

PELTIGERA

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Peltigera Willd., *Fl. Berol. Prodr.* 347 (1787), *nom. cons.*; from the Greek *pelte* (a shield), in reference to the appearance of the lobes.

Type: *P. canina* (L.) Willd.

Peltidea Ach., *Methodus* 282 (1803). T: *Peltidea aphthosa* (L.) Ach. [= *Peltigera aphthosa* (L.) Willd.]

Thallus foliose, heteromerous, dorsiventral, lobate, in rosettes or irregularly spreading, 1–20 cm wide. Lobes sublinear-elongate or cochleate, radial, contiguous or overlapping, blue-grey, olive-brown, grey-green, grey-brown or reddish brown when dry; margins entire or incised, with or without phyllidia or small brown tomentose apothecial initials. Upper surface smooth to dimpled or ±bullate, matt or glossy, intact or cracked and torn, with or without tomentum, pruina or maculae. Isidia, soredia or phyllidia present or absent. Medulla white, paraplectenchymatous; hyphae loosely interwoven. Lower surface ecorticate, densely arachnoid-tomentose, dark-pigmented especially at the centre or with anastomosing pale to dark flattened or raised veins; vein interstices rounded, elongate or irregularly shaped; rhizines numerous, solitary or confluent. Photobiont cyanobacterial (*Nostoc*) and/or a green chlorococcoid alga (*Coccomyxa*). Cephalodia (not in Australian species) containing *Nostoc*, located on the upper or lower surface of the thallus. Ascomata apothecia, hemiangiocarpous, deeply immersed in the thallus to superficial, marginal, saddle-shaped, finger-shaped (tubular) or plane; disc oval to rounded, red-brown to black, often with a reflexed or crenulate margin, or immarginate, on horizontal or ascending lobes. Hymenium colourless, 80–100 µm thick, brownish above; paraphyses simple. Asci fissitunicate, *Peltigera*-type, cylindrical to clavate, (1–) 2–8-spored; apex of the endoascus with a IK1+ blue annulus. Ascospores ellipsoidal, narrowly to broadly fusiform or acicular, straight or curved, 1–7 (–9)-septate, colourless, pale to medium brown or red-brown, smooth or finely warted. Pycnidia immersed to sessile, marginal. Conidia fusiform to bifusiform, 6–11 × 2–5 µm.

Chemistry: Thallus containing tridepsides or hopane triterpenoids or, commonly, without detectable chemistry.

The family *Peltigeraceae* includes two genera, the more common and diverse *Peltigera* is distinguished from *Solorina* Ach. (not in Australia) by having marginate and immersed to superficial ascomata (sunken and immarginate in *Solorina*) and smooth 3–7 (–9)-septate ascospores, rather than predominantly 1-septate and minutely ornamented as in *Solorina*.

Peltigera is a cosmopolitan genus with an estimated 60–75 taxa (Goffinet & Hastings, 1994; Kirk *et al.*, 2001; Vitikainen, 2004a). It is most diverse in the Northern Hemisphere (Miadlikowska & Lutzoni, 2004) with c. 30 species recorded from Europe (Vitikainen, 1994) and North America (Goward *et al.*, 1995). Sixteen species have been reported from New Zealand (Galloway, 2000, 2007), and 15 are known from Australia (Louwhoff, 2008). These lichens commonly occur in humid or moist, mainly shaded habitats, on the forest floor, or along roadsides. They are predominantly terricolous or muscicolous, rarely saxicolous or corticolous. Galloway (2000, 2007) noted that species grow rapidly and often occur in disturbed habitats where they have a comparatively short life span.

Peltigera contains both bipartite and tripartite taxa. All Australian *Peltigera* species are bipartite, containing *Nostoc* as their primary photobiont. This was one of the earliest lichen genera to be described, but it remains rather poorly understood. Although it is readily recognised in the field, the genus is a taxonomically complex group, and many challenges remain at the species level (Goffinet & Hastings, 1994; Goward *et al.*, 1995, 2003; Miadlikowska & Lutzoni, 2000; Miadlikowska *et al.*, 2003).

A phylogenetic revision of *Peltigera* proposed eight monophyletic sections based mainly on Northern Hemisphere taxa (Miadlikowska & Lutzoni, 2000). The Peltigeraceae and the genus *Peltigera* were found to be monophyletic (Wiklund & Wedin, 2003; Miadlikowska & Lutzoni, 2004). While *Solorina* is not monophyletic, it is strongly supported within the Peltigeraceae (Miadlikowska & Lutzoni, 2000), and is believed to be closely related to *Peltigera* (Eriksson & Strand, 1995). Secondary metabolites are diverse and taxonomically important in the genus (Kurokawa *et al.*, 1966; Goffinet & Hastings, 1994; Miadlikowska & Lutzoni, 2000). However, chemistry is of limited usefulness among Australian species, with secondary metabolites detected in eight taxa, but only consistently and reliably in four. *Peltigera* is associated with an unusually large number of lichenicolous fungi, many of which are known only from this host genus (Hawksworth, 1980; Vitikainen, 1994).

S.Kurokawa, Y.Jinzenji, S.Shibata & H.-C.Chiang, Chemistry of Japanese *Peltigera* with some taxonomic notes, *Bull. Natl. Sci. Mus. Tokyo* 9: 101–114 (1966); D.L.Hawksworth, Notes on some fungi occurring on *Peltigera*, with a key to accepted species, *Trans. Brit. Mycol. Soc.* 74: 363–386 (1980); J.W.Thomson, *American Arctic Lichens I. The Macrolichens* 327–346 (1984); J.R.Laundon, The typification of Withering's neglected lichens, *Lichenologist* 16: 211–239 (1984); O.W.Purvis & P.W.James, *Peltigera* Willd. (1787), in O.W.Purvis, B.J.Coppins, D.L.Hawksworth, P.W.James & D.M.Moore (eds), *The Lichen Flora of Great Britain and Ireland* 440–447 (1992); J.Holtan-Hartwig, The lichen genus *Peltigera*, exclusive of the *P. canina* group, in Norway, *Sommerfeltia* 15: 1–77 (1993); O.Vitikainen, Taxonomic revision of *Peltigera* (lichenised Ascomycotina) in Europe, *Acta Bot. Fenn.* 152: 1–96 (1994); B.Goffinet & R.I.Hastings, *The Lichen Genus Peltigera (lichenised Ascomycetes) in Alberta*, Provincial Museum of Alberta, Edmonton, Natural History Occasional Paper 21: 1–54 (1994); O.E.Eriksson & A.Strand, Relationships of the genera *Nephroma*, *Peltigera* and *Solorina* (Peltigerales, Ascomycota) inferred from 18S rDNA sequences, *Syst. Ascomycetum* 14: 33–39 (1995); B.Goffinet & R.I.Hastings, Two new sorediate taxa of *Peltigera*, *Lichenologist* 27: 43–58 (1995); T.Goward, B.Goffinet & O.Vitikainen, Synopsis of the genus *Peltigera* (lichenised Ascomycetes) in British Columbia, with a key to the North America species, *Canad. J. Bot.* 73: 91–111 (1995); O.Vitikainen, Taxonomic notes on Neotropical species of *Peltigera*, in M.P.Marcelli & M.R.D.Seaward (eds), *Lichenology in Latin America: History, Current Knowledge and Applications* 135–139 (1998); D.J.Galloway, The lichen genus *Peltigera* (Peltigerales: Ascomycota) in New Zealand, *Tuhinga* 11: 1–45 (2000); J.Miadlikowska & F.Lutzoni, Phylogenetic revision of the genus *Peltigera* (lichen-forming Ascomycota) based on morphological, chemical and large subunit nuclear ribosomal DNA data, *Int. J. Pl. Sci.* 161: 925–958 (2000); D.O.Øvstedal & R.I.Lewis Smith, *Lichens of Antarctica and South Georgia* 262–264 (2001); P.M.Kirk, P.F.Cannon, J.C.David & J.A.Stalpers, *Dictionary of the Fungi*, 9th edn. CAB International, Wallingford (2001); B.Goffinet, J.Miadlikowska & T.Goward, Phylogenetic inferences based on nrDNA sequences support five morphospecies within the *Peltigera didactyla* complex (lichenised Ascomycota), *Bryologist* 106: 349–364 (2003); J.Miadlikowska, F.Lutzoni, T.Goward, S.Zoller & D.Posada, New approach to an old problem: incorporating signal from gap-rich regions of ITS and rDNA large subunit into phylogenetic analyses to resolve the *Peltigera canina* complex, *Mycologia* 95: 1181–1203 (2003); E.Wiklund & M.Wedin, The phylogenetic relationships of the cyanobacterial lichens in the Lecanorales suborder Peltigerineae, *Cladistics* 19: 419–431 (2003); J.Miadlikowska & F.Lutzoni, Phylogenetic classification of peltigeralean fungi (Peltigerales, Ascomycota) based on ribosomal RNA small and large subunits, *Amer. J. Bot.* 91: 449–464 (2004a); O.Vitikainen, *Peltigera*, *Lichen Fl. Greater Sonoran Desert Region* 2: 389–399 (2004b); D.J.Galloway, *Flora of New Zealand Lichens. Revised Second Edition* 2: 1098–1122 (2007); P.M.McCarthy, *Checklist of the Lichens of Australia and its Island Territories*. Australian Biological Resources Study, Canberra. Version 17 March 2008. <http://www.anbg.gov.au/abrs/lichenlist/introduction.html> (2008); S.Louwhoff, New and additional records and a new combination of Australian *Peltigera*, *Australas. Lichenol.* 63: 40–46 (2008).

1	Thallus sorediate, isidiate or phyllidiate.....	2
1:	Thallus lacking soredia, isidia and phyllidia	13
2	Thallus sorediate (<i>1</i>)	3
2:	Thallus isidiate or phyllidiate, lacking soredia	6

3	Upper surface lacking tomentum (2)	15. P. ulcerata
3:	Upper surface tomentose	4
4	Rhizines dense and fibrillose, forming a thick cottony mat; veins dark brown (3:).....	7. P. lambinonii
4:	Rhizines not dense and fibrillose, not forming a thick cottony mat; veins pale brown to tan	5
5	Rhizines fasciculate to fibrillose, brush-like at the tips (4:)	4. P. extenuata
5:	Rhizines simple to loosely branched, not fibrillose or brush-like at the tips	1. P. didactyla
6	Thallus with button-like isidia (2:).....	8. P. lepidophora
6:	Thallus phyllidiate	7
7	Upper surface lacking tomentum (6:).....	8
7:	Upper surface tomentose.....	10
8	Upper surface pruinose (7)	10. P. polydactylon
8:	Upper surface pruinose	9
9	Pruina restricted to the lobe margins; apothecia subhorizontal; terpenoids absent (8:).....	14. P. tereziana
9:	Pruina submarginal to laminal; apothecia erect; terpenoids present.....	12. P. pruinosa
10	Lobe margins pruinose (7:).....	14. P. tereziana
10:	Lobe margins not pruinose.....	11
11	Upper surface grey-brown or olive-brown when dry; tomentum covering the upper surface only; rhizines simple at the margins (10:)	11. P. praetextata
11:	Upper surface grey or grey-brown when dry; tomentum covering the upper and lower surfaces; rhizines fibrillose or confluent at the margins	12
12	Lobe margins frilled, frequently with secondary lobules, upturned at apices; marginal rhizines in confluent lines (11:).....	13. P. rufescens
12:	Lobe margins entire to phyllidiate-incised, plane, upturned or somewhat inflexed at apices; marginal rhizines fibrillose, not in confluent lines	5. P. fibrilloides
13	Upper surface smooth (1:)	14
13:	Upper surface sparsely to densely tomentose	15
14	Thallus thin and somewhat papery; rhizines simple to fasciculate, not confluent at apices, 5–10 mm long; marginal phyllidia absent (13).....	3. P. dolichorhiza
14:	Thallus rather brittle but not papery; rhizines simple to fasciculate, confluent at apices, occasionally tufted, 2–4 mm long; marginal phyllidia sparse to common	10. P. polydactylon
15	Tomentum sparse, generally confined to lobe apices; lobes elongate; lobe margins irregularly incised or torn (13:).....	2. P. dilacerata
15:	Tomentum dense at lobe apices, sparse laminally; lobes not elongate; lobe margins not irregularly incised or torn.....	16
16	Lobe margins ruffled and frilled, upturned at apices, frequently with secondary squamules or lobules (15:).....	13. P. rufescens
16:	Lobe margins entire, notched or phyllidiate-dissected, not ruffled or frilled, upturned at apices or not	17
17	Veins and rhizines covered with flattened woolly arachnoid tomentum; rhizines small-tufted at margins, becoming tangled and matted centrally (16:)	6. P. lairdii
17:	Veins and rhizines covered with erect tomentum; rhizines simple, fasciculate or fibrillose, not tangled and matted	18
18	Lobe margins entire or scalloped, plane or downturned at apices; rhizines simple or fasciculate, not fibrillose (17:).....	9. P. membranacea
18:	Lobe margins entire to phyllidiate-incised, plane, upturned or somewhat inflexed at apices; rhizines fibrillose	5. P. fibrilloides