

Cladonia Hill ex Browne
(LECANORALES: CLADONIACEAE)

After Thomson (1967), except where noted
Many sections need to be revised See Poelt & Vezda Erg. I.

Rev. Jan. 1994

Primary (basal) thallus squamulose to foliose, persistent or disappearing; basal squamules closely adpressed or ascending to erect, rounded to elongate, entire or variously indented, sometimes sorediate, usually corticate at least on upper surfaces; upper cortex dense, of thick walled hyphae \pm perpendicular to the surface; lower surface usually decorticate, without rhizines; attached to the substrate by hyphae ("hyphal rhizines" according to Rogers, but there is probably a better name). Medulla white. Lower surface white or sometimes yellow. Hyphae rather loose, rarely dense or conglutinate (according to Galloway, but he also states in the same description that the hyphae of the medulla are conglutinate and those of the cortex are dense, so what does that leave?). Photobiont conglomerate in an irregular layer in upper part of the medulla.

Secondary (erect) thallus usually present, consisting of usually hollow (solid at first) podetia (vertical developments of the apothecial stalks), laminal or sometimes marginal, simple or branched, blunt, pointed or forming scyphi ("cups"), appearing fruticose; outer surface usually at least partly corticate, but often with \pm decorticate areas, corticate granules, soredia, areoles, or squamules which may be peeling or not, sometimes peltate (schizidia); axils open, perforate, or closed. Medulla usually 2layered, the outer white, of \pm loose hyphae, containing algal glomerules, the inner glassy or white, cartilaginous (hard and horny), with conglutinate hyphae surrounding central canal, forming a continuous chondroid tissue or consisting of strands. Soredia farinose (1040 μ m diam.) or granular (40120300 μ m diam.), often densely encrusted with lichen compounds; corticate granules (100300 μ m diam.) similar to soredia but with a well developed \pm continuous, thin corticate layer, sometimes present. Base of podetia persistent or dying away with growth continuing at apices; apices sterile or with apothecia or pycnidia.

Apothecia usually raised on podetia, terminal (normally larger than diameter of supporting stalk) or on margin of cups, rarely sessile on squamules; disk markedly convex, pale to dark brown to blackish, or bright red, solitary or clustered peltate to compound or confluent; margin proper, not prominent, radiate;

hypothecium colorless to pale; hymenium red, pale or dark brown, 3070 um tall; paraphyses 25 um thick, simple or little branched; asci clavatecylindrical, unitunicate, thickened at apex; tholus and outer gelatinous sheath I+ blue; spores 8, irregularly biseriate, simple, hyaline, thin walled, fusiform, oblong, ellipsoid or ovoid, 624 x 24.5 um.

Pycnidia terminal on podetia or sessile or shortstipitate on squamules or on cup margins, cylindrical, ovoid, toplike orcapitate; ostiole small or dilated, brownblack, ashy or red; gel red or hyaline; fulcrum exobasidial; pycnospores cylindrical, filiform, curved or rarely straight, 514 x 0.51 um. Cortex often with atranorin or usnic acid; medullary chemistry very diverse, including depsides, depsidones, dibenzofurans, terpenes and quinone pigments. Photobiont Trebouxia. On soil, moss, rotting wood, or bases of trees, or on soil or moss over rock; mainly on acidic humusrich substrates, a few species on calcareous substrates. Arcticalpine to tropical.

Most European authors lump Cladina under Cladonia.

Although the genus has been studied to death by a zillion people, I am inclined to agree with Bill Weber that Cladonia is an "abomination", due to the extreme variability of most species. Most people no longer attempt to recognize the numerous infraspecific taxa that were treated in Thomson's monograph. Scanty or poorly developed material, and (in most parts of N. America at present) basal squamules without podetia are hopeless except for a few species with very large and distinctive squamules. What is needed are more good illustrations of both podetia and squamules. Except for substances with positive spot tests, many of the chemicals are difficult to identify.

KEY TO SEGREGATE GENERA AND "NATURAL" GROUPS

After Thomson (1967), Huovinen & Ahti (1982), and others

[Note: Thomson (1967) treated the groups here called subgenera of Cladonia as sections, the sections as subsections, and the subsections as series; I have raise everything up one rank, but I'm not sure whether all of these new combinations are legit.]

1. Primary thallus crustose, persistent, lacking true cortex. Podetia simple or sparingly branched, lacking true cortex, outer medullary algae and forming a pseudocortex. Apothecia small and subpeltate, in apical clusters. Containing atranorin and

protolichesterinic acid. Eastern. (Pycnothelia papillaria)

1. Primary thallus squamulose or foliose and persistent, or crustose and soon disappearing, with true cortex. Podetia simple, awlshaped or with cups, or with branches, becoming intricately branched, outer cortex present or absent. Apothecia larger and peltate, or as small as the podetial diameter.

Chemistry various.2

2. Primary squamules long and linear (0.51 x 1015 mm), corticate both above and below; apothecia sessile or subsessile at the tips of the primary squamules; K+ yellow; containing atranorin and protolichesterinic acid. Eastern N.

America.(Gymnoderma lineare)

2. Primary squamules (if present) mostly shorter and broader; apothecia (if present) usually on the tips of podetia. Chemistry various. 3

3. Surface of podetium decorticate, loosely arachnoid to somewhat gelatinized, with warty verruculae containing the algae, without soredia (rarely appearing sorediate when diseased); squamules always lacking; podetia with a regular mode of intricate branching (age of growth rate possible at least in areas with seasonal climate), dying at base but growing from the tips, able to continue growth for decades; axils at least partly open; cups always absent; mature (fertile) podetia scarcely thickened. Pycnidia terminal on podetia, blunt, more or less in whorls. Stereome distinct, cartilaginous, sharply delimited from outer medulla, never fibrose. Podetia gray or yellow, often with usnic acids; main medullary components orcinol depsides (baeomycesic and squamatic acids, barbatic and thamnolic acid groups). Section Unciales s. str.

4. Main medullary components orcinol depsides; dibenzofurans (didymic and porphyrllic acids); often with usnic acids, rhodocladonic acid, and bellidiflorin, sometimes zeorin. Podetia simple to weakly branched and cups/axils closed, except for C. leporina in sect. Cocciferae. "Cocciferae group sensu lato". 6

5. Apothecia and pycnidia ± dark brown, K. Primary thallus of larger squamules. Podetia lacking usnic acid (KC) in most groups. Podetia simple to ± weakly branched; cups/axils open or closed. 7

6. Apothecia and pycnidia red (occasional forms with orange or yellow apothecia), K+ redviolet. Primary thallus of tiny or large squamules. Podetia [usually?] yellow tinged and containing usnic

acid..... Section Cocciferae (Del.) Evans s. str.

6. Apothecia and pycnidia pale brown. Primary thallus of tiny squamules. Podetia yellow tinged and containing usnic acid, KC+ yellow, K, P. Chemically very similar to the Cocciferae. "Section Ochroleucae"

7. Podetia with axils and interior of the cups usually both closed (except in "Furcatae"). [Subg.? "Clausae" (nom. illeg.?)]. 8

7. Podetia with interior of the cups opening into hollow podetia and axils also opening at least in part. [Subg.? Perviae] 13

8. Podetia with central cavity small and walls thick, cupless, almost always terminating in apothecia. Primary squamules small to large, underside white; podetia with cups or cupless. (Section Podostelides). 9

8. Podetia with central cavity large and walls thin, usually with cups, but some species cupless, commonly sterile. Primary squamules small to large, underside white; podetia with cups or cupless. Section Cladonia. 10

9. Pycnidia borne on the primary squamules; podetia short or quite short, usually terminated by apothecia which may be pale or dark. Main medullary components orcinol depsidones (protocetraric acid group). "Section" Foliosae
10. Primary squamules small to large, underside white; podetia with cups or cupless. 11

11. Main medullary components orcinol depsides (imbricatic, perlatolic, evernic, boninic, cryptochlorophaeic, merochlorophaeic, paludosic acids, and sekikaic acid group) and the orcinol depsidone (grayanic acid); orcinol depsidones; the orcinol depside homosekikaic acid sometimes present. Cups/axils open or closed. 12

12. Cups/axils open. Main medullary components protocetraric acid group. Chasmariae pr. p.: Furcatae

12. Cups/axils closed. Main medullary components protocetraric and stictic acid groups. "Thallostelides": Cladonia

13. Primary thallus absent, or primary squamules large (to 2.5 cm long) and broad, in loose turfs, margins broadly lobed or entire. Containing atranorin.

Northern. [Section?]

Megaphyllae

13. Primary squamules small or rarely elongated, margins narrow or narrowly divided or crenated. Often containing atranorin; only rarely with usnic acid. [rank? Cladoniae (Microphyllae of Thomson); Section Perviae sensu lato]. 14

14. Main medullary components orcinol depsides (baeomycesic and squamatic acids, barbatic and thamnolic acid groups). Thallus P+ or P. Squamosae group (= Section Perviae sensu str.)

ARTIFICIAL KEY TO CLADONIA

(This needs to be done, but is difficult and I haven't had time to do it properly yet; this is a very preliminary skeleton)

1. Podetia present.2
1. Podetia absent; only primary squamules present.
(no key at present)
2. Apothecia and pycnidia red. Cocciferae s.
str.
2. Apothecia and pycnidia brown, or absent.3
3. Podetia intricately branched, dying at the base, usually
without squamules. [See natural key for more info. on
distinctions between Cladina and
Cladonia]. 4
3. Podetia simple to moderately branched, usually with squamules
on or at base of podetia. 5
4. Surface of podetia ecorticate. Cladina
4. Surface of podetia corticate. Unciales (including C.
boryi group)
5. Podetia with ± distinct cups.
6
5. Podetia without cups. 10
6. Podetia short, the cups funnelshaped to gobletshaped; podetia
unbranched but occasionally proliferating. 7
6. Podetia taller and more slender, the cups narrow or irregular;
podetia sometimes branched. 9
7. Cups open. see Perviae
7. Cups closed. 8
8. C. chlorophaea group
8. Sect. Cladonia: C. gracilis group
- 9.
- 9.
10. All or almost all podetia tipped with apothecia. 11
10. Apothecia absent, or present only on some podetia or some
parts of podetia. 12

11. Helopodium

11. Macropus

12. **With soredia.**

12. **Without soredia.**

In: Purvis, et al., Lichen Flora of Great Britain and Ireland.

Rogers, 19 . Genera of Australian Lichens. Galloway, D. 1985.

Flora of New Zealand Lichens.