K⁺ yellow thallus (atranorin) and dark brown hypothecium, that and the hymenium interspersed with oil droplets.



Nb

Endohyalina insularis (Arnold) Giralt, van den Boom & Elix (2010)*Rinodina insularis* (Arnold) Hafellner (1979)

Thallus lichenicolous, absent or inconspicuous. Apothecia lecideine, ± immersed in the host thallus, 0.2–0.4 (–0.5) mm diam.; thalline margin absent; true exciple black, concolorous with a flat to ± convex disc, becoming excluded; hymenium 50–70 (–80) µm high; epithecium dark brown; paraphyses 1.5–2 µm diam., apices 3–5 µm diam. with a brown cap; hypothecium brown. Asci *Bacidia*-type. Ascospores *Dirinaria*-type (Fig. 1D), 11–15 × 5.5–7 (–8) µm. **BLS 2462.**

On thalli of *Lecanora rupicola* on acid coastal rocks; a single record. N. Wales, Anglesey (Church Bay).



Nb

MONEROLECHIA Trevis. (1857)

Thallus crustose, areolate, subsquamulose to distinctly squamulose; squamules weakly convex to bullate, closely appressed or sometimes aggregated in elevated clusters, deep chocolate to grey- or greenish-brown, ± with a thin epinecral layer; medulla I–. **Prothallus** black or not distinct. **Photobiont** chlorococcoid. **Apothecia** adnate or sessile, thalline margin present or not (not in British species), true exciple thin, sometimes becoming excluded with age; disc and margin black, not pruinose, flat to convex. **True exciple** narrow, poorly differentiated. **Epithecium** brown. **Hymenium** without oil droplets. **Hypothecium** dark brown. **Hamathecium** of paraphyses, unbranched to moderately branched, apically swollen, with a brown pigmented cap. **Asci** 8-spored, clavate, *Lecanora*-type. **Ascospores** deep brown, 1-septate, septum narrow, smooth or indistinctly ornamented. **Conidiomata** pycnidia, urceolate to globose, unilocular, pycnidium walls lined with short, barely branched conidiophores, conidiogenous cells terminal. **Conidia** aseptate, bacilliform, colourless. **Ecology**: most species initially parasitic on other lichens, developing an independent thallus.

A segregate from *Buellia* accepted by Marbach (2000) and Kalb (2004), distinguished by its lichen-parasitic habit, hymenium without oil droplets, *Lecanora*-type asci, bacilliform conidia, and small ascospores which lack wall thickenings at maturity. Prieto & Wedin (2016) showed that *M. badia* clustered outside of the *Buellia* clade, although further phylogenetic studies are needed to clarify generic relationships. Only one species is reported from our region; it is included in the key to *Buellia* above.

Literature

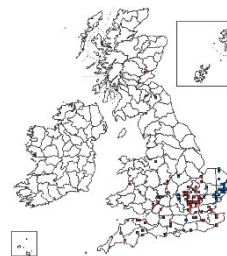
Coppins *et al.* (2009), Elix (2015), Kalb (2004), Marbach (2000), Prieto & Wedin (2016).

Monerolechia badia (Fr.) Kalb (2004)*Buellia badia* (Fr.) A. Massal. (1853)

Thallus crustose, bullate, subsquamulose to distinctly squamulose; squamules convex, closely appressed, 0.5–1 mm diam.; without a prothallus; surface matt to shiny, deep chocolate to grey-brown, not pruinose, with a thin epinecral layer of dead cells; medulla I–. Apothecia soon sessile on the thallus surface, 0.3–0.8 (–0.9) mm diam.; thalline margin thin, becoming excluded with age; disc and margin black, not pruinose, flat to convex; true exciple narrow, poorly differentiated; epithecium brown; hymenium without oil droplets; hypothecium dark brown; paraphyses unbranched to moderately branched, apically swollen, with a brown pigmented cap. Asci 8-spored, clavate. Ascospores cylindrical to ellipsoidal, not constricted at the septum, with obtuse ends, not curved, 10–15 (–17) × (6–) 7–8 (–8.5) μm, young spores olive-brown, mature spores deep brown, 1-septate, the septum narrow, not thickening during spore ontogeny, old spores indistinctly ornamented. Pycnidia rare, urceolate to globose, unilocular, pycnidium walls lined with short, barely branched conidiophores, conidiogenous cells terminal; conidia aseptate, bacilliform, 4–5 × 1–1.5 μm. No substances detected by TLC. **BLS 1546.**

On siliceous rock, especially roof tiles, usually closely associated or parasitic on *Xanthoparmelia* species; uncommon or overlooked, local. S. and central England, Wales (Cardigan, Radnor), S. and E. Scotland.

Nb

**ORCULARIA** (Malme) Kalb & Giralt (2011)

Thallus whitish, grey or evanescent. **Photobiont** chlorococcoid. **Apothecia** initially erumpent and apparently lecanorine, initially surrounded by thalline tissue simulating a thalline exciple, becoming sessile. **True exciple** poorly developed, composed of hyphal tissue, inner cells elongate, colourless to pale brown, outermost cells short, brown, swollen like the apical caps of the paraphyses. **Hypothecium** brown, not deep. **Hymenium** not interspersed with oil droplets. **Hamathecium** of paraphyses with distinct but moderately swollen dark brown caps. **Asci** *Bacidia*-type. **Ascospores** *Orcularia*-type, bilocular with long lumina canals (isthmi), or tetralocular with one additional lumen in each canal, pale brown with paler apices, ± citriform with mucronate apices, walls smooth, torus absent, with the septum inserted after lateral wall thickenings become distinct. **Conidia** filiform. Chemistry: no secondary lichen products, xanthonones, myeloconone D1 or norstictic acid.

A segregate from *Rinodina* with a distinctive ascospore type. As Kalb & Giralt (2011) noted, there are some parallels between *Orcularia* and *Amandinea*, particularly the filiform conidia and apothecia that initially appear to have a thalline margin. However, ascospore morphology and ontogeny is quite different in the two genera. Four species are currently recognized, of which only one occurs in our region; it is included in the key to *Rinodina* (Physciaceae).

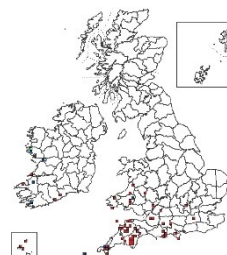
Literature

Giavarini *et al.* (2009), Kalb & Giralt (2011).

Orcularia insperata (Nyl.) Kalb & Giralt (2011)*Rinodina biloculata* (Nyl.) Sheard (1967)

Thallus thin, pale grey, continuous or rarely rimose and flat; prothallus inconspicuous. Apothecia 0.25–0.3 mm diam., sessile, rarely contiguous; thalline margin absent or poorly developed; true exciple brown or colourless, rarely continuous below the hypothecium, ca 50 μm thick, concolorous with the disc, or more rarely with the thallus, entire and persistent; disc black, persistently flat; epithecium dark brown; hymenium 60–80 μm tall; hypothecium 30–60 (–80) μm high, dark brown, I+ blue. Asci 40–45 × 17–19 μm. Ascospores 11.5–19 × 6.5–9.5 μm, thin-walled, thickened

Nb



only at the septum, *Orcularia*-type (Fig. 1F). Pycnidia black, ca 80 µm diam. Conidia filiform, 12–15 × 0.8 µm. Lichen products not detected by TLC. **BLS 1282**.

On bark and twigs; local. S. and S.W. England, W. and central Wales, W. Ireland, Channel Islands. Found much more frequently recently; either spreading or previously much overlooked.

Characterised by the pigmented true exciple, brown hypothecium and *Orcularia*-type ascospores.

PSEUDOTHELOMMA M. Prieto & Wedin (2016)

Thallus crustose, well-developed, verrucose or ± areolate, grey; one species with globose short-stalked **isidia** in black patches on the thallus surface. **Cortex** thin, without granular crystals. **Medulla** I- or I+ dark blue. **Ascomata** immersed in thalline warts, mazaedial. **Disc** black, flat, sometimes with a greenish or greenish-yellow pruina. **Thalline margin** absent. **True exciple** not sclerotized, thin and poorly developed laterally and forming a basal collar around the hypothecium. **Hypothecium** blackish brown, well-developed. **Hamathecium** absent. **Asci** cylindrical, with uniseriately arranged spores. **Ascospores** 1-septate, blackish brown, constricted at the septum, with a slightly uneven surface. **Conidiomata**: not known. **Chemistry**: thallus K-, C-, KC-, Pd-; occasionally usnic acid in the thallus, and epanorin and rhizocarpic acid in the hymenium and mazaedium. **Ecology**: on exposed dry lignum, particularly on wooden posts.

Separated from *Thelomma* based on phylogenetic studies by Prieto & Wedin (2016), and distinguished morphologically by the narrow exciple, the ecology, the thin crystal-free cortex and rather large septate ascospores. Only one species has been reported from our region.

Literature

Hitch & Purvis (2009), Lendemer (2013), Prieto & Wedin (2016), Tibell (1976, 1994).

Pseudothelomma ocellatum (Körb.) M. Prieto & Wedin (2016)

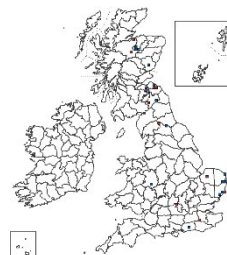
Thelomma ocellatum (Körb.) Tibell (1976)

Thallus crustose, well-developed, areolate or with elevated coarse flattened warts, grey; isidia frequent, forming irregular but well-delimited blue- or brown-black ± convex clusters; medulla I+ blue. Apothecia immersed, unknown in Britain and Ireland. Ascospores 1-septate, constricted at the septum with an uneven surface, 22–28 × 12–15 µm. Thallus C-, K-, Pd-, UV-. Occasionally with atranorin, norstictic and usnic acids (exciple and ascospore mass with rhizocarpic acid and epanorin). **BLS 1406**.

On tops and sides of weathered fence posts and gate rails; local. England (East Anglia, W. Sussex, Welsh Marches, Northumberland), E. Scotland.

Sterile, isidiate material occurs predominantly in nutrient-enriched lowland sites, whereas fertile material is characteristic of high altitudes.

LC NS



TETRAMELAS Norman (1852)

Thallus crustose, subsquamulose or granular, not determinate, usually grey or whitish (brown to yellowish or orange in some non-British species), some species lichenicolous but with an ± independent thallus at some stages of development. **Soralia** present in one species (not in British taxa). **Prothallus** not differentiated. **Photobiont** chlorococcoid. **Ascomata** apothecia, ± sessile and

sometimes with a constricted base, the disc sometimes pruinose. **Thalline margin** absent or present as a thalline rim when young. **True exciple** well-developed (though sometimes becoming excluded), sometimes flexuose, dark-pigmented. **Epithecium** brown to olivaceous or aeruginose. **Hymenium** sometimes with oil droplets. **Hypothecium** dark brown. **Hamathecium** of paraphyses, septate, unbranched or branched in the upper third, apices swollen and pigmented, often with a dark brown cap. **Asci** with 8 or fewer spores, clavate, *Bacidia*-type. **Ascospores** brown, 1- to 3-septate, usually large, fusiform and slightly curved, \pm *Callispora*-type when immature (see Giralt & Clerc 2011), when mature the pigmented parts of the spore wall consisting of a thick wall and a thin, irregularly cracked epispore, which is less than half as thick as the wall. **Conidiomata** pycnidia, immersed; wall dark brown at least in the upper part. **Conidia** aseptate, colourless, bacilliform. **Chemistry**: varied, often containing xanthenes (arthothelin, 6-O-methylarthothelin, isoarthothelin or 2,5,7-trichloro-3-O-methylnorlichexanthone) and/or atranorin). **Ecology**: overgrowing mosses or plant debris on soil, or lichenicolous, a few species directly on rock, mostly montane.

A segregate from the currently phylogenetically compromised genus *Buellia*, differentiated primarily by characters of ascospore morphology and ontogeny, and supported by DNA data (Prieto & Wedin 2016). British taxa are mostly montane and all rare, and overgrow mosses or are lichenicolous. They are keyed out also under *Buellia* (see above).

Literature

Baruffo *et al.* (2006), Coppins *et al.* (2009), Elix (2018b, 2019), Giralt & Clerc (2011), Giralt *et al.* (2009), Lohtander (1995), Nordin (2004), Nordin & Tibell (2005), Prieto & Wedin (2016).

- 1 Overgrowing mosses; thallus well-developed, greyish white.....2
Lichenicolous on *Physcia* and *Physconia*; thallus developing within the host medulla*pulverulentus*
- 2(1) Thallus convex-areolate to bullate; C-*papillatus*
Thallus granulose; C+ yellow, at least under the microscope*insignis*

Tetramelas insignis (Nägeli ex Hepp) Kalb (2004)

CR D

Buellia insignis (Nägeli ex Hepp) Körb. (1855)

Lepraria cacuminum (A. Massal.) Lohtander (1995)

Thallus thin to moderately thick, granulose to somewhat warted; prothallus indistinct; medulla I-. Apothecia 0.5–1.1 mm diam., superficial; disc flat at first, later convex, \pm pruinose when young; epithecium green-brown, N+ red; hymenium ca 100 μ m tall, \pm with oil droplets; hypothecium dark brown. Ascospores 21–32 \times 8–13 μ m, 1-septate, sometimes \pm curved, the wall paler and thinner at the apices, smooth to finely warted. Thallus C+ yellow, K+ yellow, Pd \pm yellow, UV+ orange (atranorin and 6-O-methylarthothelin). **BLS 0208**.

Overgrowing mosses, montane. Scottish Highlands (Ben Lawers, Perthshire), with single records from Wales (Snowdon) and Cornwall.

The C+ yellow reaction is characteristic but is best seen in a microscope section. *T. papillatus* differs in the bullate thallus and the smaller ascospores. Most British records do not contain apothecia, and were made under the name *Lepraria cacuminum*; see Baruffo *et al.* (2006). Lohtander (1995) incorrectly (under the current rules) used the name for the species now known as *Lepraria alpina* (B. de Lesd.) Tretiach & Baruffo.

Tetramelas papillatus (Sommerf.) Kalb (2004)

Buellia papillata (Sommerf.) Tuck. (1866)

Thallus convex-areolate to bullate, white to grey-white. Apothecia to 1.0 mm diam., sessile, discrete to confluent, sometimes pruinose, soon convex and immarginate, when young often with a thalline rim; exciple dark-pigmented; epithecium brown; hymenium without oil droplets; hypothecium brown. Ascospores (15–) 18–22 (–25) \times 7–10 μ m; wall uniformly thickened, finely warted. Pycnidia unknown. Thallus C-, K+ pale yellow, Pd-, UV- (atranorin). **BLS 0256**.

On mosses on siliceous rock in alpine areas; rare. Scotland (Beinn Eighe).

Similar to *T. insignis* which has larger ascospores and non-bullate thallus.

CR D



Tetramelas pulverulentus (Anzi) A. Nordin & Tibell (2005)*Buellia pulverulenta* (Anzi) Jatta (1900)

Thallus developed within the medulla of the host, with an independent cortex 10–20 µm tall and its own photobiont cells. Apothecia 0.3–0.5 (–0.7) mm diam., superficial; exciple pigmented throughout, with rounded, rather thick-walled cells; epithecium brown; hymenium 55–77 µm tall, without oil droplets; hypothecium brown; paraphyses 1.6–2.3 µm diam., apices to 5 µm diam. Ascospores (14.5–) 16–21 (–23) × 6.5–8.5 µm, (1-)3-septate, finely warted. Pycnidia rare; conidia 5–6 × ca 1 µm. Lichen substances not detected by TLC. **BLS 1855**.

On *Physcia aipolia* and *Physconia distorta*; rare. Scotland (Mid-Perths, W. Sutherland).

A lichenicolous fungus living in the thallus of *Physcia* and *Physconia* species which sometimes becomes ± bleached in infected areas.

NE NR

**Literature**

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