

IIC: C. chlorophaea group

Key mostly after Poelt & Vezda (1977), but partly after Bevis (unpublished Cladonia in Michigan), Thomson (1968, 1984), and various articles by C. Culberson; need info. from the numerous other studies on this group. Quite frankly I find that many of the spot tests with K and C are extremely unreliable, and most of the substances are very difficult to identify by TLC. While several studies do show that there are some correlations between the chemistry, morphology, and ecology and distribution of many of the taxa, supporting recognition of numerous species, the whole group (like most of the damned genus Cladonia) is in spite of intensive efforts by many people over many years, still an absolutely abysmal, horrible, stinking mess.

IIC1. Podetia and cups without soredia.

1. Basal squamules appressed, lobed at thallus margin, rosetteforming, 12 x 13 mm, subentire to sparsely lobed; upper surface greenish to dark brown and glossy; lower surface white and soft. Podetia 0.73 cm tall, 12 mm thick, greenish brown, simple or more rarely branched by proliferating scyphi; podetial stalk often elongated; scyphi 34 mm wide, closed, rather shallow, gradually flaring; surface of podetia subcontinuously corticate, verruculose to squamulose in lower parts, upper parts becoming ecorticate, granulose to phyllidioid (also inside the scyphi). K, P+ red, with fumarprotocetraric and protocetraric acids, Cph2, with accessory atranorin and rarely Cph1. On soil, humus, cliffs, and decaying woods, in calcareous areas. Arctic to temperate (Alaska to Iceland, south to westcentral Canada, midwestern and northeasternmost

U.S. C. pocillum

1. Basal squamules thin, ascending, not lobed at thallus margin, grayish to brownish. Podetia smooth to scalywarty corticate or partly ecorticate (often difficult to distinguish from coarsely sorediate species). 2

2. Thallus usually K+ orange to red on active parts (but sometimes K), C+ red, KC+ purplish red in extracts only (merochlorophaeic acid and 4Odemethylcryptochlorophaeic major; palusodic, cryptochlorophaeic, submerochlorophaeic), fumarprotocetraric acid + or C. merochlorophaea var. merochlorophaea ("und benachbarte Sippen", i.e., and related species, which Poelt & Vezda do not specify clearly; C. cryptochlorophaea is the only other named taxon that also keys out here)

2. Thallus K or very rarely K+ yellow; C, KC; P+ red or P.
..... 3

3. Thallus P+ red (fumarprotocetraric), K or very rarely K+ yellow (atranorin). Surface of podetia coarsely areolate and granular; insides of cups with schizidia. [See key to "Cladonia s. str." for fuller description]C. pyxidata3.
Thallus P, K. Cups very short (to 0.5 cm), almost unstalked, 510 mm wide. Thallus P. Imbricaric acid (according to Poelt & Vezda); or? Sphaerophorin, 40demethylsphaerophorin (isosphaeric acid) (according to ?). S. Dakota and WyomingC. imbricaria

**IIC2. Podetia and cups with soredia
(at least in the upper part)**

1. Podetia almost entirely and uniformly farinose (finely powdery). 2

1. Podetia at least the lower half corticate; soredia granular (to warty). 3

2. Podetia relatively tall and slender. Containing only fumarprotocetraric acid (+ atranorin). Cups abruptly flaring at mouth, trumpetshaped or tromboneshaped, in one form ("C. major") becoming 2040 mm tall, with stalk to 3 mm thick and cups large; K, P+ red. Primary squamules persistent or disappearing, middlesized, 210 mm long, digitately or irregularly lobed, crenate to sinuate or incised on the margins, flat to involute or concave above; upper side glaucescent to olive green or pale glaucescent; underside white; esorediate or sparsely granulose below. Podetia 1020 mm tall, the stalk 12 mm thick; cups flaring rapidly to form trumpet shapes, entire margined or rarely proliferate, the interior closed; surface sometimes slightly corticate at the base but mainly decorticate and farinose sorediate. Apothecia brown, on margins of cups or on short stipes from margins. K, or the young parts K+ brownish, KC. On earth, rotting logs, tree bases, and on thin soil over rocks. Northern (Alaska to Iceland), south to California and central Rockies in the west, to Great Lakes area and North Carolina in the east.C. fimbriata

2. Podetia short and stout. Often containing bourgeanic acid (= substance H) in addition to fumarprotocetraric acid, + atranorin. Podetia greenish, smooth at the base; K+ brown, P+ red. (see C. humilis + str., including C. conista and C. conistea)

3. Podetia tall (to 1 cm); cups flaring gradually in the upper half, giving the shape of C. fimbriata; base of stalk corticate to the flare but with squamules and schizidia common, the upper part with a mixture of coarse soredia (0.10.2 mm) and schizidia (to 0.4 mm broad), usually slate gray, the upper part becoming decorticate, matt, white to browning; interior of cup covered with a mixutre of coarse soredia and schizidia. Apothecia on short stipes from margins of cups, brown. Sometimes with secondary cups proliferating on margins of the primary ones. Primary squamules 12 mm broad, rounded, ascending; upper surface olive green; lower surface white to blackening, sorediate or not. Rangiformic, norrangiformic, and fumarprotocetraric acids, K, C, KC, P+ red. On soils high in humus, over rocks, or old logs and

tree bases. Alaska to California, most frequent in NW Washington and southern British

Columbia. C. asahinae

3. Podetia short and stout; cups often rather squat and flaring rather abruptly; mostly wide (0.3-1.0 cm) cups, never cupless, usually 0.5-3 cm high (overall appearance similar to that of C. pyxidata). (C. chlorophaea s. lato). 4

4. Podetia pale greenish, mealy to granular soresiate; soresia (10-40) 40 um diam. (dry), C, KC, K+ brown, P+ red (fumarprotocetraric acid and often bourgeanic acid (= substance H), + atranorin) C. humilis s. lato 5

4. Podetia usually at least partly dirty brownish to dark brown. Soresia often distinctly greenish, granular, (20-80) 80 um diam. (dry), P or P+ red, KC or KC+ red. 7

5. Cup margins entire; base of podetia corticate; soresia on outer layer of the cups farinose. Containing bourgeanic acid (var. bourgeana A. W. Archer) or without it (var. humilis). Podetia gobletshaped, the base more smoothly corticate than that of the other species in the group; soresia farinose or occasionally granular, but mostly ca. 50(100) um diam.; color lighter green than in most members of the group. On soil and rotting logs. California, Great Lakes area, NE United States; scattered populations in western Canada. C. humilis + s. str.

5. Cup margins with numerous (5-23) digitate proliferations which are bluntpointed or expand to form cups (rarely giving rise to further proliferations); soresia very coarsely granular (80-200 um diam.), appearing just above base, giving rise to isidioid structures and small peltate squamules which also cover the cups. Primary squamules large, 7-12 x 3-8 mm, persistent, flattened to involute, wrapping around podetia and sometimes appearing cyathiform (approaching those of C. cyathomorpha), entire to irregularly crenatelobate to shallow subdigitately lobate; upper surface glaucescent green to olive; lower surface white ashy, darkening and veined toward base, subfibrillose, esoresiate or with granular soresia below margins. Podetia 3-10(20) mm tall, simple; cortex present throughout or absent towards base. Exposed inner layer opaque, white to brownish, hardly fibrillose. Cups 1-8 mm diam., closed, shallow (to deep?), frequently with punctiform opening in center of interior, enlarging and deforming with age. Apothecia borne singly along cup margins or tips of proliferations, 0.1-0.2 mm diam., dark reddish brown. K+ yellow, KC, P+ orangered, containing atranorin, bourgeanic acid, fumarprotocetraric and protocetraric acids. On thin soil near

Pacific Ocean, California. C. cf. humilis sensu Hammer

6. Podetia K+ yellow (atranorin); surface often with pale grayish tone. On mossy trees, rocks and mineral soils, oceanic. "C. conistea"

6. Podetia K (or brownish); surface scarcely grayish, often short and with relatively wide cups. Usually on slightly acid loamy or sandy soils, less distinctly oceanic. "C. conista"

7. Podetia mostly light greenish gray to greenish brown, not intensely brown, 0.7-1.5 mm thick; cups 35 mm wide. Podetia K,C, KC, P+ red, with fumarprotocetraric and protocetraric acids only, or sometimes also unknown Cph2 only (+ atranorin in Southern Hemisphere, and rarely Cph1) or P, without acids. Podetia smooth, with coarse soredia. Primary squamules persistent, 1.52 mm long and wide. Podetia 0.74 cm tall, simple or marginally (rarely centrally) 13 times branched by proliferating scyphi, occasionally with lateral branches; scyphi gradually to rather abruptly flaring, closed, rather shallow; surface of podetia granulate sorediate (also inside the scyphi), with scattered, small phyllidia and squamulose; subcontinuous cortex sometimes present in basal parts of senile podetia. Very common especially on slightly acidic to calcareous substrates, on mossy rocks, tree bases, dead wood, and humus-rich soils. C. chlorophaea (Sommerf.) Sprengel s. str.

7. Podetia often intensely brown, more slender, with narrower cups, richly sorediate to nonsorediate. Always with other acids, P+ or P, with or without fumarprotocetraric and protocetraric acids. Especially on strongly acidic soils and tufts, also on decaying wood or moss cushions. C. grayi group. 8

8. Thallus usually K+ orange or red (on actively growing parts), C+ red and KC+ strong red (at least extracts). 9

8. Thallus and extracts K, C or + yellow, KC. 11

9. Containing perlomeria, merochlorophaea, 40methylcryptochlorophaea; cryptochlorophaea, anziaea, stenoporic acids. Soredia granular. C. perlomera

9. Without perlomeria, anziaea, stenoporic, or 40methylcryptochlorophaea acids; with either merochlorophaea or cryptochlorophaea acids but not both. 10

10. Containing merochlorophaeic acid and 4Odemethylcryptochlorophaeic major; palusodic, cryptochlorophaeic, submerochlorophaeic acids minor or trace. Podetia slaty gray to dark brown, brownish green to chocolate brown or even blackish. C+ and KC+ purplish red in extracts only, K or K+ red on active parts , P+ red (fumarprotocetraric acid) or P; without atranorin. Cups broad; surface rough. Apothecia on flattened stalks. Primary squamules persistent. Podetia shaped as in C. chlorophaea but usually in looser and more brittle mats, darker in color. Scattered from Alaska to Greenland, south to Washington in the west, most frequent in Great Lakes area east to SE Canada and NE United States, south to Pennsylvania. Ahti (1966) distinguished the two morphotypes keyed out below. C. merochlorophaea var.

merochlorophaea. 11

10. Containing cryptochlorophaeic and paludosic acids. Podetia often relatively pale and greenish. C+ red, KC+ red in acetone extracts, K+ red, P or (commonly in Europe, rarely in N. America) P+ red, with fumarprotocetraric acid;± atranorin. Podetia often richly soresediate and soredia coarse; stalks very coarsely verrucose. Podetia gobletshaped. On soil and bases of trees. Occasional in Alaska and NW Canada, south to Oregon in the west; most frequent in the Great Lakes Area and NE United States.C. cryptochlorophaea

11. Podetia dark in color, with the entire surface rough, corticate, minutely verrucose, the inner surface of the cups areolate corticate or obscurely soresediate with coarse gray brown granules, proliferations flattened and with dark brown apothecia, the outer surface of podetia distinctly corticate, P+ red or P; on soil containing much humus, on tundra heaths, and in bogs. morph 1

11. Podetia dirty grayish green rather than brown and covered with farinose soredia, P+ red; in more mesic habitats, occurring among mosses and on rotting wood. morph 2

12. With grayanic acid, 4Odemethylgrayanic acid, C; often P+ red (fumarprotocetraric acid), sometimes P . Often richly soresediate. Podetia dark brown to gray, roughly corticate at base; cups broad, coarsely soresediate/areolate; soredia white to greenbrown or gray, usually dense. Primary squamules usually persistent, small to middlesized. Podetia gobletshaped. Soredia ca. 50(100) um diam. Surface of podetia tending to be rugose. K, KC, P or P+ red. On soil and on bases of trees, Alaska to Washington, occasional across southern Canada, most frequent in the eastern

U.S., south to Texas and Florida. C. grayi Merr.
ex Sandst.

**12. With homosekikaic acid, + or sekikaic
acid. 13**

**13. C+ yellow, KC, P + red (fumaroprotocetraric acid) or P,
containing sekikaic acid** in addition to homosekikaic.

Morphologically as in v. merochlorophaea. C.
merochlorophaea" var. novochlorophaea

**13. C, without sekikaic acid; apparently always P+ red
(fumaroprotocetraric acid).** Distinctly soresiate; soresidia finely
mealy at least on the podetia. Wyoming. C. homosekikaica

ADD:

Several additional unnamed chemotypes in the C. chlorophaea group
have been cited by Culberson and other authors, usually with
little or no info. on morphology or ecology.

C. carneola and sterile species of the normally redfruited
section Cocciferae, may also be confused with the C. chlorophaea
group, but usually have a distinctly yellowish tinge, KC+ yellow
(usnic acid).