

Revisions of British and Irish Lichens



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Peltigerales: Peltigeraceae

Cover image: *Peltigera membranacea*, on peaty soil, Raasay, VC104 N Ebudes, Scotland.

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to compile new printed editions of the entire lichen biota of Britain and Ireland is extensive, and many parts are out-of-date even as they are published.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

including the genera *Crocodia*, *Lobaria*, *Lobarina*, *Nephroma*, *Peltigera*, *Pseudocyphellaria*, *Ricasolia*, *Solorina* and *Sticta*

by

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PELTIGERACEAE Dumort. (1822)

Thallus foliose, often large, sometimes irregularly spreading, dorsiventral, lobed, the lobes sometimes branched; upper surface smooth or wrinkled, sometimes ridged or reticulate, sometimes scabrid, pruinose or minutely tomentose; lower surface corticate or not, sometimes with cyphellae or pseudocyphellae, sometimes tomentose, rhizoids present or absent. **Photobiont** green algae or cyanobacteria, in the former case sometimes with cyanobacteria in internal or external cephalodia. **Soredia** and **isidia** sometimes present. **Ascomata** apothecia, sessile or \pm stalked, initially deeply immersed, the covering layer becoming stretched and eventually fragmenting. **Hymenium** strongly concave when immature, often with a conspicuous margin. **Hamathecium** of unbranched paraphyses immersed in a gelatinous matrix, often with a very well-developed pigmented epithelial layer. **Asci** with a thickened apex, with a large J+ ring, ocular chamber often poorly developed, sometimes with an outer J+ gelatinized layer. **Ascospores** often elongate, hyaline or brown, transversely septate. **Conidiomata** pycnidial, at least the ostiolar region pigmented. **Conidiogenous cells** elongate or bacilliform, formed from percurrently proliferating conidiogenous cells. **Conidia** small, hyaline.

Accepted here in a broad sense to include the Lobariaceae and Nephromataceae, following work by Kraichak *et al.* (2018) that was accepted by Lücking (2019). Most members of the family are large and conspicuous, and their distributions and conservation have been carefully studied. However, the recent description of the new tiny fruticose genus *Sinuicella* in Northwestern North America (Stone *et al.* 2021) indicates that other important discoveries cannot be ruled out.

Literature

Burgaz & Martínez (2003), Cornejo & Scheidegger (2018), Dal Grande *et al.* (2014), Högnabba *et al.* (2009), Kraichak *et al.* (2018), Lücking (2019), Miadlikowska & Lutzoni (2004), Moncada *et al.* (2013), Simon *et al.* (2017, 2020), Spribille & Muggia (2013), Stone *et al.* (2021), Wedin & Wiklund (2004), Widhelm *et al.* (2019, 2021).

1	Photobiont green algae, sometimes with cyanobacteria in cephalodia	2
	Photobiont cyanobacteria	8
2(1)	Thallus lobes rounded, with urceolate apothecia \pm immersed in the centre of the thallus (if absent, lobes flat or slightly convex, lower surface orange and without distinct veins)	<i>Solorina</i>
	Thallus lobes spreading, or if rounded then with distinct raised veins; apothecia if present on margins of the thallus	3
3(2)	Lobes without a lower cortex; rhizines often conspicuous to the margin	<i>Peltigera</i>
	Lobes with a distinct lower cortex; rhizines absent from the margin of the lower surface	4
4(3)	Cyphellae and pseudocyphellae absent on lower surface	5
	Cyphellae or pseudocyphellae present on lower surface	7
5(4)	Thallus straw-yellow to yellow-green (usnic acid); apothecia on lobe undersides ...	<i>Nephroma arcticum</i>
	Thallus shades of green or brown; apothecia (when present) on the upper side of lobes	6
6(5)	Upper surface ridged, with distinct depressions, ridges often sorediate or isidiate; underside with large convex tomentum-free areas	<i>Lobaria</i>
	Upper surface smooth or partly wrinkled, distinct depressions and reticulate ridges absent; not sorediate or isidiate; underside uniformly tomentose	<i>Ricasolia</i>
7(4)	Cyphellae white, with distinct raised margins present on lower surface	<i>Sticta canariensis</i>
	Pseudocyphellae yellow, present as punctiform or effigurate breaks in the lower cortex	<i>Crocodia</i> (green algal morph)

- 8(2) Cyphellae or pseudocyphellae present on lower surface 9
 Cyphellae and pseudocyphellae absent from lower surface, but bald patches may be present
 amongst the tomentum 10
- 9(8) Cyphellae present, with distinct raised margins, thallus smelling of fish when wet *Sticta*
 Pseudocyphellae present, without distinct raised margins, thallus not smelling of fish
 when wet *Pseudocyphellaria*
- 10(8) Lower surface glabrous or sparingly tomentose, apothecia (if present) on lower surface
 of lobe ends *Nephroma*
 Lower surface tomentose, apothecia (if present) on upper surface of thallus or lobe ends 11
- 11(10) Lower surface with a ± well-developed coarse network of white or brown veins; apothecia
 (if present) on short marginal projections *Peltigera*
 Lower surface without veins, but with bald patches amongst the tomentum; apothecia
 (if present) laminal *Lobarina*

CROCODIA Link (1833)

Thallus foliose, dorsiventral, in neat rosettes to irregularly spreading, with or without surface tomentum, soralia or isidia. **Photobiont** green, ?*Dictyochloropsis*. **Medulla** yellow. **Lower surface** yellow to dark brown, tomentose, with scattered, prominent yellow pseudocyphellae. **Ascomata** apothecia, submarginal to laminal, distinctly pedicellate; **thalline margin** always containing photobiont cells, concolorous with thallus, with or without soredia, isidia or phyllidia. Disc plane to concave, matt, red-brown to dark brown, not pruinose. **Epithecium** red-brown, minutely granular. **Hymenium** colourless to pale straw-yellow. **Hypothecium** opaque, pale yellow-brown to red-brown, unchanged in K. **Asci** broadly clavate, 8-spored. **Ascospores** ellipsoidal with pointed apices, 3-septate, pale to dark red-brown to brown. **Conidiomata** pycnidia, scattered, occasional, minute, punctiform to ± raised-papillate, to 0.1 mm diam., red-brown when moist, black when dry. **Conidia** colourless, straight, bacilliform. **Ecology**: confined to humid, sheltered, oceanic habitats.

A segregate from *Pseudocyphellaria*, characterized by a yellow medulla, yellow pseudocyphellae on the lower surface, distinctively pedicellate apothecia with a green photobiont in the thalline margin tissues, a colourless hymenium, ellipsoidal red-brown 3-septate ascospores, colourless bacilliform conidia, and fernene or lupane triterpenoids as characteristic chemical signatures (Galloway & Elix 2013). The description above has been adapted from that work. Only one species is known from our area.

Literature

Galloway & Elix (2013), Högnabba *et al.* (2009), James & Purvis (2009), Jørgensen & Galloway (2011), Moncada *et al.* (2013).

Crocodia aurata (Ach.) Link (1833)

CR C2 IR

Pseudocyphellaria aurata (Ach.) Vain. (1890)

Thallus 2–6 (–10) cm diam., forming rosettes or irregularly spreading; lobes 3–12 mm broad, rounded or indented at the apices, often discrete at margins and overlapping centrally; upper surface bright green when wet, pale grey when dry, smooth, undulate, often scabrid-areolate in parts, ± pubescent at the margins, bearing conspicuous coarsely granular bright yellow ± linear lip-like marginal soralia which occasionally also spread on to the upper surface; medulla yellow; lower surface pale pink-brown, darker towards the centre, thickly tomentose to the

margins, ± wrinkled-uneven with numerous yellow pseudocyphellae, 0.1–0.6 mm diam.; photobiont green. Medulla and soralia C–, K–, KC–, Pd–, UV+ dull to bright orange or salmon-pink (pulvinic acid, pulvinic dilactone and calycin). **BLS 1194**.

On trees, rocks and *Calluna* stems; formerly local, now decreasing and very rare, extinct on mainland Britain. S. & S.W. England, Channel Islands, Isles of Scilly, S.W. Ireland (S. Kerry, Blasket Island).

Characterized by the bright yellow, predominantly marginal linear soralia, yellow medulla and green photobiont. *Pseudocyphellaria citrina* commonly has both laminal and marginal soralia, a white to only pale yellow medulla, a blue-green photobiont and Pd+ orange medulla.



LOBARIA (Schreb.) Hoffm. (1796)

Thallus foliose, dorsiventral, irregularly spreading; lobes branched, the apices rounded or truncate, often incised. **Upper surface** smooth, flat or wrinkled, sometimes with distinct depressions with a network of ridges. **Soredia** and **isidia** present. **Cortex** pseudoparenchymatous. **Photobiont** green algae (*Dictyochoropsis* or *Trebouxia*) with cyanobacteria (*Nostoc* or *Scytonema*), often present in internal cephalodia. **Lower surface** tomentose; rhizines present, simple to squarrose. **Pseudocyphellae** and **cyphellae** absent. **Ascomata** apothecia, rather rare. **Thalline exciple** present. **Asci** 8-spored, *Peltigera*-type. **Ascospores** colourless or pale brown, 1- to 7-septate, fusiform to elongate. **Conidiomata** pycnidia, immersed, pimple-like, ostiole brown-black. **Conidia** cylindrical-elongate, slightly swollen at both ends. **Chemistry**: depsides, depsidones. **Ecology**: characteristic of ancient woodlands and parklands, especially in humid, sheltered areas.

In Great Britain and Ireland, only one species of *Lobaria* remains following phylogenetic researches, with *L. scrobiculata* being removed to *Lobarina* and *L. amplissima* and *L. virens* to *Ricasolia* (Moncada *et al.* 2013, Cornejo & Scheidegger 2015, Tønberg *et al.* 2016). The key from Rose & Purvis (2009) is retained here for the convenience of users.

The three genera *Lobaria*, *Lobarina* and *Ricasolia* contain some of the largest British lichens and were seriously threatened in many areas due to acid rain; now changes in woodland management and overall eutrophication are probably the major adverse effects, with potential threats from climate change. *Sticta* and *Pseudocyphellaria* are frequent associates in the *Lobarion* community (James *et al.* 1977).

Literature

Cornejo & Scheidegger (2010, 2015), Elix & Tønberg (2006), James *et al.* (1977), Moncada *et al.* (2013), Nadyeina *et al.* (2014a, b), Rose & Purvis (2009), Tønberg *et al.* (2016), Werth & Scheidegger (2012), Werth *et al.* (2021).

- | | | |
|------|--|------------------------------|
| 1 | Upper surface ridged, with distinct depressions, ridges often sorediate or isidiate; underside with large convex tomentum-free areas | 2 |
| | Upper surface smooth or partly wrinkled, distinct depressions and reticulate ridges absent; not sorediate or isidiate; underside uniformly tomentose | 3 |
| | | |
| 2(1) | Upper surface shiny, pale brown or greenish brown when dry, bright green when wet; photobiont green algae (sometimes with internal cephalodia) | <i>pulmonaria</i> |
| | Upper surface matt and yellow-buff when dry, deep blue-grey when wet; photobiont cyanobacteria | <i>Lobarina scrobiculata</i> |

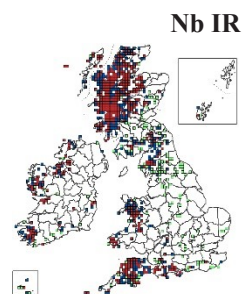
- 3(1) Upper surface pale green-brown when dry, without coralloid cephalodia on the upper surface *Ricasolia virens*
 Upper surface ivory-white to pale grey-white when dry, often with dark brown coralloid cephalodia on the upper surface *Ricasolia amplissima*

Lobaria pulmonaria (L.) Hoffm. (1796)

Thallus wide-spreading, often exceeding 30 cm diam., ± loosely attached at one end, at times pendulous and strap-shaped; lobes 1–3 cm wide, ± dichotomously divided, often rather elongate, sinuate-indentured with truncate apices; upper surface pale green-brown when dry, bright green when wet, strongly reticulately ridged with marked depressions, often with coarse soredia and/or isidia along ridges; lower surface tomentose, brown, with naked paler convex areas corresponding to depressions in the upper surface; photobiont green algae (*Dictyochloropsis*), often with cyanobacteria in internal cephalodia in the medulla. Apothecia occasional, on ridges and towards the margin; disc 2–4 mm diam., reddish brown, with a thin thalline margin. Ascospores 18–30 × 5–9 µm, colourless or pale brown, fusiform, (1-) 3 (-5)-septate. Pycnidia on the ridges, immersed; conidia ca 5 × 1 µm, bacilliform. Medulla C–, K+ yellow-orange, KC+ yellow-orange, Pd+ orange, (stictic [major], constictic [major or submajor], norstictic [minor], cryptostictic [minor], and salazinic [trace] acids + related trace substances). **BLS 0857**.

On broad-leaved trees, low scrub, *Calluna* and mossy rocks; rarely on old walls in the N.W.; locally abundant in Scotland (especially in the West) but rare and decreasing in much of the south. S.W., S.E. & N.W. England, N.W. & W. Wales, N.E. & W. Scotland, W. Ireland.

Distinctive; most individuals are ± isidiate, occasionally specimens may be markedly sorediate. Host to many lichenicolous fungi; the following have been recorded from Britain and Ireland: *Abrothallus lobariae* (Diederich & Etayo) Diederich & Ertz (2018) (as '*Phoma lobariae*' anamorph), *Calycina alstrupii* Suija & Motiejūnaitė (2017), *Endophragmiella hughesii* D. Hawksw. (1979), *Monodictys fuliginosa* Etayo (1996), *Nanostictis christiansenii* Etayo (1996), *Nectriopsis lecanodes* (Ces.) Diederich & Schroers (1999), *Niesslia lobariae* Etayo & Diederich (1996), *Plectocarpon lichenum* (Sommerf.) D. Hawksw., *Pronectria fissuriprodiens* Etayo (1996), *Psammina lobariae* (Diederich & Etayo) Earl.-Benn. & D. Hawksw. (2005), *Sclerococcum (Dactylospora) lobariellum* (Nyl.) Ertz & Diederich (2018), *Spirographa fusisporella* s. lat. (teleomorph as well as '*Cornutispora*' anamorphs), *Tremella lobariacearum* Diederich & M.S. Christ. (1996), *Unguiculariopsis manriquei* Etayo (1996) and *Verrucococcum coppinsii* V. Atienza, D. Hawksw. & Pérez-Ort. (2021).



LOBARINA Nyl. ex Cromb. (1894)

Similar to *Lobaria* in lobe configuration and medullary chemistry, but the thallus is covered with shallow depressions and has a much denser lower tomentum leaving white, rounded areas that do not correspond to the thallus depressions. The presence of usnic acid in the cortex is diagnostic, and *L. scrobiculata* is the only British species of *Lobaria* in its traditional sense with cyanobacteria as exclusive photobiont. There are around 15 species (Lücking *et al.* 2016), of which only one occurs in Great Britain and Ireland.

Literature

Lücking *et al.* (2016), Moncada *et al.* (2013), Prieto *et al.* (2015), Rose & Purvis (2009).

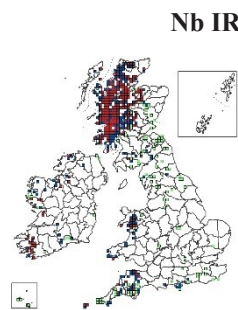
Lobarina scrobiculata (Scop.) Nyl. ex Cromb. (1894)*Lobaria scrobiculata* (Scop.) DC. (1805)

Thallus to 10 cm diam., irregularly lobate; lobes 1–3 cm broad, rounded, often concave, the margin entire or slightly crenulate; upper surface dark bluish green or deep greyish blue when wet, yellowish green when dry, pitted with large shallow depressions, slightly ridged but the ridges not forming a distinct network; soralia blue-grey, at first punctiform, becoming irregular and spreading along ridges and lobe margins; lower surface pale brown, tomentose, reticulate, with whitish convex areas without tomentum; photobiont cyanobacterial (?*Nostoc*). Apothecia infrequent, disc 1–2 mm diam., red-brown with a thick inflexed, sometimes sorediate thalline margin. Ascospores 18–23 × 4–7 µm, 1- to 3-septate, colourless, elongate-fusiform. Pycnidia not seen. Medulla C–, K+ yellow, KC+ deep orange-pink, Pd+ orange, UV+ violet-glaucous. Two chemotypes: 1) usnic acid, stictic acid + satellites incl. norstictic acid, scrobiculatin with two satellites, 2) usnic acid, scrobiculatin with two satellites. **BLS 0858**.

On old broad-leaved trees, often at the edges of old woodland, more widespread and also on wayside trees in Scotland, also on *Calluna* and mossy rocks in coastal areas. It extends into drier, more open sites than the other species of *Lobaria* s.l. Scotland (W, N. & C. Highlands), extending locally to S.W. Scotland, N. Wales, S.W. England and S.W. Ireland.

The species appears to have declined far more than the other *Lobaria* s.l. spp. with environmental changes in the last century, and is now extinct in England east of W. Somerset to Devon. It was formerly widespread in Europe but is now extinct in most of C. & S. Europe, except in some montane forests.

Host to *Catillaria lobaricola* (Alstrup) Coppins & Aptroot (2008) (including its '*Phoma*' anamorph) and *Plectocarpon scrobiculatae* Diederich & Etayo (1994), which is sometimes mistaken for fruiting bodies of the host. Also a single occurrence of *Unguiculariopsis manriquei*.

**NEPHROMA** Ach. (1809)

Thallus foliose, dorsiventral, spreading, ± loosely attached, ± rosette-forming or rarely fragmentary; lobes rounded to slightly elongate, entire, indented or with folioles, often ascending at the margins.

Upper surface ± smooth, matt or shining, rarely ± pubescent. **Soralia** sometimes present. **Cortex** pseudoparenchymatous. **Photobiont** green (*Coccomyxa*) or blue-green (*Nostoc*), cephalodia (containing *Nostoc*) internal in species with a green photobiont. Medulla white or yellow. **Lower surface** corticate, smooth to subpubescent or tomentose. **Ascomata** apothecia, sessile, rounded to reniform, on the lower surface at apices of lobes; disc pale brown to red-brown or reddish black. **Thalline margin** present. **Asci** 8-spored, *Peltigera*-type. **Ascospores** pale brown, fusiform, 3-septate. **Conidiomata** pycnidia, marginal, in semi-immersed warts; ostiole black, pimple-like. **Conidia** bacilliform. **Chemistry**: hopane triterpenoids (see below for details), depsides, pigments. **Ecology**: on bark, more rarely on rocks, oceanic to boreal-montane; often characteristic of ancient woodlands and sensitive to SO₂ pollution.

Resembles *Peltigera* both morphologically and chemically, but characterized by the apothecia arising on the lower surface towards and at the ends of the lobes, and the presence of a well-defined lower cortex. Distinctive morphotypes occur according to the photobiont present in some species.

The major range of named terpenes which may occur in British species of *Nephroma* are: T₁ peltidactylin (7β-acetoxihopan-22-ol); T₂ dolichorrhizin (15α-acetoxihopan-22-ol); T₃ zeorin (hopane-6α,22-diol); T₄ (hopane-7β,22-diol), T₅ (hopane-15α,22-diol); and T₆ (hopane-6α,22-triol).

Literature

Belinchón *et al.* (2014a, b), James & White (1987, 2009), Sérusiaux *et al.* (2011), Timdal *et al.* (2020, 2021).

- 1 Photobiont blue-green; fresh thalli ± blue-black or black-brown when wet; cephalodia absent 2
 Primary photobiont green; fresh thalli yellow-green when wet; cephalodia present *arcticum*
- 2(1) Soredia absent; apothecia usually frequent or thallus with numerous folioles 3
 Soredia present; apothecia rare; folioles absent..... *parile*
- 3(2) Lower surface smooth; medulla yellow or pale yellow, K+ purple (rarely white and K-) 4
 Lower surface pubescent or tomentose; medulla white, K- 6
- 4(3) Folioles absent; commonly fertile *laevigatum*
 Folioles present, marginal and often laminal; rarely fertile 5
- 5(4) Containing anthraquinones and hopane triterpenoid T6 *laevigatum*
 Containing anthraquinones and hopane triterpenoids T2, T3, ± T4, ± T6..... *tangeriense*
- 6(3) Lower surface distinctly tomentose, with scattered pale raised papillae; thalline margin entire
 *resupinatum*
 Lower surface densely pubescent, without papillae; thalline margin and supporting lobe pectinate
 *helveticum*

Nephroma arcticum (L.) Torss. (1843)

Thallus 6–8 cm diam., forming rosettes or fragmented and irregularly spreading; lobes *ca* 15 mm broad, ± rounded, the margins entire, undulate, rarely crenulate; upper surface yellow-green when wet, straw-coloured when dry, smooth to partly wavy, glabrous, with convex cephalodial warts; medulla white; lower surface pale brown-white at the margins, with a conspicuous brownish black tomentum towards the centre; photobiont green in the medulla, blue-green in cephalodia. Apothecia not observed in British material, to 20 (–30) mm diam., rufous-brown; thalline margin ± raised. Ascospores 23–27 × 4–6 µm, 3-septate, subfusiform. Pycnidia rare, marginal; conidia 3–4 × 1–2 µm. Thallus C–, K+ yellowish, KC+ yellow, Pd+ yellow; medulla UV+ (nephroarctin, phenarctin, zeorin, ± usnic acid). **BLS 0916**.

On lichen-moss heaths; very rare. Scotland (Beinn Eighe, N. Highlands).

Characterized by the yellow-green, large-lobed thallus, absence of soralia and the dark tomentose lower surface. The only British species with a green photobiont. In arctic regions thalli are often larger and abundantly fertile. Distinguished from *Peltigera* spp. by the presence of a smooth lower cortex and absence of a network of veins and rhizines.

END



Nephroma helveticum Ach. (1810)

Thallus 3–4 cm diam., forming ± compact rosettes or irregularly spreading; lobes 2–3 mm broad, ± elongate; margins entire or with small terete isidium-like outgrowths and phyllidia that occasionally spread to the lamina, fertile lobes ± pectinate. Upper surface pale grey-brown to red- or dark brown, ± smooth, sometimes ± thinly pubescent; medulla white; lower surface dark brown to black, tomentose or densely pubescent; photobiont blue-green. Apothecia frequent; thalline margin conspicuously pectinate, the dorsal surface scabrid, often markedly honeycombed. Ascospores 21–27 × 6–8 µm, 3-septate. Pycnidia rare. Thallus and medulla C–, K–, KC–, Pd–, (triterpenoids: major - T4, trace T1; unidentified accessory substances). **BLS 1664**.

On mossy rocks or trees. Scotland (Perth, Killin, Achmore Woods); now extinct in Britain and Ireland.

A boreal-temperate species, forming part of a world-wide species complex exhibiting much variation and a wide ecological amplitude (Tindal *et al.* 2021). Characterized by the presence of isidium-like outgrowths and phyllidia resulting in the distinctive pectinate thalline margin and subtending lobes. Distinguished from *N. resupinatum* by the less tomentose lower surface, which also lacks the pale papillae of that species.

Ex



***Nephroma laevigatum* Ach. (1814)**

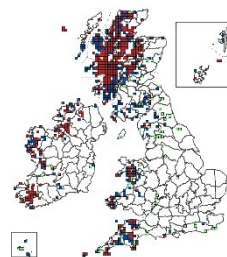
Thallus 3–8 cm diam., spreading, rarely fragmentary, the lobes 2–10 mm broad, robust, often coriaceous, the margins entire, decumbent or ± reflexed, rarely developing small folioles; upper surface grey-brown to deep red-brown, ± smooth or partly wavy; medulla yellow; lower surface smooth to longitudinally striate-ridged or wavy, pale at the margins, becoming brown-black towards the centre, without a tomentum; photobiont blue-green. Apothecia frequent; thalline margin entire or rarely subcrenulate; dorsal surface conspicuously scabrid-areolate and ridged. Ascospores $17\text{--}20 \times 5\text{--}7 \mu\text{m}$. Pycnidia infrequent. Medulla K+ purple, rarely K– (anthraquinones, hopane triterpenoid T₆). **BLS 0917.**

Primarily on bark in mossy, humid communities in markedly oceanic habitats in relict woodlands. W. Britain and Ireland. Not a strongly oceanic species; historic records suggest that it was once also widespread in the lowlands, but has been lost there to pollution.

A rare morph with a white medulla occurs on the Isles of Scilly (Tresco) and may have been originally introduced from Madeira into Tresco Gardens; it should not be confused with *N. bellum* (Sprengel) Tuck. (1841), a more northern, boreal-montane to continental species which does not occur in our region; that has a subtomentose lower surface and a different hopane triterpenoid pattern. Material on sunny rocks has a very similar morphology to *N. tangeriense*, and in those habitats the species can only reliably be separated by TLC.

Host to the lichenicolous fungi *Nectriopsis lecanodes*, *Protounguicularia nephromatis* (Zurb. & Zavarzin) Huhtinen *et al.* (2008), *Refractohilum galligenum* D. Hawksw. (1977) and *Roselliniella nephromatis* (P. Crouan) Matzer & Hafellner (1990).

Nb IR



***Nephroma parile* (Ach.) Ach. (1810)**

Thallus to ca 8 cm diam., forming rosettes or fragmentary; lobes spreading, 3–8 mm broad, often thin; margins entire or subcrenulate, rarely ascending; upper surface bluish grey to dark red-brown with marginal pustular soralia which later spread on to the surface; medulla white; lower surface smooth to wrinkled, glabrous or in part subpubescent, rarely tomentose; soralia blue-grey to brown then partially corticate; photobiont blue-green. Apothecia extremely rare, often small and immature; dorsal surface ± smooth, sorediate. Ascospores $18\text{--}20 \times 6\text{--}7 \mu\text{m}$. Pycnidia rare. Medulla K± yellow (hopane triterpenoids: T₂, T₃ and T₅ and distinctive unidentified accessory substances.) **BLS 0918.**

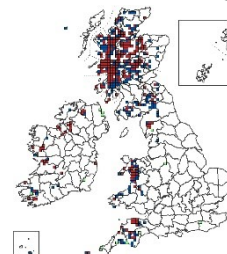
On bark and mosses, characteristic of old woodlands, forming part of the *Lobarion* association, also rarely on sheltered mossy coastal rocks. W. Britain and Ireland; similar in distribution to the commoner *N. laevigatum* but less oceanic and more boreal-montane.

The only sorediate British species of the genus. Distinguished from *Peltigera collina* by the presence of a lower cortex and the smooth lower surface, absence of a network of veins and rhizines and a different hopane compliment. *Sticta limbata*, which occurs in similar habitats, has a tomentose lower surface with scattered cyphellae.

Host to *Nectriopsis lecanodes* and an unidentified species of *Xenonectriella*.

Nephroma orvoii is a recently described, primarily northern species (Tindal *et al.* 2020) that is similar to *N. parile* and should be sought in our region. It has a distinct but thin tomentum, brown corticate soredia and lobe ends with a honeycomb-like surface (often it is also darker brown in coloration). It was previously recognized as a chemotype/race of *N. parile*, and TLC or sequencing may be needed for certain identification.

LC



***Nephroma resupinatum* (L.) Ach. (1810)**

Thallus to 10 cm diam., forming rosettes or with lobes suberect and ± unoriented; lobes 5–17 mm broad, robust; margins entire, rounded and crenulate or lobulate; upper surface grey-brown, ± wavy to ± honeycombed, ± uniformly pubescent or finely subtomentose, occasionally with phyllidia arising from irregular verrucae; medulla white; lower surface pale brown-white, markedly tomentose, with scattered raised white papillae; photobiont blue-green. Apothecia frequent, to 1.1 (–1.5) cm diam., subtending lobe markedly recurved, dorsal surface tomentose, coarsely scabrid and faveolate-reticulate. Ascospores $21\text{--}24 \times 4\text{--}6 \mu\text{m}$. Pycnidia rare, marginal; conidia $4\text{--}5 \times 1\text{--}2 \mu\text{m}$. Thallus and medulla C–, K–, KC–, Pd– (no distinguishing medullary

Ex



substances detected by TLC). **BLS 0919**.

On bark or rocks in cool, moist shady habitats. Long thought to be extinct in the British Isles, but rediscovered at a site in Mid Perthshire; formerly recorded only from Aberdeen, nr. Invercauld (in 1792). The formal conservation evaluation given above (Woods & Coppins 2012) has not yet been updated to account for the new finding.

Easily recognized by the tomentose upper surface of the thallus with raised, white papillae on the lower surface and the absence of any lichen chemistry. See also *N. helveticum*.

Nephroma tangeriense (Maheu & A. Gillet) Zahlbr. (1932)

Thallus 3–4 (–9) cm diam., forming compact rosettes or dispersed and fragmentary; lobes 2–6 mm broad, fragile, thin; margins entire, often ascending and crisped, frequently developing horizontal or ascending folioles which are scattered or form dense imbricate clusters; folioles dorsiventral, rounded or variously sublobulate and notched at the margins; upper surface ± smooth, with scattered crenulate folioles 1–2 mm broad; medulla yellow; lower surface smooth to ridged-undulate, without a tomentum, pale at the margins, becoming brown-black towards the centre; photobiont blue-green. Apothecia rare, similar to *N. laevigatum* but smaller, not observed in British material. Pycnidia not observed. Medulla K⁺ purple, with the same anthraquinones as *N. laevigatum*, but a wider range of hopane triterpenoids: ± T₂, T₃, ± T₄, ± T₆. **BLS 1665**.

On mossy rocks and on soil in exposed situations, as well as on trees and shrubs, part of the *Lobarion* community, with a preference for warmer, drier habitats than *N. laevigatum*; very local. S.W. England, (Lizard), Channel Islands (Sark), Isles of Scilly (Tresco), Wales (Cardigan, Lleyn Peninsula).

Distinguished from most forms of the usually fertile *N. laevigatum* by the numerous crenulate dorsiventral folioles along the margins and on the lamina, which may ± obscure the main lobes when well-developed. The small lobules which may be produced as part of the regeneration of damaged thalli in *N. laevigatum* remain exclusively marginal, decumbent and are more uniformly rounded. Some forms of *N. laevigatum* on sunny rocks, however, are very close phenetically to *N. tangeriense* and require TLC to distinguish.



PELTIGERA Willd. (1787)

Thallus foliose, forming compact to very wide-spreading rosettes, lobes rounded or elongate, discrete, contiguous or overlapping, bright green, blue-grey, grey-brown or brown, flat, wavy or bullate, smooth, matt or shiny, scabrid, tomentose or pruinose, the margins entire or lobulate, the surface and/or margins smooth or with folioles, schizidia or soralia. **Lower surface** non-corticate, densely arachnoid-tomentose or with anastomosing pale or dark veins, from which arise conspicuous rhizines. **Cephalodia** (when present) external, containing *Nostoc*, either on the upper or lower surface of thalli in species with green photobionts. **Cortex** pseudoparenchymatous. **Photobiont** blue-green (*Nostoc*) and (or) chlorococcoid (*Coccomyxa*). **Medulla** white, of ± loosely interwoven hyphae. **Ascomata** apothecia, saddle-shaped, flattened or oval, red-brown to black, often reflexed and becoming ± curved and bean-shaped or with crenulate margins, on horizontal or vertical, ascending lobes. **Hymenium** colourless; paraphyses unbranched, upper parts brown. **Asci** 8-spored, cylindrical, fissitunicate, the apex with a well-developed K/I+ blue ring, *Peltigera*-type. **Ascospores** narrowly fusiform to acicular, usually 3-septate or occasionally multiseptate, colourless to pale brown. **Conidiomata** pycnidia, developing at the lobe margins (especially at the tips of the lobes); conidiogenous cells slender. **Conidia** colourless, aseptate, multiguttulate, variously ellipsoidal, obpyriform or cymbiform, with a truncate base. **Chemistry**: tenuiorin, methyl gyrophorate and gyrophoric acid; up to 6 diagnostic hopane triterpenoids and tridepsides in some species. **Ecology**:

terricolous in cool, moist habitats, in short turf, also on mossy tree trunks and rocks in woodland.

Peltigera is a diverse genus with complex morphology. According to recent research (e.g. Magain *et al.* 2017b, 2018), levels of cryptic speciation and photobiont specialization are high, and the global distributions assumed for many species need re-evaluation. It is possible that some British species are aggregates rather than single taxa.

Although a conspicuous and readily recognized genus, identification to species level based on morphology is not easy and depends on well-developed material in good condition. Particular attention must be given to the upper surface of the lobes, including the presence or absence of a tomentum (sometimes difficult to see in fully hydrated fresh material) and also to the lower surface, including the colour and extent of veining and form of rhizines; the terpene patterns are diagnostic for those species without a tomentum on the upper surface and are essential when identifying fragmentary material. All but three British species contain *Nostoc* as the primary photobiont.

Nephroma has apothecia borne on the undersides of the ends of lobes of the thallus.

The major range of named terpenes that may occur in British species of *Peltigera* with a nontomentose or scabrid upper surface and *Nostoc* photobiont are: T₁, peltidactylin (7 β -acetoxyhopan-22-ol); T₂, dolichorrhizin (15 α -acetoxyhopan-22-ol); T₃, zeorin (hopane-6 α ,22-diol); T₄, (hopane-7 β ,22-diol); T₅, (hopane-15 α ,22-diol); T₆, (hopane-6 α ,7 β ,22-triol).

Peltigera species are host to many lichenicolous fungi; those given below under their hosts do not constitute exhaustive lists, with many collections awaiting determination. See Halıcı & Hawksworth (2012), Hawksworth (1980) and Hawksworth & Miądlkowska (1997), among other sources. The lichenicolous agaric *Arrhenia peltigerina* also occurs; it is a relative of the lichenized genus *Lichenomphalia*.

Literature

Barrasa & Rico (2010), Chagnon *et al.* (2018, 2019), Goward *et al.* (1995), Halıcı *et al.* (2012), Hawksworth (1980), Hawksworth & Miądlkowska (1997), Hitch *et al.* (2009), Holtan-Hartwig (1993), Jüriado *et al.* (2017), Magain *et al.* (2016, 2017a, b, 2018), Martinez & Hafellner (1998), Miądlkowska *et al.* (2014, 2018), Pardo-De La Hoz *et al.* (2018), Vitikainen (1994).

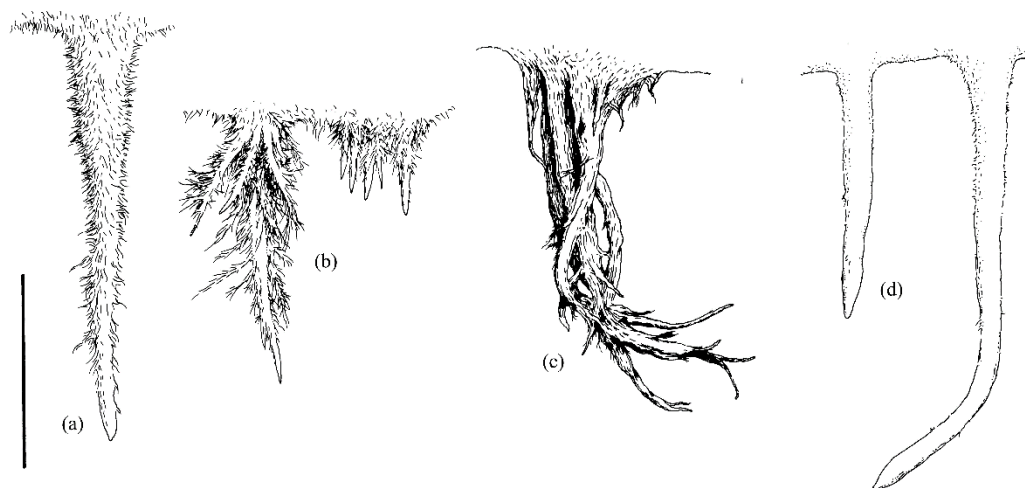


Fig. 1. *Peltigera* rhizines: (a) *P. membranacea*; (b) *P. canina*; (c) *P. horizontalis*; (d) *P. praetextata*. Scale bar = 1 mm.

- | | | |
|---|---|---|
| 1 | Thallus bright green when moist; photobiont green (<i>Coccomyxa</i>); cephalodia present on either the upper or lower surface | 2 |
| | Thallus blue-grey, grey, brown or black when moist; photobiont cyanobacteria (<i>Nostoc</i>); cephalodia absent | 4 |

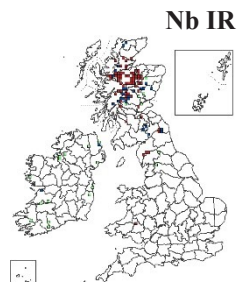
- 2(1) Thallus of solitary or several appressed fan-shaped lobes; cephalodia on lower surface associated with dark, radiating veins; rhizines absent, apothecia frequent *venosa*
Thallus of large branching ± widely spaced lobes; cephalodia on upper surface; rhizines present; apothecia rare 3
- 3(2) Cephalodia appressed, convex, wart-like, never detaching; lower surface with a distinct network of pale to dark brown veins *leucophlebia*
Cephalodia peltate, flat or ± concave, with free margins, easily detaching leaving small, pale scars; lower side without obvious venation *britannica*
- 4(1) Thallus sorediate 5
Thallus without soredia 6
- 5(4) Soralia mostly marginal, linear; thallus upper surface without tomentum; mostly on mossy trees and rocks in N. and W. Britain and Ireland *collina*
Soralia laminal, ± rounded; thallus upper surface tomentose; on neutral, often recently disturbed soil, occasionally on trees and old stumps *didactyla*
- 6(4) Thallus with isidia, schizidia or lobules 7
Thallus lacking isidia, schizidia or lobules 11
- 7(6) Thallus upper surface with laminal, button-like isidia; thinly tomentose *lepidophora*
Thallus with schizidia or lobules; tomentose or not 8
- 8(7) Schizidia developing along cracks in the upper cortex; upper surface ± bullate, ± grey-tomentose *praetextata*
Schizidia or lobules marginal; upper surface not tomentose 9
- 9(8) Veins absent but scattered pale interstices present; rhizines thick, black, bundled *elisabethae*
Veins numerous, raised with wide interstices; rhizines pale to ochraceous, simple 10
- 10(9) Veins white, narrow, raised; marginal schizidia or lobules abundant, no secondary substances present *degenii*
Veins ± ochraceous, ± diffuse; marginal schizidia absent, lobules usually few or absent; medulla C+ red (gyrophoric acid) *hymenina*
- 11(6) Upper surface tomentose-pubescent overall, or at least at lobe ends and margins 12
Upper surface lacking tomentum, entirely smooth, or rarely sparingly pruinose at tips and margins (×20), or ± entirely scabrid 18
- 12(11) Lower surface lacking distinct venation; upper surface with a thin dense erect tomentum, especially towards and at the margins *malacea*
Lower surface with distinct veins at least towards the margins of lobes; upper surface with appressed tomentum and sometimes partly pruinose 13
- 13(12) Thallus rarely more than 3 cm broad; lobes soon becoming erect; apothecia ± vertical on ends of ascending lobes *didactyla*
Thallus mostly greater than 3 cm broad; ± widely spreading, horizontal, only ascendant at the extreme lobe ends when fertile 14
- 14(13) Lobe surface ± uneven-bullate-ridged, margins ± down-turned 15
Lobe surface ± flat or faintly ridged, margins ± raised, often somewhat swollen or crisped 17

- 15(14) Rhizines simple, dagger-like, \pm dispersed, pubescent, thallus large (to *ca* 30 cm diam.), thallus forming broadly radiating patches 16
Rhizines bottle-brush-like, forming a continuous mat (as in a shag-pile carpet), thallus compact, not wide-spreading *canina*
- 16(15) Thallus often strongly bullate, grey to brown-grey; lower surface and rhizines white throughout *membranacea*
Thallus not strongly bullate, sometimes with schizidia; lower surface and rhizines dark towards the centre *praetextata*
- 17(14) Veins wide, flat, becoming dark brown on older parts of thallus; rhizines fasciculate, \pm confluent; apothecia saddle-shaped, dark brown *rufescens*
Veins narrow, elevated, pale; rhizines simple, mostly scattered; apothecia flattened, pale brown *ponojensis*
- 18(11) Upper surface scabrid-roughened 19
Upper surface smooth or rarely pruinose 20
- 19(18) Lower surface dark towards the thallus centre; rhizines brush-like (squamose) [TLC recommended to distinguish from *P. scabrosella*] *scabrosa*
Lower surface pale towards the thallus centre; rhizines pale when young, simple *scabrosella*
- 20(18) Upper surface of lobes \pm pruinose ($\times 20$) at least towards the margins and lobe ends; apothecia dark brown to black *neckeri*
Upper surface glabrous; apothecia red-brown to brown 21
- 21(20) Apothecia rounded, often broader than long, held horizontally; veins distinct, brown with pale interstices; rhizines concentrically arranged as if in annual rings; old woodland species *horizontalis*
Apothecia longer than broad, often \pm ascending at the lobe ends, veins pale to ochraceous to dark brown 22
- 22(21) Lobe margins crisped and contorted; veins dull to dark brown, distinct towards margins, rhizines persistently dark brown, tightly fasciculate, sparse towards lobe margins *polydactylon*
Lobe margins wide-spreading, not crisped or contorted; veins pale to ochraceous, diffuse towards the margins, rhizines pale, simple, continuing to lobe margins 23
- 23(22) Veins white to pale yellow, narrow, raised; marginal schizidia or lobules usually but not always abundant, no secondary substances present *degenii*
Veins \pm ochraceous, \pm diffuse; marginal schizidia absent, lobules usually few or absent; medulla C⁺ red (gyrophoric acid) *hymenina*

***Peltigera britannica* (Gyeln.) Holt.-Hartw. & Tønsberg (1983)**

Green when wet, like *P. leucophlebia*, photobiont green (*Coccomyxa*), but the cephalodia (with *Nostoc*) on the upper surface are concave, button or saucer-shaped with free entire or somewhat crenulate edges, rarely proliferating margins and are easily detached leaving white scars; the lower surface usually undifferentiated or with indistinct veins; rhizines often few, in scattered groups, bottlebrush-like. Apothecia not seen in European material. Thallus with tenuiorin, methyl gyrophorate, \pm gyrophoric acid (C \pm red), phlebic acid A and B, T₂ and T₅. **BLS 1666.**

On bark or mossy rocks and walls in damp, sheltered habitats, often in woods but avoiding calcareous sites; local. N. England, Wales (Brecon, Anglesey), throughout much of Scotland.



The more continental *Peltigera aphthosa* (L.) Willd. (1787), incorrectly recorded from Britain, has cephalodia which are appressed, convex, somewhat corrugate and not readily detached from the surface, the lower surface is blackened towards the centre, woolly but without rhizines and, unlike *P. leucophlebia*, the apothecia are uniformly corticate on the underside. The relationship between *P. aphthosa* and *P. britannica* is in need of further investigation; according to Miadlikowska *et al.* (2018) *P. britannica* nests within a paraphyletic *P. aphthosa*.

A blue-green morphotype has been recorded rarely in the Scottish Highlands which develops from the cephalodia and may become independent. The specimens are up to 3 cm across, have crenate or dentate margins with erect hairs; the upper surface is blue-grey with a characteristic network of pale interconnected spots, the underside is blackened, densely felted with scattered bundles of simple rhizines; secondary attached lobules of the green morphotype are usually present.

Host to *Raciborskiomyces peltigericola* (D. Hawksw.) M.E. Barr (1997) and *Thelocarpon epibolum* Nyl. (1866).

***Peltigera canina* (L.) Willd. (1787)**

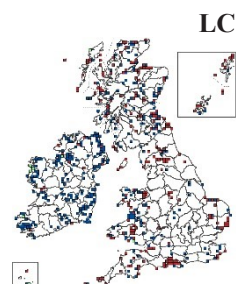
Like *Peltigera membranacea*, but with more flattened, smooth veins in the central parts of the thallus and irregular rhizines that are markedly bushy and beard-like, and confluent at the base. Apothecia dark brown to black, saddle-shaped. Ascospores $42\text{--}53 \times 2.6\text{--}5.2 \mu\text{m}$. Thallus with negative reactions; no lichen products detected by TLC.

BLS 1039.

Amongst moss and short grass, on arid sandy slightly basic to acid soils and dunes, fixed shingle, heathland and dry grassland. Widely dispersed but local in Britain and Ireland.

The bullate lobes with inflexed margins and richly branched woolly confluent rhizines are diagnostic.

Host to *Corticifraga peltigerae* (Fuckel) D. Hawksw. & R. Sant. (1990), *Dinemasporium strigosum* (Pers.) Sacc. (1881), *Pezizella epithallina* (W. Phillips & Plowr.) Sacc. (1889), *Pronectria robergei* (Mont. & Desm.) Lowen (1990), *Pseudorobillarda peltigerae* Diederich (1998) and *Stigidium peltideae* (Vain.) R. Sant. (1960).



***Peltigera collina* (Ach.) Schrad. (1801)**

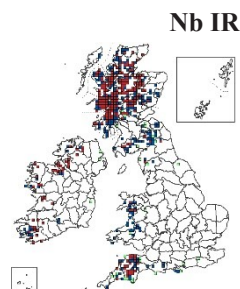
Thallus to 10–15 cm diam., usually less; lobes 1–1.5 (–3) cm broad, elongate (to ca 3 cm), radiating or ± randomly arranged (in old specimens), appressed for most of their length; margins ± raised, undulate, ± entirely sorediate; upper surface grey, blue-grey or rarely brown, smooth, ± shiny, occasionally somewhat scabrose, rarely pruinose towards the margins; soralia marginal, pale grey or slightly blue, rather coarsely granular and partly pigmented and partly corticate when young; lower surface with pale brown veins and ± simple rhizines. Apothecia rare, small, to 2 mm diam., rounded or ± elongate, eventually saddle-shaped, on short ascending lobes, dark brown or black. Ascospores $39\text{--}70 \times 4\text{--}5 \mu\text{m}$, 3 (–5)-septate. Thallus with tenuiorin, methyl gyrophorate, ± gyrophoric acid (C+ red), T₁, T₃ and additional unidentified terpenoids.

BLS 1040.

On mossy trunks and rocks, often in sheltered situations. N. & W. Britain and Ireland.

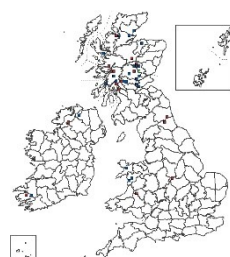
The only *Peltigera* with marginal soralia in the British Isles. When sterile it may be confused with *Nephroma parile*, which lacks veins, has an almost smooth underside and a different chemistry.

Host to *Pyrenidium actinellum* Nyl. (1865), *Nectriopsis lecanodes*, *Stigidium peltideae* and *Xenonectriella lutescens* (Arnold) Weese (1919). There are also several finds of an undescribed ‘*Karsteniomyces*’ coelomycete with colourless 1-septate conidia, $12\text{--}16 \times 1.2\text{--}1.5 \mu\text{m}$ in size.



***Peltigera degenii* Gyeln. (1927)**

Thallus to 10 (–20) cm diam., wide-spreading; lobes 0.5–1 cm broad, 2–4 cm long; upper surface blue-grey, occasionally brown, glossy, tomentum absent, smooth or bullate-wrinkled, marginal isidia and lobules often present; lower surface white-cream, with narrow ± conspicuous elevated white to pale yellow-brown veins and slender, simple or little-branched pale cream or grey brown rhizines with a ± smooth



surface, occasionally slightly pubescent. Apothecia round, becoming recurved, on erect elongate lobes. Ascospores $45\text{--}65 \times 2.5\text{--}5 \mu\text{m}$. Conidiomata unknown. Thallus with negative reactions; no lichen products detected by TLC. **BLS 1041**.

On mossy rocks, fallen trunks in ravines, rotting logs and tree bases; local. England (Durham), Scotland, C. to N. Wales, Ireland (N. Ireland, Kerry).

The narrow, uniformly pale raised veins and simple, unbranched rhizines as well as the absence of lichen products are diagnostic. Care is needed to distinguish this species from morphs of *P. praetextata* with sparse tomentum.

Peltigera didactyla (With.) J.R. Laundon (1984)

Thallus to 5 cm diam., rosette-shaped or consisting of a few coalescing lobes in small groups level with or sunk into the substratum; lobes small, 0.5–1 cm broad and 1–2 cm long, mouse-ear-shaped when young, becoming markedly ascending when fertile; upper surface finely grey-white tomentose especially towards the margins; when young, with laminal, rounded or irregular pale sorediose patches; soralia to 2.5 mm diam., discrete, later becoming confluent, filled with pale blue-grey to brown coarsely granular soredia, disappearing with the formation of apothecia; lower surface with distinct raised pale cream or faintly flesh-coloured to ochraceous veins, anastomosing with well-developed interstices; rhizines simple, downy, occasionally bottlebrush-like; apices often somewhat brush-shaped. Apothecia held vertically, \pm oblong, saddle-shaped, red-brown or brown, delicately crenulate and denticulate at the margin. Ascospores $40\text{--}75 \times 3.5\text{--}4.5 \mu\text{m}$, 3- to 7-septate. Conidiomata rare; conidia $6\text{--}7.5 \times 3\text{--}4 \mu\text{m}$. Thallus with low concentrations of gyrophoric acid (C+ red) and methyl gyrophorate have been occasionally recorded in the soralia. No lichen products detected by TLC. **BLS 1053**.

Characteristic of recently disturbed sites, including cuttings, earth banks, roadsides, lawns, old soil in flower pots, urban wasteland, mine spoil heaps, bonfire sites, quarries and grey dunes; occasionally found on trees and old tree stumps; common. Scattered throughout Britain and Ireland.

Can be confused with the markedly horizontally spreading *Peltigera rufescens*, also with *P. membranacea*, which is larger and has a bullate upper surface. *P. didactyla* is unusual in that a juvenile sorediate state is superseded by a fertile non-sorediate state; as the thalli become fertile, the soralia are reduced to pale, non-sorediate scars that eventually disappear.

Host to *Corticifraga fuckelii* (Rehm) D. Hawksw. & R. Sant. (1990), *C. peltigerae*, *Illosporium carneum* Fr. (1829) (? as the anamorph of *Pronectria robergei*), *Hawksworthiana peltigericola* (D. Hawksw.) U. Braun (1988), *Libertella malmedyensis* Spig. & Roum. (1880), *Polycoccum peltigerae* (Fuckel) Vězda (1969), *Pronectria robergei*, *Pyrenidium actinellum* and *Scutula dedicata* Triebel *et al.* (1997).

Peltigera elisabethae Gyeln. (1927)

Thallus 10–15 cm diam., lobes 1.5–2 cm broad and to 5 cm long; upper surface grey-brown, metallic-shiny, with pale slash-like cracks (as in *P. neckeri*), peeling near the margins to form lobulate crisped and curled isidiooid schizidia and lobules; medulla thick; lower surface dark brown-black, paler near the margins, without veins but with small, starkly white interstices centrally; rhizines dark, fasciculate, rather thick, concentrically arranged as if in annual rings. Apothecia rare (not observed in British material), horizontal, with a flat rounded or oval disc as in *P. horizontalis*. Ascospores $25\text{--}45 \times 3\text{--}7 \mu\text{m}$, 3-septate. Thallus with tenuiorin, methyl gyrophorate, gyrophoric acid (C+ red), T₃ and \pm T₄, and unidentified terpenoids. **BLS 1667**.

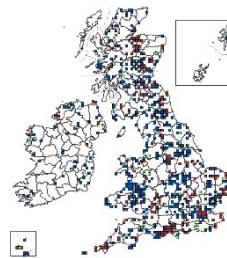
On mossy rocks over 700m, but in the Ochil Hills at a considerably lower altitude. Scottish Highlands, Wales (Snowdonia).

Characterized by the thick thallus, crisped marginal schizidia and the non-veined felted dark underside with only scattered, pale interstices. *Peltigera horizontalis* has very distinct anastomosing dark veins and entire margins to the lobes.

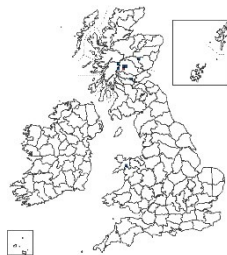
Peltigera horizontalis (Huds.) Baumg. (1790)

Thallus 10–20 (–40) cm or more in diam., forming wide-spreading patches; lobes to 3 cm broad and 5 cm long; upper surface blue-grey, often tinged brown, \pm glossy, margins \pm entire or indented, rarely sublobulate and

LC



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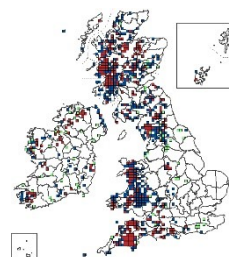
LC

crisped; lower surface white towards the margins, becoming darker towards the centre, with conspicuous anastomosing dark brown-black veins with numerous starkly white elongate interstices; rhizines fasciculate, often brown-black or black, concentrically arranged as if in annual rings. Apothecia rounded, occasionally broader than long, horizontal, discs flattened, red-brown. Ascospores $30\text{--}46 \times 3\text{--}7 \mu\text{m}$, 3-septate. Conidiomata unknown. Thallus with tenuiorin, methyl gyrophorate, \pm gyrophoric acid (C+ red), T₃, T₄ and unidentified terpenoids. **BLS 1042**.

On mossy trunks of old trees, rotting logs, stumps and mossy rocks, often in sheltered valleys, especially in woodlands with a long history of ecological continuity; locally abundant. W. Britain and Ireland, but extending locally eastwards.

A distinctive old woodland indicator species, characterized by the rounded apothecia held horizontally. The dark brown anastomosing veins bearing fasciculate dark rhizines are also diagnostic; *Peltigera elisabethae* differs in having marginal schizidia and a more evenly felted dark but non-veined underside.

Host to *Pyrenidium actinellum*, *Scutula epiblastematica* (Wallr.) Rehm (1890) and *Stigmidium peltideae*.



Peltigera hymenina (Ach.) Delise ex Duby (1830)

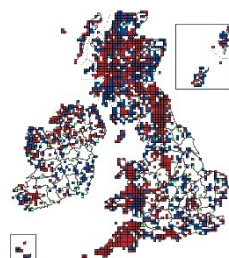
Thallus 10–20 cm diam., wide-spreading; lobes 1–2 cm broad, overlapping, \pm ascending at the apices and margins; margins neither crisped nor with folioles (small regenerative lobules are occasionally present); upper surface glossy to \pm matt, occasionally partly glossy, grey or slightly brown, without or rarely with a few slash-like cracks; lower surface with \pm well-defined pale to deep ochre veins extending towards the lobe margins, with frequent pale interstices; rhizines pale, slender, simple, unbranched, occasionally splitting towards the ends. Apothecia common, saddle-shaped, to 5×3 mm, pale brown or red-brown, \pm on short extensions from the margins of the lobes. Ascospores $50\text{--}80 \times 4\text{--}5 \mu\text{m}$, 3- to 7-septate, oblong-elongate, acicular. Conidiomata unknown. Thallus with tenuiorin, methyl gyrophorate, \pm gyrophoric acid (C \pm red), T₂, \pm T₃ and \pm T₄. **BLS 1043**.

On soil, mosses and rocks, sheltered banks, lawns, dunes and tree bases in damp situations; common. Throughout Britain and Ireland.

A very variable species with lobes ranging from small, very numerous and dissected, to wide, entire and sparse; frequently sterile. The ochre-coloured veins with unbranched pale rhizines are diagnostic. For differences from *Peltigera neckeri* and *P. polydactylon* see those species. Large and robust thalli with a slightly undulating upper surface, with a distinct network of dark veins and whitish interstices on the lower surface may occur (Clarke 2016).

Host to *Arrhenia peltigerina* (Peck) Redhead *et al.* (2002), *Arthonia fuscopurpurea* (Tul.) R. Sant. (1960), *Corticifraga fuckelii*, *C. peltigerae* (rarely), *Dinemasporium strigosum*, *Hawksworthiana peltigericola*, *Illosporium carneum*, *Lichenopeltella peltigericola* (D. Hawksw.) R. Sant. (1993), *Nectriopsis lecanodes*, *Paranectria superba* D. Hawksw. (1982), *Pezizella epithallina*, *Phaeoseptoria peltigerae* Punith. & Spooner (1997), *Pronectria tenuispora* (D. Hawksw.) Lowen (1990), *Scutula ?epiblastematica*, *Stigmidium peltideae* and *Xenonectriella lutescens*.

LC



Peltigera lepidophora (Vain.) Bitter (1904)

Thallus to 5–7 cm diam., often smaller, level with or sunken into the substratum; lobes to 1 cm broad, *ca* 3.5 cm long, concave to ear-shaped, with ascending, entire or \pm eroded and sometimes inrolled margins; upper surface grey-brown, smooth, glabrous in part or \pm thinly tomentose to somewhat scabrous; isidia to 1 mm diam., numerous, button-like, resembling cephalodia, crowded and contiguous, sometimes overlapping or widely dispersed; lower surface with often rather indistinct white to pale grey, rarely pale brown anastomosing veins and discrete unbranched pale rhizines; photobiont *Nostoc*. Apothecia not known in Britain. Thallus with negative reactions; no lichen products detected by TLC. **BLS 1044**.

On flat mossy rock ledges in a river gorge; rare. Scotland (E. Perthshire).

Distinguished by the small size and numerous dorsiventral peltate cephalodium-like isidia on the partly thinly tomentose upper surface. Rather similar to the juvenile stage of *Peltigera didactyla*, which is sorediate and widespread.

CR B



Peltigera leucophlebia (Nyl.) Gyeln. (1926)

Thallus forming patches to 20 (–25) cm diam.; lobes 2–4 cm broad, rounded; margins often distinctly wavy, crisped, flat to ± ascending and irregularly divided; upper surface bright green when wet; photobiont green (*Coccomyxa*); pale grey or tinged brown when dry, smooth or indented, ± erect-tomentose near margin, smooth at the centre, with brown appressed convex wart-like cephalodia (with *Nostoc*), to ca 1.2 mm diam. that are not easily detached; lower surface with a distinct network of veins, brown-black towards the centre, paler at the margins, with correspondingly pale or dark simple rhizines. Apothecia rather rare, round or saddle-shaped, on short extensions from the lobe margins, fertile lobes partly corticate or wholly decorticate on the underside beneath the apothecia. Ascospores 47–80 × 5–6 μm, 3- to 7-septate, colourless or pale brown. Thallus with tenuiorin, methyl gyrophorate, ± gyrophoric acid (C+ red), 4 unidentified triterpenes (only one of which is common to *P. britannica*). **BLS 1045**.

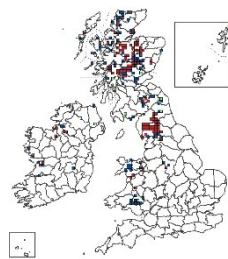
On mosses amongst rocks, often in ± calcareous habitats; widespread but local. Upland British Isles.

Characterized by the bright green colour when wet, large rounded lobes, the appressed cephalodia on the upper surface which are difficult to remove and the distinct network of dark brown veins on the underside of older parts of the thallus.

Peltigera leucophlebia is a polyphyletic and highly diverse taxon that appears to contain a number of segregate taxa (Pardo-De La Hoz *et al.* 2018), but British and Irish material was not included in their study so its significance is unclear for our region. It may be separated from the non-British *P. aphthosa* by the ± decorticate undersurface below the apothecia. See also *P. britannica*, which is sterile in Britain and in which the cephalodia are concave, sessile and easily detached.

Host to *Corticifraga fuckelii*, *Pyrenidium actinellum*, *Raciborskiomyces peltigericola*, *Stigmidium peltideae* and *Thelocarpon epibolum* var. *epithallinum* (Leight.) G. Salisb. (1953).

LC

**Peltigera malacea** (Ach.) Funck (1827)

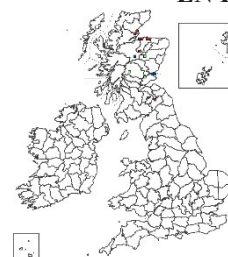
Thallus 10–20 cm diam., rather thick, to ca 1.5 mm; lobes to 3 cm broad and 10 cm long, often imbricate; margins ± raised, undulate; upper surface ± even, downy or greasy, blue-green, tinged brown when dry, deep olive-green or brown when wet, smooth or often thinly scabrid-tomentose with erect hairs especially towards the lobe margins; lower surface pale at the margins, soon becoming brown-black, ± uniformly tomentose, veins and rhizines mostly absent, paler interstices few or absent. Apothecia round, appressed, brown-red, ± crenulate at the margin. Ascospores 55–70 × 5–6 μm, 3- to 5-septate, elongate-fusiform. Conidiomata unknown. Thallus with tenuiorin, methyl gyrophorate, ± gyrophoric acid (C+ red) and unidentified terpenoids (as in *P. leucophlebia*). **BLS 1046**.

On acid dunes and conifer plantations on sand; rare. Scotland (primarily E. coast).

Distinguished by the continuous non-veined grey to dark brown felted underside, scarce rhizines and vertical, hair-like tomentum on the upper side, especially toward the margins.

Host to *Corticifraga fuckelii*, *C. peltigeriae*, *Dinemasporium strigosum*, *Nectriopsis lecanodes*, *Paranectria superba* and *Sporormiella intermedia* (Auersw.) S.I. Ahmed *et al.* (1969).

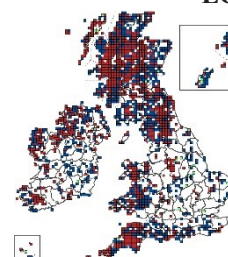
EN B

**Peltigera membranacea** (Ach.) Nyl. (1887)

Thallus to 30 cm or more, often forming broadly radiating patches, grey or often brown-grey; lobes to 1–2 (–4) cm broad, discrete or more usually contiguous, thin; margins uneven, down-turned, entire, indented or lacerate and radiating; upper surface thinly to thickly white-grey tomentose, at least towards and at the margins, rarely flat, markedly bullate-ridged, without folioles but occasionally with swollen regenerative secondary lobules; lower surface uniformly whitish, with pale, raised veins and well-developed simple dispersed pubescent dagger-like rhizines. Apothecia common, rounded, becoming saddle-shaped, red-brown to brown. Ascospores 50–73 × 3.5–4 μm, 3- to 5-septate, colourless or pale brown. Conidiomata unknown. Thallus with negative reactions; no lichen products detected by TLC. **BLS 1047**.

Overgrowing or amongst mosses on the ground, mossy rock faces and buttresses, also tree trunks; common. Throughout Britain and Ireland, rarer in the east.

LC



Compare with *Peltigera canina* which has bushy, ± contiguous, beard-like rhizines. For specimens with schizidia, see *P. praetextata*.

Host to *Corticifraga fuckelii*, *C. peltigerae*, *Dinemasporium strigosum*, *Illosporium carneum*, *Lichenopeltella peltigericola*, *Nectriopsis lecanodes*, *Neobarya peltigerae* Lowen *et al.* (2007), *Polycoccum peltigerae*, *Raciborskomyces peltigericola*, *Scutula miliaris* (Wallr.) Trevis. (1853) (as ‘*Karsteniomyces*’ anamorph), *Skytella mulleri* (Willey) D. Hawksw. & R. Sant. (1988) and *Stigmatidium peltideae*.

Peltigera neckeri Hepp ex Müll. Arg. (1862)

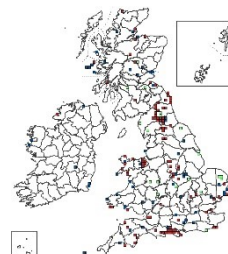
Thallus small, to 10 (–20) cm diam., rather similar to *P. hymenina*; lobes 0.7–1 (–1.5) cm broad and 3–4 cm long, with upturned margins; upper surface typically thinly white-grey-pruinose, often only towards the margins (×20 lens), shining, often with ± elongate pale slash-like cracks with ± raised edges exposing the white medulla; lower surface pale at the margins, black towards the centre, with a few wide mostly diffuse dark veins with white interstices, rhizines mostly few, diffuse, confluent. Apothecia mostly short-stalked, discs dark brown-black, reflexed, becoming bean-shaped. Ascospores 50–75 × 2.5–5 µm, 3-septate. Thallus with tenuiorin, methyl gyrophorate, ± gyrophoric acid (C+ red), T₂, T₃, T₄ and two unidentified terpenoids. **BLS 1048.**

On mosses on soil, including lead-contaminated soil, or rocks, grass and tennis courts, churchyards and ± basic dunes; local and infrequent but possibly overlooked; scattered throughout England, Scotland & Wales, rare in Ireland.

The pruina is often only thinly present on a few lobes and should be carefully searched for; the unusual chemistry is diagnostic and the apothecia are usually darker than in related species. The dark veins separate this species from *Peltigera hymenina* where they are persistently ochre-coloured.

Host to *Corticifraga fuckelii* and *Hawksworthiana peltigericola*.

Nb



Peltigera polydactylon (Neck.) Hoffm. (1790)

Thallus to 20 (–30) cm diam., radiating or overlapping; lobes 1–1.5 cm broad and 4–5 (–12) cm long, ascending, markedly wavy and crisped-contorted, becoming squamulose; upper surface shining, dark brown; lower surface with very distinct dull to dark brown anastomosing broad low veins present to the margins with numerous rounded to ± elongated pale interstices; rhizines often confluent when young, pale to dark brown. Apothecia rectangular, pale to dark brown, on 0.5–2 cm stalks. Ascospores (40–) 50–68 (–73) × 2.5–5 µm, 3-septate. Thallus with tenuiorin, methyl gyrophorate, ± gyrophoric acid (C± red), T₁, T₂ and T₃. **BLS 1049.**

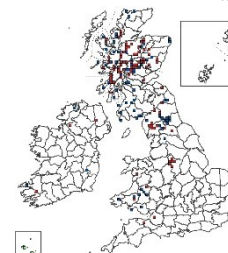
Amongst mosses, on tree bases and rocks; local, much over-recorded due to historic confusion with *P. hymenina* [reflected in the map]. S. England (Mendips), N. England, Scotland (Perthshire, Inverness).

Peltigera neckeri differs in the presence of an often sparse grey pruina on the upper surface, especially at the lobe margins; the rhizines ± confluent, pale, becoming blackened inwards and a few wide, dark veins; apothecia very dark brown. *P. hymenina* has the upper surface not pruinose; rhizines ± solitary, simple from the margin inwards, ± ochraceous, veins pale to ochre; apothecia red-brown. *P. polydactylon* has the upper surface not pruinose; rhizines ± confluent, brownish from the margin inwards, veins very distinct, brown to blackish; apothecia brown-red.

Host to *Lichenopeltella peltigericola*, *Polycoccum peltigerae* and *Pyrenidium actinellum*.

Peltigera seneca, morphologically similar to *P. polydactylon* but identifiable by TLC, was recently found in Norway and could be present in Britain and Ireland (Timdal & Rui 2021).

Nb



Peltigera ponojensis Gyeln. (1931)

Thallus 8–10 (–15) cm diam., radiating; lobes *ca* 1 cm broad and 5–6 cm long; upper surface tomentose, glossy or glabrous towards the centre, the margin raised, ± flexuose; lower surface white with pale, raised veins and pale simple scattered to aggregated rhizines. Apothecia rare, flat, convex to saddle-shaped; disc pale brown. Ascospores 43–63 × 3–5.2 µm. Conidiomata unknown. Thallus with negative reactions; no lichen substances detected by TLC. **BLS 1668.**

On chalk grassland, roadsides, metalliferous sites, alpine rocks, ± calcicole; a poorly

Nb



known species thought to be rare. S. England (Wiltshire, Fyfield Down), C. England (Derbyshire), C. Scotland (Breadalbane Mtns).

Characterized by the elevated, pale-coloured veins with whitish, mainly simple rhizines, as well as large, flat apothecia with pale brown apothecial discs. The status of this species and its separation from *P. rufescens* is in need of further study.

***Peltigera praetextata* (Flörke ex Sommerf.) Zopf (1909)**

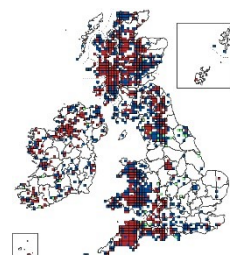
Thallus to 20 (–30) cm diam.; lobes 1–1.5 (–2) cm broad and 5–7 cm long; upper surface grey, brown-grey to dark brown, ± grey-tomentose (sometimes confined to lobe ends), with few to numerous scale-like schizidia, scattered or in dense overlapping clusters along the flat to upright margins of older parts and along fracture lines on the surface; lower surface with flattened veins, dark at the centre and pale towards the edge; rhizines dark towards the thallus centre, unbranched and ± smooth, not confluent. Apothecia rare, rounded, elongate or saddle-shaped. Ascospores 35–58 × 2.5–5 µm. Conidiomata unknown. Thallus with negative reactions; no lichen substances detected by TLC. **BLS 1050.**

On mossy trees, rotting logs, damp rocks and soil, often in sheltered situations; common. Throughout Britain and Ireland, but rarer in C. & S.E. England.

The separation of *Peltigera membranacea* and *P. praetextata* may present difficulties but the presence of schizidia and ± smooth rhizines in the latter species are diagnostic, although the schizidia are sometimes sparsely developed or even absent in abundantly fertile specimens.

Host to *Corticifraga peltigerae*, *Lichenopeltella peltigericola*, *Polycoccum peltigerae*, *Pronectria robergei*, *Scutula epiblastematica*, *Skyttella mulleri* and *Stigidium peltideae*.

LC



***Peltigera rufescens* (Weiss) Humb. (1793)**

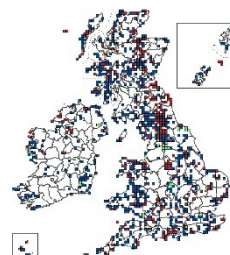
Thallus to 20 cm diam. rosette-forming or fragmented; lobes to 0.5–1 cm broad and ca 4 cm long, ± radiating, contiguous or somewhat overlapping; margins even, crinkled or crisped, ± elevated, upturned, swollen; the centre appressed, often with adventitious lobules and small lobes; upper surface thickly tomentose especially towards the margins, brown, ± white-grey-pruinose or sometimes patchily frosted in older parts, flat or wavy, rarely ± bullate when well-developed; lower surface with numerous wide flattened veins, not conspicuously hairy, rarely somewhat scabrid, darkening towards the thallus centre and with dark branched ± fasciculate rhizines coalescing at the base. Apothecia frequent, often large and conspicuous, elevated and recurved, on lateral ends of main lobes, usually saddle-shaped with an inrolled, coarsely crenulate or denticulate, uneven thalline margin. Ascospores 40–70 × 3–5 µm, 3- to 5 (-6)-septate. Conidiomata occasional; conidia 7–10 × 2.5–4.5 µm. Thallus with negative reactions; no lichen products detected by TLC. **BLS 1051.**

Most frequent in dry, sunny situations preferring ± basic soils, earth banks, dunes; common and widespread. Throughout Britain and Ireland.

Peltigera rufescens is sometimes confused with fertile *P. didactyla*, which is generally less leathery and has smaller apothecia on narrow entire erect lobes. *P. membranacea* has a bullate thallus and down-turned thin margins; those in *P. rufescens* are upturned and ± swollen. *P. rufescens* generally occurs in more basic, sunny habitats, often with *P. canina*.

Host to *Arthonia peltigerea* Th. Fr. (1866), *Corticifraga fuckelii*, *C. peltigerae*, *Dacamptia rufescentis* (Vouaux) D. Hawksw. (1986), *Dinemasporium strigosum*, *Illosporium carneum* (? as anamorph of *Pronectria robergei*), *Hawksworthiana peltigericola*, *Lasioisphaeriopsis salisburyi* D. Hawksw. & Sivan. (1980), *Lichenopeltella peltigericola*, *Nectriopsis lecanodes*, *Paranectria superba*, *Pezizella epithallina*, *Polycoccum crassum*, *Polycoccum peltigerae*, *Pronectria robergei*, *Pyrenidium actinellum* and *Scutula epiblastematica* and *Stigidium peltideae*.

LC



***Peltigera scabrosa* Th. Fr. (1861)**

VU D2

Thallus wide-spreading, to 5–10 (–20) cm diam., subcoriaceous; lobes 1–3 (–4) cm broad and to 10–18 cm long, margins ± raised, rounded; upper surface roughened, scabrid, blue- to brown-green when moist, brown when dry, not tomentose; lower surface with brown to black-brown distinct veins in the central region; rhizines dark brown to black, fibrillose to fasciculate. Apothecia not seen in British material (disc 3–6 mm diam., convex, on

extended lobes. Ascospores $75\text{--}90 \times 3\text{--}5 \mu\text{m}$). Thallus with tenuiorin, methyl gyrophorate, gyrophoric acid (C+ red), T₁, T₂, T₃, T₆ and two unidentified triterpenoids. **BLS 1052.**

On acid soil, montane; very rare. N. Scotland (Highlands, Ross, Orkney Isles). See also *P. scabrosella*.

Peltigera scabrosa is an aggregate of four species (Magain *et al.* 2017a) and TLC or molecular identification should be performed to confirm the presence of *P. scabrosa* s. str. in Britain.

***Peltigera scabrosella* Holt.-Hartw. (1988)**

Thallus to 2.5 cm diam., closely attached; lobes short and narrow, to 25 mm broad, ± imbricate, acute, the margins ascending, involute; upper surface grey to grey-brown, roughened-scabrid; lower surface pale, veins diffuse, ochraceous, rhizines white to pale brown, slender, simple. Apothecia round, on short elongations or directly on lobe ends. Ascospores $80\text{--}95 \times 3.5\text{--}4 \mu\text{m}$. Thallus with tenuiorin, methyl gyrophorate, gyrophoric acid (C+ red), T₂, T₃ and two unidentified triterpenoids. **BLS 2304.**

On mosses over moist, conglomerate rock, very rare. Scotland (Cawdor Wood, East Inverness-shire).

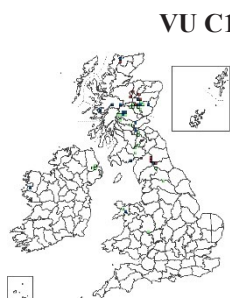
P. scabrosella has pale, simple rhizines which may be in loose bundles, a pale underside and a pink-red triterpenoid on TLC plates. In *P. scabrosa* the rhizines are fasciculate or fibrillose, soon blackened and the lower side is darkened in the centre.

***Peltigera venosa* (L.) Hoffm. (1789)**

Thallus to 2 cm diam., of a single, rounded or mussel-shaped lobe or of several, discrete or overlapping fan-shaped lobes; lobes 0.5–2 cm broad, often thicker than 1 mm; margin entire or indented, rather regular; upper surface bright green when wet, photobiont green (*Coccomyxa*), grey-green when dry (becoming pale to dark brown in dried collections), smooth, ± shiny; lower surface with conspicuous fan-shaped pale to dark brown radiating veins, without rhizines, tomentose; cephalodia (with *Nostoc*) scattered, associated with veins, superficial, dark brown or grey, rounded or irregular and wart-like. Apothecia usually present, 1–6 per lobe, marginal, oval, wider than long, black-brown, horizontal, flattened. Ascospores $30\text{--}47 \times (4\text{--}) 7\text{--}8 \mu\text{m}$. Thallus with tenuiorin, methyl gyrophorate, ± gyrophoric acid (C± red), phlebic acids A and B, T₁ and up to four unidentified terpenoids. The blue-green morphotype lacks lichen substances. **BLS 1054.**

On calcareous schists, other basic metamorphic rocks and metalliferous soils, more rarely on limestone, chiefly in upland sites; very local. N. areas of Britain, Wales (Snowdonia).

A distinctive neat small usually fertile bright green species with conspicuous fan-shaped brown non-rhizinate veins, associated with wart-like cephalodia on a pale background on the lower surface; the apothecia are flat and rounded. *Peltigera britannica* and *P. leucophlebia* are much larger with cephalodia on the upper surface. A blue-green morphotype of *P. venosa* frequently occurs separately or sometimes with the green morphotype; this consists of small, ± ascending, overlapping, brown-black squamules to 1 mm long, semi-circular or ligulate, photobiont *Nostoc*, evenly distributed throughout the inner part of the lobe. This phase resembles extreme, compacted, reduced morphs of *Scytinium gelatinosum* and other small *Leptogium* s. lat. species.



PSEUDOCYPHELLARIA Vain. (1890)

Thallus foliose, dorsiventral, spreading, rosette-forming or irregularly branched, loosely attached; lobes rounded or truncate, variously indented, often ascending at margins. **Upper surface** smooth or wrinkled, sometimes reticulately ridged, matt or dull. **Lower surface** tomentose, dotted with scattered

pseudocyphellae. **Soredia** and **isidia** present or absent. **Cortex** pseudoparenchymatous, of anticlinally arranged \pm isodiametric thick-walled cells. **Photobiont** blue-green (*Nostoc*). **Medulla** white or yellow. **Ascomata** apothecia, hemiangiocarpic, sessile or stalked, very rare or absent. **Thalline margin** present. **Asci** *Peltigera*-type, 8-spored. **Ascospores** brown, 1- to 3-septate, fusiform-ellipsoidal. **Conidiomata** pycnidia, very rare, *Lobaria*-type, globose or ovoid, walls dark brown at the ostiole, paler below. **Conidia** bacilliform. **Chemistry**: orcinol and β -orcinol derivatives, triterpenoids, terphenylquinones and pulvinic acid derivatives. **Ecology**: confined to humid sheltered oceanic woodlands.

Nephroma lacks pseudocyphellae on the underside of the thallus, and our most common species are not tomentose below. Related to *Lobaria*, *Lobarina* and *Sticta* (with which *Pseudocyphellaria* species often grow), but characterized by the presence of irregular pseudocyphellae on the lower surface, the emergent apothecia and varied chemistry. The genus is diverse and conspicuous in the S. Hemisphere, particularly in temperate rain-forest areas of S. America and New Zealand.

Five species of *Pseudocyphellaria* with green photobionts were separated into the genus *Crocodia* by Galloway & Elix (2013), including *P. aurata*, found in a few sites in Britain and Ireland.

Literature

Bogomazova (2018), Galloway (1988), Galloway & Elix (2013), Högnabba *et al.* (2009), James & Purvis (2009a), Jørgensen & Galloway (2011), Lücking *et al.* (2017).

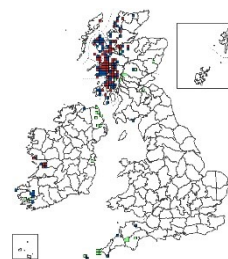
- | | | |
|------|---|--------------------------------------|
| 1 | Soralia and pseudocyphellae bright yellow; isidia absent | 2 |
| | Soralia and pseudocyphellae white, grey or lilac-grey; isidia present or absent | 3 |
| 2(1) | Photobiont green; thalli bright green when wet; medulla bright yellow; soralia \pm restricted to margins, bright yellow | <i>Crocodia aurata</i> |
| | Photobiont blue-green; thalli dull grey-brown when wet; medulla white or pale yellow in parts; soralia both laminal and marginal, bright yellow | <i>citrina</i> |
| 3(1) | Medulla C+ red, KC+ orange-pink; lobes rounded; surface \pm reticulately ridged; soralia both laminal and marginal | <i>norvegica</i> |
| | Medulla C-, KC-; lobes elongate, surface \pm smooth; soralia or isidia mostly marginal | <i>intricata</i> and <i>lacerata</i> |

Pseudocyphellaria citrina (Gyeln.) Lücking, B. Moncada & S. Stenroos (2017)

Nb IR

Pseudocyphellaria crocata auct. br., *non* (L.) Vainio (1898)

Thallus 2–3 (–10) cm diam., at first rosette-forming, soon irregularly spreading; lobes 5–15 mm broad, rounded or elongate, indented at the apices, often discrete at the margins and overlapping centrally; upper surface pale grey-brown (in shade) to dark red-brown, smooth or with a \pm coarse ridged network from which yellow soralia are derived, at first punctiform, later becoming confluent; medulla white; lower surface pale brown, darker brown towards the centre, tomentose to the margins, with frequent conspicuous yellow pseudocyphellae; photobiont blue-green. Apothecia very rare, disc 1–2 mm diam., dark red-brown, margin thin, pale reddish brown, often wrinkled. Ascospores (18–) 22–30 \times 5–9 (–12) μ m, 1(-3)-septate, fusiform, brown. Medulla and soralia C-, K+ yellow, KC-, Pd+ orange, UV \pm dull orange (pulvinic, stictic and constictic acids, pulvinic lactone, calycin, tenuiorin, methylglyrophosphate and hopane-6 α ,7 β ,22-triol, norstictic acid in the apothecia). **BLS 1195**.



On mossy trunks and branches of *Corylus*, *Fraxinus*, *Quercus*, *Sorbus aucuparia*, *Salix* and old *Calluna* stems and mossy boulders in moist or boggy sheltered well-wooded or coastal sites; local. S.W. England (N.W. Cornwall), W. Scotland, W. & S.W. Ireland.

Characterized by the blue-green photobiont, white medulla, yellow pseudocyphellae and yellow soralia which are laminal and marginal, and the presence of stictic acid (Pd+ orange). *Crocodia aurata* has a green photobiont, yellow medulla and soralia which are predominantly marginal and a very different chemistry (Pd-).

Revision of the *Pseudocyphellaria crocata* group in the Americas (Lücking *et al.* 2017) revealed that *P. crocata* s. str. does not occur in the New World. The identity and distribution of genuine *P. crocata* (type from India) needs further study; only a single sequence of a specimen from Thailand representing this species is currently available, and its voucher could not be located (Lücking *et al.* 2017). ITS barcodes of multiple samples from Scotland and Macaronesia (Canary Is. and Madeira) show that they also do not belong to *P. crocata* s. str. as represented by the Thai sequence, and conform instead to *P. citrina*, a widespread species in the New World.

Nectriopsis lecanodes is the only lichenicolous fungus recorded from this host.

***Pseudocyphellaria intricata* (Delise) Vain. (1898)**

Thallus 3–6 (–10) cm, rosette-forming at first, soon irregularly spreading; lobes to 1 cm broad, elongate and canaliculate, often deeply incised, with rounded apices; upper surface dark red-brown, ± greyish in shaded habitats, ± shiny, smooth, ± undulate or rarely weakly ridged; sorediate, isidiate or with lobules or phyllidia, the propagules predominantly marginal; medulla white; lower surface pale to dark brown, tomentose to the margins with scattered rather sparse white pseudocyphellae; photobiotic blue-green. Medulla and soralia C⁻, K⁺ yellow, KC⁻, Pd⁻, UV[±] bluish white (± tenuiorin and ± methylgyrophorate and main terpenes 7β-acetoxyhopan-22-ol, hopane15α, 22-diol). **BLS 1196.**

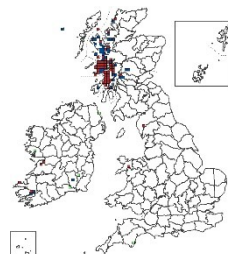
On mossy trunks and branches of *Corylus*, *Fraxinus*, *Quercus*, *Sorbus aucuparia* and *Salix*, on mossy boulders and, more rarely, old *Calluna* stems in moist sheltered well-wooded sites; locally frequent. W. Scotland, W. & S.W. Ireland; apparently extinct in S.W. England (S. Devon).

This name is used despite uncertainty regarding its application, having been applied worldwide to many unrelated lineages. Propagule morphology appears closely linked to microhabitat, with sorediate morphs on trees and isidiate to lobulate morphs on rocks.

Closely related to *P. norvegica* but characterized by the KC⁻ medulla, the ± smooth upper surface and canaliculate lobes. Immature specimens of *P. intricata* and *P. norvegica* may resemble *Nephroma*. In the latter, the underside is ± glabrous and smooth and lacks incipient pseudocyphellae. Cannot be distinguished from *P. lacerata* by morphology, but by far the commoner of the two taxa in our region.

Host to *Pyrenidium actinellum* and *Roselliniella nephromatis*.

NT IR



***Pseudocyphellaria lacerata* Degel. (1941)**

Indistinguishable from *P. intricata* morphologically or chemically, requiring sequencing for confirmation. Propagules on the two confirmed UK specimens were farinose soredia, but other propagule types are known outside of our region, correlated with microhabitat characteristics as with *P. intricata*. **BLS 1197.**

On mossy branches of broad-leaved trees in old woodland; very rare. N. Wales, W. Scotland.

VU D1 IR

***Pseudocyphellaria norvegica* (Gyeln.) P. James (1979)**

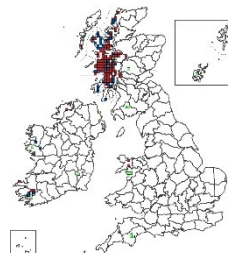
Like *P. intricata*, but differing in the chemistry and particularly the distinctive KC⁺ orange, C⁺ red medulla reaction due to a range of depsides related to the barbatic acid complex, the most important of which are 2'-O-methylnorbarbatic and 2'-O-methylnorobtusatic acids; tenuiorin and methylgyrophorate are absent and the two terpenes are the same as those in *P. intricata*; medulla and soralia are a brighter UV⁺ ice-blue than in *P. intricata*. The thallus often has a coarse, incomplete ridged network on the upper surface and more rounded and wider lobes; soralia are usually laminal and marginal, characteristically elongate and sigmoid on the upper surface and often have a pronounced lilac-mauve tinge when fresh. **BLS 1198.**

On moist, sheltered tree trunks and mossy rocks, often near water, or in *Salix* carrs and *Corylus* stands. W. Scotland, extending locally to England, Wales, S.W. & N.W. Ireland.

Immature material, with ± exclusively marginal soralia, may be easily confused with *P. intricata*; in such cases the KC⁺ orange, C⁺ red medulla is diagnostic.

Host to *Pyrenidium actinellum* and *Roselliniella nephromatis*.

Nb IR



RICASOLIA De Not. (1846)

Thallus large, forming rosettes or irregularly branched; lobes broad with rounded apices, sinuate-indentured, often wavy, contiguous and overlapping towards the centre, occasionally with marginal folioles; upper surface grey-white to pale grey-brown when dry, green-grey to bright green when wet, thick, wrinkled or smooth. **Cephalodia** internal and/or external, then \pm shrubby, dark blue-green-brown to brown-black, sometimes developing independently from the main thallus; lower surface tomentose, pale brown, paler towards the margin. **Photobiont** green algae in thallus and cyanobacteria (*Nostoc*) in cephalodia. **Apothecia** large, disc orange to red-brown. **Ascospores** fusiform to \pm acicular, colourless or pale brown, 1- to 3-septate. **Pycnidia** frequent, convex. **Conidia** aseptate, bacilliform or dumb-bell shaped. **Chemistry**: medulla with m-scrobiculin as major component, or no lichen substances present. **Ecology**: characteristic of ancient woodlands and parklands, especially in humid, sheltered areas.

A segregate from *Lobaria*, based primarily on chemical and molecular phylogenetic data (Moncada *et al.* 2013, Tønsberg *et al.* 2016). *Ricasolia amplissima* and *R. virens* (see below) cluster together (Moncada *et al.* 2013, Cornejo *et al.* 2017, Simon *et al.* 2020); however (Widhelm *et al.* 2019) indicated that the genus may be polyphyletic, with the type species (*R. amplissima*) rather isolated from other [unnamed] species assigned to that genus. As with *Lobaria* s. str., species are important components of the Lobarion community (James *et al.* 1977).

Literature

Cornejo *et al.* (2017), James *et al.* (1977), Moncada *et al.* (2013), Rose & Purvis (2009), Simon *et al.* (2020), Tønsberg *et al.* (2016), Widhelm *et al.* (2019).

- 1 Upper surface ivory-white to pale grey-white when dry, grey-green when wet; often with dark brown coralloid cephalodia on the upper surface which may develop independently *amplissima*
Upper surface pale green-brown when dry, bright green when wet; cephalodia at least mostly internal *virens*

Ricasolia amplissima (Scop.) De Not. (1846)

Lobaria amplissima (Scop.) Forssell (1883)

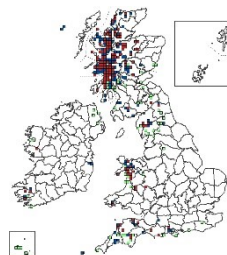
Thallus often exceeding 30 cm diam., forming large rosettes or irregularly branched; lobes 5–10 (–15) cm broad, with rounded apices, sinuate-indentured, wavy, discrete at the apices, contiguous and overlapping towards the centre; upper surface grey-white when dry, green-grey when wet, thick, wrinkled or smooth; cephalodia to 2 cm diam., occasionally absent and/or developing independently, richly branched, shrubby, dark blue-green-brown to brown-black; lower surface tomentose, pale brown, paler towards the margin. Photobiont green algae in the thallus and cyanobacteria (*Nostoc*) in cephalodia. Apothecia occasional; disc red-brown. Ascospores 40–60 \times 6–7 μ m, 1- to 3-septate. Pycnidia in conical warts to 0.7 mm diam., frequent, scattered, convex, the ostiole black; conidia aseptate, bacilliform, 4–5 \times 1–1.5 μ m. Medulla C–, K \pm pale yellow, KC \pm deep pink, Pd– (m-scrobiculin [major], p-scrobiculin [submajor], pseudocypbellarin A [minor], unknown scrobiculin derivative [trace]). **BLS 0855**.

Chiefly on trunks and main branches of *Fraxinus*, *Ulmus*, *Acer pseudoplatanus* and *Quercus*, occasionally on rocks. Prefers better-lit situations than *Lobaria pulmonaria* and *R. virens*. Western areas of Britain and Ireland; frequent in W. Scotland, scarce elsewhere; now rare in S.W. England, absent east of the New Forest.

This distinctive, large species is characterized by its pale grey-white thallus with neat rounded notched lobe margins, green photobiont and often the presence of densely branched, shrub-like cephalodia, which may occasionally occur independently and have been named *Dendriscoaulon umhausense* (Auersw.) Degel. (1942). Very rarely additional lobes of the green morphotype may arise secondarily from the cephalodia on the main thallus.

Host to *Nectriopsis lecanodes* and *Pyrenidium actinellum*.

Nb IR



Ricasolia virens (With.) H.H. Blom & Tønsberg (2016)*Lobaria virens* (With.) J.R. Laundon (1984)

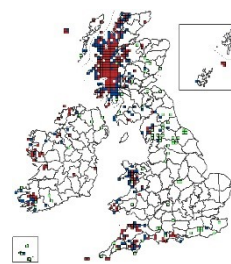
Thallus to 10 cm diam., ± closely appressed, often forming rosettes; lobes 3–10 mm wide, rounded at the apices, indented, wavy, occasionally with marginal folioles, often overlapping and becoming imbricate towards the centre; upper surface pale grey-brown to grey-green when dry, bright green when wet, often smooth and shiny, more rarely becoming transversely wrinkled and ridged in older parts; lower surface pale brownish white, evenly tomentose without tomentum-free, naked patches; photobiont green algae but with scattered internal cephalodia in the medulla. Apothecia frequent, disc 1–3 mm diam., pink- or orange-red with a thick inflexed thalline margin. Ascospores 25–45 × 8–11 µm, colourless or pale brown, fusiform, 1(-3)-septate. Pycnidia frequent, the ostiole dark brown; conidia widening at both ends, 4–5 × ca 1.5 µm. Medulla C–, K+ pale yellow or K–, KC± pink, Pd–, No secondary substances identified. **BLS 0856.**

On *Quercus*, *Fraxinus*, *Ulmus* and *Fagus*, mostly confined to ancient woodlands, occasionally on sheltered rocks in woods and on western sea-cliffs; locally common. Western areas of Britain southwards to S. & S.W. England (Cornwall, Dorset, Hampshire - New Forest), Sussex (very rare), Ireland.

Characterized by the dull grey-green colour, bright green when wet, its smooth, mostly closely appressed thallus and tendency to tolerate more shade than other members of the genus. Dendriscoauloid cyanomorphs similar to those found in *R. amplissima* have been reported in Norway (Tønsberg *et al.* 2016) and should be looked for in our region.

Host to *Nectriopsis lecanodes*, *Sclerococcum (Dactylospora) lobariellum* and *Tremella lobariacearum*.

Nb IR

**SOLORINA** Ach. (1808)

Thallus foliose, wide-spreading, or reduced to a collar round the apothecium (in *S. spongiosa*). Upper surface green-grey, bright apple-green when wet. **Lower surface** indistinctly veined, tomentose and with clusters of unbranched or branched rhizines. **Photobiont** *Coccomyxa*, *Nostoc* present in dark internal or external cephalodia. **Ascomata** apothecia, large, rounded, irregularly scattered, impressed to deeply immersed in the upper surface; disc dark red-brown, slightly to very deeply concave. **Thalline margin** absent. **Hamathecium** of unbranched paraphyses, conglutinate, not or little swollen at the apex. **Asci** clavate (1-) 2-, 4- or 8-spored, *Peltigera*-type. **Ascospores** red-brown or brown, ellipsoidal to fusiform, 1(-5)-septate with a median constriction, wall ± uniformly thickened, surface ornamented. **Conidiomata** not known. **Chemistry**: lichen products mostly absent; one species with solorinic acid (orange pigment). **Ecology**: on soil, markedly calcicole, one species (*S. crocea*) mildly calcifuge.

This genus is easily recognizable by the presence of ± impressed dark apothecia, hence the popular name ‘socket lichens’. It is polyphyletic according to Stone *et al.* (2021), with *Solorina crocea* occupying a different clade to the other British species. Lichenicolous fungi on *Solorina* are described by Zhurbenko (2020, 2021).

Literature

Gilbert (2009), Martínez & Burgaz (1998), Stone *et al.* (2021), Thomson & Thomson (1984), Wedin *et al.* (2007), Zhurbenko (2020, 2021).

- | | | |
|------|---|------------------|
| 1 | Underside of thallus vivid orange | <i>crocea</i> |
| | Underside white or pale brownish | 2 |
| 2(1) | Thallus confined to a narrow rim surrounding the apothecia; external cephalodia forming a dark spongy mat amongst and under the apothecia | <i>spongiosa</i> |
| | Thallus ± well-developed, lobed; cephalodia internal | 3 |

- 3(2) Thallus well-developed, 2-5 cm diam.; asci 4-spored*saccata*
 Thallus small, ca 1 cm diam.; asci (1-) 2-spored*bispora*

Solorina bispora Nyl. (1860)

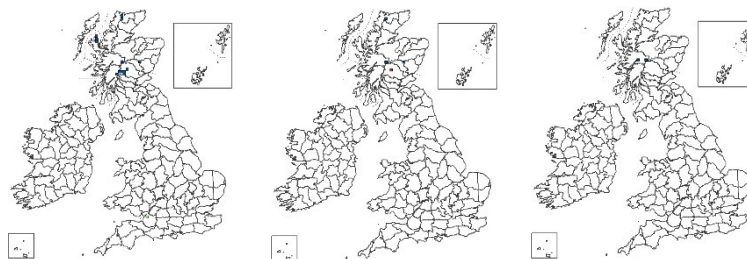
NT

Thallus small, consisting of mostly scattered, rounded or irregular lobes 5–10 mm diam., each with a single urceolate apothecium 2–5 mm diam. towards the centre of each lobe; upper surface pale grey to brown-grey, often pruinose; cephalodia internal, rarely external. Asci normally 2-spored. Ascospores 2-celled, ± ellipsoidal to broadly fusiform, ornamented with a deep, continuous reticulum, 60–105 × 25–45 µm. No lichen substances detected by TLC. **BLS 1327**.

Base-rich cliffs, montane; rare but locally abundant. Scotland (Highlands).

The species is polyphyletic according to Stone *et al.* (2021). On the basis of ascospore size, number and septation, three varieties are recognized by some authors, though it is not clear whether these are correlated with their phylogeny. These are:

- (a) var. *bispora* Nyl.; as above; see map left below.
 (b) var. *macrospora* (Harm.) H. Olivier (1921) [**BLS 1328**]; as (a) but ascospores larger, 95–140 × 30–56 µm, very rare; Caenlochan, Ben Hope, Sutherland; map centre below.
 (c) var. *monospora* (Gyeln.) Frey (1952) [**BLS 1899**]; asci 1-spored, ascospores 3-(4) celled, very large, 95–160 × 30–45 µm; known from a single site in the Ben Alder range; map right below.



The small thallus, which contains *Coccomyxa* and internal cephalodia, varies from pale grey to brown-green and tends to be strongly grey-white pruinose remaining pale when moist. Morphs resembling *S. spongiosa* with a supporting cushion-like coralloid thallus of dark external cephalodia are known. In the field *S. bispora* could be mistaken for small high-alpine morphs of *S. saccata*, but it is readily distinguished by its (1-)2-spored asci and much larger ascospores.

Host to *Arthonia peltigerea* and *Scutula tuberculosa* (Th. Fr.) Rehm (1906).

Solorina crocea (L.) Ach. (1808)

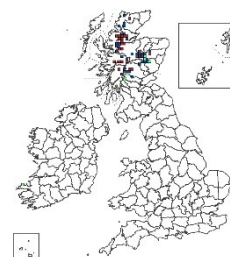
Nb

Thallus forming large rosettes of rather thick, rounded lobes; upper surface olive-green when moist, red-brown when dry, uneven or scabrid; lower surface bright orange, tomentose with a ± reticulate pattern of brown veins; with internal cephalodia. Apothecia to 7 mm diam., rare, dark brown, ± round, not or only a little depressed into the thallus; disc to 1 cm diam., flat or convex. Asci 6- to 8-spored. Ascospores 35–45 × 10–12 µm, brown, cylindrical, 1-septate, ornamented with rounded papillae. Medulla and lower surface K+ purple (solorinic acid). **BLS 1329**.

A ± calcifuge soil lichen of persisting snow-beds, leached windswept ridges, solifluxion areas, stonefields; locally abundant above 900 m, rarely descending to lower altitudes on river shingle. Scotland (Highlands), Ireland (an old record from Brandon Mountain, Kerry).

A highly distinctive species on account of the vivid orange lower surface. The structure of the thallus is unique among British lichens in having two discrete and ± continuous photobiont layers; an upper layer of *Coccomyxa* and a lower one of *Nostoc*.

Host to *Cercidospora punctillata* (Nyl.) R. Sant. (2004) and more commonly *Rhagadostoma lichenicola* (De Not.) Keissl. (1930).



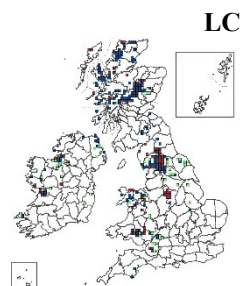
Solorina saccata (L.) Ach. (1808)

Thallus generally well-developed, spreading, composed of conspicuous rounded lobes with \pm wavy margins; upper surface pale grey, \pm tinged brown when dry, bright apple-green when wet; glabrous to densely white-pruinose; lower surface white or pale brown, densely tomentose, rhizines present, not or indistinctly veined. Apothecia to 6 mm diam., frequent, brown-black, deeply sunk in depressions in the upper surface. Asci normally 4-spored. Ascospores $32\text{--}50 \times 18\text{--}27 \mu\text{m}$, cylindric-ellipsoidal, 1-septate, with a thick red-brown furrowed and pitted epispore when mature. No lichen products detected by TLC. **BLS 1330.**

On limestone, basalt and basic schist outcrops, calcareous grassland, dunes, machair and mossy walls; a well-marked calcicole; locally abundant in uplands, rare in lowlands. Throughout upland areas of Britain and Ireland.

The thallus incorporates a continuous layer of *Coccomyxa*, below which are scattered internal cephalodia of *Nostoc* which can be seen on the underside as dark spots occasionally spanning the entire thickness of the thallus so that their position is also denoted by blackish areas on the upper surface. At higher altitudes the thallus may be much reduced with a densely white-pruinose surface and closely resembles that of *S. bispora* (q.v.).

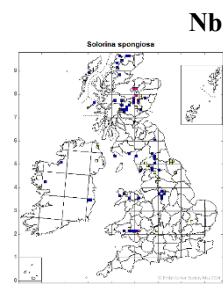
Host to *Scutula tuberculosa* and *Stigmidium solorinarium* (Vain.) D. Hawksw. (1983), and more rarely *Pyrenidium actinellum* and *Thelocarpon epibolum* var. *epithallinum*.

**Solorina spongiosa** (Ach.) Anzi (1862)

Those parts of the thallus with *Coccomyxa* very reduced, restricted to a continuous or lacerate narrow rim surrounding the scattered, small to moderate-sized urceolate apothecia, to 5 mm diam., on a spreading cushion of dark grey-black, partially buried cephalodia, which are \pm densely coralloid-warted or nodulose, gelatinous when wet; the external cephalodia with *Nostoc*, become dark and sponge-like when wet. Asci (2-)4-spored. Ascospores $30\text{--}50 \times 18\text{--}24 \mu\text{m}$; epispore thickened and ornamented with deep angular pits. No lichen products detected by TLC. **BLS 1331.**

In similar habitats to *Solorina saccata* but considerably rarer and less often in crevices, most records being from basic soil, old walls built with lime mortar, damp quarry floors and damp calcareous coastal dunes; local. Throughout Britain and Ireland but rare in the lowlands.

Distinguished from *Solorina saccata* by the dark external cephalodia and the mature ascospores which appear smoother in optical section. Occasional transitional morphs occur which are difficult to place and the status of the two species needs investigation. The apothecia are always accompanied by a narrow border or cuff of thallus containing green algae (*Coccomyxa*). The cephalodia can exist independently but are never fertile.

**STICTA** (Schreb.) Ach. (1803)

Thallus foliose, dorsiventral, loosely attached, single- to multi-lobed; lobes \pm rounded, variously indented, sometimes ciliate. **Upper surface** smooth or wrinkled, \pm matt. **Lower surface** tomentose, pitted by scattered cyphellae. **Soredia** and **isidia** present or absent. **Cortex** pseudoparenchymatous. **Photobiont** chlorococcoid or cyanobacteria (*Nostoc*). **Ascomata** apothecia, sessile, mostly very rare or absent. **Thalline margin** present. **Hamathecium** of unbranched paraphyses. **Asci** *Peltigera*-type, 8-spored. **Ascospores** colourless to pale brown, 1- to 3(-7)-septate, \pm fusiform. **Conidiomata** pycnidia, *Lobaria*-type, globose to ovoid; wall red-brown at the ostiole, paler below. **Conidia** bacilliform. **Chemistry**: lichen products not detected by TLC in most species; anthraquinones in a few. **Ecology**: on bark, more rarely rocks, characteristic of humid, sheltered woodlands.

A large genus with around 200 species, mostly in humid tropical to temperate regions and most

diverse in the Neotropics and the S. Hemisphere. Similar in morphology and habitat to *Lobaria*, *Lobarina* and *Pseudocyphellaria*, but distinguished by the presence of cyphellae on the lower surface, a medullary chemistry deficient in depsides, depsidones or triterpenoids, but rich in methylamine and trimethylamine and polyhydric alcohols, the trimethylamine often imparting a fishy smell to damp thalli particularly when handled. Very sensitive to SO₂ air pollution (<30 µg m⁻³).

An important character for identification is the membrane surface of the cyphellae that are present in all species on the lower surface of the thallus. In some species the cells of the membrane are minutely but distinctly papillate; this may be seen most easily by cutting a relatively thick section of the thallus and examining it under the compound microscope.

Several species are host to the lichenicolous fungus *Abrothallus welwitschii* Mont. ex Tul. (1852).

Literature

James & Purvis (2009b), Lindgren *et al.* (2020), Magain & Sérusiaux (2015), Moncada *et al.* (2014), Simon *et al.* (2018), Widhelm *et al.* (2019).

- | | | |
|------|---|---------------------|
| 1 | Upper surface pale green or glaucous-green, bright green when wet; photobiont green; without isidia or soredia | <i>canariensis</i> |
| | Upper surface brown-grey, rarely green-brown, darker when wet; photobiont blue-green; thallus with soredia, isidia or folioles | 2 |
| 2(1) | Thallus always producing soralia, mainly at lobe margins | <i>limbata</i> |
| | Thallus never with soralia, always with isidia or phyllidia | 3 |
| 3(2) | Thallus with the upper surface strongly maculate; margins always and upper surface usually with phyllidia (flattened isidia) | <i>canariensis</i> |
| | Thallus with the upper surface never strongly maculate, isidia most usually coralloid, never developing into typical phyllidia | 4 |
| 4(3) | Papillae present on cyphella membrane | 5 |
| | Papillae absent on cyphella membrane | 6 |
| 5(4) | Thallus rounded, monophyllous (and then typically mushroom-like) or with several rounded lobes, hardly dissected, dark brown, rarely pale greyish; margin typically involute, rarely sparsely ciliate on very young lobes or regenerating lobules; thallus rather robust; papillae on cyphella membrane few per cell; apothecia unknown | <i>fuliginoides</i> |
| | Thallus rounded to palmate, with lobes rounded (when young) to truncate (when old), dark dull brownish, lead grey or pale greyish; margin usually ciliate, usually not involute, especially when young; thallus very fragile and easily broken when dry; papillae on cyphella membrane numerous per cell, easily seen in fresh material; apothecia present in well-developed specimens, typically ciliate | <i>ciliata</i> |
| 6(4) | Thallus distinctly branched, almost always dichotomously, typically glossy; lobes involute, shallowing and usually with ascending margins; lower surface usually dark, especially towards the centre, strongly contrasting with the white cyphellae | <i>sylvatica</i> |
| | Thallus not distinctly branched, although lobes can be lacerate or dissected, not typically glossy; lobes rounded, not shallowing; lower surface usually pale or brownish, not strongly contrasting with the white cyphellae | 7 |
| 7(6) | Lobe surface with distinct swellings, irregular in shape but always present, with isidia developing on their upper parts | <i>atlantica</i> |
| | Lobe surface with no or irregular swellings, but rather typically reticulate or scrobiculate, and isidia developing on the edges of these dimples | <i>fuliginosa</i> |

Sticta atlantica Magain & Sérus. (2015)

NE

Thallus first fan-shaped, eventually becoming suborbicular or (more rarely) irregular, 4–7 cm diam., sometimes forming large colonies that can reach *ca* 15 cm diam., subcoriaceous when wet and usually papyraceous and brittle when dry; lobes suborbicular, 1–1.8 cm broad, adnate or slightly ascending, imbricate and overlapping, flat or undulating, the apices rounded, crenate to lacerate, the margin not thickened; upper surface with regular or irregular swellings or grooves, brownish or bluish grey, the same colour when wet or dry, matt or somewhat glossy, maculae yellowish and rather distinct on bluish grey thalli, sparse and not confined to certain parts of the thallus; cilia absent or rarely found on regenerating lobules, whitish, < 0.5 mm long; isidia always present, marginal or laminal, when marginal forming a string of minute \pm coralloid structures, sometimes becoming distinctly stipitate, when laminal forming stipitate coralloid masses to 1 mm diam., coarse or delicate, usually shining, concolorous with the thallus; lower surface foveolate to scrobiculate, white, cream-colored to brownish, tomentum always present, sparse towards the margin but sometimes becoming very dense towards the centre, sometimes agglutinated into rhizine-like fascicles; cyphellae abundant, round to slightly irregular, rather angular on old lobes, cupuliform to urceolate with a wide pore, with an erect white or cream-colored margin, the membrane not papillate. Apothecia and pycnidia never produced, conidia sometimes produced from rhizines. No substances detected by TLC. **BLS 2663.**

On branches of *Quercus*, S.W. Ireland.

Sticta atlantica has suborbicular thallus lobes, with a crenate to lacerate margin and upper surface with typically regular or irregular swellings or ridges on which isidia start their development to form coralloid stipitate masses. The species can be confused with *S. fuliginosa*, which mainly differs by its larger lobes (1.5–3 cm broad in well-developed specimens) without swellings.

Sticta canariensis (Flörke) Delise (1825)

Sticta dufourii Delise (1823)

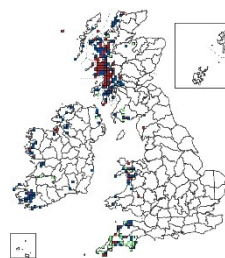
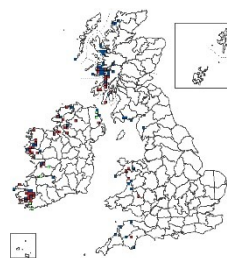
Green algal morph with thallus 1–5 (–15) cm diam., often forming extensive patches: lobes to 1 cm diam., elongate and dichotomously branched, discrete or overlapping, apices \pm truncate, bright green when wet, \pm shiny, smooth, often with a median channel; lower surface flat to somewhat ribbed, whitish to red-brown, \pm darkening to black-brown towards the centre, \pm uniformly felted-tomentose with small scattered rounded white cyphellae 0.3–0.6 mm diam. Apothecia rare; disc to 7 mm, red-brown; thalline margin paler, entire or crenulate, of small \pm rounded cells, \pm uniformly thickened, with colourless walls; epithecium red-brown, K–, conglutinated; hypothecium dense, pale grey-brown, not clearing in K; paraphyses *ca* 3 μ m diam., not swollen at the apex. Ascospores colourless, (20–) 23–28 (–32) \times 6–7 (–8) μ m, 1(–3)-septate. Pycnidia level or slightly elevated, with a dark brown apex; conidia 5–7 μ m long, straight, both ends slightly swollen. **BLS 1365.** The map includes combined thalli.

Cyanobacterial morph with thallus 1–5 cm diam., often forming extensive colonies, lobes to 2 cm diam., overlapping, margins rounded, irregularly incised, very thin and wrinkled, \pm minutely dissected into small terete or often flattened branched isidia, to 0.5 mm diam., often aggregated into dense clusters, 0.2–1 mm diam., occasionally becoming densely imbricate and covering the entire surface of older parts of the thallus; upper surface pale grey to dark grey-brown, matt, sometimes white-marbled; lower surface finely white-tomentose, pale brown-white, \pm reticulately ridged, with scattered white cyphellae. Apothecia and pycnidia not known. **BLS 1366.**

Composite thalli of the cyanobacterial and green morphs occur together, scattered throughout western Britain and Ireland. These are easily distinguished when wet as contrasting bright green leaflets arising from dark blue-black, lobed thalli. The two morphs are the response of a single mycobiont to different photobionts. As all lichen names are based on the mycobiont alone a single name has to be applied to two seemingly very disparate morphs sharing the same mycobiont. Pairs of such morphs are not uncommon in the *Peltigeraceae*. The impact of the two different photobionts on the same mycobiont suggests that the photobiont plays an important, but poorly understood, perhaps chemical role, in determining the combined shape and structure of lichen species.

Amongst mosses on trees and rocks in perpetually moist, very sheltered, deeply shaded sites, often under a canopy of herbaceous vegetation, e.g. *Pteridium*; locally frequent, the blue-green morphotype is the most widespread in W. Britain and Ireland. The free-living green algal morph is much rarer, confined to a few localities

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in W. Scotland, N. Wales and S.W. & W. Ireland.

The cyanobacterial morph differs from other *Sticta* species in our region by the combination of strongly maculate upper surface and production of phyllidia (i.e. flattened isidia). The thallus margin is often irregular and minutely dissected, a feature shared with *S. atlantica*, which has strongly isidiate margins but terete isidia.

The cyanobacterial morph is host to *Corticiruptor abeloneae* (P.M. Jørg.) Wedin & Hafellner (1998) with pale apothecia and *Hemigrapha atlantica* Diederich & Wedin (2000) with black apothecia.

Sticta ciliata Taylor (1836)

Thallus 1–3 (–5) cm diam., rarely forming large colonies, at first fan-shaped and developing from a single point, eventually becoming suborbicular to irregular, ± papyraceous even when wet and extremely brittle when dry; lobes adnate to slightly ascending, imbricate and usually overlapping, slightly to distinctly revolute when mature, with rounded apices and an entire to crenate, lacerate or sinuose unthickened margin; becoming slightly, but distinctly scrobiculate to foveolate, with a distinct microrelief somewhat highlighted by scars of broken isidia, greyish to dark chocolate brown, the same colour or somewhat paler when dry, matt or moderately glossy, sometimes with a whitish pruina; cilia always present on young lobes, typically abundant on fast-growing thalli in suitable conditions, lasting on parts of older thalli, especially on their regenerating parts, simple to agglutinated with usually pointed ends, ± white, 0.2–0.5 mm long; isidia always present, abundant, laminal, typically branched and coralloid, usually with a short (<0.1 mm) but distinct stipe, forming coralloid masses 0.2–0.5 mm across; lower surface foveolate to scrobiculate, whitish to cream-colored, darker towards the centre, with sparse to dense tomentum; cyphellae abundant, irregular to angular, rarely round, cupuliform to rarely flat, erumpent, the margin indistinct or elevated and slightly involute, white to cream-coloured, 0.3–1.2 mm diam., the membrane composed of cells with a papillate outer wall, each cell with 6–15 (–20) minute papillae, 1–2 × 1–1.5 µm in size. Apothecia sometimes abundant, 0.2–1.2 mm diam., submarginal, sessile, developed over a distinct invagination, disc reddish brown to dark brown, glossy, slightly concave especially when young, always with a crown of white to pale orange cilia. Ascospores fusiform, straight or slightly curved, 26–46 × 7–8.5 µm, with 1(–3) septa, with a minute but distinct mucoid appendage above. Pycnidia sometimes present, immersed in the thallus lobes, outer wall and opening without any distinct colour. Conidia bacilliform, 2–3 × 1–1.2 µm. No substances detected by TLC. **BLS 2664.**

On mossy bark of broadleaved trees, especially *Fraxinus* and *Salix*, rarely on mosses over rock, in oceanic areas of high humidity. Usually the dominant segregate of *Sticta fuliginosa* s. lat. in ravines and other highly humid woods, where it can be abundant. Fairly common in S.W. England, also from N. Wales and W. Scotland.

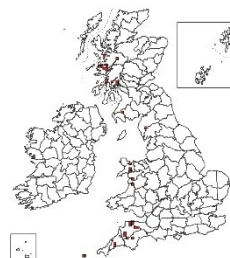
Sticta ciliata is easily recognized by its fragile and irregular thallus with marginal cilia; it is also the only fertile species amongst all cyanomorphic species of *Sticta* in Europe. *S. fuliginoides* may also have ciliate thalli, especially when young and where the thallus has regenerated after mechanical damage.

Host to *Abrothallus welwitschii* Mont. ex Tul. (1852).

Sticta fuliginoides Magain & Sérus. (2015)

Thallus first developed on a short robust stipe (to 1 cm high) as a single lobe, vase- or trumpet-shaped, typically with revolute margins, eventually developing several imbricate to overlapping fan-shaped lobes with an irregular, mostly suborbicular outline, 2–3 (–5) cm diam., subcoriaceous but rather brittle when dry, old thalli sometimes with a crenate to lacerate and hardly revolute margin; upper surface smooth to slightly scrobiculate, dark brown or rarely pale greyish both when wet or dry, matt or slightly glossy; cilia usually absent, sometimes seen on small regenerating lobes, unbranched, white, < 0.5 mm long; isidia always present, abundant, laminal, dispersed throughout, first globose or with a flattened top, eventually forming upright coralloid masses to 0.2 mm high, sometimes forming substipitate lobules on old thalli, concolorous with or darker than the thallus; lower surface smooth to scrobiculate, sometimes strongly so, pale orange to brownish, darker towards the centre in old thalli, usually with sparse to dense tomentum; cyphellae usually abundant, round or angular, urceolate with a wide pore, the margin elevated and involute, whitish to cream-colored, 0.4–0.6 (–1.5) mm diam., the membrane composed of cells with a papillate outer wall, each cell with 4–6 (–8) minute papillae 1–2.5 × 1–1.5 µm in size, tending to break down in old thalli. Apothecia and pycnidia never produced, but conidia may be produced from the tomentum on the lower surface of the thallus.

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No substances detected by TLC. **BLS 2666.**

In similar habitats to *S. ciliata* and *S. fuliginosa* and normally less frequent, but can dominate in more open situations; currently known from Cornwall, Devon, Somerset and the Scilly Is, S. Wales, N. Wales and W. Highlands, but likely to be more widely distributed.

Sticta fuliginoides almost always has thalli with an involute margin when young, appearing like clusters of mushrooms. Cilia are only formed on young thalli or when regenerating following mechanical damage, and then they are usually smaller than those in *S. ciliata*. *S. fuliginosa* does not typically form mushroom-shaped thalli when young, but is difficult to distinguish when older; the papillae on the cyphella membrane is the most reliable distinguishing feature.

Host to *Abrothallus welwitschii*.

Sticta fuliginosa (Hoffm.) Ach. (1803)

Thallus first developing as a bunch of several palmate, elongate or fan-shaped lobes without a distinct stipe, eventually with suborbicular and overlapping lobes, usually reaching 5–7 cm diam., fragile and papyraceous, rather brittle when dry; adnate or ascending, imbricate especially when well-developed, branching polytomous or irregular, apices flat and slightly undulating, sometimes slightly revolute, the margin entire to crenate or even lacerate; greyish to brown in wet or dry conditions, maculae and cilia usually absent; isidia always present, abundant, laminal, mainly developing on ridges of the upper surface, at first glossy and rounded to applanate, soon developing vertical coralloid masses, sometimes substipitate, to 0.5 mm in height, darker than the thallus; lower surface smooth to scrobiculate, sometimes strongly so, white or pale orange to brownish, darker towards the centre in old thalli, with sparse to well-developed tomentum; cyphellae abundant, more abundant towards the margins, round or angular, cupuliform to urceolate with a wide pore, the margin erect, slightly revolute, whitish to cream-colored or brownish, 0.4–1.1 mm in diam., larger ones more angular and reaching 1.5–2.1 mm, the membrane not papillate. Apothecia very rare, pycnidia not seen, conidia sometimes produced from the lower tomentum. No substances detected by TLC. **BLS 1367.**

On mossy trees and damp rocks in humid, sheltered situations, in ancient, oceanic woodlands; more frequent than *S. ciliata* in less humid situations. Abundant in Scotland, locally frequent elsewhere in western part of the British Isles, S to Devon, Cornwall. Many records of this species were made before the recognition of *S. ciliata* and *S. fuliginoides* as segregates, and their relative abundance is not yet clear; the map only includes recent, substantiated records.

Sticta fuliginosa has no straightforward diagnostic character and can be recognized because it does not have the diagnostic features of other species: i.e. no cilia, no mushroom-like appearance when young, no swellings on the upper surface, no dichotomously branched thallus and no papillae on cells of the cyphella membrane. Fertile collections identified as this species (apart from the type itself) are probably *S. ciliata*.

Lichenicolous fungi reported on *S. fuliginosa* s. lat. are: *Abrothallus welwitschii*, *Nectriopsis lecanodes* and *Pyrenidium actinellum*.

Sticta limbata (Sm.) Ach. (1803)

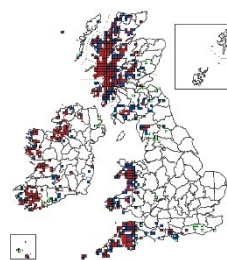
Thallus usually developing as a bunch of several palmate, elongate or fan-shaped lobes without a distinct stipe, eventually with suborbicular and overlapping lobes, 1–3 cm diam., fragile and papyraceous, rather brittle when dry. Lobes usually branched once or twice, adnate or ascending, the apices slightly undulating, flat or usually slightly revolute, the margin entire to crenate and sinuose, entirely covered with soralia forming a somewhat swollen edge. Upper surface smooth, pale to dark brown or greyish in wet or dry conditions, faintly maculate when greyish, matt or slightly glossy, cilia absent; soredia rather coarse to farinose, typically bluish grey, rarely brownish. Lower surface sometimes scrobiculate, white or pale orange to brownish, rarely darker towards the centre in old thalli, with sparse to dense tomentum; cyphellae abundant, slightly more abundant towards the margins, round or angular, cupuliform to urceolate with a wide pore, the margin erect, slightly revolute, whitish to cream-colored or brownish, 0.3–1.0 mm diam., the membrane not papillate. Apothecia and pycnidia never produced. No substances detected by TLC. **BLS 1368.**

On mossy bark and rocks in old woodlands and parklands; locally frequent. Western part of Britain and Ireland, extending locally to E. England (Sussex, Northumberland) and C. & E. Scotland.

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The only sorediate *Sticta* in the British Isles; small specimens can be confused with *Nephroma parile* which is not tomentose below and lacks cyphellae.

Host to *Abrothallus welwitschii*, *Corticifraga* aff. *fuckelii* and *Pyrenidium actinellum*.

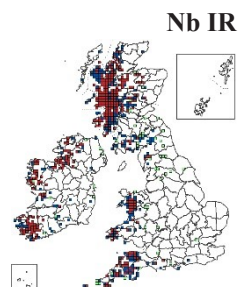
***Sticta sylvatica* (Huds.) Ach. (1803)**

Thallus usually rounded or fan-shaped in outline, 1–5 cm diam., sometimes forming compound structures to 10–20 cm diam., subcoriaceous, brittle when dry, stipe absent; lobes slightly ascending and ± dichotomously branched, typically involute and forming slightly concave fan-shaped forms, 0.4–0.8 cm wide, lacinate or slightly flabellate, overlapping, with rounded to irregular apices, margins slightly swollen or not, rarely dissected or irregularly lacerate; upper surface usually dark brown when wet, paler and sometimes bluish grey when dry, usually glossy, typically foveolate or scrobiculate with shallowly reticulate ridges, but not maculate; cilia usually absent, but short scattered pale spines <5 mm long may appear between the main lobes; isidia always present, developing mainly on lobe margins or on ridges of the upper surface, sometimes covering large parts of the thallus, globose and developing coralloid masses to 0.5 mm high and in diam., very brittle and easily detached from the thallus, dark brown to almost black; lower surface uneven or slightly foveolate, brown to dark brown or almost black; the tomentum forming a sponge-like mat when well-developed; cyphellae always present on the lower surface, rounded or slightly irregular, denser near the lobe edges, 0.8–1.1 mm diam., erumpent and slightly involute, the outer wall sometimes brown or dark brown, the membrane sometimes developing large papillae. Apothecia and pycnidia never produced. No substances detected by TLC. **BLS 1369.**

On mossy trees and rocks in humid, sheltered situations, especially in old woodlands but also on mossy rocks or even by lanes. Western parts of Britain and Ireland.

Immature specimens are often difficult to distinguish from *S. fuliginosa*, but older specimens have a dichotomously branched thallus, with involute lobes and a black lower surface.

Host to *Abrothallus welwitschii*, *Pyrenidium actinellum* and *Xenonectriella streimannii* (S.Y. Kondr., Coppins & D.J. Galloway) Rossman (1999).



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