Key to the Genera of Cladoniaceae

This key is prepared by Ted Ahti and Harrie Sipman for a scheduled volume on Cladoniaceae in the Flora of the Guianas. It is a preliminary version, which contains some unpublished names, scheduled for publication in a forthcoming volume of Flora Neotropica or in the Flora of the Guianas. Comments and remarks are very welcome. Please contact **h.sipman@bgbm.org**. Included are all Cladoniaceae known from the three Guianas and from the rest of the Guyana Highland. Therefore the key can be used also for collections from the Venezuelan and Brazilian parts of this area.

1a	Primary thallus squamulose to foliose; podetia squamulose or not	*Cladonia*
1b	Primary thallus absent or crustose; podetia or pseudopodetia never squamulose	2
2a	Cortex well developed, cartilaginous, measuring about half of the podetial wall; podetium surface smooth, shiny, with numerous rounded to elliptic lateral perforations; central canal surrounded by an arachnoid medulla, its surface felty	*Cladia*
2b	Cortex thin or absent; podetium surface smooth or minutely felty, dull or slightly shiny, rarely with lateral perforations; central canal surrounded by a usually cartilagineous layer of conglutinated hyphae occupying about half of the width of the podetial wall (stereome), its surface smooth to slightly papillose, rarely granular or felty	3
3a	Podetia richly branched, greenish-yellow to ash-grey, without scyphi, cortex, soredia, granules or squamules	*Cladina*
3b	Podetia unbranched to moderately (rarely very densely) branched, greenish-yellow, brown or grey, often with scyphi, usually with a cortex, sometimes with soredia or granules, often squamulose, at least in young stagesor on basal parts	*Cladonia*

KEY TO THE SPECIES OF THE GENUS CLADIA

1a	Forming semiglobose heads; branching type extremely dense, isotomic, without distinct main axes	*C. globosa*
1b	Forming flattened mats; branching type looser, mainly anisotomic, with distinct main axes	*C. aggregata*

KEY TO THE SPECIES OF CLADINA AND SIMILAR, DENSELY BRANCHED CLADONIOID LICHENS WITHOUT SQUAMULES AND WITH FELTY, ECORTICATE SURFACE

1a Usnic acid present; colour greenish to yellowish grey — 2
1b No usnic acid; colour grey — 4

2a P+ & K+ intensely yellow (thamnolic or stictic acid) or P- & K- (barbatic or squamatic acids); surface smooth, corticoid — 11 - Cladonia key
2b P+ orange red & K- (fumarprotocetraric acid) or P- & K- (perlatolic acid); surface clearly felty, not corticoid — 3

3a P- (perlatolic acid); forming broad, dense, semiglobose heads; trichotomic branchings often frequent; no main axis distinguishable — *C. confusa*
3b P+ red (fumarprotocetraric acid); trichotomic branchings always rare; a main axis in part distinguishable — *C. densissima*

4a P+ intensely yellow (thamnolic acid) or P- (barbatic or squamatic acid; if perlatolic acid, see couplet 3) — 21 - Cladonia key
4b P+ orange red (fumarprotocetraric acid) — 5

5a Podetia near the tips with thick and compact felt layer, with smooth surface without protruding algal cell clusters and without visible stereome surface; main axes always clearly distinct except near the tips; tips often deflexed — 6
5b Podetia near the tips with thin and arachnoid felt layer, with rugulose surface caused by protruding algal cell clusters and with often visible stereome surface; main axes present or absent; tips spreading to deflexed — 8

6a Apical branchlets blunt with very thick felt layer; mostly over 0.5 mm wide at 1 mm below the tips; colour whitish to pale grey — *C. argentea*
6b Apical branchlets subulate with thinner felt layer; under 0.5 mm wide at 1 mm below the tips; colour pale grey, often with a brownish to violet tinge — 7

7a Apical branchlets with mostly short (c. 0.1 mm long) brownish points; without discoloured branchlets near the tips; colour pale grey to whitish grey; common at lower to mid elevations — *C. sprucei*
7b Apical branchlets with long (c. 0.2-0.5 mm) brownish points; often with browned branchlets near the tips; colour bluish- to violet- or brownish grey; rare

	high-altitude species	*C. rangiferina* subsp. *abbayesii*
8a	Stereome strongly blackening at base; top branchlets also blackening, slender, dichotomous, deflexed; anisotomy distinct, with distinct main axes; heads narrow, not semiglobose	*C. atrans*
8b	Stereome and tips not or little blackening; isotomy pronounced but main axes sometimes distinguishable in basal parts; forming broad rounded, often semiglobose heads	9
9a	K- (atranorin absent, homosekikaic acid often present); surface largely bare; brown to greenish-grey; forming broad, confluent, often flattish colonies	*Cladonia signata*
9b	K+ yellow (atranorin present; homosekikaic acid absent); surface thinly felty; ashy grey; forming regular, rounded heads	10
10a	Heads very dense, regularly semiglobose; main axes absent; stereome never blackening	*C. rotundata*
10b	Heads less dense, irregularly semiglobose; main axes distinguishable in basal parts; stereome sometimes blackening at the base	*C. dendroides*

KEY TO THE SPECIES OF THE GENUS CLADONIA

1a	Mature thallus dominated by squamules; podetia also in adult stage (with apothecia) scarcely longer than the squamules	2
1b	Mature thallus dominated by podetia, which exceed the squamules in length many times, or squamules absent	10
2a	Podetia present, beset with fragile or dehiscent, recurved squamules; rarely with apothecia, which are brown; P+ red (fumarprotocetraric acid)	3
2b	Podetia absent or present, then not with fragile or dehiscent squamules, but often with red apothecia; P- or P+ yellow (when P+ red, see 2a)	4
3a	Podetial squamules rounded; sterile podetia obtuse, occasionally very narrowly scyphose; basal squamules without marginal fibrils	*C. pityrophylla*
3b	Podetial squamules narrowly elongate, often almost isidia-like; sterile podetia subulate, never scyphose; basal squamules usually with scattered,	

white marginal fibrils *C. ceratophylla*

4a Squamules with marginal soredia or isidia 5
4b Not sorediate, nor isidiate 9

5a Both basal and podetial squamules elongate; margins farinosely sorediate; medulla white *C. meridionalis*
5b Basal squamules roundish; sometimes isidiate to sorediate at margins 6

6a Medulla (and squamules beneath) red *C. miniata*
6b Medulla and lower side of squamules white 7

7a Squamules elongate, finely divided, thin (c. 0.15 mm), P+ red *C. termitorum*
7b Squamules rounded, thick (c. 0.3 mm), P- 8

8a Squamules with sorediate margins *C. ahtii*
8b Squamules with cylindrical isidia on the margins *C. sp. A*

9a Medulla red; with rounded basal squamules; podetia thick, flat *C. miniata*
9b Medulla white; with elongate basal squamules; podetia thin, terete *C. secundana*

10a Podetia densely branched, without suamules and with smooth, not felty surface (NB. For densely branched Cladonia species without squamules and with tomentose, non-corticate surface see key to Cladina species. Some Cladina species may have a largely smooth surface; check near the tips of the podetia!) 11
10b Podetia less densely branched or unbranched, or with squamules 28

11a Thallus with yellowish tinge, containing usnic acid 12
11b Thallus whitish-grey to brown, without yellowish tinge 21

12a Main axes for the most part over 2 mm thick and inflated, very strongly and irregularly branched; wall often split and perforated laterally; inner wall reticulate; P+ red, P+ pale yellow or P- (usually containing fumarprotocetraric acid or stictic acid) *C. subreticulata*
12b Main axes under 2 mm thick and not inflated, less strongly and more regularly, usually dichotomically branched; wall not perforated or at axils only; inner wall not reticulate; P+ yellow or P- (usually containing thamnolic, barbatic or squamatic acids) 13

13a Central canal of podetium with glossy, smooth wall 14
13b Central canal of podetium with matt, puberulent or

felty wall 18

14a Podetia mostly under 0.4 mm wide, without distinct main axes *C. peltastica*
14b Podetia 0.5-1 mm wide, often with main axes 15

15a Not densely branched, forming loose tufts with coarse main axes; P+ yellow, K+ yellow (thamnolic acid) 16
15b Densely branched, forming "spiny" heads with thin, indistinct main axes; P-, K- (barbatic and/or squamatic acid), rarely P+ yellow or red, K+ yellow or K- 17

16a Branchlets at the ultimate tips at an obtuse angle; squamules absent; widespread in sandstone tableland *C. vareschii*
16b Branchlest at the ultimate tips at a sharp angle; squamules often present, but maybe scarce; high elevations only *C. flavocrispata*

17a Thallus P-, K- (barbatic and/or squamatic acid), rarely P+ yellow, K+ yellow (thamnolic acid) *C. spinea*
17b Thallus P+ red, K- (fumarprotocetraric acid) *C. chimantae*

18a Stereome absent, replaced by a compacted medullary layer; P+ yellow (thamnolic acid) *C. crassiuscula*
18b Stereome present, cartilaginous; P+ yellow, K+ yellow or P-, K- 19

19a Thin, much branched, creeping to erect; surface of central canal somewhat fibrose; in herbarium fine needle crystals develop at the podetial tips; P- or + weakly yellow, K+ yellow, slowly turning red (stictic acid) *C. substellata*
19b Stoutish, erect, often with dominant main axes; surface of central canal smooth; no development of needle crystals at the tips; P+ yellow, K+ yellow (thamnolic acid), rarely P-, K- (squamatic acid) 20

20a Podetia thick, little, and strongly anisotomically branched, pale greyish yellow with brown-variegated parts towards the base; cortex thin; stereome thin and soft; always P+ yellow, K+ yellow *C. sufflata*
20b Podetia slender, moderately, more or less anisotomically branched, clearly yellow, uniformly coloured througout; cortex thick; stereome strong; P+ yellow, K+ yellow or P-, K- *C. steyermarkii*

21a Branching usually clearly anisotomic, main axes distinct; not forming very dense, rounded heads 22
21b Branching mostly isotomic, no main axes distinct; usually forming very dense, rounded to elongate

heads 25

22a Podetia little branched, thick (to 3 mm); stereome soft and white; wall of central canal pruinose; among mosses on peat *C. sufflata*
22b Podetia much branched, thin (to 1 mm); stereome hard and hyaline; wall of central canal shiny; usually free-growing on sand or sandstone flats 23

23a Branchlet tips ending in fine, blackish tips (0.5-) 1-2 mm long and 0.1-0.2 mm wide *C. huberi*
23b Branchlet tips pale or shorter and wider 24

24a Podetia of uniform, grey colour; axils often closed, not much dilated; common in white-sand savannas near the coast *C. sipmanii*
24b Podetia variegated with whitish and brown patches, particularly on older parts; axils mostly perforated and often widely dilated and funnel-shaped; in sandstone tablelands of the interior *C. hians*

25a Stereome replaced by a layer of incompletely conglutinated hyphae; branches not over 0.4 mm wide lower down in the cushions; forming rounded, but more or less coalescing heads *C. pulviniformis*
25b Stereome completely conglutinated 26

26a Podetia 0.4-0.8 mm thick, usually variegate; internodes usually under 2 mm long *C. variegata*
26b Podetia 0.2-0.4 mm thick, sometimes variegate; internodes usually over 2 mm long 27

27a Surface of the podetia completely smooth; tips mostly pointing upward; not variegate *C. peltastica*
27b Surface of the podetia usually slightly felty; tips pointing in all directions; sometimes variegate *C. signata*

28a Podetia sorediate, granulose or verrucose to squamulose, largely ecorticate and felty inbetween, or with strongly verrucose surface 29
28b Podetia smooth and mainly corticate, without soredia or granules, sometimes with scattered squamules 42

29a Podetia broadly scyphose (cup-shaped), scyphi (cups) at least three times as wide as the stalk (in well-developed podetia) 30
29b Podetia ascyphose, or scyphose but then scyphi narrow, only slightly wider than the rest of the podetium 32

30a Podetia with yellowish tinge (usnic acid, KC+ yellow), P+ yellow; apothecia red; scyphi sorediate and/or granular, stalk corticate 31
30b Podetia not yellowish (KC-), P+ red (fumarprotocetraric acid); apothecia brown; scyphi

and stalk totally sorediate *C. subsquamosa*

31a Podetia farinose sorediate *C. mollis*
31b Podetia not truly sorediate but smooth to coarsely granulose *C. corallifera*

32a Podetia not sorediate, simple or little branched; tips usually persistently subulate, sometimes with narrow scyphi; smooth or with deciduous small squamules or corticate granules, hardly truly sorediate 33
32b Podetia sorediate, branchy or not; podetia often finally with narrow scyphi; with (ecorticate) soredia 39

33a Apothecia red; P+ yellow, red or P- (for narrowly scyphose specimens see C. corallifera) 34
33b Apothecia brown or absent; P+ yellow or red 35

34a Podetia very small, up to 4 mm tall; cortex verruculose; on termite mounds *C. termitorum*
34b Up to 1 cm tall; almost ecorticate, microsquamulose to granulose; mostly on wood *C. didyma*

35a P+ yellow, K+ yellow (thamnolic acid); slender, with numerous squamules; ascyphose, but sometimes with scyphoid, wide open axils 36
35b P+ red, K- (fumarprotocetraric acid); slender to stout; squamulose or not; often scyphose 37

36a Podetia slender, often with soredioid granules; with closed axils; mostly on bark of living trees *C. subdelicatula*
36b Podetia more robust, without soredioid granules; with widened, scyphoid, open axils; mostly on sand *C. polystomata*

37a Podetial squamules rounded, horizontal, often strongly concave or convex; podetia rarely ending in distinct scyphi *C. pityrophylla*
37b Podetial squamules elongate, down-turning, flat to slightly convex 38

38a Podetia usually ending in small scyphi; *C. furfuraceoides*
38b Podetia without scyphi, always with subulate tips *C. corymbites*

39a Apothecia red; podetia thick and short, pale whitish yellow to whitish (usnic acid often present in low amounts), densely sorediate; corticate near base; on wood; P+ yellow, K+ yellow (thamnolic acid) *C. prancei*
39b Apothecia brown; podetia long subulate, grey to

brownish (usnic acid never present), thinly sorediate or with granules, which may be attached to each other and form microsquamules; on wood or sand; P+ red, K- (fumarprotocetraric acid)(when P+ yellow, K+ yellow, see also C. subdelicatula) 40

40a Podetia with open axils; P+ yellow, K+ yellow *C. granulosa*
40b Podetia with closed axils; P+ red, K- 41

41a Podetia completely ecorticate, pale greenish throughout; mainly on vertical faces of wood *C. subradiata*
41b Podetia corticate near base and below scyphi, pale grey and easily browning, sometimes melanotic below; mainly on mineral soil *C. polyscypha*

42a Podetia regularly scyphose; scyphi proliferating from the center *C. rappii*
42b Podetia subulate or bluntish, often branchy, occasionally with scyphoid, enlarged open axils (funnels), or with small scyphi proliferating from the margin 43

43a With yellow tinge (usnic acid, sometimes in low concentrations) 44
43b Without yellow tinge 45

44a Podetia usually under 0.5 mm thick, moderately to densely branching, with narrowly perforated or closed axils; often abundant at lower elevations; P+ yellow or P- *C. peltastica*
44b Podetia usually over 1 mm wide, with widely opened axils; rare, at high-altitide *C. hians*

45a Apothecia red, usually present; podetia almost unbranched, stoutish, with strongly areolate cortex and somewhat squamulose *C. guianensis*
45b Apothecia brown, rarely present; podetia branched, more or less squamulose 46

46a Podetia strongly squamulose; cortex glossy; P+ yellow, K+ yellow (thamnolic acid) or P-, K- (squamatic acid) (if P+ red, K-, then see couplet 16) *C. sphacelata*
46b Podetia scarcely squamulose; cortex not glossy; P+ yellow or red, K+ yellow or K- 47

47a P+ red, K- (fumarprotocetraric acid); very densely branched (resembling Cladina); usually forming large, brown mats; squamules very scarce *C. signata*
47b P+ yellow, K+ yellow (thamnolic acid) or P-, K- (various substances); moderately branched; squamules common 48

48a Whitish-grey; podetia thin, 0.4-0.6 mm, erect, very fragile, scarcely branched and with closed axils; cortex often rugulose — *C. rugulosa*

48b Ashy grey; podetia thin or stoutish, entangled and richly branched, not very fragile; axils more or less perforated — 49

49a Podetia thin, rarely over 0.4 mm wide, without main axes; axils closed — *C. peltastica*

49b Podetia thick, with clear main axes c. 1 mm wide; axils often wide open — 50

50a Not all axils perforated, especially not near tips, and the perforations small; surface almost continuously corticate and of uniform, greyish colour; common in coastal white sand savanna — *C. sipmanii*

50b All axils gaping open, often funnel-shaped; surface variegated with pale and dark patches, at least in older parts of the podetia; restricted to the sandstone tablelands — *C. hians*

by Ted Ahti and Harrie Sipman, for the Biological Diversity of the Guianas Program, 1997