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Pertusariales: Ochrolechiaceae

Cover image: *Ochrolechia androgyna*, on bark of *Quercus petraea*, Rydal Park, Westmorland.

Revisions of British and Irish Lichens is a free-to-access serial publication under the auspices of the British Lichen Society, that charts changes in our understanding of the lichens and lichenicolous fungi of Great Britain and Ireland. Each volume will be devoted to a particular family (or group of families), and will include descriptions, keys, habitat and distribution data for all the species included. The maps are based on information from the BLS Lichen Database, that also includes data from the historical Mapping Scheme and the *Lichen Ireland* database. The choice of subject for each volume will depend on the extent of changes in classification for the families concerned, and the number of newly recognized species since previous treatments.

To date, accounts of lichens from our region have been published in book form. However, the time taken to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published. Issuing updates as a serial electronic publication means that important changes in understanding of our lichens can be made available with a shorter delay. The accounts may also be compiled at intervals into complete printed accounts, as new editions of the *Lichens of Great Britain and Ireland*.

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Pertusariales: Ochrolechiaceae

including the genera *Lepra*, *Ochrolechia* and *Varicellaria*

by

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OCHROLECHIACEAE R.C. Harris ex Lumbsch & I. Schmitt (2006)

Thallus crustose, often thick and warted, sometimes papillate and occasionally spinose, white to dark grey, the upper cortex thin or absent. **Photobiont** chlorococcoid. **Ascomata** apothecia, initially immersed in the thallus but becoming sessile, \pm discoid (rarely cupulate or poriform), lecanorine with a distinct true exciple, often pruinose. **Hamathecium** of branched and anastomosed pseudoparaphyses. **Asci** releasing spores through a vertical split, usually broadly cylindrical, with a thick multilayered strongly amyloid wall, 1- to 8-spored. **Ascospores** often very large and thick-walled, colourless, usually aseptate. **Conidiomata** pycnidia, immersed in the thallus. **Conidia** bacillar to elongate cylindrical.

The Ochrolechiaceae was separated from the Pertusariaceae in a phylogenetic reappraisal of the order Pertusariales by Schmitt *et al.* (2006), including *Ochrolechia* and tentatively also *Variolaria* (here treated under the earlier name *Lepra*) and *Varicellaria*. Both of those taxa were included within *Pertusaria* by Chambers *et al.* (2009). The inter-relationships of these genera are still unclear, but their circumscription is robust and all are monophyletic. To aid in continuity, the key to *Pertusaria* (Pertusariales: Pertusariaceae) also includes species of *Lepra* and *Varicellaria*, as in edition 2 of the *Lichens of Great Britain and Ireland*.

Literature

Schmitt & Lumbsch (2004), Schmitt *et al.* (2003, 2006, 2012), Schmitz *et al.* (1994).

- 1 Thallus C+ yellow or orange-red, apothecia usually discoid, not developing from soralia; ascus wall uniformly K/I+ blue; ascospores \pm thin-walled in relation to their size..... **Ochrolechia**
Thallus C- or C+ pinkish (carmine) red, asci with a K/I+ blue outer sheath; ascospores usually very thick-walled, the walls sometimes laminar 2
- 2(1) Thallus and/or soralia C-; fertile warts soralium-like, usually with a single apothecium; disc \pm widely exposed, densely white-granular pruinose **Lepra**
Thallus and/or soralia C+ carmine red, containing lecanoric acid; fertile warts not resembling soralia, containing one or several apothecia; disc pore-like or becoming \pm exposed, not or lightly pruinose **Varicellaria**

LEPRA Scop. (1777)

Thallus crustose, superficial, thin to moderately thick, continuous or rimose-cracked, fissured-areolate or warted. **Soralia** or **isidia** frequent. **Cortex** thin, cartilaginous, composed of thick-walled septate agglutinated hyphae. **Photobiont** chlorococcoid. **Ascomata** apothecia, \pm sessile with an expanded, open disc, often developing from soralia, sometimes pruinose or occluded with granular soredia. **Hamathecium** of paraphyses, lax, branched and richly anastomosed. **Asci** 1- or 2-spored, broadly cylindrical, apex without a distinct ocular chamber, outer sheath K/I+ blue, otherwise K/I-, with an inner extensible layer, *Pertusaria*-type. **Ascospores** very large, relatively thin- to thick-walled, the wall not laminar or ornamented. **Conidiomata** pycnidia, rare. **Conidia** straight, \pm acicular or bacilliform. **Chemistry**: picrolichenic, protocetraric (and derivatives) and thamnolic acids, xanthenes rarely present. **Ecology**: varied, on bark or siliceous to slightly basic rocks, sometimes overgrowing mosses.

Lepra is the correct name at generic rank for the *Variolaria* group (formerly placed with *Pertusaria*) according to Hafellner & Türk (2016) and Wei *et al.* (2017).

Literature

Archer & Elix (2018), Chambers *et al.* (2009), Dibben (1980), Hafellner & Türk (2016), Hanko (1983), Lendemer & Harris (2017), Lumbsch *et al.* (1993), Wei *et al.* (2017).

1	Isidia or soralia present; apothecia often absent	2
	Isidia and soralia absent; apothecia often present	11
2(1)	Isidia present, fine granule-like to coarse and papilla-like	3
	Soredia present, delimited punctiform to wide-spreading and effuse	5
3(2)	Thallus entirely composed of conspicuous finger-like isidia; on soil or mosses (rarely on rock); montane	<i>dactylina</i>
	Thallus clearly crustose, ± developing isidia; on rock or bark; lowland or montane	5
4(3)	Isidia 2–3 × 0.5–2 mm, often predominant; often ± abraded; thallus dark grey, taste very bitter; medulla KC+ magenta-pink (fleeting)	<i>melanochlora</i>
	Isidia to 2 × 0.1–0.5 mm, not dominant; thallus white to grey, taste mild; medulla KC± yellow to red	<i>corallina</i>
5(3)	Soralia KC+ purple-violet; tastes very bitter	6
	Soralia KC± yellow, orange or red; tastes mild	7
6(5)	Thallus forming ± compact cushions; upper surface warted-papillate, the apices and ridges breaking down into small, elevated, punctiform soralia	<i>pulvinata</i>
	Thallus ± flat, ± smooth; soralia discrete, scattered over the thallus	<i>amara</i>
7(5)	Soralia Pd–, K–, rounded-disc-like to warted	<i>albescens</i>
	Soralia Pd+ yellow to rust-red, K± yellow to red or brownish	8
8(7)	Soralia K± dirty brownish, rounded, ± punctiform	9
	Soralia K+ yellow to red, sometimes confluent, convex or irregularly excavate	<i>excludens</i>
9(8)	Soralia Pd+ orange-rust red, thallus thin to moderately thick, sometimes cracked-areolate but not warted	10
	Soralia Pd+ yellow changing to red; thallus thick, warted	<i>leucosora</i>
10(9)	On coniferous bark, Scottish Highlands (rare)	<i>borealis</i>
	On siliceous rock, widespread though usually upland	<i>aspergilla</i>
11(1)	Thallus K+ red (crystals); on rock	<i>monogona</i>
	Thallus K± yellow (sometimes reddish after some while but crystals not present); on bark or associated mosses	12
12(11)	Fertile warts white, Pd+ rust-red, K+ yellow; disc wide; true exciple continuous, ± even	<i>multipuncta</i>
	Fertile warts grey, concolorous with the thallus, Pd–, K– or K+ reddish after some while; disc narrow; true exciple irregular, crenate	<i>ophthalmiza</i>

Lepra albescens (Huds.) Hafellner (2016)

LC

Pertusaria albescens (Huds.) M. Choisy & Werner (1932)

Thallus thin to moderately thick, pale grey to dark greenish grey, ± waxy, often zoned at the margin; upper surface smooth to coarsely warted, often rimose-cracked; taste mild; soralia rounded, scattered or contiguous, very variable, large, mostly >1 (–4.0) mm diam., typically concave and marginate, disc-like, paler than the thallus, or smaller, white to pale grey-white, coarsely granular-sorediate, more rarely convex, becoming ±

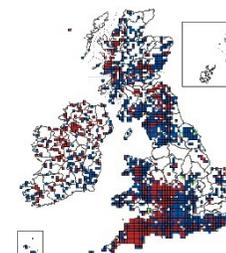
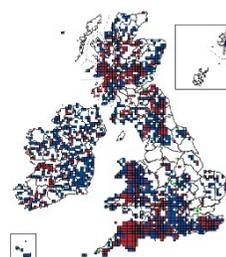
crowded, pseudocoralloid outgrowths. Apothecia very rare, to 4 mm diam., usually several combined in large sorediate-pruinose warts, concave, opening with deeply lacerate, white thalline margins; discs densely white-pruinose. Asci 1(-2)-spored. Ascospores 170–300 × 50–115 µm. Thallus C–, K–, KC–, Pd–, UV– (fatty acids). **BLS 1056**.

On bark of parkland, woodland and wayside broad-leaved trees and more rarely conifers, rarely on weakly basic siliceous rocks, porous sandstones, sometimes overgrowing mosses and plant detritus on the ground; very frequent and pollution tolerant. Throughout Britain and Ireland.

Characterized by the grey thallus, zoned margin and often large, concave or flat KC– soralia and a mild taste. Very variable, especially in the form of the soralia which may be broad and discoid, smaller, convex and white, or irregular, contiguous and warted. In *L. amara* the soralia are KC+ violet and the thallus has a very bitter taste.

The species is host to several lichenicolous fungi, including *Sclerococcum (Dactylospora) parasiticum* (Flörke) Ertz & Diederich (2018), *Lichenostigma alpinum* (R. Sant. *et al.*) Ertz & Diederich (2013), *L. aff. maureri*, *Pronectria pertusariicola* Lowen (1999), *Roselliniopsis tartaricola* (Linds.) Matzer (1993), *Sphinctrina turbinata* (Pers.) De Not. (1846), *Spirographa fusisporella* agg. and *Trichonectria pertusariae* Etayo & van den Boom (2005).

Pertusaria albescens* var. *corallina (Zahlbr.) J.R. Laundon (1963) [BLS 1057], lower map, with a coarsely nodulose warted-granular thallus and poorly defined soralia that are often confluent in older parts of the thallus, is widespread on mosses on bark and sheltered stonework. No molecular data are available for this taxon, and a formal combination into *Lepra* is not made pending further studies. *P. polythecia*, endemic to S.W. Ireland, closely resembles var. *corallina* but has a different series of fatty acids, similar to the range in *L. ophthalmiza*. Its status needs further review. Specimens with small, white soralia may be confused with *L. amara*. *Ochrolechia turneri* is superficially similar but has less organized soralia with C+ yellow soredia.



***Lepra amara* (Ach.) Hafellner (2016)**

Pertusaria amara (Ach.) Nyl. (1873)

Like *L. albescens*, but the thallus is often smaller and less well-zoned at the margin. The soralia are typically smaller, sometimes punctiform, 0.5–1.5 mm diam., discrete or occasionally contiguous, rather regularly scattered over the thallus and with an extremely bitter taste due to picrolichenic acid. Apothecia not known (see note on *L. slesvicensis* below). Soralia and medulla C–, K– (K+ reddish brown after a few hours), KC+ violet, Pd–, UV– (picrolichenic acid). **BLS 1058**.

On a wide range of broad-leaved trees, rarely conifers, rarely on the ground and on low vegetation, occasionally on sheltered, humid, siliceous rock; common. Throughout Britain and Ireland.

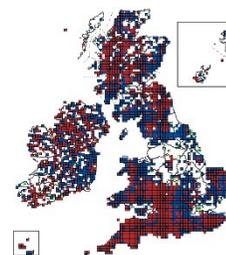
Hosted lichenicolous fungi include *Cornutispora ciliata* auct., *Lichenostigma alpinum*, *Opegrapha anomaea* Nyl. (1857), *Sphinctrina turbinata*, *Spirographa fusisporella* agg. and *Trichonectria pertusariae*.

The intensely bitter taste due to picrolichenic acid (KC+ violet) is only encountered in this species and in *L. melanochlora* and *L. pulvinata*. *L. amara* is very variable, even when those species are excluded. Morphs with a thin thallus and markedly radiating prothallus occur on ± porous rocks. Bark-inhabiting colonies with indistinct, ± endophloeodal thalli and excavate soralia occur on smooth bark of *Sorbus aucuparia* in old woodland in Wales and probably elsewhere.

A morph with picrolichenic acid and a largely similar thallus, but with protocetraric acid (Pd+ red) and apothecia that develop from soralia was described as *Pertusaria slesvicensis* Erichsen and treated as *Lepra slesvicensis* by Hafellner & Türk (2016). However, Tønsberg (1992) considered it to be a fertile morph of *L. amara*, and noted that protocetraric acid was present only in the apothecial tubercles. Material corresponding to this morph has been reported from the Isle of Wight, Jersey and Devon (Chambers *et al.* 2009). No sequences appear to be available, and its status needs confirmation.

L. pulvinata has been included in *L. amara* as a form, but was shown by Kondratyuk *et al.* (2015) to be distinct using molecular data; it has a thallus forming ± compact cushions, the upper surface warted-papillate with the apices and ridges breaking down into small, elevated, punctiform soralia, never forming discrete round soralia.

LC



L. melanochlora is isidiate rather than sorediate, and the KC+ reaction is fleeting and magenta rather than violet.

Lepra aspergilla (Ach.) Hafellner (2016)

LC

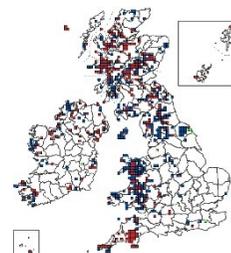
Pertusaria aspergilla (Ach.) J.R. Laundon (1992)

Thallus rather thin to moderately thick, even, sometimes ± fissured or cracked-areolate; prothallus indistinct, marginal, often paler; upper surface pale or dark grey; soralia ± evenly scattered, to 1 mm diam., white, punctiform, flat or somewhat convex, rounded; isidia very rare, small, cylindrical. Apothecia unknown. Thallus C–, K+ dirty yellow-brown, KC+ yellow-red, Pd+ orange-rust red, UV– (fumarprotocetraric (major), succinprotocetraric (major) and ± protocetraric acids). **BLS 1070**.

On siliceous outcrops, scree and walls, mainly upland; fairly frequent. Widespread except in S.E. and C. England.

Sclerococcum (*Dactylospora*) *parasiticum* and *Marchandiomyces corallinus* (Roberge) Diederich & D. Hawksw. (1990) have been reported on this host.

Characterized by the small, pale, punctiform soralia and succinprotocetraric acid in concentration above or equal to fumarprotocetraric acid. The soralia in *L. amara* are KC+ violet and taste bitter; those in *Pertusaria lactea* are C+ red; *L. excludens* is K+ red and mild-tasting; specimens on bark in relict Scottish pine woodlands previously referred here are *Pertusaria borealis*. See also *L. leucosora*.



Lepra borealis (Erichsen) I. Schmitt, Hodkinson & Lumbsch (2017)

Nb IR

Pertusaria borealis Erichsen (1938)

Thallus thin to thick, pale grey to pale green-grey, continuous, often fissured; prothallus indistinct; soralia mostly delimited, rounded, convex, rarely excavate, to 1.5 (–3) mm diam., occasionally fused; soredia white, coarse. Apothecia rare, developing within soralia, disciform, single-pored; disc pale pink, to ca 0.7 mm diam. Ascospores 6 per ascus, 18–20 × 10–14 µm; Thallus C–, K+ brownish, Pd+ red (fumarprotocetraric, protocetraric and succinprotocetraric (trace) acids). **BLS 1883**.

On old *Pinus* lignum, rarely *Betula* lignum in Caledonian Pine forest, C. Scotland; rare. Europe, N. America.

Pertusaria pupillaris, from similar habitats, is ± immersed in bark and lacks succinprotocetraric acid. *L. amara* has KC+ violet soralia and a very bitter taste.



Lepra corallina (L.) Hafellner (2016)

LC

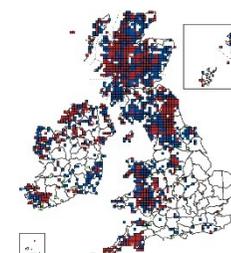
Pertusaria corallina (L.) Arnold (1861)

Thallus rather thick, pure white to pale or dark grey, continuous, rimose-areolate; prothallus often conspicuous, white; isidia 0.1–0.3 mm diam., abundant, often covering the thallus, cylindrical or becoming coralloid, erect or ± decumbent and unoriented. Fertile warts rare, 1.5–2 mm diam., convex, sharply constricted at the base, often with an uneven to warted upper surface enclosing 2–4 (–11) apothecia; apothecial disc 0.3–0.5 mm, ± expanded, flat or ± convex, pale or dark brown, often faintly white-pruinose. Asci 2-spored. Ascospores 80–140 (–230) × 40–80 µm; wall 2–3 µm thick, not zoned or striate. Thallus C–, K+ yellow to yellow-orange, KC+ yellow, Pd+ yellow-red, UV– (thamnolic acid). **BLS 1066**.

On dry, siliceous rocks, mainly in upland areas, very rarely on bark (*Betula*) and wood; common. Throughout Britain and Ireland, very rare in S.E. and C. England.

Characterized by the white-grey, isidiate thallus, the isidia being cylindrical-coralloid and without brown apices, and by the presence of thamnolic acid. *Pertusaria pseudocorallina* has a pale green-grey thallus with a brownish tinge, shorter, ± globose isidia with brown apices and is K+ yellow→red (crystals). *P. coccodes* is greener grey and also K+ yellow→red (crystals).

Thalli commonly support black sporodochial tufts of the lichenicolous hyphomycete *Sclerococcum sphaerale* (Ach.) Fr. (1825), the presence of which suppresses isidial formation in the host. Two collections have been made of apothecia that may represent the ‘*Dactylospora*’ teleomorph of *S. sphaerale* or be *S. (Dactylospora) parasiticum*. Other lichenicolous fungi include *Marchandiomyces corallinus* and *Spirographa fusisporrella* agg.



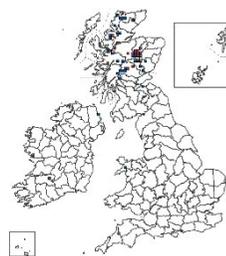
Lepra dactylina (Ach.) Hafellner (2016)*Pertusaria dactylina* (Ach.) Nyl. (1863)

Thallus thin, white, smooth or uneven, mainly obscured by erect crowded isidia 1–2.5 (–4) mm tall \times 0.4–1 mm diam., robust, at first papillate, becoming columnar, mostly unbranched, at times 2- or 3-forked, occasionally becoming fused, \pm constricted towards the base and blunt and rounded at the apices, which are I+ blue. Fertile warts very rare; apothecia 1 per wart, immersed in the apices of the isidia; disc (0.2–) 0.5 (–1) mm diam., \pm black, often white-pruinose and surrounded by a torn warted margin. Asci 1-spored. Ascospores 120–300 \times 60–100 μ m, wall 3–5 (–10) μ m thick, smooth. Thallus C–, K+ yellow, KC+ yellow, Pd+ red, UV– (fumarprotocetraric and \pm protocetraric acids). **BLS 1069.**

On soil, mosses and decaying vegetation, sometimes in grassland, mostly above 900 m alt.; local. N. Scotland (Highlands), one record from N. Wales (Snowdonia).

Characterized by the stout, peg-like isidia with concolorous tips, reacting Pd+ red and the montane, terricolous habitat. *Pertusaria oculata* occurs in similar habitats but develops more numerous slender grey coralloid isidia with characteristic darker brown to black tips which are K+ violet-purple.

Nb

**Lepra excludens** (Nyl.) Hafellner (2016)*Pertusaria excludens* Nyl. (1885)

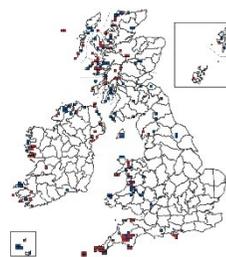
Thallus wide-spreading, rather thick, deeply rimose-cracked-areolate; prothallus \pm distinct, concolorous or paler; areoles coarse, 0.5–2 mm, irregularly angular, flat or \pm convex, sometimes somewhat papillate; upper surface white-grey, matt, becoming rugose-roughened; soralia 0.6–1 (–1.5) mm diam., abundant, \pm convex, arising from wide, low warts, coarsely granular, mostly paler than the thallus, occasionally tinged yellowish, discrete or becoming confluent, convex or somewhat irregularly excavate with irregular, raised margins. Apothecia rare, arising within the soralia; disc pruinose, soon aborting. Ascospores unknown. Conidia 4–5 \times ca 0.5 μ m, straight. Soralia C–, K+ yellow \rightarrow blood-red, KC+ yellow-red, Pd+ yellow-orange, UV \pm pale grey or grey-yellow, (norstictic, \pm salazinic, \pm unknown fatty acids, \pm UV+ yellow xanthone). **BLS 1071.**

On sunny, siliceous rocks, especially granite, mainly coastal. Western coasts of Britain and Ireland.

Characterized by the extensive, mainly thick cracked pale thallus with numerous rounded raised soralia developing from the breakdown of coarse low convex tubercles. Older records (especially from inland sites) are probably confused with *Pertusaria lactescens*. *L. aspergilla* has a thinner, not or indistinctly areolate, Pd+ orange-rust red thallus. *L. excludens* is possibly the sorediate counterpart of *L. monogona*, but the latter taxon has not been sequenced.

Pronectria pertusariicola is the only lichenicolous fungus reported from this host.

Nb

**Lepra leucosora** (Nyl.) Hafellner (2016)*Pertusaria leucosora* Nyl. (1877)

Forms circular colonies up to 10 cm diam.; thallus thick, pale to dark grey, cracked, areolate, with a zoned margin, prothallus absent; upper surface rough with warts 0.5–1.5 mm diam.; circular white soralia abundant, crowded towards the centre of the thallus but remaining discrete; soredia coarsely granular. Thallus K–, KC–; medulla C–, K \pm dirty brown; soralia C–, K \pm dirty brown, Pd+ yellow changing to red, UV– (protocetraric acid). **BLS 2311.**

On slightly basic rock in coastal sites, including walls and churchyards, preferring slightly sheltered situations; rare. Channel Islands, across Europe including inland sites.

Formerly regarded as synonymous with *L. aspergilla* but differs in chemistry, the warted upper surface and the neat, rounded soralia.

NE



Lepra melanochlora (DC.) Hafellner (2016)*Pertusaria melanochlora* (DC.) Nyl. (1872)

Thallus rather thick, grey to dark grey, ± rimose with abundant crowded coarse ± cylindrical isidia-like papillae, 2–3 mm tall × 0.5–2 mm broad, rarely branched, with blunt, flattened pale apices, often abraded exposing a white medulla which may form a few granular soredia. Fertile warts rare, arising from papillae, later expanding to 2–3.5 mm diam.; apothecia often poorly developed, 1–5 per papilla; disc 1.5–2 mm diam., black, whitish pruinose, flat or convex, irregular, surrounded by a curved, wrinkled thalline exciple. Asci 1-spored. Ascospores 180–250 (–300) × 70–130 (–200) µm; wall ca 22 µm thick, smooth, unzoned. Conidia 4–5 × 0.5–1 µm, cylindrical. Thallus C–, K+ yellow-red, KC+ magenta-violet (fleeting), Pd+ orange-red, UV– (picrolichenic and protocetraric acids). **BLS 1081.**

On siliceous rock, typically on the sides of large boulders; very rare. S.W. England (Dartmoor), N. Wales (Merionethshire, Caernarvonshire), Scottish Highlands, S. Ireland. There is an old specimen from Wormbridge (Herefordshire), in the Natural History Museum herbarium.

Like *L. amara* and *L. pulvinata*, it has a characteristic very bitter taste and KC+ magenta-violet thallus; it is separated by the distinctive gross peg-like pale-tipped papillae. The KC reaction is fleeting and best observed on squashes of thallus or papillae on filter paper.

EN(B)

**Lepra monogona** (Nyl.) Hafellner (2016)*Pertusaria monogona* Nyl. (1872)

Like *L. excludens*, but soralia and isidia absent and fertile. Fertile warts numerous, arising from low tubercles, ± elevated, becoming 1.5–2.5 mm diam. Apothecia 1–4 (–6) per wart, deeply immersed; disc flat, ± veiled, ± black, coarsely white-pruinose, surrounded by an irregular, often smooth and raised thalline exciple, the inner edge somewhat torn; epihymenium with numerous crystals, K–. Asci 1-spored, often aborting. Ascospores 100–300 × 50–100 µm, wall relatively thin (4–5 µm), not striate or zoned. Thallus reactions and chemistry as in *P. excludens*. **BLS 1082.**

On sunny siliceous coastal rocks. S.W. England, Isles of Scilly, Channel Islands, Wales (Pembrokeshire, Merionethshire), W. Scotland, W. Ireland; rare.

Characterized by the fertile warts in which apothecia are immersed with white-pruinose discs and by the K+ red thallus. The broad thick-margined rounded apothecia with an irregular ± pruinose opening and veiled disc are also diagnostic; they are usually paler than the thallus.

Nb

**Lepra multipuncta** (Turner) Hafellner (2016)*Pertusaria multipuncta* (Turner) Nyl. (1861)

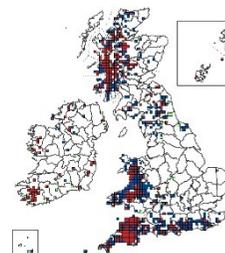
Thallus wide-spreading, grey, thin to moderately thick; prothallus often present; upper surface ± smooth to coarsely warted, ± rimose-cracked, with ± elevated flat starkly white sorediate warts 0.5–1.5 (–2) mm diam. Apothecia frequent, (1–) 2–3 (–5) ± concealed within each sorediate wart; disc ca 0.5 mm diam., pale to blackish brown, veiled in soredia and crystals. Asci 1-spored. Ascospores 90–170 × 30–70 µm, elongate-ellipsoidal to cylindrical; wall ca 4.5 µm thick, uniform. Thallus and soralia C–, K+ chestnut brown to reddish brown, KC+ chestnut brown to reddish brown, Pd+ orange-red, UV– or glaucous (physodalic and ± protocetraric acids). **BLS 1083.**

On smooth, often leached acid bark, particularly on large twigs and branches, rarely on siliceous rocks. Throughout Britain, locally abundant, especially in the west. Rare in Ireland where it is associated with old woods and veteran trees.

The thallus is very variable; on sheltered, smooth bark it is often thin, continuous and even, but in more exposed habitats it is more robust and the surface is coarsely warted. Distinguished by the white, well-delimited scattered sorediate warts containing apothecia, 1-spored asci and chemistry; *L. albescens* and *L. amara* can appear similar but are nearly always sterile and have a different chemistry. See also *L. ophthalmiza*.

Thallus frequently black-speckled by the conidiomata of *Lichenostigma alpinum*. Other lichenicolous fungi reported include *Cornutispora ciliata* auct., *Everniicola flexispora* D. Hawksw. (1982) and *Spirographa fusisporrella* agg.

LC



Lepra ophthalmiza (Nyl.) Hafellner (2016)*Pertusaria ophthalmiza* (Nyl.) Nyl. (1865)

Like *L. multipuncta*, but thallus smooth to very uneven-warted; soralia 0.5–1.2 mm diam., with a ± raised irregular tumid segmented-crenulate margin, sparingly sorediate and torn on the inner side. Apothecia 1–2, sunken in soralia; disc partially obscured, ± greyish-pruinose; epihymenium K– or faintly purplish. Asci 1-spored. Ascospores (90–) 130–150 (–170) × (36–) 50–70 (–76) μm, ellipsoidal or cylindrical-ellipsoidal, wall 6–7 μm thick. Thallus and soredia C–, K– or K+ reddish after some while, KC– or KC+ violet, Pd–, UV– (4 fatty acids). **BLS 1085**.

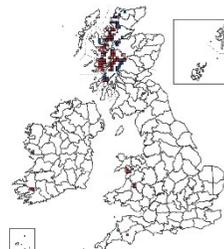
On leached, acid bark and overgrowing mosses in humid wet woodland, chiefly on *Betula*, *Quercus* and conifers; local. W. Scotland, N. & C. Wales (Merionethshire, Radnorshire), Dartmoor.

The type host for the teleomorphic *Sclerococcum ophthalmizae* Coppins (2018) and for the anamorphic *S. simplex* D. Hawksw. (1979).

Some morphs contain picrolichenic acid (as does *L. amara*) and then demonstrate a K+ reddish and KC+ violet reactions, but these may take some time to develop. The crenate margins of the soralia and developing apothecia are diagnostic. *L. multipuncta* can appear similar but has physodalic and ± protocetraric acids (Pd+ and K+ yellow-orange) and the margins of the soralia and apothecia remain even and smooth. In the field the raised ascomata of *L. ophthalmiza* can resemble those of a *Thelotrema*.

The type of *Pertusaria hutchinsiae* (Borrer) Leight. (1851) has been re-examined and found to be assignable to *L. ophthalmiza*, but we do not feel it serves nomenclatural stability by replacing the name of a well-known species with one that has hardly been used.

Nb IR

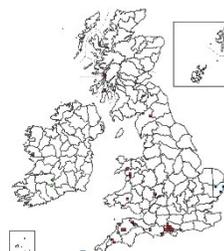
**Lepra pulvinata** (Erichsen) Hafellner (2016)*Pertusaria amara* forma *pulvinata* (Erichsen) Almborn (1948)

Like *L. amara*, but the thallus forms ± compact cushions; upper surface warted-papillate, the apices and ridges breaking down into small, elevated, punctiform soralia, never forming discrete round soralia. Rarely immature apothecia occur within the warts, with asci but lacking spores, but these lack the crenate margins of *L. ophthalmiza* which may have similar chemical reactions. Soralia and medulla C–, K– (K+ reddish brown after a few hours), KC+ violet, Pd–, UV– (picrolichenic acid). **BLS 1090**.

On sheltered but well lit mesic bark on veteran trees or rarely mossy rocks; infrequent. S.W. England (frequent in the New Forest), Isles of Scilly, Wales, W. Scotland, W. Ireland (Cork, Galway).

Pertusaria polythecia morphologically resembles this variety but is KC– and not bitter in taste. Material on trees has been widely overlooked as *Lepra multipuncta*, which it strongly resembles, but that is K+ chestnut brown and KC–. *L. pulvinata*, however, is rarely confused with *Lepra amara*.

NE

**OCHROLECHIA** A. Massal. (1852)

Thallus crustose, ± uneven, often thick, rarely with papillae or spine-like extensions and then appearing minutely shrubby, continuous to uneven, rimose but not distinctly areolate, occasionally reduced to scattered convex warts, white or pale to dark grey, often tinged green; prothallus grey, well-developed or absent. **Upper surface** not corticate, or with a thin cortex of thin-walled hyphae. **Photobiont** chlorococcoid. **Ascomata** apothecia; disc expanded or rarely poriform, yellowish or brownish pink, often ± white-pruinose. **Thalline margin** prominent, well-developed. **True exciple** narrow, visible in some species. **Hymenium** 150–200 μm tall. **Hamathecium** of paraphyses, thin, densely branched and anastomosed. **Asci** 2- to 8-spored, with thick, amyloid walls, *Pertusaria*-like.

Ascospores large, aseptate, relatively thin-walled taking into account their size, smooth. **Conidiomata** pycnidia. **Conidia** cylindrical-elongate, not curved. **Chemistry:** orcinol depsides and depsidones (principally gyrophoric and lecanoric acids), xanthonones, fatty acids. **Ecology:** on \pm acid bark, mosses or soil detritus and mainly siliceous rocks.

Distinguished from *Pertusaria* by the thick, amyloid ascus wall, thinner walled spores and, to some extent, the chemistry. One British species (*O. xanthostoma*), with ascocarps enclosed in warts, closely resembles a *Pertusaria*. *O. inversa* (Nyl.) J.R. Laundon was historically included within the genus and superficially resembles a member of the Ochrolechiaceae, but was found to belong to the Lecanoraceae and it is a later synonym of *Lecanora alboflavida* Taylor (Fletcher *et al.* 2009).

Kukwa (2011) listed a specimen of *O. upsaliensis* in the Stockholm herbarium from Angus (Glen Clova), collected by William Gardiner in 1846, and historical collections from Morrone and Craig Calliach are discussed below under *O. parella*. The species has not been refound, and its status on the British list needs confirmation.

Ochrolechia species are hosts to a wide range of lichenicolous fungi, and a worldwide key to these can be found in Zhurbenko *et al.* (2018).

Literature

Brodo (1991), Brodo & Lendemer (2012), Fletcher *et al.* (2009), Hako *et al.* (1986), Howard (1970), Jabłońska & Kukwa (2007), Kukwa (2009a, b, 2011), Kukwa *et al.* (2018), Ren (2017), Zhurbenko *et al.* (2018).

- | | | |
|------|---|---------------------|
| 1 | Without soralia, isidia or spine-like extensions; apothecia usually present | 2 |
| | With soralia, isidia or spine-like extensions; apothecia absent or rare | 7 |
| 2(1) | Apothecia within thalline warts; disc punctiform (<i>Pertusaria</i> -like); cortex C- | <i>xanthostoma</i> |
| | Apothecial disc open, spreading, flattened, rounded or thallus sterile; cortex C+ red or C- | 3 |
| 3(2) | Thallus C+ red; apothecia sometimes absent | <i>tartarea</i> |
| | Thallus C+ yellow or C-; apothecia usually present | 4 |
| 4(3) | On rock, rarely bark; apothecia mostly crowded, disc 1–5 mm diam., epithecium C+ red; thallus
cortex KC+ yellow, medulla UV- | 5 |
| | On smooth bark; apothecia widely dispersed, disc 1–2 mm diam., C+ yellow; thallus
cortex KC+ rose-red, medulla UV+ vivid white | 6 |
| 5(4) | Medulla of thalline margin of apothecia C+ red, containing olivetoric acid; currently known
only from western Ireland | <i>incarnata</i> |
| | Medulla of thalline margin of apothecia C-; widespread and common | <i>parella</i> |
| 6(4) | Disc pruinose | <i>szatalaensis</i> |
| | Disc not pruinose | <i>laevigata</i> |
| 7(1) | Thallus granular with numerous distinctive smooth, finger-like extensions; on moorland
mosses and detritus (with \pm convex soralia – forma <i>lapuensis</i>) | <i>frigida</i> |
| | Thallus \pm continuous, finely isidiate or sorediate; mainly on trees or <i>Calluna</i> | 8 |
| 8(7) | Thallus finely isidiate, isidia branched or \pm coralloid, becoming \pm contiguous and granular-
sorediate, C+ red | <i>subviridis</i> |
| | Thallus uniformly sorediate, soralia distinct or becoming confluent, C \pm yellow or red | 9 |
| 9(8) | Soralia <0.5 mm diam., either UV+ orange or Pd+ orange | 10 |
| | Soralia >0.5 mm diam., UV \pm white, Pd- | 11 |

- 10(9) Soralia UV+ bright orange to yellow (lichexanthone), Pd-, densely spaced but remaining mostly discrete; on conifer twigs, lignum or *Calluna* stems *arborea*
 Soralia UV-, Pd+ orange, soon confluent, becoming somewhat coralloid-powdery; over mosses, *Cladonia* spp. and detritus *inaequatula*
- 11(9) Thallus and soralia C+ red-orange 12
 Thallus and soralia C± yellow 14
- 12(11) Thallus relatively thick, tuberculate and sometimes ± folded; apothecia large (to 7 mm diam.) *androgyna*
 Thallus thin to ± thick, flat to moderately tuberculate; apothecia small (to 2–3 mm diam.) 13
- 13(12) Thallus thin; soralia often yellowish; thalline margin of apothecia often sorediate *mahluensis*
 Thallus thin to ± thick; soralia green-grey; thalline margin of apothecia usually esorediate...*bahusiensis*
 [chemistry is crucial for the reliable distinction of these species from *O. androgyna*]
- 14(11) Soralia soon confluent giving thallus an overall leprose appearance, C± yellow (lichesterinic and variolaric acids); mainly on acid bark *microstictoides*
 Soralia mainly discrete, not forming a ± leprose crust, C± yellow (variolaric acid); on basic bark *turneri*

Ochrolechia androgyna (Hoffm.) Arnold (1885)

Thallus very variable, rather thick, coarsely and irregularly granular-verrucose, often irregular; white to dark grey, occasionally tinged brown, usually wide-spreading; prothallus often conspicuous, pale grey; soralia 1.5–3 mm diam., rounded and convex or becoming irregular, yellow-green to grey-green, scattered or sometimes coalescing to form a ± continuous sorediate crust. Apothecia occasional, scattered, 2–4 mm diam., thalline exciple entire, prominent, usually persistent, partly sorediate, disc pale pink to orange-brown, not pruinose, concave at first, becoming flat. Ascospores 30–45 × 13–22 µm. Thallus C+ red, K-, KC+ orange-red, Pd-, UV- (gyrophoric acid and androgyna B unknowns 1-3). **BLS 0921.**

Forming extensive, often partly crumbling patches on acid-barked trees and siliceous rocks, spreading onto mosses and other lichens; often abundant. N. & W. Britain and Ireland, more local in the E. & Midlands.

Host to several lichenicolous fungi: *Geltingia associata* (Th. Fr.) Alstrup & D. Hawksw. (1990), *Lichenostigma alpinum*, *Sagediopsis campsteriana* (Linds.) D. Hawksw. & R. Sant. (1990), *Sclerococcum (Dactylospora) parasiticum*, *Sphaerellothecium araneosum* and *Spirographa fusisporrella* agg.

A morphologically variable species aggregate. Tønsberg (1992) identified four subtly different morphotypes with a diverse chemistry: (A) with gyrophoric acid alone, (B) gyrophoric acid and three unknowns, (C) gyrophoric acid with the murolic acid complex, (D) gyrophoric and variolaric acids. Of these, A, B and C occur in Britain and Ireland. Further research by Kukwa (2011) resulted in recognition of the morphotypes at species level; Tønsberg's morphotype B is now treated as *O. androgyna sensu stricto*, while morphotype A corresponds to *O. mahluensis* and morphotype C is *O. bahusiensis*.

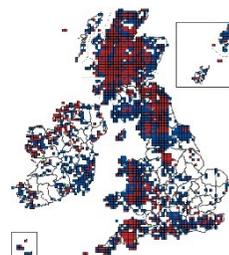
Morphological identification to segregate species level is problematic, and TLC is recommended. However, Tønsberg indicated that *O. androgyna sensu stricto* has a relatively thick grey to dark grey thallus with concolorous soralia, *O. bahusiensis* has a grey to green-grey thallus with green-grey soralia and in *O. mahluensis* the thallus is grey to yellowish grey with yellow-grey soralia.

Forms of *O. androgyna* with small soralia (ca 0.4 mm diam.) can be difficult to separate from *O. inaequatula*, which usually has a much more delicate thallus and is always associated with plant detritus and mosses, never directly on rock or bark; the soralia are Pd+ orange. See also *O. tartarea*.

Ochrolechia arborea (Kreyer) Almb. (1949)

Thallus very thin, white to pale grey, often immersed in the substratum, smooth, shiny, little cracked, with a fibrous surface texture like art paper; soralia crater-like, with a thin margin, discrete, <0.4 mm diam., circular, becoming convex and efflorescent; soredia 40–50 µm diam., spherical, dull, pale yellow to green-grey. Apothecia

LC



NT

unknown in British material. Soralia C+ red, KC+ red, Pd–, UV+ bright yellow (gyrophoric acid, lecanoric acid (trace), lichexanthone). **BLS 0949**.

On lignum of acid-barked trees (especially *Quercus*) and worked timber (also acid bark on twigs of *Pinus* and *Calluna* stems on coastal shingle in N.E. Scotland), probably under recorded but very local.

The vivid UV+ yellow reaction is unmistakable. *O. arborea* resembles a small form of *O. androgyna* but the soralia are much smaller and are densely crowded. *O. inaequatula* is UV– and grows on a wider variety of often dead substrata.



Ochrolechia bahusiensis H. Magn. (1927)

NE

Like *O. androgyna*, but the thallus tends to be somewhat thinner and grey to greenish grey with greenish grey soralia, and the apothecia (when present) are smaller (to 1.8 mm diam.) with a thalline margin that is usually not sorediate. The thallus contains gyrophoric and murolic acids. TLC is recommended for identification. **BLS 2598**.

On acid-barked trees, sometimes overgrowing mosses. Reported from two sites in central southern England (New Forest, Sussex) and the Scottish Highlands (Angus, Wester Ross, Sutherland).

Ochrolechia frigida (Sw.) Lynge (1928)

Nb

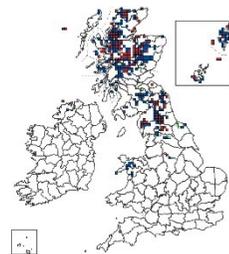
Thallus white to very pale grey, often tinged yellow, at first a very thin warted crust which soon develops small smooth spine- or papilla-like extensions to 1.5 mm in length that become coralloid, often forming extensive crusts over low vegetation, lichens, mosses and stems. Apothecia rare, to 5 (–7) mm diam., sessile; disc concave-flat, pale brown or red-brown, not pruinose; thalline exciple rather thin, smooth, entire. Ascospores 25–40 × 15–26 µm. Thallus C+ red, K–, KC+ red, Pd–, UV– (gyrophoric and ± lecanoric acid). **BLS 0922**.

Amongst mosses and overgrowing low vegetation, on high moors or mountain summits, rarely on coastal heaths; frequent. Scotland, extending to N. England & Wales (Snowdonia).

Host to the lichenicolous fungi *Geltingia associata*, *Lichenostigma alpinum* and *Sphaerellothecium araneosum*.

Easily distinguished by the distinctive pale spine-like extensions of the thallus granules. Soralia are absent in most populations, but some have coarse yellow-white coralloid soralia to 5 mm or more in diam. with soredia ca 50 µm diam., developing among the spinules and on apices of tubercles. These are always sterile in Britain, and have been distinguished as *O. frigida* forma *lapuensis* (Vain.) Coppins (1981) [**BLS 0748**].

Moss leaves encrusted by other *Ochrolechia* thalli may also appear spinulose but these are never branched. Such material may have led to the synonymy of *O. inaequatula* (see below) with *O. frigida* by Kukwa (2011).



Ochrolechia inaequatula (Nyl.) Zahlbr. (1913)

LC

Resembles a small form of *O. androgyna*. Thallus white to very pale grey, with soralia starting as tiny pustules 0.3–0.4 mm diam., quickly becoming confluent and coralloid, pale yellow; soredia granular, 70–100 µm diam.; initial sorediate pustules are on young parts of thalli. Apothecia not known in British material. Thallus C+ red, K–, KC+ red, Pd+ orange, UV– (gyrophoric acid, undetermined Pd+ substance). **BLS 1634**.

Closely encrusting mosses, *Cladonia* and plant detritus on the ground, coastal cliff tops to montane; frequent. Scotland, N Wales.

Much overlooked as a small form of *O. androgyna* or *O. frigida* f. *lapuensis*. *O. arborea* could also be mistaken for this species, but the Pd+ orange reaction is diagnostic for *O. inaequatula*. Specimens encrusting moss leaves often appear spinulose and have been confused with *O. frigida* f. *lapuensis*. *Mycoblastus alpinus* is C–.



Ochrolechia incarnata (Leight.) Kukwa, Schmitt & Ertz (2018)

NE

Morphologically indistinguishable from *O. parrella*, but with some difference in chemistry; the medulla of the thalline margins of the apothecia contains olivetoric acid leading to a C+ red reaction. **BLS 2734**.

On siliceous rocks. Currently recorded in our region only from western Ireland (Galway, Kerry), but may be more widespread in oceanic areas.

Recently rescued from synonymy with *O. parella* by Kukwa *et al.* (2018), based primarily on molecular data. It is also known from Macaronesia and Sweden.

Ochrolechia laevigata (Räsänen) Verseghy (1962) NE

Similar to *O. szatalaënsis* but the apothecia have non-pruinose discs and a different chemistry; see Kukwa (2011) for more details. **BLS 2599.**

A single British collection from Wester Ross was identified tentatively as this species by Kukwa (2011), but it differs in chemistry from type material. The species was considered to be confined to western North America by Brodo (1991), so the British material may represent an undescribed species.

Ochrolechia mahluensis Räsänen (1947) NE

Like *O. androgyna*, but the thallus tends to be somewhat thinner and grey to yellowish grey with yellowish grey soralia, and the apothecia (when present) are smaller (to 2.8 mm diam.) and slightly stipitate rather than sessile. The thalline margin is often sorediate. The thallus contains gyrophoric acid alone, with a trace of lecanoric acid. TLC is recommended for identification. **BLS 2600.**

On acid-barked trees, sometimes overgrowing mosses. A single collection is known, from Scotland (Mid Perths.), but it may well be overlooked; it is widespread in Norway (Tønsberg 1992).

Ochrolechia microstictoides Räsänen (1936) LC

Thallus semi-immersed, smooth, continuous, somewhat cracked, pale white-grey; soralia excavate, round, forming initially along cracks in the cortex or bursting through the thallus, quickly becoming confluent and irregular to form a leprose crust; soredia farinose, 20–40 µm diam., pale grey-white, tinged yellow, often aggregated into consoredia 60 µm or more in diam. Apothecia very rare, similar to those of *O. turneri*, ca 1.3 mm diam., the thalline margins sorediate. Cortex and soralia C+ yellow, K–, KC+ yellow, Pd–, UV+ white (variolaric and lichesterinic acids, sometimes with protolichesterinic acid); apothecia with variolaric (main), lichesterinic and gyrophoric acids (the last one only in the epithecium). **BLS 1781.**

On acid bark and lignum, especially fence tops, occasionally on acid rocks and stonework; frequent in upland and northern Britain; widespread but under-recorded in acid habitats in the lowlands.

The only sorediate *Ochrolechia* with lichesterinic acid in Britain and Ireland. *O. microstictoides* resembles *O. turneri* but the soralia are confluent which makes the thallus ± leprose and it grows on acidic, not nutrient-enriched bark. The isidia of *O. subviridis* are often interpreted as soredia, leading to potential confusion with this species.

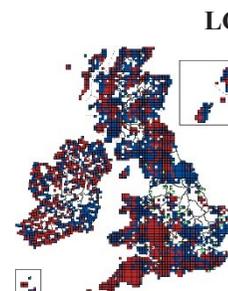
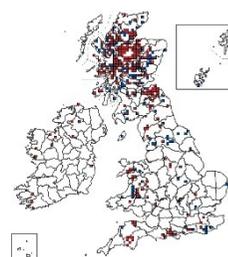
Reported lichenicolous fungi include *Lichenostigma alpinum*, *Marchandiomyces corallinus* and *Sclerococcum (Dactylospora) parasiticum*.

Ochrolechia parella (L.) A. Massal. (1852) LC

Thallus thick, smooth to granular-warted, often fissured, grey-white, ± orbicular, often concentrically ridged and markedly zoned at the circumference, surrounded by a white prothallus. Apothecia usually numerous, crowded, round or irregular-compressed, 2–5 mm diam.; disc deeply concave when young, becoming flat, pale pink-brown, often thickly and coarsely grey-white pruinose; thalline exciple thick and swollen, at times almost closing over the disc, smooth, entire; epithecium granular, the granules dissolving in K. Ascospores 45–65 (–88) × 25–40 (–50) µm, broadly ellipsoidal. Thallus C+ yellow, K–, KC+ yellow, Pd–, UV– or slightly blue (variolaric acid); apothecial disc and proper exciple C+ red, K–, KC+ red, Pd–, UV– (gyrophoric acid), thalline margin medulla often KC+ pink due to aleatoric acid. **BLS 0926.**

On siliceous or slightly base-rich rocks, walls, brickwork, slates, rarely trees; frequent. Abundant throughout Britain and Ireland.

O. parella is a very variable species with a wide ecological amplitude. Well-developed specimens have a corrugate-uneven thallus with numerous, often ± contiguous, angular apothecia. *O. incarnata* was recently distinguished from *O. parella* by Kukwa *et al.* (2018) based primarily on molecular data but with small differences in chemistry also. These authors also investigated the distinctiveness of corticolous populations



identified as *O. parella*, which have in the past been treated as *O. pallescens* (e.g. by Purvis *et al.* 1992). They concluded that the saxicolous and corticolous populations in western Europe belonged to the same species, but that some bark-inhabiting collections from central and eastern Europe belonged to a distinct clade.

Of other similar species, *O. szatalaënsis* is restricted to smooth bark (it never occurs on rock), the thallus is thin, skin-like and the apothecia always widely dispersed, and is restricted to very sheltered, shaded habitats; the UV+ white reaction of the medulla is diagnostic. *O. upsaliensis* (L.) Massal. (1852), reported in the 19th century as encrusting mosses near the summits of Morrone and Craig Calliach in Highland Scotland, has a thin, smooth to granular-wrinkled or warted thallus without soredia, abundant, pale yellow or grey-buff, strongly white-pruinose apothecia, 1–3 mm diam. and ascospores (30–) 50–75 × (25–) 30–40 μm. Thallus, thalline margin and apothecial disc pruina C± yellow, K–, KC–, Pd– (variolaric acid). It seems likely that the material of this montane species, on which these records are based, originated from outside of our area.

O. parella is host to, among others, the lichenicolous fungi *Rhizocarpon ochrolechiaae* (q.v.), *Sclerococcum* (*Dactylospora*) *parellaria* (Nyl.) Ertz & Diederich (2018), *Sphaerellothecium araneosum* and an unidentified *Pronectria* sp.; see also Zhurbenko *et al.* (2018).

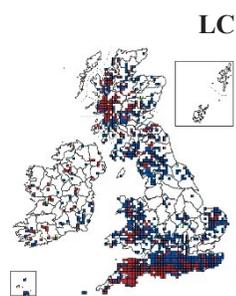
Ochrolechia subviridis (Høeg) Erichsen (1930)

Thallus superficial, usually thick (ca 1.5 mm), waxy, smooth to granular or warted, rimose-cracked, white to pale grey, the margin white, ± zonate, felt-like. Isidia soft, often dense and obscuring the thallus surface, branched or coralloid, cylindrical, to 100 μm diam., developing a white powdery crystalline coat (gyrophoric acid), becoming confluent towards the centre and forming a continuous uniformly concolorous crust, the apices often swollen and breaking down into coarse granular soredia 60–100 μm in diam. and eroding away leaving circular, white scars. Apothecia rare, sessile, deeply concave with a thick, densely and roughly isidiate thalline exciple; disc to 4 mm diam., pale pink-brown, roughened, scabrid-pruinose; epitecium finely granular, the granules dissolving in K. Ascospores 30–68 × 25–35 μm. Isidia C+ red, K–, KC+ red, Pd–, UV+ glaucous, often with a yellow tinge (gyrophoric and lecanoric (trace) acids). **BLS 0927.**

On ± well-lit bark of woodland and wayside broad-leaved trees; frequent. Throughout Britain and Ireland.

Distinguished by the extensive, diffuse patches of soft isidia, which easily erode away. The disintegrating isidia can cause confusion with sorediate species such as *O. androgyna*. *O. microstictoides* and *O. turneri* are C+ yellow (lichesterinic acid) and lack isidia. *Pertusaria coccodes* has isidia which usually remain intact and the thallus is K+ yellow→red.

Sometimes host to *Sclerococcum* (*Dactylospora*) *parasiticum*.



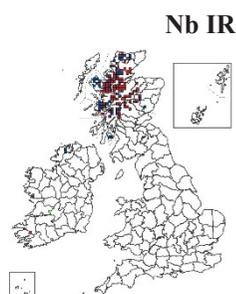
Ochrolechia szatalaënsis Verseghy (1958)

Similar to *O. parella*, but the thallus is thin, very smooth, even and pale yellow-grey, often with a black delimiting prothallus, and often forming large patches. Apothecia evenly scattered, 1–2.5 mm diam., the disc yellow-brown, pruinose, thalline margin cracked with a pie-like crust, disc C+ yellow (variolaric acid), true exciple C–. Thallus C–, K–, often? KC+ rose-pink, UV+ bright white (variolaric acid, often murolic acids and alectoronic acid), disc pruina often C+ yellow (variolaric acid), margin cortex C+ yellow, KC– or entirely or partly KC+ red (variolaric acid, often murolic acids and alectoronic acid). **BLS 1494.**

On acid-barked trees, *Salix*, *Alnus* and *Betula* in moist woodland; rather local and uncommon. W. & N. Britain, especially Scotland, N.W. Ireland.

The presence of alectoronic acid (UV+ white), widely spaced, smaller ascomata and smooth bark habitat distinguishes this species from *O. parella*. A similar, possibly undescribed species with non-pruinose discs is known from Scotland (W. Ross); it has been identified as *O. aff. laevigata* (see above).

Host to *Lichenodiplis lecanorae* (Vouaux) Dyko & D. Hawksw. (1979), *Muellerella lichenicola* (Sommerf.) D. Hawksw. (1979) and *Spirographa fusisporella* agg.



Ochrolechia tartarea (L.) A. Massal. (1852)

Thallus often very thick, to 3 mm or more, pale to dark grey, surface soft, powdery-tartareous, often with numerous irregular warts forming an uneven corrugate crust, sometimes with a paler zoned margin and a pale prothallus. Apothecia usually frequent, immersed and closed at first, becoming rounded or irregular, scattered or

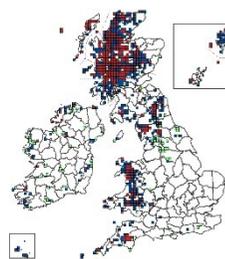
LC

crowded, sessile; thalline exciple thick, wavy; disc to 5 (–8) mm diam., pale brown to dull orange-pink, concave to flat, not or translucently pruinose, the surface often scabrose-roughened; epithecium granular, the granules dissolving in K. Ascospores (35–) 40–70 × 20–40 μm, broadly ellipsoidal. Thallus C+ orange-red, K+ pale yellow, KC+ red, medulla Pd–, UV–; apothecial disc C+ red, K–, KC+ red, Pd– (gyrophoric acid, lecanoric (trace) acids), also androgyna B unknowns 1–3. **BLS 0928.**

On siliceous boulders, leached acid bark and montane moss-lichen heaths, upland, oceanic and montane areas in wind-swept areas; frequent. Throughout Britain and Ireland, but rare or absent in C. and S.E. England.

Frequently confused with fertile examples of *O. androgyna*, which has pale to yellow-green soralia which are sometimes very sparingly produced. The apothecia of *O. tartarea* are often contorted, or have proliferating thalline exciples; occasionally the disc does not expand and the apothecia may then resemble a *Pertusaria*. (cf. also *O. xanthostoma*).

Host to several lichenicolous fungi: *Geltingia associata*, *Lichenostigma alpinum*, *Roselliniopsis tartaricola*, *Sagediopsis campsteriana*, *Sclerococcum (Dactylospora) parasiticum*, *Sphaerellothecium araneosum*, *Spirographa fusisporella* agg. and an unidentified *Pronectria* sp.



Ochrolechia turneri (Sm.) Hasselrot (1945)

Thallus thin, continuous, smooth or tuberculate, somewhat waxy, white to pale grey, sorediate; prothallus sometimes present and well-developed, pale or white-grey, delimiting; soralia numerous, grey-white, very variable in size, <0.5 mm diam., often excavate and in lines, mostly discrete but can become crowded and later confluent towards the centre of the thallus, sometimes forming a continuous, granular sorediate crust; soredia 40–60 (–75) μm diam., originating from small warts which burst to form granular, wart-like soralia, often aggregated (then to 130 μm diam.), efflorescent, fluffy, sometimes resembling coralloid isidia, usually paler than the thallus. Apothecia very rare, 2–3 mm diam., concave to flat with a thick wrinkled sorediate thalline exciple to 0.5 mm thick; disc pruinose, rough, pale yellow- or brown-pink; mature spores not seen. Soralia C+ yellow, K–, KC+ orange to pale yellow, medulla C–, Pd–, UV+ glaucous with an orange tinge (variolaric acid), apothecial disc C+ red (variolaric, gyrophoric and lecanoric (trace) acids in apothecia). **BLS 2362.**

On nutrient-enriched, well-lit bark and wood, occasionally on siliceous rocks, especially sandstones. Scattered throughout Britain and Ireland, common in Scotland. Probably frequent in southern England, but many older records need re-evaluation.

O. turneri is characterized by the grey, excavate, sometimes linear development of soredia and their C± pale yellow (not red) reaction. The similar *O. microstictoides*, on more acidic, nutrient-poor substrata, additionally contains lichesterinic acid (fatty acid). *Pertusaria albescens* var. *corallina* (see under *Lepra albescens*) has coarser coralloid isidia. The thallus of *O. subviridis* is isidiate and C+ red.

Known to host *Sclerococcum (Dactylospora) parasiticum*.



Ochrolechia xanthostoma (Sommerf.) K. Schmitz & Lumbsch (1994)

Thallus thin, white to pale grey, very thin, areoles smooth or rimose-cracked, shiny (perhaps with an epinecral layer), eroding leaving a few flat to concave areoles between rock crystals; prothallus inconspicuous. Ascromata in warts, strongly resembling species of *Pertusaria*, 0.4–0.5 (–1.5) mm diam., irregularly semi-globose, constricted at the base, smooth, often crowded. Apothecia 1–3 (–6) per wart; visible as pink dot-like depressed poriform discs 50–100 μm diam., often surrounded by a thick shining pink to pale brown rim, with a thin thalline cuff below; epithecium red-brown, K– colourless. Asci 4-spored. Ascospores 55–75 (–85) × 30–40 μm, colourless, becoming brown when old, wall 1–1.5 μm thick, uniform, smooth. Thallus C–, K–, KC+ rose-pink, Pd–, UV+ brilliant white (alectoronic and lichesterinic acids). **BLS 1097.**

On *Calluna* stems, siliceous rocks, old wall tops, mosses and soil, usually above 700 m alt. but descending to sea level in the north. C. and N. Scotland to the Orkney and Shetland Isles.

Distinguished by the globular fertile warts with several pinkish ‘ostioles’ closely resembling a species of



Pertusaria. The only British specimen identified as *Pertusaria trochiscea* (from Scotland; Aberdeen, Peddie's Hill), on mosses overgrowing serpentine, is incorrectly identified; it has been considered to be a race of *O. xanthostoma* lacking alecronic acid (UV–, TLC nil).

VARICELLARIA Nyl. (1858)

Thallus crustose, often rather thick, white or pale grey, mostly sorediate. Cortex thin, cartilaginous, composed of thick-walled septate agglutinated hyphae. Photobiont chlorococcoid. Ascomata apothecia, usually solitary in fertile warts that develop from the inner thallus layer, disciform with a well-developed thalline margin. Hymenial gel not bluing in iodine. **Hamathecium** of paraphyses, lax, branched and richly anastomosed. **Asci** 1- or 2-spored, broadly cylindrical, apex without a distinct ocular chamber, outer sheath K/I+ blue, otherwise K/I–, with an inner extensible layer, *Pertusaria*-type. **Ascospores** very large, relatively thin- to thick-walled, the wall not laminar or ornamented. **Conidiomata** pycnidia, rare. **Conidia** straight, ± acicular or bacilliform. **Chemistry**: all species contain lecanoric acid, and may also contain lichexanthone or variolaric acid. **Ecology**: on bark or siliceous to slightly basic rocks.

Varicellaria is a sister group to *Lepra* within the *Ochrolechiaceae* according to Schmitt & Lumbsch (2004) and Schmitt *et al.* (2012), and to the whole of the *Ochrolechiaceae* as analyzed by Wei *et al.* (2017). There are few diagnostic characters in morphological terms, but all species possess lecanoric acid and display a C+ carmine red reaction. The type of *Varicellaria* is *V. rhodocarpa* (Körb.) Th.Fr. (1871), which is morphologically and phylogenetically distinct from the other species accepted by Schmitt *et al.* (2012), and there could be an argument for restricting the genus to this species and placing the others in yet another new taxon. *V. rhodocarpa* has one-septate ascospores and occurs on soil or detritus in arctic-alpine environments.

Literature

Schmitt & Lumbsch (2004), Schmitt *et al.* (2003, 2012), Wei *et al.* (2017).

- | | | |
|------|--|----------------------|
| 1 | Thallus sorediate, apothecia rare; on bark or rock..... | 2 |
| | Thallus not sorediate, apothecia always present; on bark..... | <i>velata</i> |
| | | |
| 2(1) | Soralia markedly convex, often becoming confluent; soredia granular, 40–100 µm diam.; almost always on bark..... | <i>hemisphaerica</i> |
| | Soralia not strongly convex, sometimes surrounded by a narrow thalline collar; soredia very coarse, mostly 100–200 µm diam.; on rock | <i>lactea</i> |

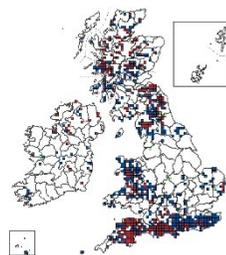
Varicellaria hemisphaerica (Flörke) Schmitt & Lumbsch (2012)

Pertusaria hemisphaerica (Flörke) Erichsen (1932)

Thallus medium to thick, forming extended, conspicuous patches, pale bluish grey; prothallus distinct, zoned, white; upper surface smooth or uneven to warted; soralia 1–2 mm diam., markedly convex, often becoming confluent; soredia granular, pale to concolorous, 40–100 µm diam. Apothecia unknown. Soralia C+ carmine-red, K–, KC+ red, Pd–, UV± glaucous (lecanoric acid, unidentified substance). **BLS 1075**.

On rough well-lit moderately acidic to mesic bark on mature broad-leaved trees, often towards the lower part of the trunk, in open woodlands, parklands and waysides, very rarely on rock, chiefly sandstone; frequent. S. England, Wales, Ireland, rarer in N. & W. areas of Scotland.

The pale bluish-grey tinged thallus with an often broad white zoned margin and conspicuous paler or concolorous convex soralia, C+ carmine-red, UV± glaucous, are distinctive features. *Ochrolechia subviridis* has



LC

a darker green to grey-white thallus, C+ orange-red, K-, Pd- and has less delimited or ± confluent, granular-pseudo-isidiate soralia. When growing on rocks *V. hemisphaerica* resembles *V. lactea* in which the soralia are also C+ carmine-red but which has a white, regularly rimose-cracked thallus and only slightly convex, pure white and discrete soralia. *Loxospora elatina* has a thallus that is K+ immediately bright yellow, soft soralia and prefers damp acid bark.

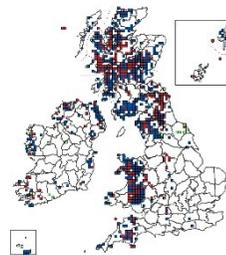
Host to the lichenicolous fungi *Sclerococcum (Dactylospora) parasiticum*, *Roselliniopsis tartaricola* and *Stigmatidium eucline* (Nyl.) Vězda (1990).

Varicellaria lactea (L.) Schmitt & Lumbsch (2012)

LC

Pertusaria lactea (L.) Arnold (1872)

Thallus wide-spreading, rather thick, white to grey-white; prothallus paler, often ± zoned; upper surface smooth or ± roughened, matt, mostly rather regularly rimose-areolate; areoles coarse, 0.3–0.8 mm diam., flat to strongly convex, irregularly rounded or angular; soralia 0.5–1.5 mm diam., white, ± convex, at times surrounded by a fragile thalline collar, occasionally ± efflorescent, mostly discrete, rather widely but evenly scattered, rarely contiguous; soredia (50–) 100–160 (–220) µm diam., sometimes aggregated into consoredia. Fertile warts 0.4–0.5 (–0.7) mm wide, very rare, soralium-like, mostly with 1 (–2) apothecia; disc pale brown, at first white-pruinose, often surrounded by an irregular sorediate thalline exciple. Asci 1-spored. Ascospores 180–240 × 60–100 µm, walls very thick (8–10 (–33) µm), not laminar or striate. Conidia 4.5 × 0.5 µm, cylindrical. Thallus C+ carmine-red, K-, KC+ red, Pd-, UV± faintly glaucous (lecanoric and variolaric acids). **BLS 1077.**



On dry, mostly sunny siliceous or occasionally slightly calcareous rocks, boulders and scree; common. Throughout upland and coastal areas of W. and N. Britain and Ireland.

Characterised by the white-grey, areolate thallus with neat, round, ± convex, white, C+ bright red soralia; *V. hemisphaerica*, which is also C+ red, has a pale blue-grey thallus with paler, but not white, markedly convex soralia and usually occurs on trees. *Lepra excludens* is broadly similar in thallus and soralia, but is C-.

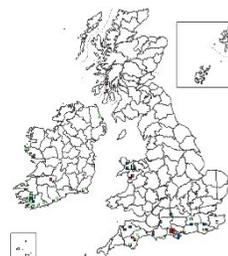
Host to the lichenicolous fungi *Roselliniopsis tartaricola* and *Stigmatidium eucline*.

Varicellaria velata (Turner) Schmitt & Lumbsch (2012)

VU(B2, D2) IR

Pertusaria velata (Turner) Nyl. (1861)

Thallus thin to rather thick, white to pale grey or glaucous, smooth to ± coarsely wrinkled and ± rimose-cracked, seldom completely areolate. Fertile warts 0.5–0.8 (–1.2) mm diam., numerous, scattered or crowded, rounded, flat, ± constricted at the base; apothecia 1(–2) per wart; disc pale pink or reddish but often ± densely white-pruinose, C+ red; thalline exciple well-developed, 0.2–0.25 mm broad, smooth or ± crenate, somewhat raised, persistent; epihymenium with numerous crystals, K-. Asci 1(–2)-spored. Ascospores 150–280 (–310) × (40–) 57–90 µm, wall 9–15 µm thick, not laminate. Thallus K-, Pd-, UV-, apothecial margin and disk C+ carmine-red, medulla UV+ orange (lecanoric acid, ± lichexanthone). **BLS 1096.**



On mesic bark on sheltered but well-illuminated trunks of veteran trees, particularly *Fagus*, *Quercus* and *Fraxinus*, in ancient woodlands and parklands; very local. S. England (especially Hampshire, New Forest), N. Wales, W. Scotland, S.W. Ireland.

Sometimes confused with *P. hemisphaerica*, which occurs in the same habitats but is sorediate and unknown fertile. The UV+ orange medulla is a useful non-destructive alternative to the C+ red apothecia in confirming this rare species in the field and can identify sterile thalli.

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