NORDIC LICHEN FLORA

Volume 5

Cladoniaceae

Edited by

Teuvo Ahti, Soili Stenros & Roland Moberg

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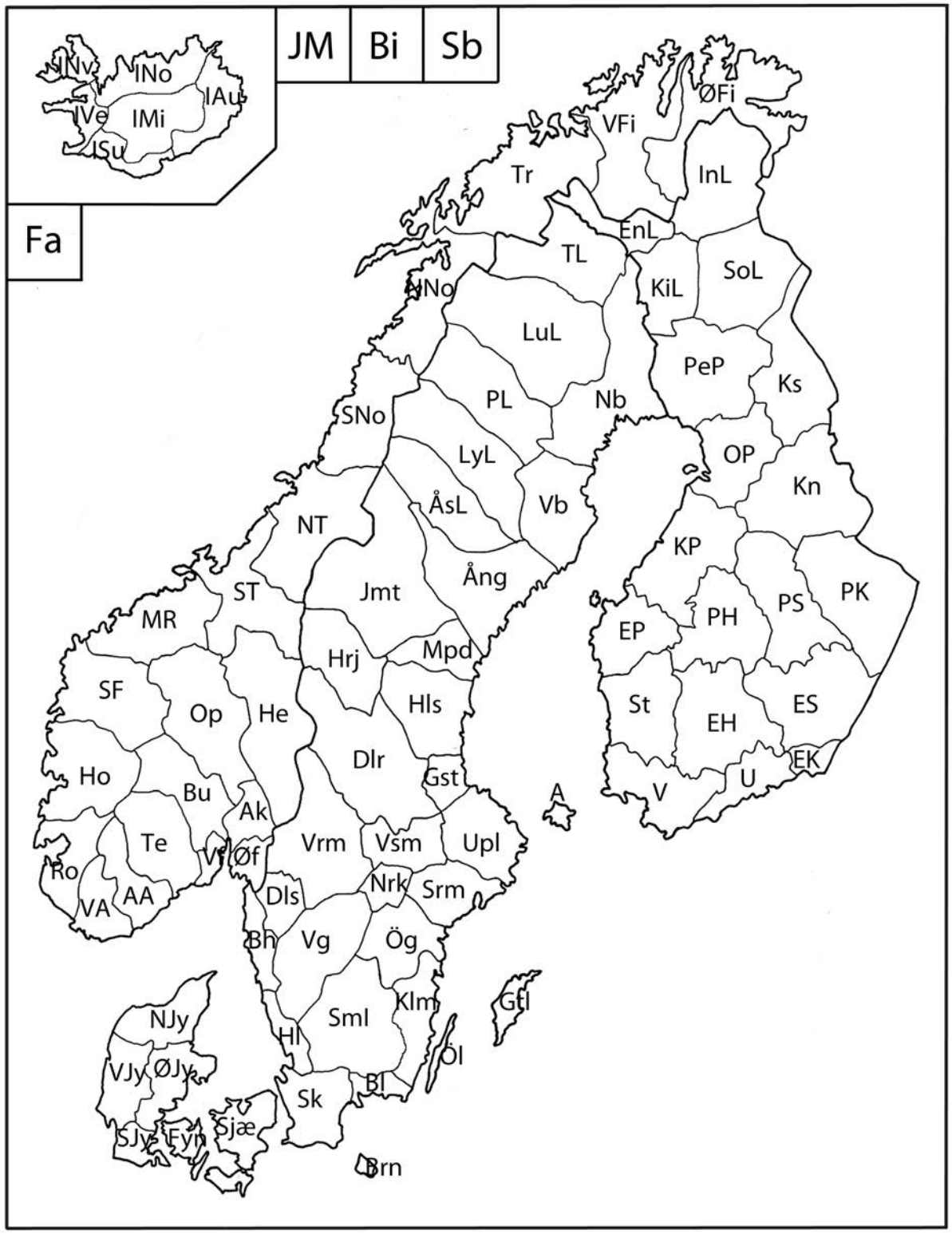
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Preface

The fifth volume of the *Nordic Lichen Flora* deals with one macrolichen family, the *Cladoniaceae*, comprising about 500 species and about 10 genera in the world. In the Nordic countries there are exactly 100 species recognized in this treatment.

The *Cladoniaceae* are primarily terricolous and lignicolous lichens, but also epiphytic. They are extremely common in the boreal forests and arctic tundra, in some cases even some of the dominant organisms in the vegetation and landscape. Even more noteworthy is that the family includes the reindeer lichens, which form the staple diet for the more than 2 million domesticated and wild reindeer or caribou throughout the northern latitudes in Eurasia and North America. Some species, primarily *Cladonia stellaris*, are also commercially exploited in ornamental and pharmaceutical industry. They have also played considerable role in history in alcohol production and as sources of cattle forage, medicines and even human food. The species of *Cladoniaceae* have a reputation of being very difficult to recognize at species level because of their extraordinary morphological variation according to the environmental conditions. Since the 1930's the chemistry of the secondary metabolites of the *Cladoniaceae* offered new characters, which much helped the classification, but even then the occurrence of infraspecific chemotypes confused the recognition of species. In the last 20 years the so-called molecular taxonomy has much clarified the situation but also introduced new problems. Most species of *Cladoniaceae* have not yet been subjected to the DNA analyses and few have been adequately studied with larger material throughout their ranges. Therefore many taxonomic decisions in this treatment must also be regarded as tentative.

In our longterm project to clarify the taxonomy and composition of the *Cladoniaceae* of the whole world we have received invaluable help from numerous individuals in different countries. As to study of the Nordic flora we are especially grateful to the curators and other staff of the herbaria where we have visited or from where we have received loans: AMNH, B, BG, BM, C, G, H, ICEL, KUO, LD, LE, MACB, O, OULU, S, TU and UPS. In addition we especially like to mention Dr Eric Steen Hansen, Mr Reidar Haugan, Dr Anders Nordin, Dr Piotr Osyczka, Dra Raquel Pino Bodas, Prof. Göran Thor, Dr Einar Timdal and Dr Tor Tønsberg.

Teuvo Ahti & Soili Stenroos

February 2013

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Cladoniaceae

Teuvo Ahti & Soili Stenroos

Lichen-forming fungi. Thallus dimorphic. PRIMARY THALLUS (thallus horizontalis) squamulose or foliose, more rarely crustose, papillose or granulose, often soon evanescent. SECONDARY THALLUS (thallus verticalis) formed of generative PODETIA or PESUDOPODETIA, which are usually erect, fruticose, terete structures (rarely fruticose structures lacking); podetial squamules frequent, morphologically similar to the primary thallus; outer or upper surface of all thallus corticate or ecorticate. ASCOMATA flat to globose apothecia, usually forming clusters of hymenial discs at tips of vertical thalli, rarely on horizontal thalli; discs dark to pale brown, blackish, red or pale ochraceous; hymenia containing amyloid gelatinous substance; paraphyses simple or branched, capitate or not; asci cylindrical to clavate, distinctly shorter than paraphyses; ascus-tip structure a variant of the *Porpidia* type, with strongly amyloid apical dome, including very narrow, pin-like, weakly amyloid central zone surrounded by a tubelike, strongly amyloid zone; ascus wall nonamyloid except for outer layer; dehiscence taking place through a rostrate peak formed by eversion of dome; spores usually 8 per ascus, hyaline, unicellular, oblong to fusiform, rarely 2–4-celled. CONIDIOMATA emergent, sessile to stipitate, on primary thallus or at tips of vertical structures, often doliiform to pyriform; conidia narrow, falciform (rarely straight), fusiform, simple, hyaline. PHOTOBIONT *Asterochloris* (perhaps rarely *Trebouxia*).

Chemistry. Secondary chemistry rich (more than 60 compounds reported), including numerous depsides, several depsidones, a few dibenzofurans and dibenzofuranoid derivatives, anthraquinones, higher aliphatic acids and triterpenoids. Huovinen & Ahti (1982) presented a theoretical biosequential scheme for the precursors of major compounds in *Cladonia* to explain the production and evolution of complex secondary chemistry with special reference to chemotaxonomy.

Note. Recent molecular investigations have affected the generic composition of *Cladoniaceae* to some extent. As to the genera in the Nordic Countries it should be noted that the genus *Cladina* has been returned to *Cladonia*, and the genus *Pilophorus* was moved from *Stereocaulaceae* to *Cladoniaceae*.

Literature. Jahns, Nova Hedwigia 20: 1–179 (1970); Stenroos et al., Mycol. Progr. 1: 267–282 (2002); Stenroos & DePriest, Amer. J. Bot. 85: 1548–1559 (1998); Wedin et al., Lichenologist 32: 171–187 (2000).

Key to genera

1. Primary thallus squamulose, usually persistent, rarely evanescent; podetia usually 1–3(–10) cm tall, unbranched or branched, hollow; scyphose, blunt or subulate; frequently sorediate or squamulose ..... *Cladonia*
– Horizontal or primary thallus crustose, persistent or evanescent, never squamulose; vertical thallus either absent or very short, dentiform or to over 10 cm tall, much branched, hollow to solid; never scyphose or squamulose; very rarely sorediate 2
2. Horizontal thallus evanescent, rarely seen; vertical thallus usually 4–12 cm tall, forming intricately branched, yellowish, grey or brown cushions ..... *Cladonia* (group "*Cladina*")
– Horizontal thallus always present; vertical thallus absent, dentiform or short, cornuted 3
3. Horizontal thallus consisting of verrucae and granules, whitish; podetia hollow, up to 1 cm tall, dentiform to sparingly branched; apothecia brown; spores nonseptate to uniseptate ..... *Pycnothelia*
– Horizontal thallus granulose to sorediate, grey; pseudopodetia solid or apothecia sessile; apothecia black; spores nonseptate ..... *Pilophorus*

Cladonia P.Browne, *nom. cons.*

Civ. Nat. Hist. Jamaica: 81 (1756). – Type (*cons.*): *Cladonia subulata* (L.) F.H.Wigg.

Syn. *Cenomyce* Ach., *Cladina* Nyl.

D: bægerlav, rensdyrlav **I:** krókar, bikarfléttur **F:** torvijäkälät, poronjäkälät **N:** begerlav, reinlav **S:** bägarlavar, renlavar

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Primary thallus crustose to squamulose, persistent or soon evanescent. Podetia unbranched to richly branched, then branching pattern isotomic or anisotomic and dichotomous, trichotomous (rarely to 6–tomous); axils closed to perforate; true (closed) scyphi commonly produced by many species, at least just before production of hymenia, but some species have perforated, dilated funnels ("open scyphi"); scyphi simple or either marginally or centrally proliferating to produce additional scyphi. Many species ascyphous, producing subulate ot blunt tips. Surface of podetia usually clearly corticate, but cortex often replaced by diffuse, rarely limited, soralia; many species totally ecorticate, minutely arachnoid. Podetial wall with distinct, cartilaginous or weaker stereome, with a narrow canal in the interior (very rarely solid). Podetial growth determinate (mainly in species with persistent primary thallus) or indeterminate (for many decades; mainly in species with evanescent primary thallus). Ascomata apothecia, mostly developing at apical tips of podetia, with finally convex, emarginate hymenial disks, which are dark to pale brown, ochraceous or red, often in dense, compound groups, but rare in many species. Spores 8 (rarely 4 or 6) per ascus, fusiform, oblong or ovoid, simple, hyaline, 6–24 × 2–4.5 µm, often poorly developed and of little taxonomic importance and therefore not described under each species. Conidiomata pycnidia, at apical tips of podetia (terminally or exceptionally lateral) or on primary thallus (basal), usually frequent, emergent, sessile to shortly stalked, cylindrical, doliiform, pyriform or ampullaceous, often highly variable in shape, black to dark or light brown, containing hyaline or red slime; conidia falciform, 5–14 × 0.5–1 µm.

Chemistry. See family description. The cortical substances are atranorin (rarely with chloroatranorin), isousnic and usnic acids. When known the optical isomers (+)-usnic or (–)-usnic acids are specified, because it is of taxonomic importance. The major medullary compounds include baeomycesic, barbatic, bourgeanic, cryptochlorophaeic, didymic, fumarprotocetraric, grayanic, homosekikaic, lichesterinic, merochlorophaeic, 4'-*O*-methylcryptochlorophaeic, norstictic, paludosic, perlatolic, psoromic, rangiformic, rhodocladonic, sekikaic, squamatic, stictic, and thamnolic acids, as well as homoheveadride, skyrin, sphaerophorin, strepsilin, and zeorin (many minor compounds not listed). Spot tests with reagents and thin-layer chromatography are very useful in identification. Many species have chemotypes, which are normally not regarded here as distinct species unless they are supported by morphological or molecular characters. Many species are well-screened as to secondary chemistry, while a number of others have not been thoroughly analyzed as to chemical variation. The identity and frequency of many minor compounds are still very insufficiently known.

Note. The genus *Cladonia* is notorious for its extreme environmental variability. This means that it is impossible to make perfect keys for identification, and the determination may be difficult. However, there are many easily identified species and with experience most species can be recognized even in the field. In the past (e.g., Vainio 1887–1894, 1922; Sandstede 1931) numerous forms and varieties were recognized in *Cladonia* species; the majority of them are now considered to be environmental or ontogenetic modifications, which have no taxonomic importance and should not be used.

The species only recorded in Greenland in the Nordic countries are included in the keys and as photos but not treated otherwise: *Cladonia alaskana* A.Evans, *Cladonia farinacea* (Vain.) A.Evans, *Cladonia granulans* Vain., and *Cladonia scotteri* Ahti & E.S.Hansen. The otherwise excluded species include *Cladonia brevis* (Sandst.) Sandst., recorded from Norway, Sweden and Finland, but perhaps based on small specimens of *C. macrophylla* or *C. polycarpoides*.

1. Podetia present. Primary thallus present or absent 2
– Podetia absent or very rare. Squamules dominant (only species which are usually in sterile state) 107
2. Podetia ecorticate, surface minutely fibrose. Always richly branched. No soredia, scyphi or squamules 3
– Podetia corticate (surface appearing smooth, hard), at least in part, or throughout sorediate 11
3. Podetia forming broad, rounded, richly branched-cushions, distinct main axes absent (isotomous) or present at base. Extreme apical branchlets divergent. P–, P+ red or P+ yellow, UV+ whitish (perlatolic acid) 4
– Podetia forming less dense cushions, single podetia slender, with distinct main axes (anisotomous). Extreme apical branchlets erect or deflexed. P+ red or P–, UV– (no perlatolic acid) 7
4. Tips of podetia P+ red. Iceland ..... 8. *C. azorica*
– Tips of podetia P– or P+ yellow 5
5. Tips of podetia P+ deep yellow (psoromic acid) ..... 77. *C. stellaris*, chemotype 2
– Tips of podetia P– (no psoromic acid) 6
6. Podetia yellowish to whitish grey, tips very dense, with clearly rounded heads, usually no distinct main axes. Apical branchlets mainly 4–5-tomous ..... 77. *C. stellaris*, chemotype 1
– Podetia grey to greenish grey with slightly yellow tint, tips not very dense, main stem distinguishable towards base. Apical branchlets mainly 3-tomous ..... 68. *C. portentosa*
7. Podetia predominantly dichotomous, main axes very slender. Apical branchlets strongly deflexed, conspicuously brown. Yellowish green or ash-grey. P+ fast red. ..... 20. *C. ciliata*
– Podetia predominantly 3–4-tomous. Main axes slender to thicker (over 1 mm). P+ red or P– 8
8. Podetia yellowish green, containing usnic acid 9
– Podetia ashy grey to blackish brown, without usnic acid 10
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10. Medulla of basal, necrotic podetia turning coal black. Pycnidial slime red ..... 81. *C. stygia*
– Medulla at base staying pale grey, not turning uniformly black. Pycnidial slime hyaline ..... 72. *C. rangiferina*

11. Podetia yellowish green, esorediate, esquamose, almost continuously and fairly smoothly corticate (or corticoid) throughout, richly to moderately branched. P– 12
– Podetia usually grey to brown, more rarely yellowish, often sorediate or squamulose, unbranched to richly branched, surface smoothly corticate or not. P+ or P– 15
12. Podetia erect, yellowish green, usually much browned at apex, tips very thin, forked, subulate, curved, often bearing scattered scyphi, main axes distinct ..... 4. *C. amaurocraea*
– Podetia erect to ascendent, greyish to greenish yellow, little browned at apex, tips thick, acute, spiny, never scyphose, main axes usually indistinct 13
13. Tips of podetia producing abundant, bluish crystal needles in herbarium. Podetium surface matt, whitish, with very thin cortex ..... 95. *C. zopfii*
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14. Branching predominantly polytomous, axils largely open. Somewhat robust. Medulla usually UV– ..... 92a. *C. uncialis* subsp. *uncialis*
– Branching.predominantly dichotomous, axils mainly closed. Very slender to turgid. Medulla usually UV+ white (squamatic acid) ..... 92b. *C. uncialis* subsp. *biuncialis*
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– Podetia brownish or greenish grey. Usnic acid absent 28
17. Podetia and often also basal squamules sorediate 18
– Podetia and squamules esorediate, but often coarsely granulose or microsquamulose, appearing sorediate 22
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– Podetia shorter (0.5–3 cm). Soredia granulose to farinose 20
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20. Podetia very small (1–7 mm), with abundant farinose sorediate primary squamules, without true scyphi ..... 46. *C. incrassata*
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– Podetia usually shorter, unbranched or branched, thin or thick, basal and podetial squamules often well-developed, often scyphose or funneled. Often farinose sorediate 43
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– Podetia green, grey or brown, moderately branched, usually somewhat squamulose, smooth or granulose, without tubercular knots. Atranorin normally absent. In acid or calcareous habitats 40
40. Podetia slender, scabrose, granulose or coarsely sorediate, at least the thin apical branchlets, usually also squamulose. Generally coastal 42
– Podetia slender to robust, smooth, but often in part squamulose. Widespread 41
41. Podetia usually bluish grey, P–, K+ yellow. Cortex clearly checkered-areolate ..... 73. *C. rangiformis*
– Podetia P+ red, K–. Cortex rather uniformly brown to grey ..... 37. *C. furcata*
42. Podetia clearly farinose sorediate in patches in apical parts. Greenland ..... [*C. farinacea*]
– Podetia granular and phyllidiate, subsorediate in apical parts ..... 75. *C. scabriuscula*
43. Podetia usually branched, ascyphose but axils may be swollen to produce scyphoid funnels, which are usually open, i.e. perforate. Usually UV+ white, P– or P+ yellow 44
– Podetia usually unbranched or little branched, commonly forming scyphi. Usually UV–, P+ red 53
44. P+ yellow, K+ yellow, UV– 45
– P–, K–, UV+ white or bluish white 46
45. Basal squamules, tiny, crowded, dissected, coralloid-branched. Podetia thin, coarsely granular sorediate, less than 1 cm tall, inconspicuous ..... 61. *C. parasitica*
– Basal squamules larger, not coralloid-branched. Podetia taller, thicker ..... 76. *C. squamosa*, chemotype 2
46. Podetia esquamose, short (to 1.5 cm), with perforate scyphi. UV+ blue-white (grayanic acid) ..... 14. *C. callosa*
– Podetia abundantly to slightly squamulose, taller, with perforated axils, often forming funnels. UV+ white (squamatic acid) 47
47. Podetia slender, with mostly perforate axils but no wide, scyphoid funnels 48
– Podetia sturdier, with scyphoid funnels with obvious perforations 50
48. Podetia sorediate, but with few squamules 49
– Podetia not sorediate, smooth to squamulose 50
49. Podetia very slender, 3–8 cm tall, sparingly branched towards apices, axils usually with narrow perforations, without funnels, tips subulate ..... 40. *C. glauca*
– Podetia sturdy to slender, 1–6 cm tall, gaping, wide funnels usually present, tips rarely subulate ..... 17. *C. cenotea*
50. Podetia abundantly squamulose, slender, 3–9 cm tall, with narrow, irregular funnels ..... 76. *C. squamosa*, chemotype 1
– Podetia esquamose or slightly squamulose, funnels present or absent 51
51. Funnels present, often with starlike openings, with

numerous pycnidia on the rims ..... 25a. *C. crispata* var. *crispata*
– Funnels absent, axils and tips not wider than the rest of podetium 52
52. Podetia esquamose, somewhat glossy, basal parts usually strongly melanotic ..... 83. *C. subfurcata*
– Podetia somewhat squamulose, matt, basal parts not melanotic ..... 25b. *C. crispata* var. *cetrariiformis*
53. Podetia scyphose, verticillate (scyphi proliferating from centre). Esorediate 54
– Podetia ascyphose or scyphose, not (or very exceptionally) verticillate. Often sorediate 61
54. P+ yellow (psoromic acid). Squamules abundant. Podetia scarce, slender ..... 69. *C. pulvinata*
– P+ red (fumarprotocetraric acid). Squamules abundant or scarce. Podetia robust to slender 55
55. Primary squamules persistent, large, 0.8–3.5 cm long, glaucous grey. K+ yellow (atranorin). Podetia sturdy, with only 1–2 tiers 56
– Primary squamules usually smaller or not glaucous. K– or K+. Podetia not sturdy, often with many tiers 57
56. Primary squamules 0.7–3 cm long, scyphi often deformed and apothecia clustered. Coastal ..... 82. *C. subcervicornis*
– Primary squamules 0.8–1.5 cm long, scyphi distinct, wide, with 1–3 tiers. Alpine and arctic snow-beds ..... 54. *C. macrophyllodes*
57. Podetia glaucous grey, tall (to 8 cm), strongly melanotic at base. Mainly in arctic-alpine snow-bed habitats 58
– Podetia greenish grey to brown, smaller 59
58. Podetia irregular, scyphi usually deformed or small, rarely with several regular successive scyphi ..... 88. *C. trassii*
– Podetia fairly regular, scyphi repeatedly (3–9 times) forming successive tiers of scyphi ..... 90. *C. uliginosa*
59. Podetia very slender, mostly subulate or with a single, narrow scyphus, occasionally proliferating from centre or margins ..... 80. *C. stricta*
– Podetia not very slender, never subulate, usually with 2–5 tiers of scyphi 60
60. With persistent cushions of basal squamules. Podetia often scarce, with 1–3(–7) tiers of scyphi ..... 18. *C. cervicornis*
– With inconspicuous, evanescent basal squamules. Podetia gregarious, with 2–5(7) tiers ..... 93. *C. verticillata*
61. Podetia covered by soredia or soredioid granules, at least in part 62
– Podetia not sorediate 72
62. Podetia ascyphose, subulate or with narrow (to 2 mm) scyphi 63
– Podetia always scyphose, scyphi usually 0.5–2 cm wide 90
63. Podetia dirty grey, brownish toward tips, with some cortex near base. UV+ pale (homosekikaic acid), P– (often) or P+ red ..... 74. *C. rei*
– Podetia green, greenish grey or bluish grey. UV–, P+ red, rarely P 64
64. Primary thallus inconspicuous, evanescent. Podetia tall (to 12 cm), brownish green, cortex high up (1/3 of podetium length) corticate 65
– Primary squamules small or large (to 1.5 cm), persistent. Podetia slender, green or glaucous, smaller (1–5 cm tall), cortex usually more basal 66
65. Podetia subulate or with very narrow scyphi only in very old podetia, becoming tall ..... 24a. *C. cornuta* subsp. *cornuta*
– Podetia regularly with wide scyphi, usually much squamulose and swollen, shorter (2–5 cm) ..... 24b. *C. cornuta* subsp. *groenlandica*
66. Primary squamules small, usually with bright red spots. Podetia thin, especially towards tips, vividly green, ascyphose. P–. Apothecia ochraceous ..... 58. *C. norvegica*
– Primary squamules small to large, without red spots. Podetia stouter, usually finally scyphose. P+ red. Apothecia brown 67
67. Podetia finely sorediate, soredia abundant 68
– Podetia coarsely, sparsely sorediate 70
68. Podetia 4–10 cm tall, grey, continuously sorediate, essentially ecorticate throughout, usually with some long, curved branchlets ..... 85. *C. subulata*
– Podetia 1–4 cm tall, greenish grey, with corticate sheath at base, otherwise sorediate, no lateral branchlets 69
69. Podetia becoming robust, cortex extending to 1/3 of podetium length or higher, including bottoms of scyphi, which are common. Often glaucous ..... 60. *C. ochrochlora*
– Podetia staying slender, cortex extending little from podetium base, scyphi scarce, not corticated. Not glaucous ..... 22. *C. coniocraea*
70. Podetia whitish, always ascyphose, clearly granulose sorediate. K and P+ yellow to slowly red (norstictic acid) ..... 1. *C. acuminata*
– Podetia at least in part brownish, finally scyphose, soredia inconspicuous. P+ readily red (fumarprotocetraric acid) 71
71. Surface minutely microsquamulose and granular, usually only subulate, rarely sparsely scyphose. Iceland, Svalbard ..... 47. *C. islandica*
– Surface verruculose-knobby, sparsely sorediate on narrow scyphi. Iceland ..... 39. *C. glacialis*

72. Podetia ascyphose, with shredded appearance, i.e., longitudinally cracked, glaucous to pale or brownish grey 73
– Podetia scyphose, at least commonly, with scyphi (1 –)4–10 mm wide..... 81
73. Primary squamules small (to 4 mm long). Podetia slender, cortex checkered..... 74
– Primary squamules larger (to 10 mm). Podetia stoutish..... 75
74. Podetia very slender, furrowed and verruculose, always with apothecia on apical branchlets. P+ instantly red ..... 62. *C. peziziformis*
– Podetia less slender. P– or P+ yellow or slowly red..... 735
75. Podetia P–, UV+ white (perlatolic acid), whitish, microsquamulose and granulose..... 29. *C. decorticata*
– Podetia P+ yellow or red, UV–, glaucous to grey 76
76. Podetia 1–6 cm tall, often somewhat branched, with rough cortex consisting of peltate, curved squamules. P+ golden yellow (psoromic acid) ..... 53. *C. macrophylla*
– Podetia 0.5–3 cm tall, unbranched to little divided, cortex smooth to rough but not consisting of curved squamules. Rarely P+ gold 77
77. Primary thallus whitish, highly dissected, forming dense cushions in arctic-alpine areas. Podetia rare, often very slender. Containing porphyrilic acid .....38. *C. galindezii*
– Primary thallus grey to brown, not highly dissected. Podetia thicker, clavate 78
78. Primary thallus becoming brownish. Podetia grey to brownish, clearly clavate, always fertile. Besides atranorin usually containing homosekikaic or rangiformic acid. Greenland.....[*C. scotteri*]
– Primary thallus glaucous to grey. Podetia thin to clavate. Chemistry usually different..... 79
79. Primary squamules large (to 10 mm). Podetia stout, cortex largely smooth, not checkered. Commonly containing norstictic or psoromic acids .....87. *C. symphycarpa*
– Primary squamules smaller (to 4 mm). Podetia thinner 80
80. Podetia unbranched, clavate, to 3 cm tall. P+ yellow to slowly red (norstictic acid, no atranorin) .....66. *C. polycarpoides*
– Podetia usually slightly branched, often not distinctly clavate but flattened, to 2 mm tall. Usually P+ yellow, rarely red (chemistry variable, always atranorin, commonly with rangiformic or fumarprotocetraric acid, very rarely with norstictic acid) ..... 15. *C. cariosa*
81. Podetia pale yellow (usnic acid), 1–3 cm tall, surface cottony, scyphi narrow or tips subulate. Greenland..... [*C. alaskana*]
– Podetia grey, green or brown..... 82
82. Podetia robust, irregularly turgescent, to 7(–12) cm tall, with narrow scyphi or blunt tips, with many holes and cracks, even on scyphi, with large squamules or not ..... 89. *C. turgida*
– Podetia not irregularly turgescent..... 83
83. Podetia generally simple and regularly scyphose, 1–3(–5) cm tall, surface sorediate, granulose or roughly corticate, often verruculose 824
– Podetia usually taller (4–15 cm), scyphi produced but with long stalks or scyphi not always present, surface usually smoothly corticate, often glossy 100
84. Podetia largely stalkless or very shortly (5 mm) stalked. Medulla UV+ white (sphaerophorin), P–... ..... 45. *C. imbricarica*
– Podetia with longer stalk. Usually UV– or pale and P+..... 85
85. Podetial cortex largely plated or peeling along with coarse granules 86
– Podetial surface mainly densely verruculose, with granules and microsquamules..... 88
86. Basal squamules well-developed, forming ± flat, contiguous rosettes. Calciphilous ..... 65. *C. pocillum*
– Basal squamules sparse or abundant, ascending to suberect. Calcifuges..... 87
87. Basal squamules large (to 1 cm diam), with distinct, raised veins below. Podetia 0.5–1 cm tall, usually pale grey..... 28. *C. cyathomorpha*
– Basal squamules mostly smaller, not distinctly veined below. Podetia usually over 1 cm tall .....70. *C. pyxidata*
88. Podetia up to 5 cm tall, strongly melanotic at base with age, chocolate brown and shiny in open habitats. P+ red, containing only fumarprotocetraric acid complex.....49. *C. libifera*
– Podetia 1–2 cm tall, melanotic or not, dark brown to green, not clearly shiny. P– or P+ red..... 89
89. Podetia dark brown to blackish, in shade green, minutely verruculose cortex, usually not granulose at all, frequently with apothecia. Containing homosekikaic and sekikaic acids.....59. *C. novochlorophaea*
– Podetia dark brown to grey, cortex less verruculose, but with more tendency to become eroded and form soredioid structures. Containing merochlorophaeic acid ..... 56. *C. merochlorophaea*
90. Podetia covered by farinose soredia, at least on and inside the scyphi 91
– Podetia only with small granules or granular soredia 98
91. Podetia with glaucose tint, short (0.5–2 cm), with short stalks, scyphi broad,..... 94
– Podetia vivid green to brownish-grey, taller (1–4

cm), with long stalks, scyphi narrower (3–6 mm) 93
92. Podetia K+ yellow, containing atranorin, often very low-growing, soredia confined to upper part of podetia. Oceanic ..... 44. *C. humilis*
– Podetia K–, containing bourgeanic acid, often more slender, 2 cm tall, soredia extending lower down. Continental ..... 23. *C. conista*
93. Podetia vivid green to ash-grey, never brown, abundantly sorediate almost throughout (or stalk occasionally corticate) ..... 34. *C. fimbriata*
– Podetia brownish grey or green, only partly sorediate, sometimes with granules 94
94. Podetia greenish brown, upper parts farinose to granulose sorediate. Containing homosekikaic acid; Iceland ..... 43. *C. homosekikaica*
– Podetia darker brown or grey. Not containing homosekikaic acid 95
95. Podetia at base strongly melanotic, dark brown to grey 96
– Podetia not or weakly melanotic at base, usually dark brown 97
96. Greenish brown to grey. Containing merochlorophaeic acid, often P–. Widespread ..... 56. *C. merochlorophaea*
– Pale greyish green to reddish brown. Always P+ red (only fumarprotocetraric acid complex). Coastal ..... 2. *C. albonigra*
97. Podetia greenish or pale grey. C–, UV+ ice blue (containing grayanic acid) ..... 42. *C. grayi*
– Podetia dark greenish grey. C+ fugitively wine red, UV– (containing cryptochlorophaeic acid) ..... 26. *C. cryptochlorophaea*
98. Podetia irregularly covered by granular and finer soredia, stalk at base usually microsquamulose. Containing rangiformic acid ..... 7. *C. asahinae*
– Podetia coarsely granular or granulose sorediate. Not containing rangiformic acid 99
99. Podetia dark to blackish brown, sparsely granulose sorediate. Often P–, always containing homosekikaic and sekikaic acid ..... 59. *C. novochlorophaea*
– Podetia pale greenish brown, usually much decorticated, irregularly granulose. Always P+ red, containing only fumarprotocetraric acid complex ..... 19. *C. chlorophaea*
100 Podetia matt, whitish, lead grey or glaucous, K+ clearly yellow (atranorin abundant). Cortex checkered, upper parts minutely pruinose, dying base turning yellowish ..... 33. *C. ecmocyna*
– Podetia brown to green, K– or slightly yellow. Cortex not checkered or pruinose 101
101. Cortex grey, matt, fibrose, verruculose or microsquamulose 102
– Cortex usually brownish, shiny, usually not much squamulose 103
102. Podetia 3–8 cm tall, strongly melanotic at base, cortex pale grey, minutely tomentose to fibrose towards tips, clearly scyphose, scyphi often squamulose at margins ..... 63. *C. phyllophora*
– Podetia 1–4 cm tall, greenish brown, not melanotic, cortex smooth to verruculose. granulose and squamulose, irregularly scyphose or ascyphose ..... 71. *C. ramulosa*
103. Podetia tall (often 15 cm), never squamulose, pale green to brown, dying base turning pale or yellowish ..... 55. *C. maxima*
– Podetia tall or short, often somewhat squamulose, brownish, dying base turning black or brown 104
104. Podetia robust, glossy, often with slightly bullate squamules, occasionally cortex broken into tubercles near base, dying base reddish to blackish brown, podetial wall tough, thick (difficult to cut with razor blade). Calciphile and arctic ..... 52. *C. macroceras*
– Podetia thin to slightly robust, squamules never bullate, tubercles absent, dying base brown or melanotic, podetial wall thin. Calcifuges 105
105. Podetia 4–12 cm tall, usually without squamules, dying base clearly melanotic and long persistent, scyphi narrow, most tips subulate. Often containing atranorin (low concentration) ..... 41b. *C. gracilis* subsp. *elongata*
– Podetia 2–8 cm tall, slightly to densely squamulose, dying base not or slightly melanotic, scyphi wide to narrow. Never containing atranorin 106
106. Stoutish, short (2–6 cm), scyphi wide (to 1 cm), constant, no subulate podetia present ..... 41c. *C. gracilis* subsp. *turbinata*
– Slender, taller (4–12 cm), scyphi narrow (0.5–1 cm), inconstant, subulate podetia ± dominant ..... 41a. *C. gracilis* subsp. *gracilis*
107. Primary squamules dark brown, stiff, C+ emerald green. Occasionally with short, clavate podetia ..... 79. *C. strepsilis*
– Squamules C– 108
108. Squamules yellow. Containing usnic acid 109
– Squamules brown, grey or bluish. Usnic acid absent 110
109. Squamules small, with very narrow, dissected lobes. No rhizines at margins ..... 5. *C. angustiloba*
– Squamules 6–40 mm long, broad to narrow. Scattered white rhizines on the margins ..... 36. *C. foliacea*
110. Squamules large, often 1–4 cm long, 1 cm wide, glaucous, conspicuously white below 111
– Squamules small to larger, not glaucous but brown or green 112
111. Squamules to 3 cm long, with long black base.

Podetia, if present, almost clavate, indistinctly scyphose. Coastal.....82. *C. subcervicornis*
– Squamules not with long base. Podetia clearly verticillate, with wide, flat scyphi. Arctic-alpine .....54. *C. macrophyllodes*
112. Medulla P+ red 113
– Medulla P– or P+ yellow 116
113. Squamules forming dark brown, flat rosettes on calcareous habitats..... 65. *C. pocillum*
– Squamules ascending or upright.....114
114. Squamules very small, mainly erect, green to brown, with crenulate margins, often with almost sessile, brown apothecia .....13. *C. caespiticia*
– Squamules larger, mostly ascending, margins not clearly erect. Podetia stalked, scyphiferous.....115
115. Squamules 0.5–3 cm long, forming loose colonies. K+ yellow (atranorin).....89. *C. turgida*
– Squamules 0.2–1 cm long, forming dense cushions. K– (no atranorin) ..... 18. *C. cervicornis*
116. Medulla P–. Squamules greyish green to brown, to 8 mm long. Never found fertile. Containing barbatic acid and chlorovinetorin .....48. *C. krogiana*
– Medulla P+ yellow, sometimes then slowly red, K+ yellow (atranorin) or then slowly red. Squamules whitish, glaucous or led grey, rarely brown.....117
117. Squamules whitish, very small, congested. P+ yellow, also containing porphyrilic acid. Arctic-alpine .....38. *C. galindezii*
– Squamules grey to brownish, fairly large (0.5–2 cm long), not very congested. P+ yellow or slowly red 118
118. Squamules glaucous to led grey, not brownish. Besides atranorin usually containing norstictic, fumarprotocetraric or psoromic acids. Widespread .....87. *C. symphycarpa*
– Squamules brownish. Besides atranorin containing homosekikaic or rangiformic acids. Greenland .....[*C. scotteri*]

1. **Cladonia acuminata** (Ach.) Norrl.

in Norrlin & Nylander, Herb. Lich. Fenniae, Index: 3 [no. 57a] (1875). – *Cenomyce pityrea* f. *acuminata* Ach., Syn. Meth. Lich.: 254 (1814). – Type: Switzerland (Helvetia), Schleicher 57–2 (H-ACH 1712E lectotype, Stenroos & Ahti, Ann. Bot. Fenn. 27: 318, 1991 ‘1990’).

Syn. *Cladonia foliata* (Arnold) Kernst., *nom. illeg.*, *Cladonia norrlinii* Vain., *nom. illeg.*, *Cladonia acuminans* R.C. Harris, *Cladonia acuminata* var. *norrlinii* Lynge

F: suipputorvijäkälä **I:** alkrókar **N:** spisslav **S:** spetsig bägarlav

Literature. Ahti, Ann. Bot. Fenn. 1: 13–14 (1964); 2000: 236–237; Huovinen et al., Ann. Bot. Fenn. 26: 298, 304 (1989); Lång, Bot. Notiser 1912: 35–36 (1912); Pino-Bodas et al., Lichenologist 44: 121–135 (2011); Vainio 1894: 73–80, 1922: 86–88.

Figs. Carlin 1981: figs 8A, 8B; Krog et al. 1994: 146; Pino-Bodas et al. 2011: fig. 3C; Stenroos et al. 2011: 115.

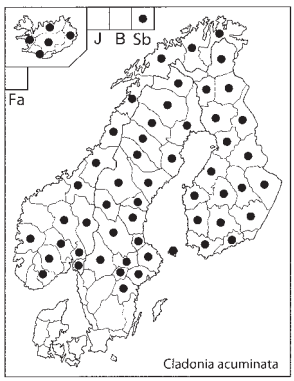
Primary thallus squamulose, inconspicuous, persistent to evanescent. Podetia to 3.5 mm tall, whitish grey to ochraceous, at the very base darkening or even melanotic, flexuose, occasionally tortuose, unbranched to usually slightly dichotomously or trichotomously branched near top; branchlets mostly short; axils closed but may become perforated and develop into slits and join with lateral fissures; tips acute or blunt, ascyphose. Surface at base roughly and discontinuously corticate and squamulose, above granulose-sorediate, often becoming denuded. Stereome strong, cartilaginous, in part trabeculate, central canal grooved. Apothecia infrequent, in groups at branch tips, reddish to blackish brown, finally forming compound discs to 3 mm wide. Pycnidia infrequent, on basal squamules or at podetial tips, ampullaceous to ovoid, containing hyaline slime.

Chemistry. K+ yellow turning red, P+ yellow, slowly turning orange red, UV–. Atranorin, norstictic acid, connorstictic acid, unidentified fatty acid. Also a chemotype with atranorin and psoromic acid (“*C. acuminans”*) expected (found in Ladoga Karelia, Russia; widespread in North America and East Asia). In Tierra del Fuego also other compounds detected, including the stictic acid complex.

Habitat. Terricolous, on bare mineral soil or humus, usually on basic or weakly acid, often calcareous soils, e.g. earth banks, grasslands, littoral meadows by sea, rock outcrops and in early postfire stages.

Distribution. Widespread but usually scattered, most frequent in calcareous areas in the north and in the mountains; rare in Svalbard, and absent in Denmark and southernmost Sweden. **Gr. F:** *A V U St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL InL.* **I:** *ISu IVe*

IMi IAu INo. **N:** *Øf Ak He Op Bu Te AA Ho ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL*. Arctic to temperate Eurasia and North America, Dominican Republic, Brazil, Tierra del Fuego.



Note. Characterized by the whitish, ascyphous podetia, which react P+ red. The red reaction may be slow (from yellow to red) when the norstictic acid has a low concentration. Such a specimen caused a recognition of "*C. norrlinii"* (reactions supposed to be yellow). However, the yellow reaction may also be due to psoromic acid (see above). In North America the psoromic acid chemotype was recently recognized as a distinct species, *C. acuminans,* but its distinction was not supported by later molecular studies. *Cladonia acuminata* has been reported from Færoe Islands, but no correctly identified specimens seen.

2. **Cladonia albonigra** Brodo & Ahti

Canad. J. Bot. 74: 1152 (1996). – Type: Canada, British Columbia, Queen Charlotte Islands, Graham Island, 2 mi. SE of Port Clements, 1971 Brodo 18104 & Wong (CANL holotype).

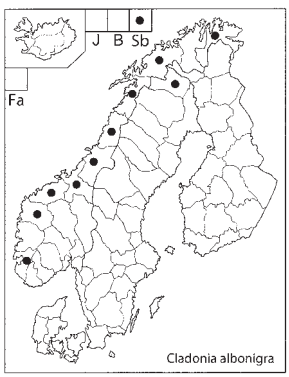
Literature. Brodo & Ahti, Canad. J. Bot. 74: 1152–1153 (1996); Holien, Graphis Scripta 17: 62–63 (2005); Øvstedal et al. 2009: 156.

Figs. Ahti 2000: 101 (as *C. chlorophaea*); Brodo & Ahti 1996: 1152; Holien 2005: 63.

Primary thallus squamulose, usually persistent. Podetia 1–4(–5) cm tall, greyish green to reddish brown, melanotic at base (sometimes almost entirely blackened), scyphose, proliferating from the margins or centre of the scyphi, producing up to four tiers, margins entire or dentate. Surface partially areolate, sorediate to coarsely granular on upper half of podetia; podetial squamules occasional. Apothecia rare, becoming hemispherical, 2 mm diam. Pycnidia sparingly produced, at margins of scyphi, globular to pyriform, constricted at base, containing hyaline slime.

Chemistry. C–, K–, P+ red, UV+ bright blue-white or UV–. Fumarprotocetraric acid complex; in western North America also chemotypes with grayanic acid (e.g. in type specimen) or 4'-*O*-methylcryptochlorophaeic acid.

Habitat. On mossy and humid coastal rocks, often on boulders near streams.



Distribution. On lowland coasts of Norway, especially in Nordland. **N:** *Ro SF MR ST NT SNo NNo Tr ØFi.* **AI:** *Sb.* **S:** *TL*. Oceanic. From Alaska to Washington in western North America (and similar specimens known from Nova Scotia and Newfoundland), elsewhere in Europe only known from Hogland (Gogland) Island, Russia, in Gulf of Finland, but distribution poorly clarified.

Note. All the Norwegian material resembles *C. subulata* in structure of podetial surface but the podetia are shorter and have broader scyphi (never subulate) and the base is blackening. It is somewhat uncertain whether it belongs to *C. albonigra,* as described from western Canada. The first Norwegian collections were made by Sommerfelt in the 1820's, but this species has been badly overlooked. The type material of *C. chlorophaea* actually belongs to this species, and therefore the name *C. chlorophaea* shall be proposed for conservation with another type.

3. **Cladonia alpina** (Asahina) Yoshim.

J. Hattori Bot. Lab. 31: 198 (1968). – *Cladonia floerkeana* var. *alpina* Asahina, J. Jap. Bot. 15: 665 (1939). – Type: Japan, Hokkaido, Prov. Ishikari (Kamikawa Distr.), Mt. Ashibetsu, 1935 Asahina 35726 (TNS lectotype, Yoshimura, J. Hattori Bot. Lab. 31: 198, 1968).

N: gaffelrødtopp

Literature. Botnen & Tønsberg, Gunneria 58: 16–18 (1988); Stenroos & Ahti, J. Hattori Bot. Lab. 75: 306 (1994); Tønsberg, Norweg. J. Bot. 25: 243–246 (1978); Tønsberg et al., Sommerfeltia 23: 52–54 (1996).

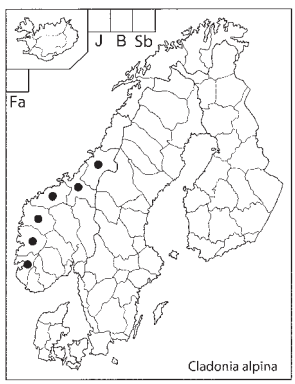
Figs. Botnen & Tønsberg 1988:16; Krog et al. 1994: 146.

PRIMARY THALLUS squamulose, persistent, inconspicuous, sometimes with conspicuous orange pigments at base. PODETIA to 6 cm tall, whitish grey, slender (occasionally very thick, to 5 mm at base), simple or usually dichotomously branched near tips, ascyphose, tips blunt to acute, upper parts whitish, farinose sorediate, cortical basal sheath often brownish and extending high up even on sterile podetia. APOTHECIA rare, red. PYCNIDIA at tips of podetia, containing red slime.

Chemistry. K–, P – or rarely ± strongly yellow, UV–. Barbatic, 4–*O*-demethylbarbatic, usually porphyrilic and conporphyrilic, thamnolic (accessory, only in Norway), and rhodocladonic acids.

Habitat. On rotten wood, thin soil over rocks or thick humus in humid places like shores; mostly found in planted *Picea abies* forests but also in coastal heaths.

Distribution. Rare. Restricted to the west coast of Norway. **N:** *Ro Ho SF MR ST NT*. Oceanic; only known from Norway, Japan (where widespread in mountains), Alaska and British Columbia.



Note. The presence of porphyrilic acid has been regarded as a diagnostic character in addition to the presence of podetia which are taller and more branched than in *C. macilenta*, which is otherwise very similar. However, in Japan and western North America some specimens lack porphyrilic acid.

4. Cladonia amaurocraea (Flörke) Schaer.

Lich. Helv. Spic. 1(1): 34 (1823). – *Capitularia amaurocraea* Flörke, Beitr. Naturk. 2: 334 (1810). – TYPE: Austria, Salzburg, Flörke 58 (BM lectotype, Ahti, Regnum Veg. 128: 66, 1993).

D: mørkspidset bægerlav **F:** louhikkotorvijäkälä **I:** bikarkrókar **N:** begerpigglav **S:** stor pigglav

Literature. Botnen & Tønsberg, Gunneria 58: 16–18 (1988); Dahl 1950: 84–85; Hasselrot, Acta Phytogeogr. Suec. 33: 31–37, 122–125, fig. 8 (1953); Huovinen & Ahti, Ann. Bot. Fenn. 23: 175, 184 (1986); Kärenlampi & Pelkonen, Repts. Kevo Subarctic Res. Sta. 7: 55–56 (1971); Litterski & Ahti 2004: 207–208, 225; Osyczka 2006: 212–214; Pišút, Preslia 31: 273–276 (1959); Stenroos et al. 2002: 248, 251, 257, 260; Vainio 1922: 42–44.

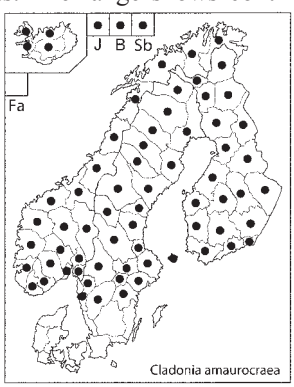
Figs. Hansen & Andersen 1995: 25; Holien & Tønsberg 2006: 83; Moberg & Holmåsen 1990: 136; Osyczka 2006: 213, 238; Rikkinen 2007: 111; Stenroos et al. 2011: 115.

PRIMARY THALLUS squamulose, very rarely observed. PODETIA, with indefinite growth, usually deriving from fragments of older thalli, 3–12(–15) cm tall, 1–3 mm thick, slender, greenish to yellowish grey, not melanotic at base, erect or ascending, often forming dense cushions, moderately branched, usually by anisotomic dichotomy, axils mostly closed; tips characteristically attenuate, brownish, occasionally scyphose; scyphi 2–5 mm wide, closed or slightly perforate, often oblique, at margins spinulose or lacerate. Surface maculate, smooth, esquamose, esorediate. APOTHECIA not uncommon, brown, forming compound discs to 3 mm broad. PYCNIDIA common, at branch tips or scyphus margins, variably doliiform, ovoid or subcylindrical, often slightly constricted at base, containing hyaline slime.

Chemistry. K–, P–, KC+ yellow, UV–. Usnic (very rarely absent), barbatic and 4–*O*-demethylbarbatic acid (also these rarely absent).

Habitat. In the arctic and alpine areas as well as in open forests near timberline, terricolous in various habitats, including peatlands. In most of the forested areas only on thin soil over rocks, particularly on big erratic blocks or other boulders, very abundant in boulder beds, rarely on wood.

Distribution. Widespread but absent in the southwest and most abundant in the middle to northern boreal forests and in alpine areas. The range shows continental tendencies, so that the species is rare or absent in many coastal areas. Absent from Færoe Is., in Iceland rather rare and mainly confined to the northwest, but very common in Greenland and present in the other Arctic islands. **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP*



Ks KiL SoL EnL InL. **I:** *IVe IMi INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr Vfi ØFi.* **AI:** *JM Bi Sb.* **S:** *Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America, circumpolar in arctic and boreal zones, outliers in mountains such as the Alps, Caucasus, and the Himalayas, in Rocky Mountains to Montana, in eastern North America south to New England.

Note. Reported from Denmark and Færoe Is., but no specimens detected; perhaps misidentifications for *C. uncialis* subsp. *biuncialis.* The usnic acid-deficient chemotype may locally form large, grey patches. Occasionally difficult to distinguish from *C. uncialis*, especially in the Arctic, but *C. amaurocraea* can be distinguished by ability to produce scyphi (though often absent, not at all known from Svalbard!) and presence of thin, brown, furcate extreme tips, or in difficult cases by presence of barbatic acid (TLC required). In the past *C. amaurocraea* was supposed to be closely related to *C. uncialis,* but in a phylogenetic analysis (Stenroos et al. 2002) these two species turned out to be only distantly related. One character against *C. uncialis* is that the internodes of podetia are curved in towards the centre of the axil (in *C. uncialis* straight or curved away from the centre of axil).

5. Cladonia angustiloba Ahti & Aptroot

Biblioth. Lichenol. 99: 12 (2009). – Type: Portugal, Azores, Pico, São João, 30 m, 2007 Aptroot 67832 (H holotype).

Literature. Ahti & Aptroot, Biblioth. Lichenol. 99: 12–15 (2009); Ahti & Stenroos, Bot. Complut. 35: 32 (2012).

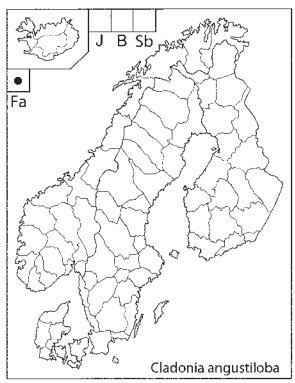
Figs. Ahti & Aptroot 2009: 13, 15.

Primary thallus squamulose, persistent, divided into numerous, 0.5–2 cm long, very narrow laciniae, incurved when dry. Podetia infrequent, yellow, 0.3–1(–2) cm tall, irregularly torn; tips usually with single, 0.1–0.3 cm wide scyphi. Surface corticate, smooth to verruculose, often squamulose, tips slightly tomentose. Apothecia infrequent, in groups at margins of scyphi, shortly stipitate, pale to dark brown, globose. Pycnidia scattered, mainly marginal on basal squamules, broadly pyriform to subspherical; colour of slime not observed.

Chemistry. K–, P+ red, KC+ yellow, UV–. Usnic acid, fumarprotocetraric acid complex, zeorin.

Habitat. On thin acidic soil over rocks.

Distribution. Known from a few localities on Sandoy, Skúvoy and Suðuroy in the Færoe Islands. **Fa.** An oceanic species known from many places in the Azores.



Note. Recognized as distinct taxon many years ago but until podetia were observed included in *C. foliacea*. Differs from *C. foliacea* by its extremely narrow, thick lobes, and by the presence of zeorin in many specimens.

6. Cladonia arbuscula (Wallr.) Flot. [subsp. arbuscula]

in Wendt, Thermen Warmbrunn: 94 (1839). – *Patellaria foliacea* var. *arbuscula* Wallr., Naturgesch. Säulchen-Flecht.: 169 (1829). – Type: Germany, Thuringia (Thüringen), Nordhausen, Wallroth Tafel 261 (STR lectotype, Ruoss & Ahti, Nova Hedwigia 41: 151, 1985).

Syn. *Cladina arbuscula* (Wallr.) Hale & W.C.Culb., *Cladina arbuscula* subsp. *squarrosa* (Wallr.) Burgaz, *Cladonia arbuscula* subsp. *beringiana* Ahti, *Cladina arbuscula* subsp. *beringiana* (Ahti) N.S.Golubk., *Cladonia squarrosa* (Wallr.) Flot., *Cladonia arbuscula* subsp. *squarrosa* (Wallr.) Ruoss, *Cladina arbuscula* subsp. *squarrosa* (Wallr.) Burgaz, *Cladonia sylvatica* (‘*silvatica´*) auct.

D: gulhvid rensdyrlav **F:** valkoporonjäkälä **I:** hreindýrakrókar **N:** lys reinlav **S:** gulvit renlav

Literature. Ahti 1961: 101–109; Luonnon Tutkija 66: 38–39 (1962); Luonnon Tutkija 92: 148–149 (1988); Huovinen & Ahti, Ann. Bot. Fenn. 23: 101–103 (1986); Myllys et al., Molec. Phylogen. Evol. 27: 58–69; Piercey-Normore et al., Botany 88: 397–408 (2010); Robertson & Piercey-Normore, Lichenologist 39: 69–82; Ruoss, Bot. Helvet. 97: 239–263 (1987); Herzogia 8: 125–136 (1989); Ruoss & Ahti, Nova Hedwigia 41: 147–158 (1985); Lichenologist 21: 33–35 (1989).

Figs. Ahti 1962: 39; Galløe 1954: pls 10, 12–13, 15–17; Hansen & Andersen 1995: 23; Holien & Tønsberg 2006: 81; Hinds & Hinds 2007: 163; Moberg & Holmåsen 1990: 148; Ruoss & Ahti 1985: Abb. 1 (*C. arbuscula* s. str. =psoromic

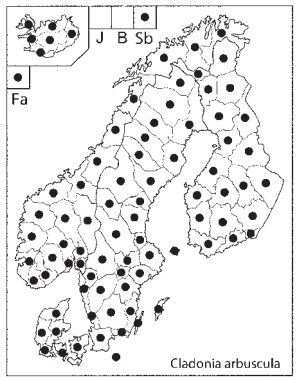
acid chemotype), Abb. 2 (as *C. arbuscula* subsp. *squarrosa*); Stenroos et al. 2011: 116; Wirth 1995: 294.

PRIMARY THALLUS crustose, evanescent. PODETIA to 7–12 cm tall, yellowish grey, necrotic bases whitish grey; much branched, branching pattern anisotomic, predominantly trichotomic (40–60%) and tetrachotomtc, less dichotomic, main axis distinct, often robust, 0.7–1.5 mm thick, axils open or closed, apical branchlets usually forming a broad, dense head, with unilaterally falcate (combed) branchlets. Surface ecorticate but rather compact, often shallowly verruculose, maculate, esorediate, esquamose. APOTHECIA uncommon, in groups at branch tips, dark brown, subspherical, very small (0.5–1 mm diam.). PYCNIDIA frequent, subcylindrical to ovoid, containing hyaline slime.

Chemistry. K–, P+ orange red, rarely deep yellow or P–, KC+ yellow, UV–. Three major chemotypes: 1) (+) Usnic, (+)isousnic, psoromic, and 2'-*O*-demethylpsoromic acids; 2) (+)usnic acid, (+)isousnic acid, fumarprotocetraric acid complex (incl. succinprotocetraric acid); 3) (+)usnic and (+)isousnic acid only. Chemotype 1 is represented by a single collection (Sweden: Uppsala) from the Nordic countries (and is present in the German type specimen of *Cladonia arbuscula*), while chemotype 2 is the dominant one. Chemotype 3 has been reported from scattered specimens in Europe, but its real frequency is not known (common in the interior of Canada, for instance). Very rarely usnic acid is absent (known from Uusimaa, Finland, at least). Traces of ursolic acid, probably often pseudonorrangiformic acid, and other unknown fatty acids and unidentified minor compounds are also present.

Habitat. A dominant or codominant lichen in pine-lichen woodlands and on thin soil over rock outcrops in southern and central parts of Fennoscandia, common but less abundant in more northern areas, also in lichen-rich bogs and coastal or alpine heaths. In addition colonizing road banks and other, open disturbed areas.

Distribution. Common in most of the area but absent from the extreme alpine or arctic regions. Very rare in Svalbard. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Gr. Fa. I:** *ISu IVe IMi IAu INv INo*. **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *Sb*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Temperate to arctic/antarctic. Europe, Asia, North America, southern South America.



Note. The variability of this species has caused taxonomic problems, which are still not fully understood. In his intensive study Ruoss (1987) recognized three subspecies in Europe. He restricted subsp. *arbuscula* for the psoromic acid-containing variant (possibly also deviating in branching system; mainly known from the SW Alps in Switzerland and Italy, also Sweden, Scotland and China), but here that variant is united with the dominant European subspecies which was called subsp. *squarrosa* by Ruoss. No DNA data to clarify the position of the psoromic acid variant is available, however. Ahti (1961) placed the populations in East Asia and western North America into subsp. *beringiana*. Recent DNA analyses by Piercey-Normore et al. (2010) do not support its segregation, and therefore subsp. *beringiana* and subsp. *squarrosa* are united (but if recognized, subsp. *beringiana* is the older name at subspecies level!). A third subspecies recognized by Ruoss, subsp. *mitis,* is provisionally here again recognized as a distinct species, although there are still unresolved morphological and molecular problems concerning its taxonomic position (see under *C. mitis*). Still the present taxon can be called subsp. *arbuscula*, because there are other subspecies recognized in Latin America and Australasia, which still await molecular studies to clarify their position. *C. mitis* is a common associate of *C. arbuscula* in vegetation in the Nordic countries, and they are traditionally recognized by their P reaction: *C. mitis* reacts P–, while *C. arbuscula* is P+ orange red. As shown by Ruoss (1987), this reaction is not fully reliable, although in by far most cases fully sufficient for separation of the taxa. With experience they can also be recognized by morphology (*C. arbuscula* is more robust and has denser, unilaterally deflexed top branchlets etc.), but not always, and there are also apparent intermediates (like "hybrids"). The two taxa also show considerably different ecology and distri-

bution (see under *C. mitis*), and therefore they are recognized here as distinct species. *C. arbuscula* is quite variable in DNA profiles and may well be interpreted as a complex of cryptic species. Then *C. mitis* would be just one of them but usually also morphologically distinguishable.

Cladonia arbuscula is commercially collected in small amounts for ornamental purposes. It is also one of the major forage lichens for domesticated and wild reindeer.

7. Cladonia asahinae J.W.Thomson

J. Jap. Bot. 51: 361 (1977, ’1976’). – Type: U.S.A., Washington, Skagit Co., Fidalgo Island, Mt. Erie S of Anacortes, 1969 Thomson 16296 (WIS holotype).

F: ukontorvijäkälä **I:** duftbikar **N:** kystbrunbeger **S:** Asahinas bägarlav

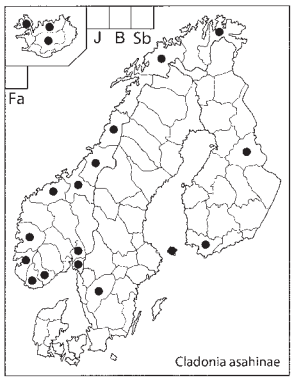
Literature. Brodo & Ahti, Canad. J. Bot. 74: 1153–1155 (1996); Holien & Tønsberg, Gunneria 51: 11–13 (1985); Huovinen et al., Bibl. Lichenol. 38: 211–222 (1990); Kowalewska et al., Herzogia 21: 63 (2008); Stenroos et al. 2002: 246.

Figs. Brodo et al. 2001: 238; Burgaz & Ahti 2009: 33; Holien & Tønsberg 1985: 12; Krog et al. 1994: 146; Stenroos et al. 2011: 117; Thomson, J. Jap. Bot. 51: 361 (1977).

Primary thallus squamulose, persistent but inconspicuous, consisting of 1–3 mm long, roundish squamules. Podetia 1.5–3 cm tall, dark green to browned, at base reddish brown, not melanotic, simple, scyphose; scyphi gradually flaring, with some marginal proliferations. Surface rugulose, areolate, areolae turn into microsquamules, especially on basal stalk of podetia, higher up granulose to sorediate, inside scyphi clearly sorediate, cup margins often bare, whitish to brownish. Apothecia rare, brown. Pycnidia at scyphus margins, ovoid, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex, rangiformic and norrangiformic acids; in western North America also a chemotype (including the type specimen) with lichesterinic and protolichesterinic acids, or another chemotype with only the fumarprotocetraric acid complex.

Habitat. On acidic humus on rocks, also on more mesic sites, occasionally on lignum, but ecology poorly known.



Distribution. Apparently rather common in coastal Norway and absent from most of the interior, but otherwise the distribution very insufficiently known. **F:** *A V Kn.* **I:** *IMi INv INo.* **N:** Øf *Ak AA VA Ro Ho MR ST NT SNo Tr ØFi.* **S:** *Vg.* Western and Central Europe, western Siberia (rare), western North America, Argentina, Chile, Antarctic, probably with oceanic tendencies.

Note. This species is a member of the *C. chlorophaea* complex, but not often recognized. It seems to have subtle morphological tendencies to distinguish it from *C. chlorophaea* and *C. pyxidata* but definite identification requires analysis of secondary metabolites or DNA. The common occurrence of squamules at base of podetia is one of its characteristic features.

8. Cladonia azorica Ahti

Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo 32(1): 36 (1961). – Type: Azores, Pico, da Cunha & Sobrinho (LISU holotype).

Syn. *Cladina azorica* (Ahti) Ahti

I: hreistur-broddar, mýrakrókar

Literature. Ahti 1961: 36; 1984: 32; Huovinen & Ahti, Ann. Bot. Fenn. 23: 95, 98 (1986); Orange, Lichenologist 25: 105–114 (1993).

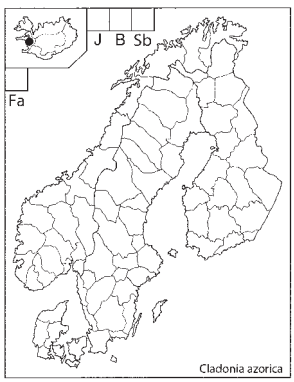
Figs. Ahti 1961: pl. 4; Orange 1993: 106, 108.

Primary thallus not observed, presumably crustose. Podetia to 10 cm tall, greyish green to whitish or pale grey, somewhat browned to bluish grey at apices, not melanotic at base, densely branched, but hardly forming rounded heads, branching type fairly irregularly isotomic or weakly anisotomic dichotomy and trichotomy, tetrachotomy uncommon, irregular main axes often distinguishable, axils closed, apical tips rather delicate, erect or deflexed; scyphi absent. Surface of podetia ecorticate, arachnoid, smooth but loose, verruculose towards base, easily disintegrating. Apothecia very small, brown. Pycnidia at tips of podetia, cylindrical, containing hyaline slime.

Chemistry. K–, P+ orange red, UV+ white. Two chemotypes: 1) Usnic acid, fumarprotocetraric acid complex, perlatolic acid; 2) Perlatolic acid, fumarprotocetraric acid complex. The latter chemotype only known from the British Isles (where it is the common one).

Habitat. In maritime heaths, coastal bogs and other humid, open, lowland locations.

Distribution. Rare, only in coastal Iceland (three localities). **I:** *IVe* (Mýrasýsla). Common in the Azores, also Ireland, England, Wales, Scotland and Iceland. Oceanic.



Note. Very close to *C. portentosa*, but distinguished by the production of fumarprotocetraric acid (P+ red) in addition to perlatolic acid. The identity of the Azorean and the more northern populations still needs confirmation. An earlier report of the presence of red slime in pycnidia is erroneous. Orange (1993) reported special features also in the wall of the pycnidia.

9. Cladonia bacilliformis (Nyl.) Sarnth.

Österr. Bot. Z. 46: 264 (1896). – *Cladonia carneola* var. *bacilliformis* Nyl., Syn. Meth. Lich. 1(2): 201 (1860). – Type: Finland, Uusimaa, Helsingfors (Helsinki), 1858 Nylander (H holotype).

F: sauvatorvijäkälä **N:** morknelav **S:** smal bägarlav

Literature. Ahti, Lichenologist 12: 127 (1980); Ahti & Stenroos, Bot. Complut. 35: 32 (2012); Hasselrot, Acta Phytogeogr. Suec. 33: 37–40, 125–127, fig. 9 (1953); Litterski & Ahti 2004: 208, 226; Timdal, Graphis Scripta 2: 125–127 (1989); Vainio 1894: 428–431; 1922: 121–123.

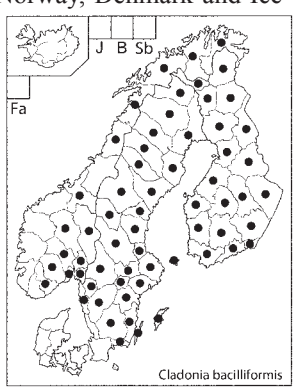
Figs. Carlin 1981: fig. 4B, 4C; Krog et al. 1994: 148; Randlane et al. 2011: 87; Rikkinen 2008: 11; Stenroos et al. 2011: 118.

Primary thallus squamulose, inconspicuous, evanescent. Podetia 0.5–2.5 cm tall, yellowish green, not melanotic at base, erect, usually unbranched, tips at first acuminate, but scyphose when mature; scyphi narrow, 0.3–1 mm wide, margin somewhat dentate. Surface finely sorediate almost throughout, only at the very base slightly corticate. Apothecia infrequent, on scyphus margins, ochraceous, forming compound discs ca 1 mm wide. Pycnidia common at tips of podetia, usually cylindrical, often stipitate, containing hyaline slime.

Chemistry. K–, P–, UV–. Usnic, barbatic and 4–*O*-demethylbarbatic acids. Rhodocladonic acid is produced in red spots caused by mite browsing (cf. *C. norwegica*), though not present in apothecia.

Habitat. On rotten conifer or birch wood, more rarely on soil in northern lichen woodlands or on thin soil over rock outcrops. Typically on sawn surface or barkless sides of old stumps, also in managed forests.

Distribution. Common in northern boreal forests, decreasing southward, rare in hemiboreal and temperate areas, not in coastal SW Norway, Denmark and Iceland. Scarce above timberline. **F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL*. **N:** *Øf Ak He Op Bu Vf Te AA ST SNo NNo Tr VFi ØFi*. **S:** *Bl Öl Gtl Klm SmI Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Circumpolar, mainly boreal, with continental tendencies. Europe, Asia, North America, southern South America.



Note. Recorded from Greenland but all the specimens seen were misidentified.

10. Cladonia bellidiflora (Ach.) Schaer.

Lich. Helv. Spic. 1(1): 21 (1823). – *Lichen bellidiflorus* Ach., Lichenogr. Suec. Prodr. 194 (1799; '1798'). – Type: Sweden (H-ACH 1569A lectotype, Ahti, Regnum Veg. 78: 68, 1993).

Syn. *Cladonia hookeri* Tuck.

D: pragt-bægerlav **F:** komeatorvijäkälä **I:** hreisturbroddar **N:** blomsterlav **S:** blombägarlav

Red-listed in: **D**

Literature. Brodo & Ahti, Canad. J. Bot. 74: 1155–1156 (1996); Hasselrot, Acta Phytogeogr. Suec. 33: 40–43, 127–129, fig. 10 (1953); Litterski & Ahti 2004: 208–209, 226; Vainio 1922: 39–40.

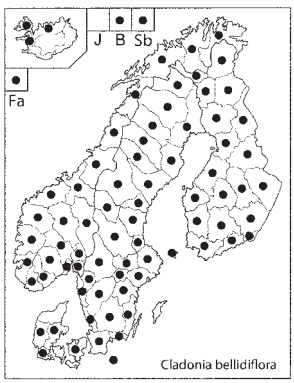
Figs. Brodo et al. 2001: 240; Galløe 1954: pls 64–66; Hansen & Andersen 1995: 25; Holien & Tønsberg 2006: 84; Krog et al. 1994: 92; Moberg & Holmåsen 1990: 137; Osyczka 2006: 213; Stenroos et al. 2011: 117; Wirth 1995: 316.

PRIMARY THALLUS squamulose, ± persistent, squamules to 8(–12) mm long, 4(–7) mm wide. PODETIA yellowish green, necrotic bases turning orange, 3–8 cm tall, little branched, usually ascyphose but scyphi sometimes present, often irregular, narrow, scarce (absent in Svalbard). Surface corticate but often disrupted, usually densely covered by 1–2 mm long squamules. APOTHECIA common, red, at tips or margins of scyphi, often large (to 3 mm). PYCNIDIA common, at subulate tips or scyphus margins, pyriform to ovoid, containing red slime.

Chemistry. K–, KC+ yellow, P–, UV+ white. Usnic (very rarely lacking), squamatic, and rhodocladonic acids, bellidiflorin (±). In North and South America also other chemotypes, with thamnolic or fumarprotocetraric acids, for instance.

Habitat. In tundra and mountain heaths, extending to northern boreal pine woodlands, further south mainly on humid rock outrops near coast or lakes, and on higher hilltops.

Distribution. Common in the mountains and in the northern boreal and arctic areas, southwards also in coastal areas, rare in the south, like in Skåne and Denmark. In Iceland common in the northwest, otherwise rare or absent. **D:** ØJy *VJy SJy Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IVe INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Bi Sb.* **S:** *Sk Bl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America, southern South America; with oceanic tendencies.



Note. Characterized by densely squamulose, yellowish podetia, which are frequently (but not so much in the south) fertile with showy, red apothecia.

11. **Cladonia borealis** S.Stenroos

Ann. Bot. Fenn. 26: 160 (1989). – TYPE: Finland, Etelä-Häme, Ylöjärvi, Pengonpohja, 1905 Sola (H holotype).

D: nordlig bægerlav **F:** kalliotorvijäkälä **I:** skarlatbikar **N:** glattrødbeger **S:** nordlig kochenillav

Literature. Ihlen & Tønsberg, Graphis Scripta 6: 77–79 (1994); Stenroos, Ann. Bot. Fenn. 26: 160–163, 312 (1989); Stenroos et al. 2002: 247.

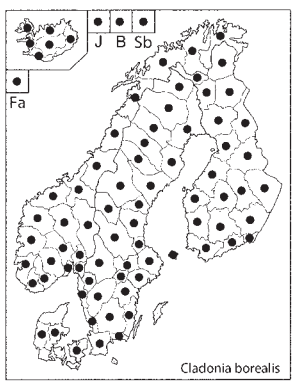
Figs. Brodo et al. 2001: 241; Hansen & Andersen 1995: 25; van Herk & Aptroot 2004: 129; Osyczka 2006: 213; Stenroos et al. 2011: 119; Wirth 1995: 299.

PRIMARY THALLUS squamulose, persistent, squamules often 5 mm long. PODETIA 1–2(–3) cm tall, yellowish green, scyphose; scyphi to 6(–12) mm wide, usually simple, occasionally proliferating. Surface in lower part continuously corticate, upper part mainly areolate, often with downward oriented plates, not granulose but with age partially denuded; scyphi areolate inside. APOTHECIA common, red, on margins of scyphi, finally compound, to 3 mm diam. PYCNIDIA common, pyriform, containing red slime.

Chemistry. K–, KC+ yellow, P–, UV–. (+)Usnic acid (rarely absent), barbatic acid, usually 4–*O*-demethylbarbatic acid, rhodocladonic acid, often a fatty acid.

Habitat. On soil in arctic-alpine heaths, dry forests, on rock outcrops and boulder beds, on bare mineral soil but also on humus, more sparsely on peat or rotten wood.

Distribution. Common in most of the area, except for the extreme south, where scattered. Very common in Iceland and the Arctic islands. **D:** (*NJy*) *VJy ØJy Sjæ.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi*



IAu INv INo. **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *JM Bi Sb.* **S:** *Sk Bl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Arctic-temperate, circumpolar. Europe, Asia, North America, South America, New Zealand, Antarctic.

Note. For a long time not distinguished from *C. coccifera* but regarded as *C. coccifera* s. str. In most of the area it seems to be more frequent than *C. coccifera* but they often grow together. In the herbarium this species never produces cystal needles on the surface, and thus even poor, older specimens are distinguishable from *C. coccifera*, *C. diversa* and *C. pleurota*. In most cases also fresh specimens are distinguishable by more smoothly corticate podetia, which are frequently fertile, but chemistry is useful for definite identification. According to a phylogenetic analysis (Stenroos et al. 2002) *C. borealis* is not very closely related to *C. coccifera* and *C. pleurota.*

12. Cladonia botrytes (K.G.Hagen) Willd.

Fl. Berol. Prodr.: 365 (1787). – *Lichen botrytes* K.G.Hagen, Tent. Hist. Lich.: 121, t. 2, f. 9 (1792). – Type: [Poland], "in silua Wilky [Wilke] et prope Tieffensee [Tiefensee]", Hagen; icon in Hagen, Tent. Hist. Lich. (1782): t. 2, fig. 9**,** first specimen from left, lectotype, Ahti, Regnum Veg. 128: 69 (1993); Poland, Bydgoszcz District, 30 km NE of Chojnice, near Wiele, Bory Tucholskie, 1990 Faltynowicz & Miadlikowska in Faltynowicz & Miadlikowska, Lich.Polon. Exs. no. 6 (H epitype, Ahti & Stenroos, Nordic Lichen Flora 5: 91, 2013.

D: træstub-bægerlav **F:** nappitorvijäkälä **N:** stubbelav **S:** stubblav

Red-listed in: **D**

Literature. Jahns & Beltman, Lichenologist 5: 357, 360, 362 (1973); Litterski, Herzogia 9: 153, 164 (1992); Litterski & Ahti 2004: 209, 227; Stenroos et al. 2002: 247, 258; Vainio 1922: 119–120.

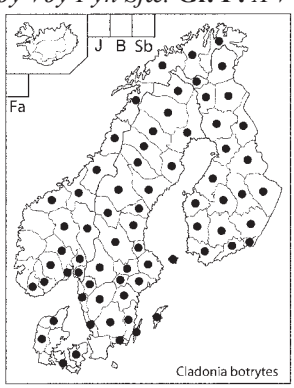
Figs. Galløe 1954: pls 189, 193, 194; Holien & Tønsberg 2006: 87; Moberg & Holmåsen 1990: 137; Rikkinen 2008: 173; Stenroos et al. 2011: 120; Thomson 1984: 114; Wirth 1995: 317.

Primary thallus squamulose, persistent, inconspicuous. Podetia to 2(–3) cm tall, 0.3–1.5 mm thick, yellowish grey, base slightly melanotic, unbranched or moderately branched in upper parts, axils closed, tips always with apothecia; scyphi absent but sometimes with pseudoscyphi formed by whorls of branchlets. Surface of podetia continuously corticate, areolate to verruculose. Rarely squamulose. Apothecia ochraceous to pale brown, always present, small (0.5–1.5 mm diam.), soon aggregated. Pycnidia on primary squamules, more rarely laterally on young podetia, shortly cylindrical to turbinate, constricted at base, containing hyaline slime.

Chemistry. K–, P–, KC+ or KC–, UV–. (+)Usnic acid (often in small amount), barbatic and 4–*O*-demethylbarbatic acids, occasionally 3–*α*-hydroxybarbatic acid and three minor unknown substances.

Habitat Usually on wood, typically on tops of sawn stumps, primarily pine, but also on bark, dead twigs on ground and on roofs of old buildings. Less common on dying mosses and humus-rich soil, but seems to be surprisingly tolerant on soil in moderately polluted industrial environments.

Distribution. Common throughout most of the forested regions, decreasing south of the southern boreal zone. Absent or rare on SW coast of Norway, also absent from Iceland. **D:** *NJy VJy Fyn Sjæ.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA VA MR ST NT SNo NNo Tr VFi ØFi*. **S:** *Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Widespread in boreal and northern temperate regions in Europe, Asia and North America. With continental tendencies.



Note. An easily recognized tiny lichen due to its constant production of ochraceous apothecia at tips of little branched, esorediate podetia. DNA studies (Stenroos 2002) have confirmed that it belongs to the group of red-fruited species.

13. **Cladonia caespiticia** (Pers.) Flörke

De Cladon.: 8 (1828). – *Baeomyces caespiticius* Pers., Ann. Bot. (Usteri) 7: 155 (1794 '1793'). – Type: No locality, Persoon (H-ACH 1722A lectotype, Ahti, Regnum Veg. 146: 69, 1993).

Syn. *Cladonia agariciformis* Arnold

D: tæppe-bægerlav **F:** murutorvijäkälä **N:** grynskjell **S:** flikbägarlav

Literature. Degelius, Acta Reg. Soc. Sci. Litt. Gothoburg. Bot. 2: 61 (1983, '1982'); Jahns et al., Ann. Bot. Fenn. 32: 39–40 (1995); Litterski & Ahti 2004: 209–210, 227; Stenroos et al. 2002: 246; Vainio 1894: 458–464; 1922: 70–71.

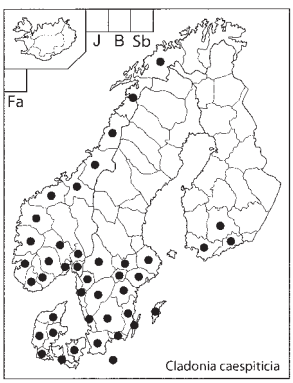
Figs. Brodo et al. 2001: 242; Galløe 1954: pls 109–109; Hale 1979: 386; van Herk & Aptroot 2004: 131; Hinds & Hinds 2007: 168; Randlane et al. 2011: 89; Stenroos et al. 2011: 120; Wirth 1995: 318.

Primary thallus squamulose, persistent, squamules dominating, in dense cushions, greenish to greyish, 2–10 mm long, somewhat elongate, crenulate. Podetia infrequent, very short (1–5 mm) or absent, ascyphose, always tipped by apothecia. Surface ecorticate, esorediate, rarely squamulose. Apothecia on tips of podetia or sessile on squamules, 0.7–3.5 mm diam., usually clearly peltate, dark brown. Pycnidia common, on primary squamules, ovoid to subglobose, constricted at base, containing hyaline slime.

Chemistry. K–, P+ (rapidly) red, UV–. Fumarprotocetraric acid complex.

Habitat. On mesic soil over earth banks in rich deciduous forests, also on trailsides or rock shelves in shaded forests.

Distribution. Common in Denmark, southern Sweden and along the Norwegian coasts (near sea level) to Møre & Romsdal, further north rare or overlooked. Very rare in Finland. Absent from the inland and northern regions, including the Arctic islands. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **F:** *V U EH.* **N:** *Øf Ak Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl.* Western Europe, Macaronesia, East Africa, Southwest and East Asia, eastern North America, and Brazil (rare). Oceanic, primarily temperate.



Note. If no apothecia are present, this species may be extremely difficult to recognize. Presence of pycnidia and the very fast P+ reaction may however give a clue. Some of the northern populations (e.g., on Vega Island; Degelius 1983) appear different, being small-lobed and very densely aggregated and often yellowish in colour. Their status needs further studies. In general, *C. caespiticia* seems to have no close relatives in Europe (Stenroos et al. 2002), but is phylogenetically in the vicinity of *C. cervicornis* and *C. foliacea*, for instance.

14. **Cladonia callosa** Delise ex Harm.

Lich. France 3: 326 (1907). – Type: France, Calvados, Nord-Falaise, Noron-L'Abbaye, Bruyères, L. de Brébisson in Malbranche, Lich. Normandie no. 355 (AUT lectotype, Deschâtres & Boissière, Bull. Soc. Linn. Provence 45: 287, 1994).

Syn. *Cladonia cervicornis* var. *myriocarpa* Delise ex Malbr., *Cladonia fragilissima* Østh. & P.James

D: skør bægerlav **N:** skjørbeger

Literature. Aptroot & Lumbsch, Herzogia 7: 243–245 (1985); Deschâtres & Boissière, Bull. Inform. Assoc. Franç. Lichénol. 19(1): 15–18 (1994a); Bull. Soc. Linn. Provence 45: 283–289(1994b); Litterski & Ahti 2004: 210, 228; Østhagen & James, Norweg. J. Bot. 24: 123–124 (1977); Paus, Graphis Scripta 6: 7–10 (1994); Tønsberg et al. 1996: 54–55; Timdal, Blyttia 40: 180 (1982);

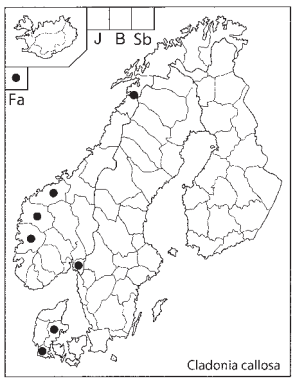
Figs. Deschâtres & Boissière 1994a: 17; 1994b: 286; van Herk & Aptroot 2004: 131; Krog et al. 1994: 157;

Primary thallus squamulose, persistent, usually dominant, squamules 1–5 mm long, 1 mm wide, incised, fragile. Podetia infrequent, to 1.5 mm tall, greyish green, barkless areas and at base melanotic; unbranched or little branched near top, producing irregular, narrow scyphi, which are proliferating from margins. Surface corticate, with cracks and holes, in part disintegrating. Stereome strong but very fragile. Apothecia very rare and small, aggregated, pale to dark brown, pruinose. Pycnidia on basal squamules, short-stalked, cylindrical, containing hyaline slime.

Chemistry. K–, P–, UV+ bluish white. Grayanic acid, often with an additional fatty acid.

Habitat. In heaths, especially over bare soil in sand dunes (in Denmark earlier abundant on roofs made of sandy soil!), also on thin soil over coastal rocks at low altitudes (5–15 m) and even peat.

Distribution. In coastal areas, locally common. **D:** *SJy* ØJy. **Fa. N:** *Øf Ho SF MR NNo*. West European, strictly coastal, from Norway to France. Clearly oceanic.



Note. Exact distribution poorly known. Often sterile and then easily overlooked.

15. **Cladonia cariosa** (Ach.) Spreng.

Syst. Veg. 4(1): 272 (1827). – *Lichen cariosus* Ach., Lichenogr. Suec. Prodr.: 198 (1799, '1798'). – Type: Sweden (Suecia) (H-ACH 1577A lectotype, Stenroos et al., Fl. Criptog. Tierra del Fuego 13(7): 22, 1992).

Syn. *Cladonia pityrodes* Nyl., *Cladonia symphycarpodes* Nyl.

D: furet bægerlav **F:** törmätorvijäkälä **I:** netjubikar **N:** småtrevlelav **S:** rötbägarlav

Red-listed in: **D**

Literature. Bültmann & Lünterbusch, Abh. Westfal. Mus. Naturk. 70: 307–309 (2008); Culberson, Bryologist 72: 377–385 (1969); Culberson et al., Biblioth. Lichenol. 53: 43–52 (1993); Hansen & Ahti, Graphis Scripta 23: 59 (2011); Osyczka & Skubala, Nova Hedwigia 93: 363–373 (2011); Pino-Bodas et al., Lichenologist 44: 121–135 (2011).

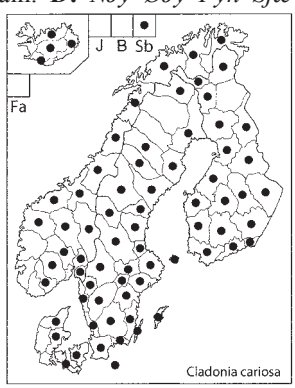
Figs. Brodo et al. 2001: 243; Carlin 1981: figs, 9B, 9D, 9E; Galløe 1954: pls 114–116; Pino-Bodas et al. 2011: figs 3A, 3B; Rikkinen 2008: 41; Stenroos 2005: 121; Türk et al. 2004: 50.

Primary thallus squamulose, persistent. Squamules small (1–2 mm long), often forming patches of crowded, sterile "crusts" of whitish colour. Podetia often scarce, sometimes abundant, 1–3 cm tall, slender, glaucous grey, not melanotic, somewhat angular and trabeculate, branched in upper parts, tips always bearing apothecia. Surface smooth to areolate, slightly pruinose. Apothecia common, brown, spherical to aggregate. Pycnidia on basal squamules or on tips of podetia, subglobose to ovoid, constricted at base, containing hyaline slime.

Chemistry. K+ yellow, P+ yellow or P–, UV–. Several chemotypes: 1) atranorin; 2) atranorin and fumarprotocetraric acid complex; 3) atranorin, norstictic and connorstictic acids, 4) atranorin, psoromic and conpsoromic acids. The chemotypes 1 to 4 often also have the accessory rangiformic and norrangiformic acids. The P reaction is normally dominated by yellow colour even if only atranorin (abundant) is present, so that the presence of the other acids is hardly distinguishable on the reaction alone. In our area the chemotypes 1 and 2, often with rangiformic acid, seem to be most frequent.

Habitat. Largely on man-made habitats along roads, railway embankments, field margins, recent burns, abandoned gravel pits, grasslands, often in trampled places. In fully natural habitats mainly on calcareous rocks and soil. In general, avoiding very acidic soil, and often forming rather ephemeral, sterile colonies.

Distribution. Infrequent over most of the area, in calcareous areas more common but in some provinces even rare. Scattered in Denmark. All the Greenland records somewhat uncertain. **D:** *NJy ØJy Fyn Sjæ Brn*. **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL EnL InL*. **I:** *ISu IMi IAu INo.* **N:** *Øf Ak He Op Bu Te AA SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *Sb*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL TL*. Europe, Macaronesia, Asia (incl. the Himalayas), North America (south to N. Mexico), Argentina and Chile. In the Northern Hemisphere temperate to arctic, circumpolar.



Note. Especially in the Arctic the *C. cariosa* group is very complicated, since different chemotypes and

similar species often occur intermixed and in stunted condition in wind-swept heath communities, as described by Bültmann & Lünterbusch (2008). We have tried to reclassify their chemically recognized entities so that much of their *C. cariosa* is included in *C. symphycarpa* or an undescribed species. The chemotype 5 of Osyczka & Skubala (2011) was referred to *C. scotteri. C. galindezii* can also be extremely similar. In a phylogenetic analysis (Pino-Bodas et al. 2011) *C. cariosa* appeared to be closely related to *C. symphycarpa* and *C. acuminata.*

16. Cladonia carneola (Fr.) Fr.

Lichenogr. Eur. Reform.: 233 (1831). – *Cenomyce carneola* Fr., Sched. Crit. Lich. Suec. 3–4: 23 (1825). – Type: Sweden, Fries, Lich. Suec. Exs. No. 115 (UPS lectotype, Stenroos et al., Fl. Criptog. Tierra del Fuego 13(7): 44, 1992).

D: gulgrøn bægerlav **F:** kruunutorvijäkälä **I:** tannibikar **N:** bleikbeger **S:** vaxgul bägarlav

Red-listed in: **D**

Literature. Stenroos, Ann. Bot. Fenn. 26: 165–167, 313 (1989); Stenroos et al. 2002: 247, 258; Vainio 1887: 420–427; 1922: 120–121.

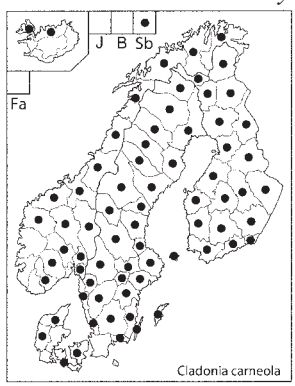
Figs. Brodo et al. 2001: 244; Galløe 1954: pls 188–192; Hansen & Andersen 1995: 26; Holien & Tønsberg 2006: 87; Krog et al. 1994: 150; Stenroos et al. 2011: 122.

Primary thallus squamulose, evanescent. Podetia to 2(–5) cm tall, pale greenish or even whitish yellow, not melanotic at base, broadly scyphose; scyphi single or successively proliferating once or twice, to 1 cm wide, margins usually regularly dentate. Surface of podetia farinose sorediate, but soredia tend to disintegrate with age, sometimes with corticate patches or scattered granules, occasionally with squamules at base. Stereome strong. Apothecia brown, infrequent, ochraceous, to 1.5 mm wide, stipitate. Pycnidia frequent, on marginal teeth of scyphi, doliiform or subcylindrical, containing hyaline slime.

Chemistry. K–, KC+ yellow, P–, UV–. Chemotypes: 1) usnic acid and zeorin; 2) usnic, barbatic and 4–*O*-demethylbarbatic acids and zeorin. Additional isousnic acid occasionally present and zeorin rarely absent. An unidentified fatty acid is also a common component. Chemotype 1 may be the only one in the Nordic countries, but the other one is known from the British Isles, for instance. Zeorin is deposited as crystal needles on surface in herbarium specimens.

Habitat. On humus in forest floor, often shaded, on rotting wood, on bare peat in bogs, on thin soil over rock outcrops, less frequent in open habitats.

Distribution. Common in the northern forested regions, decreasing southward and towards the alpine and arctic areas. Rare in Denmark and Iceland. **D:** *NJy VJy Fyn Sjæ.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *INv INo.* **N:** *Øf Ak He Op Bu Te AA SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia (S to Nepal), North America (S to Mexico), Argentina, Chile, Antarctic, perhaps New Zealand. In the Northern Hemisphere temperate to arctic, circumpolar.



Note. Without apothecia (brown) this species can be almost indistinguishable from the red-fruited *C. pleurota*, which sometimes has pale brown hymenial primordia. However, the soredia of *C. carneola* are generally finer and the scyphus margins characteristically dentate. A phylogenetic analysis (Stenroos et al. 2002) placed *C. carneola* clearly among the usually red-fruited species, but it is not very close to *C. pleurota.*

17. Cladonia cenotea (Ach.) Schaer.

Lich. Helv. Spic. 1(1): 35 (1823). – *Baeomyces cenoteus* Ach., Methodus: 345 (1803). – Type: Sweden (H-ACH 1572C lectotype, Ahti, Regnum Veg. 128: 71, 1993).

Syn. *Cladonia brachiata* (Fr.) Fr.

D: pudret bægerlav **F:** tuhkatorvijäkälä **N:** meltraktlav **S:** puderlav

Red-listed in: **D**

Literature. Anders 1928; Bulat & Dudoreva, Abstr., 12th Internatl. Baltic Conf. Mycol. Lichenol.: 135 (1993); Huovinen & Ahti, Ann. Bot. Fenn. 25: 374, 380 (1988); Pino-Bo-

das et al., Mycotaxon 113: 316 (2010); Stenroos et al. 2002: 247, 259; Vainio 1887: 471–484; 1922: 71–73.

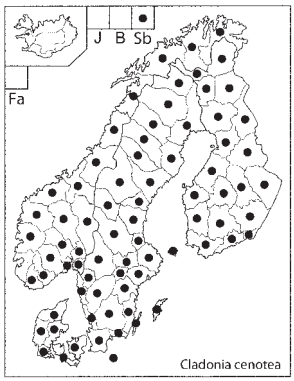
Figs. Brodo et al. 2001: 245; Galløe 1954: pls 101–104; Hansen & Andersen 1995: 26; Holien & Tønsberg 2006: 80; Moberg & Holmåsen 1990: 140; Randlane et al. 2011: 91; Rikkinen 2008: 173; Stenroos et al. 2011: 123; Wirth 1995: 319.

PRIMARY THALLUS squamulose, inconspicuous, persistent or evanescent, finely divided, esorediate or sparsely sorediate below. PODETIA 1–6(–10) cm tall, greenish, whitish or brownish grey, rarely melanotic at base, slender to stoutish in part, unbranched or very little branched, axils open, forming distinct, gaping funnels, which are proliferating from margins, funnels narrow to broad (1–8 mm), margins slightly incurved, dentate. Surface corticate at base but mostly covered by abundant, pale, farinose soredia. Stereome not very strong. APOTHECIA infrequent, small (0.5–1 mm) but aggregated, usually pale brown. PYCNIDIA frequent, on funnel margins, usually cylindrical, containing red slime.

Chemistry. K–, P–, UV+ white. Squamatic acid, barbatic acid (mainly in apothecia) often together with an unknown substance, occasionally also traces of thamnolic acid.

Habitat. Usually on decaying wood or bare peat in bogs, less frequent on humus in forest floor or on mineral soil habitats, such as roadsides and rock outcrops.

Distribution. Widespread and common in the forested zones, less frequent in Denmark and Greenland, very rare in Svalbard, absent from Iceland and the Færoe Is. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, East Africa, Asia (S to Pakistan), North America (S to West Virginia, Arizona), Argentina, Chile.



Note. Recognized by clearly open axils, somewhat dilated scyphus-like funnels and abundant cover of farinose soredia. Preliminary molecular studies indicate that the species is not very uniform. Occasionally (in bogs) it develops tall, slender morphs which are very difficult to distinguish from *C. glauca.*

18. *Cladonia cervicornis* (Ach.) Flot.

Jahresber. Schles. Ges. Vaterl. Cult. 27: 105 (1849). – *Lichen cervicornis* Ach., Lichenogr. Suec. Prodr.: 198 (1799, '1798'). – TYPE: Sweden (Suecia) (H-ACH 1672B–C lectotype, Ahti, Regnum Veg. 121: 71, 1993).

Syn. *Cladonia cervicornis* subsp. *cervicornis* (in Ahti 1980), *Cladonia sobolifera* (Delise) Nyl., *Cladonia verticillata* var. *cervicornis* (Ach.) Flörke,

D: gevir-bægerlav **F:** mätästorvijäkälä **I:** tildurbikar **N:** etasjebeger **S:** hjorthornslav

Literature. Ahti, Lichenologist 12: 125–127 (1980); Biblioth. Lichenol. 96: 17 (2007); van Herk & Aptroot, Biblioth. Lichenol. 86: 193–203 (2003); Pino-Bodas et al., Syst. Biodiversity 8: 575–586 (2010); Sandstede 1931: 385–396.

Figs. Burgaz & Ahti 2009: 37; Carlin 1981: fig. 10G; Galløe 1954: 123, 128, 129; van Herk & Aptroot 2003: 133; Krog et al. 1994: 151; Stenroos et al. 2011: 123.

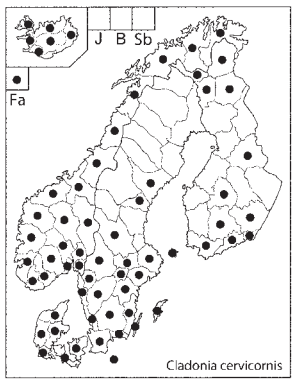
PRIMARY THALLUS squamulose, conspicuous, persistent, squamules to 2 cm long, deeply incised, forming 5–10 cm wide cushions with many erect, upcurled squamules, below soon becoming bluish grey and even brown. PODETIA often few or little developed, to 2(–5) cm tall, 0.5–1 mm thick, greyish green, often in part embrowned, necrotic base somewhat melanotic, scyphose; scyphi centrally (rarely also marginally) proliferating, 1–6 mm diam., successively forming 1–3(–7) tiers, often irregular in shape, little perforated. Surface smoothly corticate, slightly arachnoid (dull), maculate and areolate, sometimes squamulose, especially at scyphus magins. APOTHECIA uncommon, small, brown. PYCNIDIA common, on margins or centres of apical of scyphi, sessile, subglobose to ovoid, scarcely constricted at base, containing hyaline slime.

Chemistry. K–, P+ orange red, UV–. Fumarprotocetraric acid complex, in Norway (and Britain, Spain) rarely (Øf, Bu Ho) with additional atranorin, often also an unknown substance.

Habitat. Open rock outcrops, often on seepage tracks,

in coastal heaths also on soil, both acidic and calcareous.

Distribution. Very common along the oceanic coastal areas in Denmark, the Færoe Is., Iceland, southern Sweden and Norway, but extends to the Baltic coasts as well. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK EH ES PH Kn KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Mpd Ång.* Western and southern Europe, Macaronesia, North Africa, Near East, presence in North America (excl. Greenland) uncertain due to taxonomic problems.



Note. Many records from Lapland and Greenland are based on *C. macrophyllodes*, which has larger squamules, with a pale bluish-grey cast and contains atranorin in abundance. In general, the status and delimitation of *C. cervicornis* is problematic. It can be very difficult to distinguish from *C. verticillata*, which has taller podetia and is less squamulose. *C. pulvinata* (P+ yellow) and *C. krogiana* (P–) are also very similar but are chemically different. The specific status of *C. pulvinata* – earlier regarded as a psoromic acid chemotype – is supported by a molecular analysis. *C. subcervicornis* has larger squamules with black base.

19. Cladonia chlorophaea (Flörke ex Sommerf.) Spreng.

Syst. Veg. 4(1): 273 (1827), *nom. cons. prop.* – *Cenomyce chlorophaea* Flörke ex Sommerf., Suppl. Fl. Lapp.: 130 (1826). – Type: a conserved type under preparation (see Appendix).

Syn. *Cladonia pyxidata* var. *chlorophaea* (Flörke ex Sommerf.) Flörke, *Cladonia pyxidata* subsp. *chlorophaea* (Flörke ex Sommerf.) Arnold

D: brungrøn bægerlav **F:** jauhetorvijäkälä **I:** álfabikar **N:** pulverbrunbeger **S:** brun bägarlav

Literature. Ahti, Ann. Bot. Fenn. 3: 381–382 (1966); DePriest, Bryologist 96: 555–563 (1993); Huovinen et al., Biblioth. Lichenol. 38: 213–214 (1990); Jahns et al., Ber. Deutsch. Bot. Ges. 95: 316–322 (1982); Kowalewska et al., Herzogia 21: 61–78 (2008); Oksanen, Biblioth. Lichenol. 25: 429–432 (1987).

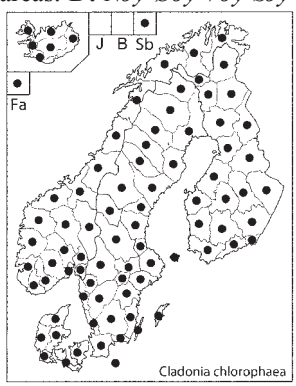
Figs. Brodo et al. 2001: 248; van Herk & Aptroot 2004: 135; Moberg & Holmåsen 1990: 142 (as *C. fimbriata*); Randlane 2011: 93; Stenroos et al. 2011: 124; Wirth 1995: 307.

Primary thallus squamulose, squamules persistent, inconspicuous. Podetia to 4 cm tall, greenish grey, often somewhat browned, scyphose; scyphi to 1.2 cm wide, repeatedly (up to three times) proliferating from the margins. Surface of podetia subcontinuously corticate at base, granulose sorediate in upper parts and within scyphi, soredia mixed with corticate granules and microsquamules, surface becoming denuded with age, larger podetial squamules common. Apothecia rather common, brown. Pycnidia common, on scyphal margins, ovoid to ampullaceous, often constricted at base, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex, often including quaesitic acid and unknown fatty acids. In other areas rarely with atranorin or physodalic acid.

Habitat. On detritus, slightly acid soil, rotting wood, tree bases and trunks, and mossy rocks.

Distribution. Common throughout the area, from lowlands to alpine and arctic areas. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Widespread on all continents, also Antarctic, sometimes the only *Cladonia* in arid regions, absent from tropical low elevations.



Note. The lectotype proposed by Ahti (1993) represents another species and therefore the basionym

Cenomyce chlorophaea needs conservation, but the problem has not yet been fully clarified. In a wide sense *C. chlorophaea* includes several species which are here treated separately, although many of them are ambiguous, possibly chemotypes. Their taxonomy and nomenclature are under study. *C. chlorophaea* s. str. is very close to *C. pyxidata*, so that there are many specimens which may be almost impossible to identify. *C. chlorophaea* is generally regarded to produce soredia on the scyphi, but usually the soredioid structures are rather to be called granules (which easily fall off). See also notes under *C. pyxidata*.

20. Cladonia ciliata Stirt.

Scott. Naturalist (Perth) 9: 308 (1888). – Type: Scotland, Kirkcudbright, New Galloway, Knocknalling Wood, 1884 McAndrew 64 (GLAM holotype).

20a. f. ciliata

Syn. *Cladina ciliata* (Stirt.) Trass, *Cladonia leucophaea* Abbayes, *Cladonia tenuis* var. *leucophaea* (Abbayes) Ahti, *Cladina leucophaea* (Abbayes) Mong., *Cladonia laxiuscula* (Delise) Sandst. (non auct.)

Red-listed in: **D**

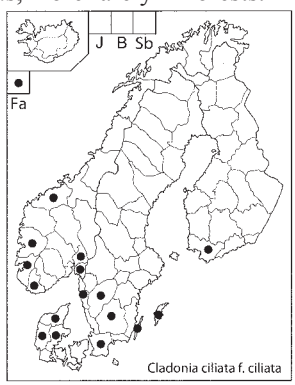
Literature. Ahti, Lichenologist 3: 85 (1965); 1961: 61–63, 108; Luonnon Tutkija 66: 38 (1962); Ann. Bot. Fenn. 15: 7–8 (1978); 1984: 42; Huovinen & Ahti, Ann. Bot. Fenn. 23: 99, 101 (1986); Litterski & Ahti 2004: 210–211, 228; Ramaut et al., Bull. Jard. Bot. État Bruxelles 36: 399–414 (1966).

Figs. Ahti 1961: pl. 17.

Primary thallus crustose, inconspicuous, rarely seen. Podetia 4–9(–15) cm tall, 0.5–0.8 mm thick, ash-grey to bluish grey, usually heavily browned (even blackish), especially the top branchlets, which are also strongly unilaterally deflexed, pale toward base, individual podetia usually very slender, regularly branched, with 3–5(–10) mm long internodes, branching type anisotomic dichotomous (c. 75%), sometimes trichotomous, axils mainly closed, extreme tips tapering, subulate. Surface ecorticate, somewhat verruculose, maculate, ascyphose, esorediate, esquamose. Apothecia common, brown, spherical, in groups on apical branchlets. Pycnidia common, usually cylindrical, containing red slime.

Chemistry. K–, P+ red, KC–, UV–. Fumarprotocetraric acid complex.

Habitat. Coastal heathlands, more rarely in forests.



Distribution. **D:** *NJy ØJy VJy.* **Fa. F:** *V.* **N:** *Øf Ak VA Ro Ho MR.* **S:** *Sk Öl Gtl SmI Bh Vg.* Western Europe (in east to Poland), western North America, cold temperate, oceanic.

Note. This is actually the usnic acid-deficient strain of *C. ciliata*. In the Nordic countries it is much less widespread than f. *flavicans*. It can usually be recognized by grey colour and strongly browned tips, although shade morphs are impossible to identify without TLC. In mixed stands the two chemotypes may appear very different, and therefore they were earlier recognized as distinct species, but are not even true geographic races (just visible minor chemotypes in our opinion) and are therefore not recognized as varieties. Forma *ciliata* may locally be the dominant chemotype, especially in highly oceanic regions. It can be difficult to distinguish f. *ciliata* from *C. rangiferina*, which is less dichotomous, more robust, has cottony surface on young branchlets, and contains atranorin (K+ yellow).

20b. f. flavicans (Flörke) Ahti & DePriest

Mycotaxon 78: 501 (2001). – *Cladonia rangiferina* f. *flavicans* Flörke, De Cladon.: 164 (1828). –Type: Without locality, Flörke in Herb. Persoon (L neotype, Ahti & Stenroos, Nordic Lichen Flora 5: 91, 2013).

Syn. *Cladonia tenuis* (Flörke) Harm., *Cladonia ciliata* f. *tenuis* (Flörke) Ahti, *Cladonia ciliata* var. *tenuis* (Flörke) Ahti, *Cladina tenuis* (Flörke) de Lesd., *Cladonia laxiuscula* (Delise) Sandst. (non auct. plur.), *Cladonia tenuiformis* Ahti

D: spinkel rensdyrlav **F:** hentoporonjäkälä **I:** hárkrókar **N:** gaffelreinlav **S:** spenslig renlav

Literature. Ahti 1961: 57–61; Luonnon Tutkija 66: 36–38 (1962); Ann. Bot. Fenn. 15: 8 (1978), 1984: 42–43; Ahti & DePriest, Mycotaxon 78: 501 (2005); Huovinen & Ahti, Ann. Bot. Fenn. 23: 99–101 (1986).

Figs. Ahti 1961: pl. 16; Galløe 1954: pls 5–7; van Herk &

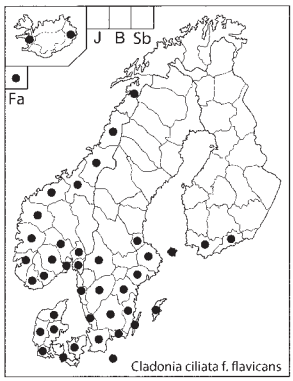
Aptroot 2004: 127; Hørnell et al. 2004: 43; Stenroos et al. 2011: 125; Wirth 1995: 297.

Like f. c*iliata*, but greenish yellow, apical parts embrowned, but rarely strongly blackish brown.

Chemistry. K–, P+ red, KC+ yellow, UV–. (+)Usnic and (+)isousnic acids, fumarprotocetraric acid complex.

Habitat. On rock outcrops or open heathlands, also in coastal forests, at low elevations.

Distribution. Common along Atlantic coasts in the Færoe Is., Denmark and Sweden, in Norway up to the Lofoten Is. In Finland almost only on islands in SW archipelago. Very rare in Iceland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. F:** *A V U.* **I:** *IVe IAu.* **N:** Øf Ak *Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Vg Ög Srm Vrm Upl Gst.* Western and southern Europe, Macaronesia, Turkey, Himalayas, East Asia, western North America, Newfoundland, southern boreal to warm temperate. Oceanic.



Note. This is the main chemotype of *C. ciliata*; see the discussion under f. *ciliata.*

21. Cladonia coccifera (L.) Willd.

Fl. Berol. Prodr.: 361 (1787). – *Lichen cocciferus* L., Sp. Pl.: 1151 (1753). – Type: Sine loco (LINN 1273.215 lectotype, Ahti, Regnum Veg. 128: 72, 1993; second-step lectotype, Jørgensen et al., Bot. J. Linn. Soc. 115: 374, 1994).

D: skarlagenrød bægerlav **F:** punatorvijäkälä **I:** kokkabikar **N:** grynrødbeger **S:** kochenillav

Literature. Ahti 2000: 187–188; Ihlen & Tønsberg, Graphis Scripta 6: 79 (1994); Stenroos, Ann. Bot. Fenn. 26: 162–164, 312 (1989); Stenroos et al. 2000: 247.

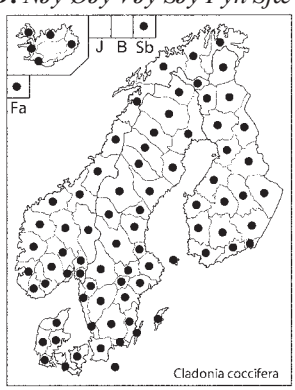
Figs. Galløe 1954: pls 49–54; van Herk & Aptroot 2004: 135; Hinds & Hinds 2007: 173; Holien & Tønsberg 2006: 84; Osyczka 2006: 219; Stenroos et al. 2011: 125.

Primary thallus squamulose, persistent, c. 10×5 mm, sparsely divided into roundish lobes, often becoming orange at dying base. Podetia to 3.5 cm tall, greenish, yellowish or whitish grey, usually with a single, 0.4–0.7(–1.5) cm wide scyphus, occasionally proliferating from scyphus margins to form another scyphus. Surface discontinuously areolate, uneven and somewhat granulose on upper parts, in herbaria (in about three years) developing numerous tiny (use microscope) cystal needles on surface. Apothecia fairly common, red. Pycnidia common on scyphus margins, black or reddish, usually pyriform, containing red slime.

Chemistry. K–, KC+ yellow, P–, UV–. (–)Usnic and zeorin (the crystal needles on surface are formed by abundant zeorin), often also isousnic, porphyrilic and "conporpyrilic" acids and other, unidentified terpenoids and fatty acids. Rhodocladonic acid in hymenia and pycnidia.

Habitat. On rock outcrops or soil in heathlands and open forests.

Distribution. Common through much of the area, especially along the coasts. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Macaronesia, Asia (S to SE Asian islands), North America, Australasia, North and South America. In the Northern Hemisphere circumpolar, arctic to warm temperate and in tropical mountains.



Note. Difficult to distinguish from *C. pleurota,* which can produce soredia on the scyphi and often contains isousnic acid in addition to usnic acid. *C. diversa* is also similar but produces fragile microsquamules on the surface. *C. borealis* has no zeorin (no crystals on surface) but contains barbatic acid and the surface has more smooth and flattish areolae. In a molecular analysis *C. coccifera* turned out to be polyphyletic, although it is distinct from *C. borealis* and *C. pleurota.*

22. **Cladonia coniocraea** (Flörke) Spreng.

Syst. Veg. 4(1): 272 (1827). – *Cenomyce coniocraea* Flörke, Deutsche Lich. 7: 14 (1821), *nom. cons.* – Type: Sweden, Närke, Svennevad, Korsmon, 1950 Kjellmert in Magnusson, Lich. Sel. Scand. Exs. no. 388 (UPS *typ. cons.*).

Syn. *Cladonia apolepta* (Ach.) H.M.Hansen & M.Lund, *Cladonia pycnotheliza* Nyl.

D: træfods-bægerlav **F:** äimätorvijäkälä **I:** sprekbroddar **N:** stubbesyl **S:** mjölig trattlav

Literature. Ahti & DePriest, Taxon 54: 184, 186–187 (2005); Pino-Bodas et al., Org. Divers Evol. 11: 343–355 (2011).

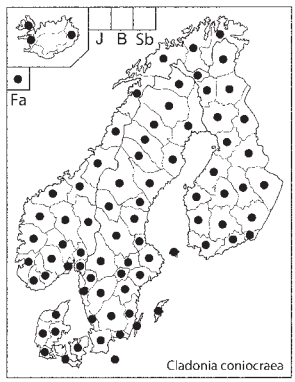
Figs. Brodo et al. 2001: 247; van Herk & Aptroot 2004: 137; Hørnell et al. 2004: 47; Moberg & Holmåsen 1990: 140; Randlane et al. 2011: 95; Stenroos et al. 2011: 126; Wirth 1995: 303.

Primary thallus inconspicuous, persistent, squamulose, squamules green rather than glaucous, small (1–2 mm wide), below commonly sorediate, not very deeply incised. Podetia 1–3 cm tall, 1 mm thick, green to grey, pale at base, unbranched, slender; scyphi often absent until produced on mature podetia before development of apothecia, narrow (0.5–1 mm), very shallow (flattish), ecorticate on bottom. Surface with a short cortical sheath at the very base, usually not above 1/4 of the length of podetium. Apothecia infrequent, usually on margins of scyphi, brown. Pycnidia fairly common, single at tips of subulate podetia or on scyphus margins, usually ovoid, containing hyaline slime.

Chemistry. K–, P+ red, C–, UV–. Fumarprotocetraric acid complex.

Habitat. On rotting wood and tree bases and trunks, especially of *Pinus, Picea* and *Betula,* less common on soil on earth banks, sand dunes and in rock crevices.

Distribution. Common throughout the southern and middle boreal forest, less common in northern boreal and temperate forest. Very rare in Iceland and the Færoe Is. and apparently absent from Greenland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IVe IAu INv.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Macaronesia, North Africa, Asia (S to Himalayas), North America (S to Mexico). Probably all Southern Hemisphere records referable to *C. ochrochlora* or other species. Apparently essentially continental in distribution.



Note. The (few) Greenland records were referred to *C. ochrochlora.* In a recent phylogenetic analysis (Pino-Bodas et al. 2011) the species *C. ochrochlora* and *C. cornuta* subsp. *groenlandica* were united into *C. coniocraea*. However, they are kept separate here, since the identity of the studied material may require revision. We do admit that these taxa seem to be extremely close and there are problems in identification of the specimens. Here *C. coniocraea* is used for greenish morphs which are short, have almost no or only short cortical sheath at base of podetia, with infrequent, very narrow, non-corticate scyphi; it infrequently grows on soil or over rocks, but rather on acidic barks of conifers or *Betula*. In comparison, *C. cornuta* subsp *groenlandica* is primarily a brown, coarse soil lichen of arctic-alpine habitats, and well-developed *C. ochrochlora* is also a more robust, glaucescent, highly corticate (especially in subtropical to tropical areas), branched, scyphose, large-squamuled species (in the north the best-developed specimens are found on moist, mossy rock outcrops in forest). However, much of the herbarium material represents juvenile material which is difficult to identify. The group certainly needs more work to clarify the taxonomy worldwide. Occasional *C. caespiticia*-looking morphs produce numerous apothecia-like galls all over the podetia and even squamules. They have been called *C. pycnotheliza* and appear mainly to be caused by lichenicolous fungi such as *Syzygospora bachmannii* Diederich & M.S.Christ. For comparison with *C. norvegica* see under that species.

23. **Cladonia conista** (Nyl.) Robbins

in Allen, Rhodora 32: 92 (1930). – *Cladonia fimbriata* f. *conista* Nyl., Ann. Sci. Nat., Bot., sér. 4: 15: 370 (1861).

– Type: Germany, "a Flörke 1" (H-ACH 1705a lectotype, Ahti, Ann. Bot. Fenn. 3: 387, 1966).

Syn. *Cladonia humilis* var. *bourgeanica* A.W.Archer, *Cladonia innominata* Lendemer

F: tannertorvijäkälä **S:** smal sandbägarlav

Literature. Ahti, Ann. Bot. Fenn. 3: 387 (1966); Lichenologist 12: 128–130 (1980); Holien & Tønsberg, Gunneria 51: 13–14 (1985); Kowalewska et al., Herzogia 21: 65–66 (2008); Laundon, Lichenologist 16: 220 (1984); Lendemer, Mycotaxon 104: 325–329 (2008); Leuckert & Poelt, Herzogia 1: 441–445 (1970); Pino-Bodas et al., Biblioth. Lichenol. 108: 161–176 (2012); Tønsberg, Blyttia 37: 127–128 (1979).

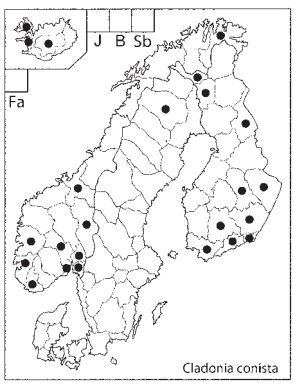
Figs. Hale 1979: fig. 344; Pino-Bodas et al. 2012: fig. 3; Stenroos et al. 2011: 144; Thomson 1968: fig. 63.

Primary thallus squamulose, persistent, squamules to 1 cm long, slightly veined below, rarely sorediate along margins. Podetia 1–3 cm tall, greyish, usually simple, stalk very short (0.5–0.8 mm), always scyphose; scyphi wide, to 8 mm diam., regular, abruptly to gradually flaring, marginal proliferations rare. Surface continuously rather smoothly corticate, cortex extending from the base to scyphus, sometimes close to its margin, but upper parts and interior of scyphi farinosely sorediate, rarely squamulose. Apothecia very rarely seen, pedicellate, brown. Pycnidia on margins of scyphi, conical, containing hyaline slime.

Chemistry. K–, P+ red, C–. Fumarprotocetraric acid complex, bourgeanic acid.

Habitat. On bare, not highly acidic soil on grasslands, along roads and at field margins.

Distribution. **F:** *V U EK EH ES PS PK Ks KiL EnL.* **I:** *IMi INv INo.* **N:** *Øf Ak He Bu Vf VA Ro Ho ST ØFi.* **S:** *LuL.* Europe, North and South Africa, Asia (S to Nepal), Australasia, North America (mainly east), South America.



Note. This species has usually been regarded as a bourgeanic acid chemotype of *C. humilis.* However, the molecular analyses (Dolnik et al. 2010; Pino-Bodas et al. 2012) support its status as a distinct species. There are also subtle morphological and distinct geographic differences. The podetia of *C. conista* tend to have taller stalks and less abruptly flaring and narrower cups than *C. humilis*. It is also much more widespread in the Nordic countries and in the boreal areas in general than *C. humilis.* The morph of *C. fimbriata* that has corticate podetial stalks may approach *C. conista* in habit but is generally more robust and taller. The typification and author citations of *C. conista* have been controversial, but the recently introduced name *C. innominata* has been stated to be unnecessary.

24. Cladonia cornuta (L.) Hoffm.

Descr. Pl. Cl. Crypt 2(1): t. 25(1) (1791). – *Lichen cornutus* L., Sp. Pl. 2: 1152 (1753). – Type: Sine loco (LINN 1273.223 lectotype, Ahti, Regnum Veg. 128: 73, 1993).

Literature. Ahti, Ann. Bot. Fenn. 17: 219–222 (1980); Fontaine et al., Lichenologist 42: 323–338 (2010); Pino-Bodas et al., Org. Divers. Evol. 11: 343–355 (2011).

24a. subsp. cornuta

D: syl-bægerlav. **F:** puikkotorvijäkälä **I:** mjölbroddar **N:** skogsyl **S:** smal syl-lav

Red-listed in: **D**

Literature. Ahti, Ann. Bot. Fenn. 17: 219–221 (1980); Vainio 1894: 127–135; 1922: 94–95.

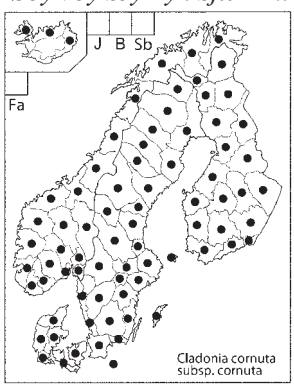
Figs. Ahti 1980: 223; Brodo et al. 2001: 249; Galløe 1954: pls 144–147; Hansen & Andersen 1995: 27; van Herk & Aptroot 2004: 137; Holien & Tønsberg 2006: 91; Moberg & Holmåsen 1990: 141; Rikkinen 2008: 63; Stenroos et al. 2011: 127.

Primary thallus squamulose, evanescent. Podetia 4–8(–19) cm tall, 0.5–2 mm thick, greenish-brown to dark brown, at base melanotic, slender to slightly flexuose, usually unbranched, occasionally long-branched, with closed axils, tips subulate, finally (infrequently) scyphose, usually only one scyphus per podetium, with 2–8 marginal, subulate to scyphose proliferations. Surface rather smooth, inconspicuously maculate, sorediate (esorediate as young), soredia dark brown to greenish, in patchy irregular soralia up to the tips, but when scyphose or fertile the podetia largely esorediate at tips or scyphi. Apothecia infre-

quent, on margins of scyphi, brown, often aggregate, shortly pedicellate. Pycnidia infrequent, mainly on scyphus margins, ovoid to pyriform, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex. Additional atranorin reported in southern South America.

Distribution. Common in most parts of the area but absent from the Færoe Is. and rare in Iceland and southern Denmark. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IAu INv INo.***N:** Øf Ak He Op Bu Vf Te AA VA Ro *Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Öl? Gtl Klm SmI Hl Bh Dls?Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America, southern South America, Australasia, Ant- arctic.



Note. Confused with *C. ochrochlora* in the southern and western areas to some extent.

24b. subsp. groenlandica (E.Dahl) Ahti

Ann. Bot. Fenn. 17: 221 (1980). – *Cladonia cornuta* var. *groenlandica* E.Dahl, Meddel. Grønland 150(2): 100 (1950). – Type: Greenland, Kujalleq (Julianehaab) District, Agdluitsoq (Lichtenaufjord), Sletten, 1937 E. Dahl (O holotype).

Syn. *Cladonia groenlandica* (E.Dahl) Trass

F: lapintorvijäkälä **S:** bägarsyl-lav

Literature. Ahti, Ann. Bot. Fenn. 17: 221–222 (1980); Brodo & Ahti, Canad. J. Bot. 74: 1158 (1996); Dahl 1950: 100–101; Pino et al., Org. Divers. Evol. 11: 343–355 (2011); Øvstedal et al. 2009: 144.

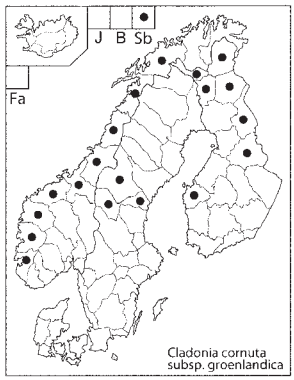
Figs. Ahti 1980: 223; Dahl 1950: pl. 2; Stenroos et al. 2011: 128.

Like subsp. *cornuta*, but generally shorter, 2–5 cm tall, almost all podetia bearing well-developed, 2–4 mm wide scyphi, which are corticate inside but with patchy soralia on outer surface and stalks.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex.

Habitat. Alpine or arctic heaths, rock outcrops or rotten wood.

Distribution. Widespread on Norwegian coast, also in northernmost Finland, rare in Svalbard. **Gr. F:** *EP Kn Ks KiL SoL EnL InL.* **N:** *Ro Ho SF MR ST NT SNo NNo Tr.* **AI:** *Sb.* **S:** *Mpd Hrj Jmt.* Oceanic, boreal coastlands in Europe, East Asia and eastern and western North America, range poorly known.



Note. This taxon often resembles *C. gracilis* subsp. *turbinata* but is sorediate. On the other hand, it can be difficult to distinguish from scyphose, short morphs of subsp. *cornuta* or particularly well-developed *C. ochrochlora* (which is almost never as brown as subsp. *groenlandica*). Recent molecular study (Pino-Bodas et al. 2011) based on one specimen from Alaska suggests that this taxon is possibly conspecific with *C. ochrochlora*. which is otherwise not known from tundra habitats. Further studies are required.

25. Cladonia crispata (Ach.) Flot.

in Wendt, Thermen Warmbrunn: 93 (1839). – *Baeomyces turbinatus* var. *crispatus* Ach., Methodus: 341 (1803). – Type: Sweden (H-ACH 1641B lectotype, Stenroos, Ann. Bot. Fenn. 25: 124, 1988).

25a. var. crispata

Syn. *Cladonia divulsa* (Delise) Vain.

D: takket bægerlav **F:** tähtitorvijäkälä **I:** stríðbikar **N:** traktlav **S:** taggbägarlav

Red-listed in: **D**

Literature. Brodo & Ahti, Canad. J. Bot. 74: 1159–1160 (1996); Dahl 1950: 86–89; Huovinen & Ahti, Ann. Bot. Fenn. 25: 374, 380 (1988); Stenroos, Ann. Bot. Fenn. 25: 124–125 (1988); Vainio 1887: 377–392.

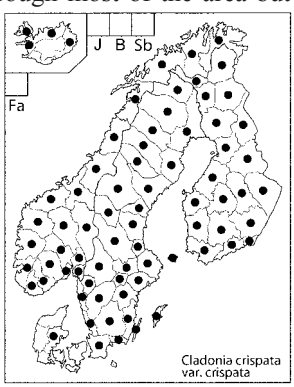
Figs. Galløe 1954: pls 90–95; Hansen & Andersen 1995: 28; Holien & Tønsberg 2006: 89; Moberg & Holmåsen 1990: 141; Rikkinen 2008: 63; Stenroos et al. 2011: 129.

PRIMARY THALLUS squamulose, squamules persistent to evanescent. PODETIA 2–6 cm tall, stoutish, 2–4 mm thick, brown to greenish, not melanotic, unbranched but with open axillary or terminal funnels, which repeatedly proliferate from margins, funnels often gaping open, rarely narrow, with dentate margins, 1–3 (–5) mm wide, pointed tips absent. Surface smoothly corticate to somewhat areolate, esorediate, often somewhat squamulose. APOTHECIA common, usually stipitate on scyphal margins, brown, crowded. PYCNIDIA common, at branch tips, funnel margins or occasionally on basal squamules, cylindrical to ovoid, often constricted at base, containing red (or rarely hyaline?) slime.

Chemistry. K–, P–, UV+ white. Squamatic acid, often (when fertile) with additional barbatic acid and traces of 4–*O*-demethylbarbatic acid. In other regions (e.g. Poland and Slovakia) rarely with thamnolic acid (then K+ and P+ yellow).

Habitat. On soil in forests, arctic-alpine and coastal heaths, rock outcrops, rotten wood, peatlands, often in highly acidic sites.

Distribution. Common through most of the area but scarce along the west coast and absent from the Arctic islands. **D:** ØJy. **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IVe IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd* Ång *Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America, northern South America (along the Andes south to Peru), East and South Africa, Papua New Guinea, New Zealand. Rare in Atlantic Europe (known from Scotland and Ireland).



Note. Usually easily identified when the apical funnels are widely open. In timberline areas there are problematic, possibly intermediate colonies which approach var. *cetrariiformis* or *C. subfurcata.* In more southern areas, particularly in bogs, squamulose morphs seemingly intermediate between *C. crispata* and *C. squamosa* can be found.

25b. var. cetrariiformis (Delise) Vain.

in Olivier, Rev. Bot. Bull. Mens. 4: 238 (1886). – *Cenomyce gracilis* var. *cetrariiformis* [‘*cetrariaeformis’*] Delise in Duby, Bot. Gall.: 625 (1830). – TYPE: France, Calvados, Vire, 1824 Delise (PC-Thuret lectotype, Ahti, Regnum Veg. 128: 74, 1993).

Syn. *Cladonia crispata* var. g*racilescens* (Rabenh.) Vain., *Cladonia subracemosa* (Vain.) Britz.

F: pistintorvijäkälä

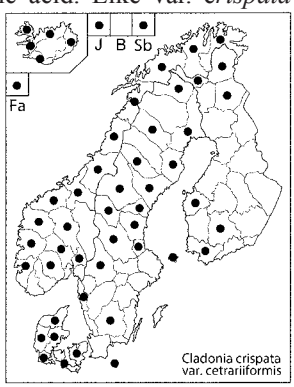
Red-listed in: **D**

Literature. Ahti, Lichenologist 3: 87–88 (1965); Hasselrot 1953: 49–50; Huovinen & Ahti, Ann. Bot. Fenn. 25: 374, 380 (1988); Carlin 1981: 378; Osyczka 2006: 220; Stenroos, Ann. Bot. Fenn. 25: 125 (1988); Vainio 1922: 56–61.

Figs. van Herk & Aptroot 2004: 139; Osyczka 2006: 219; Stenroos et al. 2011: 129.

PRIMARY THALLUS squamulose, evanescent. PODETIA 3–10 cm tall, 1–2 mm thick, yellowish brown to brownish olive, dying base pale, slender, erect, irregularly sparsely dichotomously branched, axils mainly open, tips pointed or with very narrow tube-like funnels. Surface areolate to continuously rather smoothly corticate, often somewhat microsquamulose. APOTHECIA infrequent, brown. PYCNIDIA ovoid to conical or subcylindrical, often constricted at base, containing red slime.

Chemistry. K–, P–, UV+ white. Squamatic acid, rarely with additional barbatic acid. Like var. c*rispata* with a thamnolic acid chemotype outside our area (in Poland and outside Europe).



Habitat. On soil and rocks near coasts or in arctic-alpine areas.

Distribution. Very common along the Atlantic coast in the Færoe Is., Denmark, Norway, Ice-

land, Svalbard and Greenland, also in the mountains, especially at timberline, less common along the Baltic Sea, absent from much of eastern inland areas. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Gr. Fa. F:** *A V EH EP SoL EnL InL.* **I:** *ISu IVe IAu INv INo.* **N:** *Ak Op Bu Te Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Sb.* **S:** *SmI Bh Vrm Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL PL TL.* The dominant race in Atlantic Europe. Otherwise in western and eastern Eurasia (perhaps not transcontinental), western North America, Papua New Guinea, Australasia. Range poorly known.

Note. Easily confused with *C. subfurcata*, which virtually never bears squamules on podetia, is clearly glossy and has widely open axils. In some areas the distinction of var. *cetrariiformis* and var. *crispata* can be problematic, although they are generally distinct. The status of the present varieties needs more studies.

26. Cladonia cryptochlorophaea Asahina

J. Jap. Bot. 16: 711 (1940). – Type: Japan, Honshu, Prov. Shinano (Pref. Nagano), Mt. Nyugasa (Niuagasayama), 1937 Yoshioka in Herb. Asahina 37031, as '37013' (TNS holotype).

F: jyvästorvijäkälä **I:** dularbikar **S:** kryptotrattlav

Red-listed in: **D**

Literature. Ahti, Ann. Bot. Fenn. 3: 385–386 (1966), Fl. Neotrop. Monogr. 78: 109–110 (2000); Burgaz & Ahti 2009: 32–33; Culberson & Kristinsson, Bryologist 72: 431–443 (1969); Holien & Tønsberg, Gunneria 51: 14–16 (1985); Kowalewska et al., Herzogia 21: 66–67 (2008); Leuckert et al., Nova Hedwigia 23: 503–534 (1971).

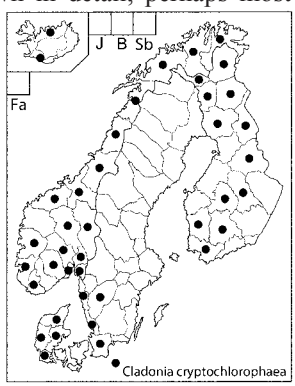
Figs. Holien & Tønsberg 1985: 15; Stenroos et al. 2011: 130; Thomson 1968: pl. 13, fig. 62.

Primary thallus squamulose, persistent, inconspicuous. Podetia 0.8–1(–3) cm tall, 0.5–1 mm thick, dark greenish grey, in part slightly browned, occasionally somewhat melanotic at base, scyphose; scyphi usually regular, single, 4–6 mm wide, margins rarely proliferating. Surface rough, without continuous cortex but with corticate, sorediate granules, phyllidia and microsquamules, which are easily shed, granules spherical to 80 µm, podetial macrosquamules rare. Apothecia infrequent, dark brown. Pycnidia infrequent, on scyphus margins, ovoid, containing hyaline slime.

Chemistry. C+ fugitively wine red (or C+ yellow orange), K+ wine red, P+ red (rarely P–), UV+ pale. Cryptochlorophaeic and paludosic acids, fumarprotocetraric acid complex (inconstant, but in Europe almost always present), plus trace amounts of 4'-*O*-methylcryptochlorophaeic and subpaludosic acids, as well as minor unknowns.

Habitat. Humus forest floor or rotten wood in mesic to dry forests, often in rather open places.

Distribution. Poorly known in detail, perhaps most frequent in the northern (and upper) boreal zone in the area, but probably not in the Arctic. **D:** *NJy ØJy VJy SJy Brn.* **F:** *V St EH PH PS Kn PeP Ks KiL SoL EnL InL.* **I:** *ISu INo.* **N:** *Øf Ak He Op Bu Vf Te VA Ro Ho MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Hl Bh Vg.* Probably circumpolar (data fragmentary) in the boreal zone over Eurasia, also widespread south to warm temperate zone in Europe, East Asia, eastern North America; additionally in Dominican Republic, along Andes from Costa Rica to Ecuador and S. Chile, South Africa, Australasia.



Note. Although usually regarded as a "chemical species" indistinguishable in morphology from *C. grayi* or other members of the *C. grayi* complex, it seems to have subtle differences; e.g. in Lapland it is often very pale and finely sorediate and podetial squamules are rarely present. The first molecular analyses seem to support its status as a distinct species. In preliminary identification the unusual reaction K+ red is useful but not always reliable, so that TLC is normally required for definite identification

27. Cladonia cyanipes (Sommerf.) Nyl.

Mém. Soc. Sci. Nat. Cherbourg 5: 95 (1858, '1857'). – *Cenomyce carneopallida* var. *cyanipes* Sommerf., Suppl. Fl. Lapp.: 129 (1826). – *Cenomyce cyanipes* (Sommerf.) Sommerf., Kongel. Norske Videnskabersselsk. Skr. 19de Aarhundr. 2: 62 (1827). – Type: Norway, Nord-Nordland, Saltdalen, Sommerfelt (BG L-4009 lectotype, Ahti, Regnum Veg. 128: 74, 1993).

F: sinitorvijäkälä **I:** renglubikar **N:** blåfotlav **S:** blå-

fotslav

Literature. Hasselrot, Acta Phytogeogr. Suec. 33: 43–46 (1953); Vainio 1894: 431–437.

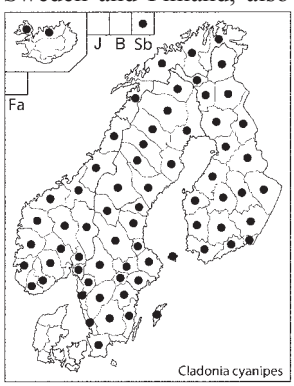
Figs. Carlin 1981: figs 4E, 4H; Hansen & Andersen 1995: 28; Krog et al. 1994: 154; Stenroos et al. 2011: 131.

Primary thallus squamulose, inconspicuous, evanescent. Podetia 4–8(–10) cm tall, 0.5–2 mm thick, greenish yellow to glaucous green, necrotic bases often with bluish tint, flexuose, unbranched or usually slightly irregularly branched by dichotomy, branches patent, axils closed, tips acuminate or narrowly scyphose; scyphi rare, 1 mm wide, dentate. Surface little corticate at base or totally ecorticate, finely sorediate but soredia easily disintegrating resulted in almost bare or scabrose surface towards the base. Apothecia infrequent, at tips of podetia, subspherical, pale ochraceous. Pycnidia at tips of podetia, single or aggregate, subcylindrical to ovoid, containing hyaline slime.

Chemistry. K–, P–, UV + faintly white. Usnic, barbatic and 4–*O*-demethylbarbatic acid, and zeorin (accessory).

Habitat. Usually on the ground. The typical habitats include old, mossy spruce forests, bog hummocks, moist rotten wood, cliff shelves, and arctic-alpine heathlands.

Distribution. Fairly common in northern and mountainous parts of Norway, Sweden and Finland, also Iceland and Svalbard, but extends to southern Sweden although not to Denmark. **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *INv INo.* **N:** *Øf Ak He Op Bu Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* A circumpolar, arctic to boreal species, with outliers in more southern mountains.



Note. This species can be difficult to distinguish from *C. bacilliformis,* but the latter has usually shorter, unbranched and clearly yellow podetia and it normally grows on rotten wood.

28. Cladonia cyathomorpha Stirt. ex Walt. Watson

J. Bot. 73: 156 (1935). – Type: Scotland, Kirkcudbright, New Galloway, near Loch Dungeon, 1881 McAndrew (E lectotype, as 'holotype', Jølle, Blyttia 35: 165, 1977).

I: trektbikar **N:** åreskjell

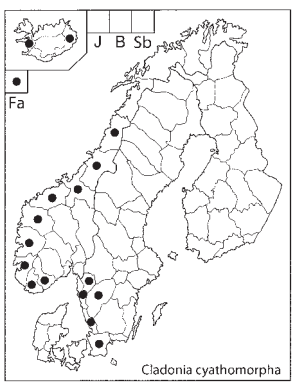
Literature. Ahti, Ann. Bot. Fenn. 3: 386 (1966); Arup, Länstyrelsen Hallands län, Meddel. 2006(5): 67 (2006); Huovinen et al., Biblioth. Lichenol. 38: 215 (1990); Jølle, Blyttia 35: 163–166 (1977); Tønsberg & Øvstedal, Blyttia 40: 60 (1982).

Figs. Arup 2006: fig. 39; Burgaz & Ahti 2009: 39; Jølle 1977: 164; Krog et al. 1994: 154.

Primary thallus persistently squamulose, squamules large, 4–10(–20) × 5–8 mm, greyish green, convolute, below white, more or less veined (some veins darkening, even reddish-brown) and somewhat floccose, above often phyllidiate and schizidiate in part. Podetia 0.5–1.5 cm tall, 1–2 mm thick, glaucous grey to brownish (sometimes with reddish hue), yellowish at base, scyphose; scyphi 3–7 mm wide, inside densely covered with bullate, pruinose phyllidia, outside the phyllidia present on scyphi but rarely extending to the stalk. Surface otherwise smoothly corticate. Apothecia very rare, not crowded, brown. Pycnidia common on margins of scyphi, pyriform, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex and an unknown, diagnostic substance, which is apparently not constant.

Habitat. On mossy cliffs, boulders, rock walls and at bases of trees (*Tilia cordata, Acer pseudoplatanus, Alnus glutinosa*) in moist, often shaded, coastal forests.



Distribution. Along coast of Iceland, Norway and Sweden, scattered to locally common. **Fa. I:** *IVe IAu.* **N:** *AA VA Ro Ho SF*

MR ST NT SNo. **S:** *Sk Hl Bh Dls Vg.* Western Europe, Macaronesia, apparently widespread in the Mediterranean, also reported from Tierra del Fuego. Northwards clearly oceanic.

Note. A relatively little known, much overlooked species, which is obviously a close relative of *C. pyxidata.* The identity of the northern coastal morphs with the Mediterranean inland morphs (see Burgaz & Ahti 2009) needs confirmation.

29. Cladonia decorticata (Flörke) Spreng.

Syst. Veg. 4(1): 273 (1827). – *Capitularia decorticata* Flörke, Beitr. Naturk. 2: 297 (1810). – Type: Germany, Berlin, Flörke, Deutsche Lich. no. 75 (UPS neotype, Ahti. Regnum Veg. 128: 75, 1993).

F: ketotorvijäkälä **N:** skjelltrevlelav **S:** flagnad bägarlav

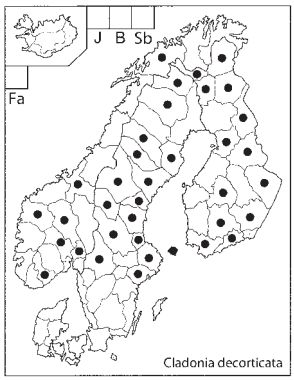
Literature. Huovinen et al., Ann. Bot. Fenn. 26: 299, 304 (1989); Vainio 1894: 67–73; 1922: 85–86.

Figs. Carlin 1981: fig. 8C; Krog et al. 1994: 155; Stenroos et al. 2011: 131.

Primary thallus squamulose, evanescent, squamules small, inconspicuous. Podetia 1–3 cm tall, 0.5–2 mm thick, whitish grey, not melanotic, unbranched or with occasional branchlets, axils open, ascyphous but with some scyphoid tips, usually tips acute or bluntish. Surface rough when the cortex is broken into granules, phyllidia and areolae, also longitudinally cracked. Apothecia rare, simple to conglomerate, dark brown. Pycnidia rare, on primary squamules, ovoid, constricted at base, containing hyaline slime.

Chemistry. K–, P–, UV+ white. Perlatolic acid and three unknown compounds.

Habitat. Always terricolous, usually on mineral-rich, weakly acidic soil on anthropogenic, xeric grasslands or rock outcrops.



Distribution. Earlier widespread in the northern and climatically continental parts of Fennoscandia, but nowadays probably much more infrequent than prevously due to altered land use. **F:** *A V U EH ES PH PK OP Kn Ks KiL SoL EnL InL.* **N:** *Ak Op Bu AA SF ST SNo? Tr.* **S:** *Srm Vrm Upl. Dlr Gstr Hls Jmt Mpd Ång Vb ÅsL LyL LuL TL.* Boreal to northern temperate, circumpolar, but known range fragmentary, continental (absent from Atlantic Europe), also in Greenland, Central Europe, Caucasus, Russian Far East, in America south to Washington, Colorado, New England, also in Tierra del Fuego.

Note. The earlier reports from Denmark and Færoe Is. seem to be erroneous. The species is inconspicuous and easily confused with *C. acuminata*, which is not P–. Often also confused with slender morphs of *C. macrophylla,* which reacts P+ strongly yellow, or *C. ramulosa*, which is P+ red.

30. Cladonia deformis (L.) Hoffm.

Deutschl. Fl. 2: 120 (1796). – *Lichen deformis* L., Sp. Pl. 2: 1152 (1753). – Type: Icon in Linnaeus, Fl. Lapp.: tab. 11, fig. 5, 1737, right-hand podetium (lectotype, Jørgensen et al., Bot. J. Linn. Soc. 115: 375, 1994); Sweden, Uppland, Värmdön, Hasseludden, 1915 Malme in Malme, Lich. Suec. Exs. no. 533 (S epitype, Jørgensen et al. Bot. J. Linn. Soc. 115: 383, 1994).

D: kreneleret bægerlav **F:** harmaatorvijäkälä **N:** begerfausklav **S:** bägarpöslav

Red-listed in: **D**

Literature. Krog, Norsk Polarinst. Skr. 144: 85–66 (1968); Østhagen, Norweg. J. Bot. 18: 87–92 (1971); Schade, Abh. Ber. Naturkundemus. Görlitz 36(1): 37–140 (1959).

Figs. Brodo et al. 2001: 251; Carlin 1981: figs 3A, 3F; Krog et al. 1994: 155; Stenroos et al. 2011: 132; Wirth 1995: 301.

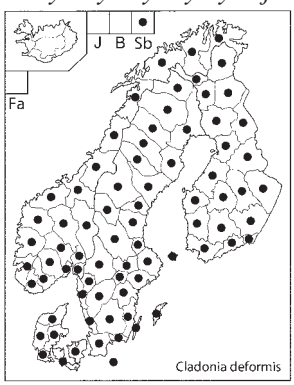
Primary thallus squamulose, usually evanescent. Podetia 2–9 cm tall, at base 1–5 mm thick, greyish yellow, turning orange yellow on necrotic base, stout, unbranched, scyphose; scyphi usually solitary, almost regular, 5–8 mm wide, margin dentate. Surface finely sorediate on scyphi and upper part of the podetial stalk, lower part rather smoothly corticate. Apothecia uncommon, to 5 mm diam., red (rarely ochraceous), on margins of scyphi. Pycnidia scarce, on scyphal margins, ovoid to conical, containing red slime.

Chemistry. K–, P–, UV–. (–)Usnic, (–)isousnic and rhodocladonic acids, zeorin, bellidiflorin, plus traces of unknown terpenoids. Zeorin deposited as crystal

needles on surface of thallus of herbarium specimens.

Habitat. On humus rich soil, in forests and over rocks, occasionally on rotten wood.

Distribution. Common throughout most of the area but most abundant in southern and central interior parts of the area. Rare in Svalbard and absent from Iceland and the Færoe Is. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Arctic to temperate, circumpolar, perhaps most abundant in the southern boreal zone but avoiding the ocean coasts (very rare in Britain!), in the Southern Hemisphere relatively infrequent but known from the Antarctic, New Zealand, Tasmania, Tierra del Fuego and Falkland Is.



Note. A fairly distinct morph with short podetia and wide, farinose sorediate scyphi is occasionally found in Lapland and elsewhere. It is often referred to *C. pleurota*, which has coarsely granulose, not farinose soredia. Because these species have identical chemistry, they may occasionally be very difficult to distinguish. The same is true with *C. carneola,* which has farinose soredia usually extending throughout the podetial surface. Up to 1970's in Europe *C. deformis* was not usually distinguished from *C. sulphurina,* which has more deformed and yellow scyphi, shows white fluorescence in UV (containing squamatic acid) and lacks zeorin crystals on surface.

31. Cladonia digitata (L.) Hoffm.

Deutschl. Fl. 2: 124 (1796). – *Lichen digitatus* L., Sp. Pl. 2: 1152 (1753), *nom. cons.* – Type: *(cons.)*: Sweden, Östergötland (Ostrogothia), Stenhammar in Stenhammar, Lich. Suec. Exs., ed. 2, no. 195 (UPS).

D: finger-bægerlav **F:** kantotorvijäkälä **N:** fingerbeger **S:** fingerlav

Literature. Litterski & Ahti 2004: 212, 229; Vainio 1887: 123–134; 1922: 33–34.

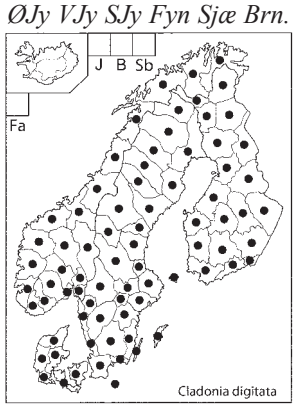
Figs. Brodo et al. 2001: 251; Galløe 1954: pls 43, 46–48; van Herk & Aptroot 2004: 139; Holien & Tønsberg 2006: 85; Moberg & Holmåsen 1990: 138; Randlane et al. 2011: 97; Rikkinen 2008: 173; Stenroos et al. 2011: 133; Wirth 1995: 325.

Primary thallus squamulose, persistent, squamules conspicuous, large, to 1.5(–3) cm long, 1 cm wide, roundish, incised, underside and margins farinose sorediate. Podetia often absent or poorly developed or deformed, small and ascyphose, but when well-developed to 4 cm tall, clearly scyphose; scyphi to 4 mm wide. Surface smoothly corticate with large, finely sorediate patches. Apothecia rather uncommon, red, to 5 mm diam., on margins of scyphi. Pycnidia common on margins of scyphi, usually ovoid to conical, briefly stalked, containing red slime.

Chemistry. K+ yellow, P+ yellowm UV–. Thamnolic acid and traces of decarboxythamnolic acid.

Habitat. On rotten wood, bases and trunks of trees, especially on conifers, rarely on humus on ground.

Distribution. Common through most of the forested parts of the region, but decreasing northwards, being scarce in Lapland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Eurasia, North America, boreal to temperate, circumpolar, rare or absent in highly oceanic regions, also found in East African mountains and the Himalayas (Bhutan).



Note. The earlier records from Greenland, Iceland and Færoe Is. are probably all incorrect.

32. Cladonia diversa Asperges ex S. Stenroos

in Ahti & Stenroos, Bot. Complut. 35: 326 (2012). – Type: Belgium, Kempisch District, Kalmthout, Van Ganzenven, 1974 Asperges 2498 (BR holotype).

D: rød bægerlav **F:** paasitorvijäkälä **I:** stakbikar **S:** småfjällig kochenillav

Red-listed in: **D**

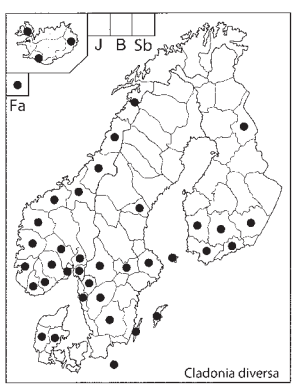
Literature. Ahti & Stenroos, Bot. Complut. 36: 326 (2012); Asperges, De Cladonia's uit de sectie Cocciferae in België 2: 358, unpubl. Ph.D. Thesis, Univ. Antwerpen, Wilrijk (1983); Dumortiera 32: 24–31 (1985); Burgaz & Ahti, Fl. Liquenól. Ibér. 4: 22, 38 (2009); Osyczka, Acta Soc. Bot. Polon. 78: 215–219 (2009); Herzogia 24: 237–238 (2011); Stenroos, Ann. Bot. Fenn. 26: 164–165, 313 (1989).

Figs. Burgaz & Ahti 2009: lám. 2 j-m; Osyczka 2009: 216; Stenroos et al. 2011: 134; Wirth 1995 (as *C. coccifera)*.

Primary thallus squamulose, persistent, inconspicuous. Podetia to 3 cm tall, greenish, bluish ot whitish grey, orange at dying base, necrotic podetia blackening inside, usually simple, occasionally proliferating from scyphus margins, slender, always scyphose; scyphi usually narrow, 2–3(4) mm wide, gradually flaring. Surface densely covered by microsquamules and granules, giving the podetia a rough appearance, macrosquamules occasional at base, soredia absent, almost totally ecorticate. Apothecia red, infrequent, forming confluent discs up to 5 mm wide. Pycnidia common, on margins of scyphi, black to red, containing red slime.

Chemistry. K–, KC+ yellow, P–, UV–. Usnic acid and zeorin constant (seen as cystal needles on lichen surface after prolonged preservation in herbarium), often also porphyrilic and conporphyrilic, additional isousnic acid common, skyrin rarely present.

Habitat. On thin soil over rocks, often on mossy seepages along shores, rarely directly on deep soil.



Distribution. Common on some coastal areas, such as Østfold, Rogaland and Hordaland in Norway (0–800 m), and SW islands of Finland. Rare in Iceland. **D:** *ØJy VJy Brn*. **Fa. F:** *A V U St EH ES Ks*. **I:** *ISu IAu INv.* **N:** Øf *Ak Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo.* **S:** *Öl Gtl SmI Bh Dls Vg Vrm Vsm Upl Mpd*. Widespread in Europe and Macaronesia, especially in oceanic areas, such as the British Is., but range poorly known. Also in East Asia and possibly eastern North America.

Note. Chemically similar to *C. coccifera* and *C. pleurota* but distinguished by abundant tiny microsquamules on surface and generally more slender habit and narrow scyphi. The species has slowly gained general acceptance and is still commonly included in *C. coccifera*, but seems to be well distinguishable. Very common in some highly oceanic coastal areas, like SW Norway and SW archipelago of Finland. The name *Cladonia diversa* Asperges was not effectively published by the author Asperges (due to a retroactive change in the ICBN) and was therefore recently validated in Ahti & Stenroos (2012, see above).

33. **Cladonia ecmocyna** Leight.

Ann. Mag. Nat. Hist., ser. 3, 18: 406 (1866). – Type: Russia, Murmansk Region, Kola Peninsula, Svyatoy nos (Svaetoinos), 1863 Fellman in Fellman, Lich. Arct. no. 28 (BM lectotype, Ahti, Ann. Bot. Fenn. 17: 225, 1980).

Syn. *Cladonia gracilis* var. *ecmocyna* (Leight.) Kernst., *Cladonia elongata* var. *ecmocyna* (Leight.) Räsänen

F: jäätorvijäkälä **I:** lautabikar **N:** snøsyl **S:** snöbägarlav

Literature. Ahti, Lichenologist 3: 86–87 (1965); Ann. Bot. Fenn. 15: 12 (1978); Ann. Bot. Fenn. 17: 225–227 (1980); Brodo & Ahti, Canad. J. Bot. 74: 1160–1162 (1996); Dahl 1950: 97–99; Huovinen et al., Biblioth. Lichenol. 38: 217 (1984); Jahns et al., Acta Bot. Neerl. 18: 627–633 (1969); Pino-Bodas et al., Org. Divers. Evol. 11: 345–355 (2011).

Figs. Ahti 1980: 228; Carlin 1981: fig. 11C; Hansen & Andersen 1995: 28; Stenroos et al. 2011: 135.

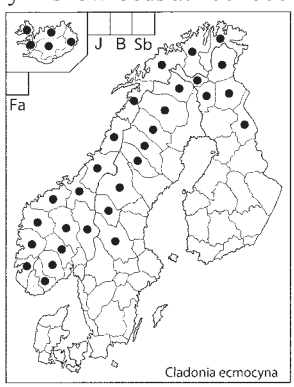
Primary thallus squamulose, evanescent. Podetia 5–10 cm tall, 0.5–4 mm thick, thus often robust, pale grey to glaucous, sometimes browned at tips, emorient bases persistent, turning pale yellow (best seen in fresh condition), unbranched or slightly dichotomously branched, most tips subulate but scyphi common, 1.5–5 mm wide, regular or irregular, dentate, often with marginal, short-stipitate, secondary scyphi or longer proliferations. Surface smooth, dull, checkered, with a maculate network of low, greenish corti-

cate areolae and rather wide, purely white medullary interspaces, not (or extremely rarely) sorediate, especially towards the tips minutely white-pruinose (use dissecting microscope), esquamose or with scattered squamules, especially near the base, podetial wall (use razor blade) thick, softish. Apothecia infrequent, 1–3 mm wide, dark to blackish brown. Pycnidia common, pyriform, constricted at base, containing hyaline slime.

Chemistry. K+ instantly yellow, P+ red, yellow pigment at base K+ purple, UV–. Atranorin (abundant), fumarprotocetraric acid complex and at least one terpenoid substance.

Habitat. Primarily in snow-beds at and above timberline but descending to upper woodlands.

Distribution. Common along the Scandinavian mountain range. In Iceland mainly in snow-beds at 200–600 m, common in NW and N, otherwise scattered. Very common in Greenland but absent from the other Arctic islands. **Gr. F:** *Ks KiL SoL EnL InL.* **I:** *IVe IMi IAu INv INo.* **N:** *He Op Bu Te AA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Dlr Hrj Jmt ÅsL LyL PL LuL TL*. Eurasia, North America, arctic to northern boreal, but confined to the moist sections of the circumpolar zones, perhaps not fully circumpolar. Also in mountains of Central and Eastern Europe and Australasia.



Note. In the field the usually clearly bluish-grey cushions in snow-bed habitats are characteristic, the pale blue tinge coming from pruinose tips. However, occasionally it is very similar to *C. maxima*, but the the presence of scattered podetial squamules and the thickish, areolate podetial wall serve to distinguish *C. ecmocyna.* These species rather often grow in mixed stands together in timberline areas in Finnish and Swedish Lapland. Distinct in molecular analyses.

34. Cladonia fimbriata (L.) Fr.

Lichenogr. Eur. Reform.: 222 (1831). – *Lichen fimbriatus* L., Sp. Pl. 2: 1152 (1753). – Type: Icon in Dillenius, Hist. Musc.: t. 14, fig. 8 (1742) lectotype, Ahti, Regnum Veg. 128: 77, 1993; Herb. Dillenius t. 14, f. 8 p.p. (OXF-Dillenius epitype, Jørgensen et al., J. Linn. Soc., Bot. 115: 376, 1994).

Syn. *Cladonia major* (K.G.Hagen) Sandst., *Cladonia minor* (K.G.Hagen) Szat.

D: bleggrøn bægerlav **F:** pikkutorvijäkälä **I:** mélubikar **N:** melbeger **S:** naggbägarlav

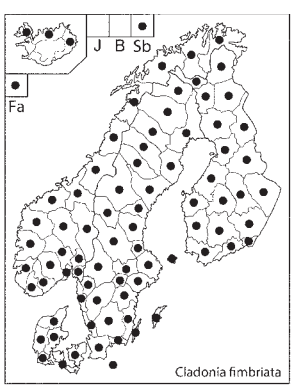
Literature. Ann. Bot. Fenn. 3: 388 (1966); Kowalewska et al., Herzogia 21: 67–68 (2008).

Figs. Brodo et al. 2001: 254; Galløe 1954: pls 157–159; Holien & Tønsberg 2006: 93; Randlane et al. 2011: 99; Rikkinen 2008: 63; Stenroos et al. 2011: 136; Wirth 1995: 326.

Primary thallus squamulose, persistent, squamules 2–4 × 1 mm, esorediate to slightly sorediate below. Podetia 0.5–3 cm tall, 0.5–3 mm thick, vividly green to whitish grey, always scyphose; scyphi 2–6(–9) mm wide, usually simple, more rarely with single proliferations from margins, margin almost entire to slightly dentate. Surface thickly farinose-sorediate, soredia not easily disintegrating, inside of scyphi soredia readily turning darker, even brownish, in open situations, cortical sheath at base usually very short but in occasional clones extending to base of scyphus. Apothecia infrequent, dark brown, 1–5 mm wide, stalked. Pycnidia at margins of scyphi, ovoid, not or little constricted at base, containing hyaline slime.

Chemistry. K–, P+ (rapidly) red, UV–. Fumarprotocetraric acid complex, often including quaesitic acid. Additional atranorin very rarely reported (and then outside Nordic countries).

Habitat. Primarily on rotten wood and tree bases, and even trunks high above the ground, also common on humus rich soil along roadsides, field margins and pastures, also in urban situations and rarely even in tundra.



Distribution. Very common in southern and central parts of the area, less common in the north, especially in uninhabited areas and above timberline. In Iceland

and Greenland on wood in birchwoods, rare. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IAu INo INv.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Arctic to warm temperate zones, and corresponding zones in the Southern Hemisphere, not in tropics, but extending to subarid regions in Central Asia. Also in South Africa.

Note. A robust morph with corticate stalk has sometimes been separated as *C. major,* but its taxonomic status needs further studies. It is found in Denmark, Iceland, Finland, Norway and Sweden.

35. Cladonia floerkeana (Fr.) Flörke

De Cladon: 99 (1828). – *Cenomyce floerkeana* Fr., Sched. Crit. Lich. Suec. 1–4: 18 (1825). – Type: Sweden, Fries, Lich. Suec. Exs. No. 82 (UPS lectotype, Ahti, Regnum Veg. 128: 77, 1993).

Syn. ?*Cenomyce carcata* Ach., *Cladonia macilenta* subsp. *floerkeana* (Fr.) V.Wirth

D: lakrød bægerlav **F:** helotorvijäkälä **I:** skartbikar **N:** kystrødtopp **S:** pinnlav

Red-listed in: **D**

Literature. Christensen, Lichenologist 19: 61–69 (1987); Vainio 1922: 29–31; Wirth, Die Flechten Baden-Württembergs: 513 (1987).

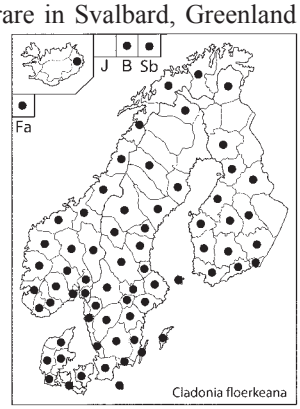
Figs. Galløe 1954: plates 33–34, 36–39; Hansen & Andersen 1995: 33; van Herk & Aptroot 2004: 141; Holien & Tønsberg 2006: 86; Moberg & Holmåsen 1990: 138; Stenroos et al. 2011: 137; Wirth 1995: 331.

Primary thallus persistent, consisting of incised squamules, 1–3 × 1–2 mm in size. Podetia 1–4 cm tall, 0.5–1 mm thick, brownish grey, simple to usually branched at apex, tips blunt. Surface totally or mostly corticate, smooth to usually rough, sparsely granulose (almost never farinose) corticate, often also somewhat squamulose. Apothecia very common, often abundant from early phases, but may be absent, red, ascogonia or young apothecia often forming corymbose systems with 50–100 discs, later coalescent to form fewer, 1–2 mm wide aggregated discs. Pycnidia usually abundant on basal squamules, rarely at tips of podetia, occasionally laterally on podetial squamules, often abundant, distinctly stalked, relatively large, spherical to ampullaceous, containing red slime.

Chemistry. Two major chemotypes: 1) K–, P–. Barbatic and (inconstant) didymic acid; 2) K+ yellow, P+ yellow. Thamnolic and didymic acid. In both rhodocladonic acid in hymenia and pycnidia. The latter chemotype is rarely found, but is known at least in the Færoe Is., Greenland, Hordaland in Norway, and Gästrikland in Sweden. Rarely also small amounts of usnic acid have been reported.

Habitat. Open rock outcrops, mossy cliffs, bare mineral soil, such as sand dunes, sometimes also on soil in lichen woodlands, more rarely on rotten wood (like pine stumps) or tree bases.

Distribution. Fairly common in Denmark, southern Scandinavia and SW Finland (where mainly coastal); in middle and northern boreal zones or arctic-alpine areas usually rare. Very rare in Svalbard, Greenland and Iceland (one locality in *IAu)*. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS KP Kn OP PeP InL.* **I:** *IAu.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi*. **AI:** *Bi Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb LyL TL.* Total distribution poorly known due to taxonomic confusion, but at least in western Eurasia, Macaronesia, parts of East Asia (but not in Japan), eastern North America, southern South America (rare), and Australasia. With oceanic tendencies.



Note. The delimitation of this small but often abundantly fruiting species has caused difficulties. Some authors have doubted whether it can be kept separate from *C. macilenta.* The common morph has very scabrose podetia due to small squamules or granules. It is characteristic of open, often exposed rock outcrops of southern and western Fennoscandia. No farinose soredia are generally present. Another morph (which includes the type material) is totally corticate, with

smooth surface and without soredia. It is especially common in Hälsingland in Sweden and Finnish coast of Bothnian Bay, at least (perhaps a distinct taxon?). It may have some, rather fine soredia. Elsewhere in the world the name *C. floerkeana* has been much misapplied to well-corticated *C. macilenta* (cortex present in fertile podetia). *C. floerkeana* may also occasionally contain thamnolic acid, which is rarely cited.

36. Cladonia foliacea (Huds.) Willd.

Fl. Berol. Prodr.: 363 (1787). – *Lichen foliaceus* Huds., Fl. Angl.: 457 (1762). – Type: Icon in Dillenius, Hist. Musc.: tab. 14, fig. 12A (1742) (lectotype, Ahti & Stenroos, Nordic Lichen Flora 5: 91, 2013); England, Shropshire (= Salop), Haughmond Hill, Leighton, Lich. Brit. Exs. no. 15 (BM epitype, Ahti & Stenroos, Nordic Lichen Flora 5: 91, 2013.

Syn. *Cladonia alcicornis* (Lightf.) Fr., *Cladonia convoluta* (Lam.) Anders, *Cladonia foliacea* var. *convoluta* (Lam.) Vain., *Cladonia endiviifolia* (Dicks.) Fr. (‘*endiviaefolia’*), *Cladonia foliacea* subsp. *convoluta* (Lam.) Suza, *Cladonia foliacea* subsp. *endiviifolia* (Dicks.) Boistel, *Lichen sterilis* Gouan

D: fliget bægerlav **F:** jalotorvijäkälä **N:** flikskjell **S:** älghornslav, bladbägarlav

Red-listed in: **F**

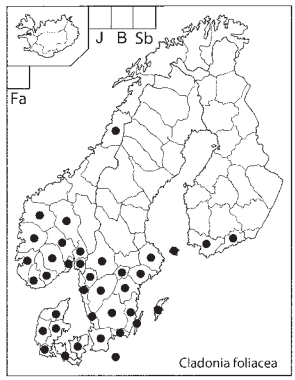
Literature. Ahti & Litterski 2005: 211–212, 229; Burgaz et al., Nova Hedwigia 57: 231–238 (1993); Burgaz & Ahti 2009: 29, 42; Huovinen et al., Ann. Bot. Fenn. 26: 301–302, 304 (1989); Jahns & Beltman, Lichenologist 5: 355, 358–359 (1973); Pino-Bodas et al., Syst. Biodiversity 8: 575–586 (2010); Vainio 1922: 115–116.

Figs. Burgaz & Ahti 2009: lám. 7a, 7c; Carlin 1981: figs 5 E, F, G; Galløe 1954: pls 177, 183–187); van Herk & Aptroot 2004: 143; Jahns & Beltman 1973: 358–359; Moberg & Holmåsen 1990: 142; Stenroos et al. 2011: 138; Wirth 1995: 313.

Primary thallus squamulose to foliose, squamules 6–40 mm long, 1–5 mm wide, irregularly lobate, with very few, scattered, white, unbranched rhizines along the margins, yellowish olive green above, pale yellow and finely arachnoid below. Podetia very rare, 0.3–2 cm tall, 0.5–3 mm thick, greenish yellow, paler at base, scyphose; scyphi narrow (1–2 mm). Apothecia very rare, on margins of scyphi, brown, forming aggregates to 4 mm diam. Pycnidia frequent, on primary squamules or on margins of scyphi, sessile or prominent, subglobose to ovoid, containing hyaline slime.

Chemistry. K–, KC+ yellow, P+ red, UV–. Usnic acid, fumarprotocetraric acid complex, occasionally traces of zeorin, rarely also psoromic acid.

Habitat. On open soil, often calcareous, but also acidic, on grasslands (including alvars), sand dunes and rock outcrops.



Distribution. Fairly common in Denmark, coastal lowlands of southern Norway and in southern Sweden. Rare in Finland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **F:** *A V U.* **N:** *Øf Ak Op Bu Vf Te AA VA Ro Ho SF SNo*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Upl.* Europe, SW Asia, North Africa, Macaronesia (south to Cape Verde Islands). Hemiboreal to subtropical.

Note. The species is here treated in a wide sense, including *C. convoluta,* against general practice. This is because in the recent phylogenetic analysis by Pino-Bodas et al. (2010) *C. foliacea* and *C. convoluta* were not distinguishable. This is supported by our field experience from Spain and Greece (and herbaria) that numerous specimens are impossible to identify with certainty. The intergradation is actually also seen in the material of Burgaz et al. (1993). Thus *C. convoluta* is interpreted to be a robust morf of *C. foliacea,* growing on highly calcareous soils. In Scandinavia suitable habitats for the *“C. convoluta”* morph only occur in Gotland and Öland, where it is common in alvar fields. The earlier records of *C. foliacea* from the Færoe Is. are referred to *C. angustiloba*, which is regarded as a closely related species with very narrowly dissected squamules.

37. Cladonia furcata (Huds.) Schrad.

Spic. Fl. Germ.: 107 (1794). – *Lichen furcatus* Huds., Fl. Angl.: 458 (1762). – Type: Icon in Dillenius, Hist. Musc.: t. 16. f. 27 (1742) lectotype, Ahti, Fl. Neotrop. Monogr. 78: 167, 2000; England, South Huntingdonshire, Winchfield, Leighton in Leighton, Lich. Brit. Exs. No. 401 (BM epitype,

Ahti, Fl. Neotrop. Monogr. 78: 167, 2000).

Syn. *Cladonia racemosa* Hoffm., *Cladonia corymbosa* (Ach.) Krohn

D: kløftet bægerlav **F:** haaratorvijäkälä **I:** flösukrókar **N:** gaffellav **S:** rislav

Literature. Jahns et al., Nova Hedwigia 30:469–526 (1978); Vainio 1894: 316–357; 1922: 48–54.

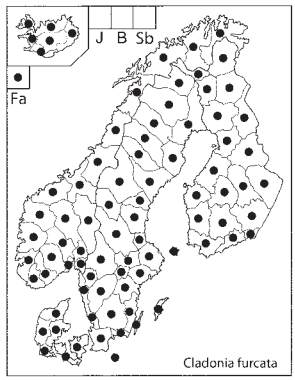
Figs. Brodo et al. 2001: 256; Galløe 1954: pls 74–79; van Herk & Aptroot 2004: 143; Holien & Tønsberg 2006: 88; Moberg & Holmåsen 1990: 143; Rikkinen 2008: 63; Schade, Abh. Ber. Naturkundemus. Görlitz 39(14): 1–39 (1964); Stenroos et al. 2011: 139; Wirth et al. 2004: 78.

PRIMARY THALLUS inconspicuous, soon evanescent. PODETIA 3–10 cm tall, 0.5–2.5 mm thick, green to brown, not melanotic, very slender to robust (then usually fertile), irregularly branched by anisotomic dichotomy, axils open to closed, tips pointed, ascyphose. Surface very smooth to somewhat areolate, often with longitudinal slits, esorediate, esquamose to occasionally highly squamulose. Stereome very hard and thickish. APOTHECIA common, occur on thickened podetia, small, usually pale brown, crowded on short pedicels. PYCNIDIA common, on apical tips or rarely on podetial squamules, ovoid to ampullaceous, constricted at base, containing hyaline slime.

Chemistry. K– (rarely + yellow but often K+ brownish), P+ red (rapidly), rarely P+ yellow, UV–. Fumarprotocetraric acid complex (high contents, hence K+), rarely (commonly in eastern North America!) additional atranorin or traces of physodalic acid. Elsewhere (e.g. Spain) also chemotypes with psoromic or bourgeanic acids.

Habitat. On soil in open to shaded habitats, especially on grasslands, lowland heaths, roadsides, rock outcrops and forests, but absent from the most acid habitats like most of the pine woodlands.

Distribution. Very common in the south, but decreasing northwards so that relatively scarce in Lapland and hardly present above timberline, but widespread in Iceland, though absent from the Arctic islands. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Widespread in temperate and boreal areas in the world. Europe, Asia, Africa, North America (but hardly transcontinental), South America, Australasia, Subantarctic islands. Somewhat oceanic.



Note. The examined specimens from Greenland were referred to *C. farinacea* or *C. scabriuscula.* They are closely related species, also according to phylogenetic analyses. *C. scabriuscula* is distinguished by its granulose to microsquamulose tips and squamulose podetia (and coastal distribution), while *C. farinacea* has farinosely sorediate patches, especially near tips of podetia. *C. furcata* is highly variable within its worldwide range, however.

38. *Cladonia galindezii* Øvstedal

Cryptog. Bryol. Lichénol. 9: 137 (1988). – TYPE: Antarctica, Graham Land, Argentine Islands, Galindez Island, 1935 British Graham Land (Penola) Expedition 1934–1937 no. 1108 (BM holotype).

Literature. Bültmann & Lünterbusch, Abh. Westfal. Mus. Naturk. 70: 305–312 (2008); Burgaz & Ahti 2009: 45; Hansen & Ahti, Graphis Scripta 23: 60 (2011); Øvstedal & Lewis-Smith, Lich. Antarctica S. Gorgia: 166–167 (2001); Stenroos, Cryptog. Bot. 3: 316–317 (1993).

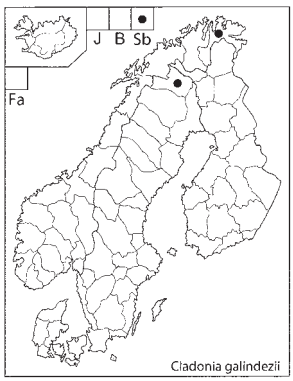
Figs. Stenroos 1993: fig. 2C; Øvstedal 1988: 138.

PRIMARY THALLUS squamulose, persistent, squamules to 5 mm long, pale brownish green, pruinose at tips, erect, densely packed and forming hard, semiglobose mounds, often turning into cylindrical, solid structures. PODETIA rare, to 1.5 cm tall, brownish green, clavate to cylindrical, unbranched or with few irregular branchlets, always fertile, wall longitudinally split, stranded. Surface of podetia covered by flat, centrally attached cortical plates. Stereome stranded. APOTHECIA rare, brown. PYCNIDIA on podetial squamules; slime not seen.

Chemistry. K+ yellow, P–, UV–. Atranorin and porphyrilic acid, ± methylporphyrilic acid, traces of un-

known fatty acids and other componds.

Habitat. Tundra soil, often extensive covers.



Distribution. Northern Sweden and Norway. In numerous places in West Greenland and also collected in East and North Greenland, as well as in Svalbard. **Gr. N:** *ØFi*. **AI:** *Sb*. **S:** *TL*. A tundra lichen originally described from the Antarctic but widespread also in West Greenland and some places in East and North Greenland, also known from high Pyrenees in Andorra, plus the Chilean Andes.

Note. There are uncertain specimens also from northern Russia. The total range is still poorly known. The species is very close to *C. cariosa*, but is distinguished by production of porphyrilic acid, thin podetia and very crowded, pruinose primary squamules.

39. Cladonia glacialis Kristinsson & Ahti

Biblioth. Lichenol. 99: 282 (2009). – Type: Iceland, Central Iceland, Arnarfellsmúlar, 600 m, 1971 Kristinsson 24629 (AMNH holotype).

I: jökulkrókar

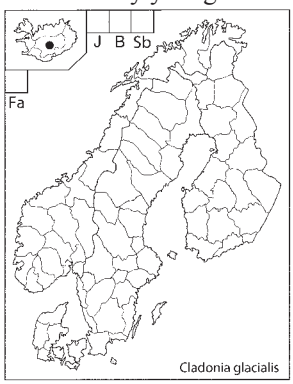
Literature. Kristinsson & Ahti, Biblioth. Lichenol. 99: 281–283 (2009).

Figs. Kristinsson & Ahti 2009: 281.

Primary thallus squamulose, persistent, inconspicuous, 2–3 × 1–2 mm wide, squamules little divided. Podetia 3–4 cm tall, 0.8–1.5 mm thick, deep grey to pale brown, matt, bases melanotic inside, slender, little branched, tips subulate or sparsely scyphose; scyphi 0.5–2 mm wide. Surface rough, cortex continuous but verruculose-knobby throughout, at base occasionally bursting into tuberculate, white spots, podetial squamules scarce, small, scyphi forming granulose soredia in patches, often proliferating from margins to form 3–7 subulate branchlets, sometimes branching dichotomously without scyphus formation. Apothecia not observed. Pycnidia at tips or scyphus margins, broadly pyriform, sessile; conidia and slime not observed.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex and a minor unidentified substance.

Habitat. In lush vegetation on relatively young terminal moraine of a glacier.



Distribution. At 600 m in front of an outlet glacier from the large Hofsjökull glacier in Central Iceland. **I:** *IMi.* Only known from the type locality.

Note. Resembles *C. phyllophora,* which has a smooth, tomentose, esorediate surface.

40. Cladonia glauca Flörke

De Cladon.: 140 (1828). – Type: Germany, Mecklenburg-Vorpommern, Wahren (=Waren), 1826 Flörke 47 (H lectotype, Ahti, Regnum Veg. 128: 78, 1993).

Syn. *Cladonia cenotea* subsp. *glauca* (Flörke) Vain.

D: grågrøn bægerlav **F:** hankotorvijäkälä **N:** sandgaffel **S:** grå bägarlav

Red-listed in: **D N**

Literature. Huovinen & Ahti, Ann. Bot. Fenn. 25: 375, 380 (1988); Pino-Bodas et al., Mycotaxon 113: 316–318, 324 (2010); Pišút, Preslia 31: 273–276 (1959); Suominen & Ahti, Ann. Bot. Fenn. 3: 421–422 (1966); Tønsberg & Høiland, Blyttia 36: 163–165 (1978); Tønsberg et al. 1996: 55–57; Vainio 1894: 484–494.

Figs. Carlin 1981: fig. 7H; Galløe 1954: pls 104–107; van Herk & Aptroot 2004: 145; Stenroos et al. 2011: 140; Tønsberg & Høiland 1978: 163; Wirth 1995: 328;

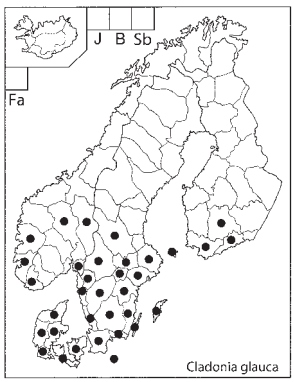
Primary thallus inconspicuous, evanescent, esorediate. Podetia 3–8 cm tall, 0.5–2 mm thick, greyish green, partly browned, not melanotic, slender, somewhat branched in upper parts, angles perforated or not, tips attenuate, ascyphous, but very narrow or slightly dilated funnels may occur. Surface corticate only at the very base, mostly farinose sorediate, with some longitudinal slits, podetial squamules few to abundant on basal parts. Apothecia rare, very small, dark brown, aggregate. Pycnidia at funnel rims or tips

of podetia, conical, little constricted at base, containing hyaline slime.

Chemistry. K–, P–, UV+ bluish white, rarely K+ and P+ yellow, UV–. Squamatic acid, sometimes with traces of barbatic acid; very rarely (not in the Nordic countries) thamnolic acid (with barbatic).

Habitat. On thin soil over rocks, sand dunes (especially in Norway), bare peat in bogs and in man-made grasslands, usually acid soils.

Distribution. Scattered to common in Denmark and southern Sweden, more rare in Norway, very rare (or overlooked?) in Finland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **F:** *A V U EH.* **N:** *Øf He Op VA Ro Ho*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Ög Vg Nrk Srm Vrm Vsm Upl Dlr.* Temperate to hemiboreal, western Europe, East Asia and eastern North America.



Note. The northern limit of the range is badly known, in part due to the difficult distinction from *C. cenotea*, especially in bogs. *C. cenotea* is less branched and usually produces distinct, perforated funnel-like swellings at ends of podetia. Also *C. rei* and *C. subulata* can be very similar but are not clearly UV+ bluish white.

41. Cladonia gracilis (L.) Willd.

Fl. Berol. Prodr.: 363 (1787). – *Lichen gracilis* L., Sp. Pl. 2: 1152 (1753). – Type: Icon in Dillenius, Hist. Musc.: t. 14, f. 13C (1742) lectotype, Ahti, Regnum Veg. 78: 79, 1993 [lapsu as 'f. 3']; corresponding specimen in Herb. Dillenius (OXF-Dillenius epitype, Jørgensen et al., Bot. J. Linn. Soc. 115: 377, 1993).

D: slank bægerlav **I:** þúfubikar **N:** syllav **S:** stängellav

Literature. Ahti, Ann. Bot. Fenn. 17: 201–215 (1980); Fontaine et al., Lichenologist 42: 323–338 (2010); Pino-Bodas et al., Org. Divers. Evol. 11: 343–355 (2011).

Note. C. gracilis is a complex of taxa, which still needs further research. The existing phylogenetic data are somewhat contradictory, but still sparse and in part based on dubious identifications.

41a. subsp. gracilis

Syn. *Cladonia chordalis* (Flörke) Nyl., *Cladonia gracilis* var. *chordalis* (Flörke) Schaer.

F: silotorvijäkälä **S:** smal stängellav

Literature. Ahti, Ann. Bot. Fenn. 17: 201–204 (1980); Carlin 1981: 388.

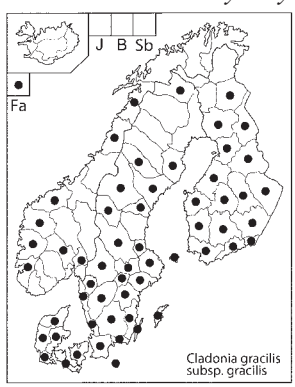
Figs. Ahti 1980: 205; Carlin 1981: 389; Galløe 1954: pls 139–147; van Herk & Aptroot 2004: 14; Holien & Tønsberg 2006: 92; Moberg & Holmåsen 1990: 143; Stenroos et al. 2011: 142; Wirth 1995: 329.

Primary thallus small, usually evanescent, growth indefinite. Podetia 4–8(–12) cm tall, 0.5–1.5 mm thick, mature, fertile podetia becoming more robust (1–2 mm thick), green to brown, somewhat melanotic at base, almost unbranched, slender, pointed, ascyphose but finally producing narrow scyphi to 0.5–1 cm wide. Surface matt to shiny, smooth, areolate and maculate, esorediate, slightly squamulose. Apothecia on short stipes on margins of terminal scyphi, usually small, numerous, brown. Pycnidia common, at scyphus margins, ovoid to mammiform, usually constricted at base, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex.

Habitat. On thin soil over open rock outcrops, not on deep soil, except on sand dunes or humid heathlands, almost never on wood.

Distribution. Common in southern and western parts of the Nordic countries, but rare in Gotland and Öland, absent or very rare in the north, being probably absent from Iceland, Svalbard and Greenland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa.** **F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks SoL.* **N:** *Ak Bu Ro Ho SF MR SNo NNo.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Mpd Ång Hrj Jmt Vb ÅsL TL.* Primarily temperate to middle boreal zones in Europe, in Asia



probably only in Turkey, coastal eastern North America, southern Chile, Argentina, Subantarctic islands and Antarctic (but taxonomic status of some of these populations uncertain).

Note. Most herbarium specimens from Iceland under that name were referred to subsp. *elongata* or *C. macroceras,* but many specimens could not be identified.

41b. subsp. elongata (Wulfen) Vain.

Acta Soc. Fauna Fl. Fenn 53(1): 92 (1922). – *Lichen elongatus* Wulfen in Jacquin, Misc. Austriac. 2: 368 (1781). – Type: Chile, Magallanes, "Iles narreaux, bois des monts de Commerson, est baie de Bougainville", 1767 Commerson (PC lectotype, Ahti, Ann. Bot. Fenn. 17: 210, 1980).

Syn. *Cladonia elongata* (Wulfen) Hoffm., *Cladonia gracilis* var. *elongata* (Wulfen) Fr., *Cladonia gracilis* subsp. *nigripes* (Nyl.) Ahti, *Cladonia nigripes* (Nyl.) Trass

F: pohjantorvijäkälä **S:** lång stängellav

Literature. Ahti, Ann. Bot. Fenn. 17: 204–207 (1980, as subsp. *nigripes*); Brodo & Ahti, Canad. J. Bot. 74: 1162–1163 (1996); Carlin 1981: 388 (as subsp. *nigripes*); Stenroos & Ahti, Ann. Bot. Fenn. 27: 321–322 (1991, '1990').

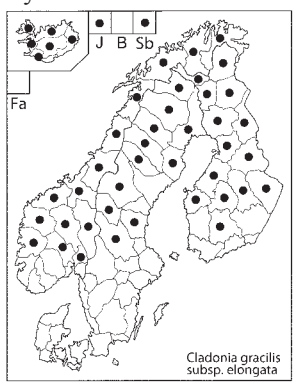
Figs. Ahti 1980: figs 4, 5; Hansen & Andersen 1995: 28; Osyczka 2006: 223; Stenroos et al. 2011: 141.

Primary thallus soon evanescent, growth indefinite. Podetia 4–12(–15) cm tall, 1–3 mm thick, greenish to brown at tops, clearly melanotic at base, unbranched to somewhat branched, axils closed, tips pointed or finally narrowly (0.5–2 mm) scyphose; scyphi may also proliferate from margins and continue the growth of podetia. Surface almost matt, smooth, but more areolate and uneven than subsp. *gracilis,* esorediate, esquamose (podetial squamules extremely rare!). Apothecia rare, at margins of scyphi, brown, occasionally large (5 mm diam.). Pycnidia on rims of scyphi, usually ovoid, containing hyaline slime.

Chemistry. K–, K+ yellow or brownish, P+ orange red, UV–. Atranorin (in most specimens but in small amount), fumarprotocetraric acid complex.

Habitat. Above timberline and in the northern boreal zone a frequent soil lichen in mesic habitats, also on rocks and even bogs, further south scattered, mainly in rock beds in special, cold situations.

Distribution. Common in northern boreal areas, reaching the alpine zone. Avoiding the coast, but detailed distribution in Norway not clarified. Scattered localities southwards to Dalarna in Sweden and Etelä-Häme in Finland. Apparently rare in Svalbard. **Gr. F:** *EH EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Ak He Op Te Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Sb.* **S:** *Dlr Hls Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Northern Eurasia, North America, southern South America, Antarctic.



Note. The Icelandic populations are problematic. Although subsp. *elongata* is present in Iceland, almost all the material rather approaches *C. macroceras.* In areas in Scandinavia where subsp. *elongata* meets subsp. *turbinata*, there are apparent "hybrids" between these taxa. Such specimens (see also Ahti 1980) come, for instance from *Vb*: Degerfors, *LuL*: Jokkmokk*, PL*: Arjeplog in Sweden, and *PeP*: Rovaniemi, *Ks*: Kuusamo, *KiL*: Kittilä in Finland. Intermediates with subsp. *gracilis* are also expected, but they are more difficult to recognize and in Finland those subspecies rarely meet. *C macroceras* can be extremely similar to subsp. *elongata.* They are sometimes found immixed even in northern boreal forest but more usually in timberline areas or also in Svalbard. *C. macroceras* is more robust, shiny, often slightly squamulose, at base with very tough medulla (use razor blade!) and often slightly melanotic.

41c. subsp. turbinata (Ach.) Ahti

Ann. Bot. Fenn. 17: 212 (1980). – *Lichen turbinatus* Ach., Lichenogr. Suec. Prodr.: 192 (1799, '1798'). – Type: [Sweden] (BM-Ach. 702h lectotype, Ahti, Ann. Bot. Fenn. 17: 212, 1980).

Syn. *Cladonia gracilis* var. *dilatata* auct., *Cladonia pachyscypha* Sandst. ex Zahlbr.

F: metsätorvijäkälä **S:** bägarstängellav

Literature. Ahti, Ann. Bot. Fenn. 17: 212–215 (1980); Carlin 1981: 388; Krog et al. 1994: 158–159.

Figs. Ahti 1980: 214; Carlin 1981: fig. 12E; Hinds & Hinds

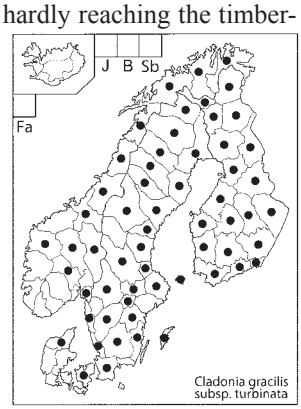
2007: 186; Stenroos et al. 2011: 143.

PRIMARY THALLUS squamulose, persistent, growth not indefinite. PODETIA 2–6(–10) cm tall, 2–4 mm thick, green to browned, robust, never pointed but always bearing regular, to 1 cm wide scyphi., sometimes with 1–6 successive marginal scyphose proliferations. Surface smooth but maculate and shallowly areolate, esorediate. APOTHECIA common, on scyphal rims, often large (to 8 mm diam.). PYCNIDIA common on scyphi, mammiform, constricted at base, containing hyaline slime.

Chemistry. K– (or brownish), P+ orange red, UV–. Fumarprotocetraric acid complex.

Habitat. Forest floor in dry to mesic habitats, rock outcrops, bog hummocks, rotten wood.

Distribution. Very common in southern to middle boreal regions, but can be scarce close to the sea. Southwards extending to *Sk* in Sweden and *Sjæ* in Denmark, but very rare. Northwards scattered in the northern boreal zone and hardly reaching the timberline and absent from the alpine and arctic areas. **D:** *NJy Sjæ.* **F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu SF ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Gtl Klm SmI Hl Bh Vg Ög Nrk Vrm Vsm Upl Dlr Gst Hls Mpd Ång Jmt Vb Nb ÅsL LyL PL LuL TL.* Northern Eurasia and North America, with continental tendencies.



Note. Most widespread of the subspecies of *C. gracilis*. Usually very distinct, but in areas where it meets subsp. *elongata* they hybridize. The same is true in areas where it meets subsp. *gracilis*. Such collections are known from *Srm* and *Upl* in Sweden and *V* and *U* in Finland, for instance. However, recent molecular studies surprisingly do not support the recognition of subsp. *turbinata*.

42. Cladonia grayi G.Merr. ex Sandst.

Cladon. Exs. No. 1847 (1929). – TYPE: U.S.A., North Carolina ('North Virginia'), Mecklenburg Co., Charlotte, Long Creek, 1928 Gray in Sandstede, Cladon. Exs. no. 1847 (FH lectotype, Ahti, Regnum Veg. 128: 79, 1993).

Syn. *Cladonia grayi* f. *aberrans* Asahina

D: grays bægerlav **F:** karheatorvijäkälä **N:** melbrunbeger **S:** Grays bägarlav

Red-listed in: **D**

Literature. Ahti, Ann. Bot. Fenn. 3: 382–384 (1966); Fl. Neotrop. Monogr. 78: 119–122 (2000); Culberson & Kristinsson, Bryologist 72: 431–443 (1969); Hammer, Mycologia 89: 900–907 (1997); Holien & Tønsberg 1985: 16–19 (1985); Kowalewska et al., Herzogia 21: 68–70 (2008); Leuckert et al., Nova Hedwigia 22: 503–534 (1971); Nourish & Oliver in Brown et al. (eds), Lichenology: Progress and Problems: 185–214 (1976).

Figs. Ahti 2000: 120; Carlin 1981: fig. 11M; van Herk & Aptroot 2004: 147; Stenroos et al. 2011: 143; Holien & Tønsberg 1985: 17 (1985).

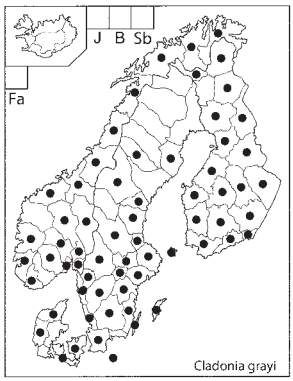
PRIMARY THALLUS inconspicuous, soon evanescent. PODETIA 1–2(–3) cm tall, stalk 0.5–1.5 mm thick, greenish or pale grey, with brown tinge, slightly melanotic at base, usually simple, regularly scyphose; scyphi to 7 mm wide, regular, usually with entire margins but sometimes proliferating. Surface granulose to farinose sorediate on and inside scyphi, easily eroding, immixed with schizidia and phyllidia, stalk more corticate, verruculose-areolate, often also squamulose. APOTHECIA infrequent, dark brown, rarely ochraceous, on stalks proliferating from scyphal margins. PYCNIDIA common on scyphi, ovoid, containing hyaline slime.

Chemistry. K–, P– or P+ red, UV+ ice blue. Two major chemotypes: 1) grayanic acid, with traces of 4–*O*-demethylgrayanic acid; 2) grayanic acid and fumarprotocetraric acid complexes, also additional minor substances and fatty acids common. In the West Indies also other chemotypes. In northern Europe chemotype 1 is usually somewhat more frequent than chemotype 2, but the reverse situation has been reported from Poland.

Habitat. On highly acidic, humus, peaty or sandy soils, also on rotten wood, in open to shady situations in forests to open rock outcrops, bogs and tundra heaths.

Distribution. Widespread and often common, but not recorded from Iceland, Færoe Islands or the Arctic

islands (but present in Greenland). **D:** *NJy VJy Fyn Sjæ Brn.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te VA Ro Ho MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Jmt Vb ÅsL.* Europe, Asia, North and South America, South Africa, Hawaii, New Zealand, arctic to warm temperate.



Note. Presence of grayanic acid is regarded as the decisive, diagnostic character of *C. grayi*, since its morphological characters are often difficult to recognize. A preliminary identification can be made under UV light because the fluorescence of grayanic acid is rather unique. However, it is not always distinctive and therefore TLC is usually applied. Earlier (up to 1950's) it was often believed in Europe that *C. grayi* always reacts P– and it was misidentified. *C. grayi* has also been used in a wide sense, to include the similar brownish species *C. cryptochlorophaea*, *C. merochlorophaea* and *C. novochlorophaea.* This "*C. grayi* group" really seems to differ from *C.chlorophaea* s. str., e.g. in ecology as it prefer to grow in very acidic habitats.

43. Cladonia homosekikaica Nuno

J. Jap. Bot. 50: 294 (1975). – Type: Japan, Hokkaido, Nemuro District, Shiretoko Peninsula, Mt. Rausu-dake, Togashi 7075 (TNS holotype).

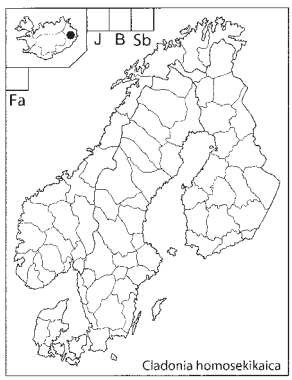
Literature. Brodo & Ahti, Canad. J. Bot. 74: 1165–1166 (1996); Burgaz & Ahti 2009: 47–48; Culberson & Kristinsson, Bryologist 72: 434–435 (1969).

Figs. Burgaz & Ahti 2009: 62; Nuno 1975: 295.

Primary thallus squamulose, persistent, inconspicuous, evanescent. Podetia to 2.5 cm tall, greenish brown, slightly melanotic at base, always scyphose; scyphi to 5 mm wide, regular, rarely proliferating from margins, which are entire or dentate. Surface almost continuously corticate, warted on basal parts, farinose to granulose sorediate on upper parts, podetial squamules occasional. Apothecia rare, brown. Pycnidia common, on scyphal margins, containing hyaline slime.

Chemistry. K–, P– or P+ red, UV+ pale. Homosekikaic and sekikaic acids, with the fumarprotocetraric acid complex inconstant.

Habitat. On acidic soil in heathlands.



Distribution. Iceland, very rare. **I:** *IAu.* Reported from scattered places in Europe (Iberian Peninsula, Greece, Lithuania), East Asia (Japan, Korea), North America (Alaska) and Australia.

Note. The taxonomic status of this species is not clear. It is clearly a member of the *C. grayi* group, having a brownish colour, but the podetia are farinose sorediate in part and contain the homosekikaic acid complex, like the scarcely sorediate *C. novochlorophaea.*

44. Cladonia humilis (With.) J.R.Laundon

Lichenologist 16: 220 (1984). – *Lichen humilis* With., Bot. Arr. Veg. Great Brit.: 721 (1776). – Type: Icon in Dillenius, Hist. Musc.: t. 14, fig. 11 (1742) holotype; England, London, Greenwich, Charlton and Woolwich, Herb. Dillenius t. 14, fig. 11 (OXF-Dillenius epitype, Ahti, Fl. Neotrop. Monogr. 78: 122, 2000).

Syn. *Cladonia 'conistea'* auct., *Cladonia conoidea* Ahti

D: lav bægerlav **F:** tannertorvijäkälä **N:** sandbrunbeger **S:** sandbägarlav

Red-listed in: **D N**

Literature. Ahti, Ann. Bot. Fenn. 3: 386–387 (1966); Lichenologist 12: 128–130 (1980); Dolnik et al., Lichenologist 42: 380–383 (2010); Laundon, Lichenologist 16: 220 (1984); Leuckert & Poelt, Herzogia 1: 441–445 (1970); Pino-Bodas et al., Biblioth. Lichenol. 108: 161–174 (2012); Tønsberg, Blyttia 37: 127–128 (1979); Tønsberg et al., Sommerfeltia 23: 57–59 (1996).

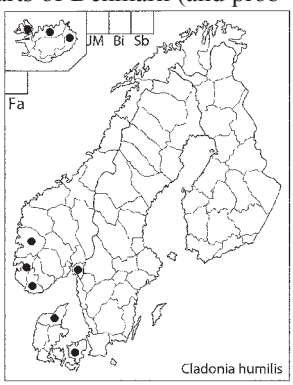
Figs. van Herk & Aptroot 2004: 147; Krog et al. 1994: 153; Pino-Bodas et al., Biblioth. Lichenol. 108: 167 (2012); Tønsberg 1979: 127.

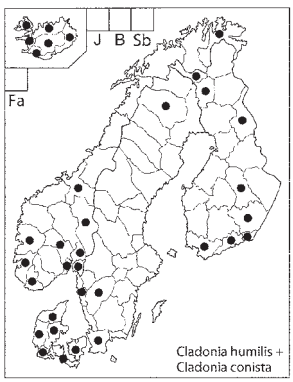
Primary thallus squamulose, persistent, squamules, relatively large, up to 1 cm long, little divided, adnate, slightly veined below, occasionally sorediate along margins. Podetia to 5(–8) mm tall, greenish grey, almost never browned, usually simple, short-stalked, stalk often shorter than scyphus, always scyphose; scyphi 3–4(–8) mm wide, regular, gradually to abruptly flaring, marginal proliferations rare. Surface continuously corticate, smooth and minutely pruinose, cortex extending from the base to scyphi, sometimes up to the margin, but upper parts and interior of scyphi also farinose (rarely granulose) sorediate, rarely squamulose. Apothecia very rarely seen, long pedicellate, brown. Pycnidia on margins of scyphi, ovoid, containing hyaline slime.

Chemistry. C–, K+ yellow (weakly), P+ red, UV–. Atranorin, fumarprotocetraric acid complex, zeorin (accessory).

Habitat. On bare mineral soil along roads, field margins and other man-made pioneer habitats, also on sandstone rocks, in Norway (*VA*) particularly on maritime sand dunes.

Distribution. Common in parts of Denmark (and probably also southern Sweden), scattered or rare elsewhere, especially northwards. **D:** *NJy Sjæ.* **I:** *IAu INv INo.* **N:** *Øf VA Ro Ho*. Western, Central and Mediterranean Europe, Macaronesia, Africa, East Asia, western North America, southern South America, Australasia. Temperate to subtropical.





[Distribution of *C. humilis* + *C. conista*: **D:** *NJy ØJy VJy SJy Fyn Sjæ*. **F:** *V U EK ES PS Ks KiL EnL*. **I:** *ISu IVe IMi IAu INv INo*. **N:** *Øf Ak He Bu Vf VA Ro Ho ST ØFi*. **S:** *Sk Bh Vg LuL*.]

Note. In times the concept of *Cladonia humilis* has commonly included *C. conista* as a chemotype. However, because recent molecular data have indicated that they are distinct species (Pino-Bodas et al. 2011), they are treated here separately. All the material in the Nordic herbaria has not been checked (usually TLC is needed). Therefore the distribution data are incomplete.

45. **Cladonia imbricarica** Kristinsson

Lichenologist 6: 143 (1974). – Type: Iceland, Central Highlands, Thjórsárver, Oddkelsalda, 1971 Kristinsson 24582 (AMNH holotype).

F: kuppitorvijäkälä **I:** flatbikar **N:** grusbrunbeger **S:** grusbägarlav

Literature. Culberson et al., Bryologist 88: 380–387 (1985); Gjerlaug, Lichenologist 21: 178–179 (1989); Kristinsson 1974: 141–145; Palice & Svensson, Graphis Scripta 21: 25 (2009);Tønsberg et al., Sommerfeltia 23: 59 (1996).

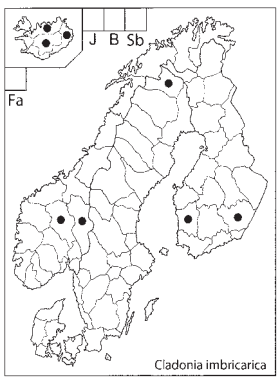
Figs. Kristinsson 1974: pl. 1B; Krog et al. 1994: 160; Stenroos et al. 2011: 144.

Primary thallus squamulose, persistent, greenish grey to brown, Podetia to 0.5 cm tall, brownish to greyish green, simple, always scyphose; scyphi 2–4 mm wide, deep, usually with very short (0.1–1 mm) stalks, occasionally even stalkless, scyphal plate may become expanded and flattened with age, margins toothed. Surface of podetia verruculose, corticate, and (especially inside scyphi) with bullate schizidia, phyllidia and granules immixed with eroded areas. Apothecia very rare, brown. Pycnidia terminal on scyphal margins, slime not seen.

Chemistry. K–, P–, UV+ white. Sphaerophorin, traces of isosphaeric acid and 4–O-demethylsphaerophorin. Unknown, probably related, substance in one specimen from Norway (*Øf*).

Habitat. On acidic soil.

Distribution. Rarely found in Iceland, Norway, Sweden and Finland. At 130–860 m in Hedmark. **F:** *St ES.* **I:** *IMi IAu INo.* **N:** *He Op.* **S:** *TL*. Europe, Greenland, western North America, East Asia (?), Ecuador, Argentina. Range poorly



known.

Note. This species resembles *C. pyxidata*, but has shorter podetial stalks (sometimes almost absent) with wider scyphi, inside with large bullata or flat squamules and different chemistry (UV+ white, for instance). Probably much overlooked.

46. Cladonia incrassata Flörke

De Cladon.: 21 (1828). – Type: Germany, Flörke, Cladon. Exs. no. 5 (G lectotype, Ahti, Regnum Veg. 128: 81, 1993).

D: tørve-bægerlav **F:** turvetorvijäkälä **N:** dvergrødtopp **S:** torvbägarlav

Red-listed in: **D F N**

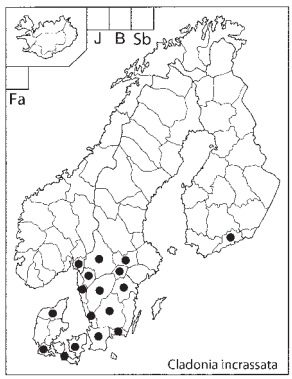
Literature. Almborn, Bot. Not. Suppl. 1(2): 203 (1948); Arup et al., Skyddsvärda lavar i SV Sverige: 170–171 (1997); Doll, Nova Hedwigia 56: 155–167 (1993); Gelting, Vilde Planter i Norden: 108–109 (1951); Kuusinen et al., Graphis Scripta 2: 130–132 (1989; Litterski & Ahti 2004: 212–213, 230; Thor & Arvidsson, Rödlistade lavar i Sverige: 122–123 (1999); Tønsberg, Graphis Scripta 7: 61–65 (1995); Vainio 1887: 182–185.

Figs. Arup et al. 1997: fig. 69G; Carlin 1981: fig. 3H; Galløe 1954: pls 55–59; van Herk & Aptroot 2004: 149; Hinds & Hinds 2007: 187; Stenroos et al. 2011: 145.

Primary thallus persistent, squamulose, squamules very small, 0.5–3 mm wide, usually abundantly sorediate on margins and below, sometimes becoming fully dissolved into a greenish to brownish masses of soredia in thick cushions. Podetia infrequent, usually tiny, 1–7 mm tall, 0.5–1 mm thick, yellowish grey, at base orange yellow, simple to sparsely branched at apex, cylindrical to clublike, ascyphose or rarely scyphose at tips; scyphi 2.5–5 mm wide. Surface minutely verruculose-corticate, sorediate in patches, rarely squamulose. Apothecia rare, red, usually present at tips of podetia, soon becoming confluent to form 2.5 mm wide discs. Pycnidia on primary squamules, sessile, ovoid, somewhat constricted at base, containing red slime.

Chemistry. K–, P–, UV+ white. Usnic, squamatic and didymic (rarely absent) acids, bellidiflorin (trace), rhodocladonic acid. Occasionally also grayanic acid (see notes).

Habitat. In Northern Europe probably exclusively recorded from man-made peat cuts in raised bogs, often in wide colonies, rarely from rotten wood or mossy stones, which are its normal habitats in many other areas. It is expected to become overgrown by plants in most of the old peatland habitats where it has been recorded.



Distribution. Denmark, mainly western in South Sweden, very rare in Norway and Finland. **D:** *NJy SJy Fyn Sjæ.* **F:** *U.* **N:** *Øf.* **S:** *Sk Bl SmI Hl Bh Dls Vg Ög Nrk Vrm Vsm.* Western Europe, Caucasus, East Asia, eastern North America (S to Florida and Puerto Rico). Oceanic, hemiboreal to warm temperate.

Note. The tiny sorediate squamules and short, fertile podetia serve to distinguish this species, but when sterile it is easily overlooked. Tønsberg (1995) reported grayanic acid in some German specimens of this species and pointed out that this strain approaches the non-sorediate *C. anitae* W.L.Culb. & C.F.Culb. with similar chemistry, recognized in the warm temperate SE United States.

47. Cladonia islandica Kristinsson & Ahti

Biblioth. Lichenol. 99: 279 (2009). – Type: Iceland, South Iceland, Árnessýsla, Herdísarvík, 1978 Kristinsson 22419 (AMNH holotype).

I: brekabroddar

Literature. Kristinsson & Ahti, Biblioth. Lichenol. 99: 279–281 (2009).

Figs. Kristinsson & Ahti 2009: 281.

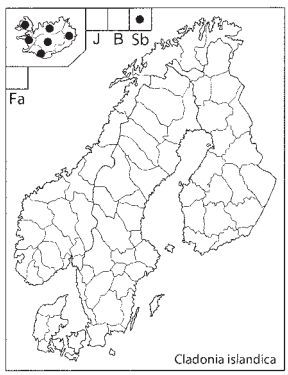
Primary thallus squamulose, persistent, squamules thickish, small to rather large, 0.2–1 mm long, little divided. Podetia 3–7 cm tall, 0.1–0.5 mm thick, brown or in shade greyish, base strongly melanotic inside; fairly slender, unbranched or infrequently branched, especially in distal parts, tips acuminate, often slightly curved or divaricate, usually ascyphose but rarely producing narrow scyphi, axils closed but may become perforate with age. Surface very rough, not sorediate but microsquamulose and coarsely gran-

ulose, often discontinuously corticate even at young stage, cortex thick, transforming into small, bullate squamules, some macrosquamules may be present towards the base. Apothecia infrequent, at tips, small, blackish brown, spores not observed. Pycnidia rather sparse, terminal or basal, broadly pyriform to cylindrical, sessile; internal slime not observed.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex.

Habitat. On mossy rocks and stone walls, also in dwarf shrub heaths, vegetated lava fields, once in birch woodland.

Distribution. Scattered throughout most of Iceland, especially frequent around Lake Mývatn with active volcanic habitats. **I:** *ISu IVe IMi IAu INv INo*. **AI:** *Sb*. Thought to be endemic in Iceland and Svalbard, but recent records from Canada and Alaska indicate that it is more widespread.



Note. Similar to *Cladonia subulata* in stature and branching type but differs by brown, shiny, microsquamulose, esorediate surface. It is expected to occur also elsewhere on the North Atlantic coasts.

48. Cladonia krogiana Løfall & Timdal

Lichenologist 34: 277 (2002). – Type: Norway, Østfold, SW side of lake Frønesjøen, 190 m, 2002 Løfall & Timdal bpl-L9029a (O holotype).

N: knauspolster

Literature. Løfall & Timdal, Lichenologist 34: 277–281 (2002).

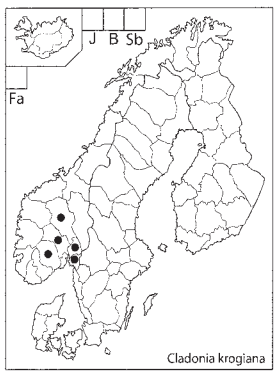
Figs. Løfall & Timdal 2002: 278.

Primary thallus squamulose, persistent, forming dense, elevated, cushions up to 10 cm wide, squamules greyish-green to brown, somewhat shiny, minutely scabrose, ascending, to 8 mm long, 4 mm wide, crenulate to deeply incised, lobes often narrowly linear. Podetia absent or rudimentary. Apothecia infrequent, directly attached to the primary squamules or very shortly stalked; only known in immature state. Pycnidia unknown.

Chemistry. K–, P– (or bluish to black!), UV–. Barbatic acid, chlorovinetorin (5,7–dichloro-3-*O*-methylnorlichexanthone), rarely fumarprotocetraric acid (trace). Chlorovinetorin is a xanthone, not known in other species of *Cladoniaceae*.

Habitat. On open rock outcrops (gneissic, amphibolitic), over thin layer of soil or mosses (type specimen on *Grimmia unicolor*), often in seepages.

Distribution. SE Norway, locally common (especially *Øf*), in hemiboreal to southern boreal zone. **N:** *Øf Ak Bu Te Op*. Also in eastern Canada (New Brunswick). Perhaps oceanic.



Note. A species with poorly known distribution (expected in *Bh* in Sweden, for instance, since there are many records from the adjacent Norway). Difficult to identify from morphology alone, because podetia are unknown and the squamules resemble those of *C. cervicornis* and other species. It reacts P–, however, and has the unique xanthone together with barbatic acid (TLC). It is perhaps most similar to *C. polycarpoides*, which reacts P+ red (norstictic acid), however. Another similar, P– species is *C. callosa,* which contains grayanic acid (UV+).

49. Cladonia libifera Savicz

Novosti Sist. Nizsh. Rast. 1965: 167 (1965). – Type: Russia, Sakha Republic (Yakutia), Aldan River, Khandyga (Chandyga), near hotsprings Teplyy klyuch (‘Tjoplyj kljucz’)1949 Tjulina in Savicz, Lichenotheca Rossica no. 150 (LE holotype).

S: svartfotad trattlav

Literature. Hansen & Ahti, Graphis Scripta 23: 60–61 (2011).

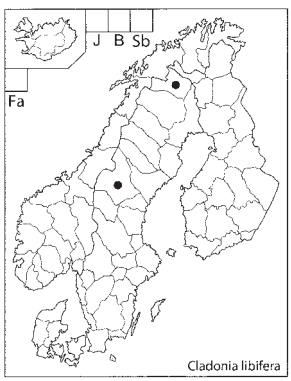
Figs. Savicz, Novosti Sist. Nizsh. Rast. 1965: 167 (1965).

Primary thallus squamulose, persistent to evanescent, to 1 cm long, 1–2 mm wide, thickish. Podetia 3–6 cm tall, 1–2 mm thick, castaneous brown to pale

grey, melanotic in necrotic parts, becoming elongate, scyphose; scyphi 0.5–1 cm wide, margins dentate and often with long, narrowly scyphose proliferations. Surface characteristically verruculose-areolate, glossy, felty, thick medulla visible in the interspaces of the areoles, phyllidioid, bullate squamules occasional on podetial stalk and inside the scyphi, spreading or downturned, occasionally rhizinate along margins, esorediate. Apothecia common, 0.5–2 mm wide, on short stalks, dark brown. Pycnidia common on scyphal margins, globose to ovoid, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex.

Habitat. On humus rich soil, probably not very acid, perhaps preferably on moist to wet sites.



Distribution. A few localities in West, East and North Greenland, also in Central and North Sweden, probably elsewhere but not recognized. **Gr. S:** *Jmt TL.* Widespread in Northeast Asia, Alaska, western Canada, Greenland.

Note. This species long recognized in Siberia, has only recently been reported from Europe and North America based on our field observations in Siberia. It is a critical taxon and member of the *C. pyxidata* group, but when well-developed it is distinguished by taller growth, melanotic base, and characteristic reddish-brown, shiny, verruculose podetial surface. The primary squamules resemble those of *C. pocillum* but are more upright and divided.

50. Cladonia luteoalba Wheldon & A.Wilson

Fl. W. Lancashire: 450 (1907). – Type: England, West Lancashire, Greygarth Fall, 1906 Wheldon & Wilson 19 (BM lectotype, Ahti, Lichenologist 3: 86, 1965, as "holotype").

Syn. *Cladonia foliacea* var. *meiophora* Asahina

F: pahtatorvijäkälä **I:** gullinlauf **N:** gulskjell **S:** gulfjäll

Red-listed in: **F**

Literature. Ahti, Lichenologist 3: 84–88 (1965); Lutukka 1: 71–72 (1985); Dahl & Krog, Nytt Mag. Bot. 17: 143–144 (1970); Østhagen, Blyttia 29: 251–253; Norweg. J. Bot. 19: 37–41 (1972); Blyttia 34: 192–193 (1976); Stenroos, Karstenia 30: 27–32 (1990).

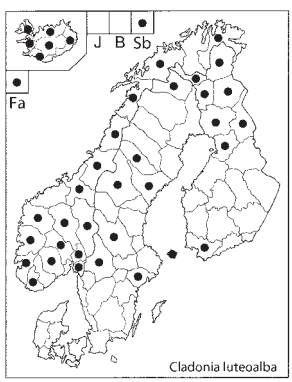
Figs. Hansen & Andersen 1995: 29; Krog et al. 1994: 160; Stenroos 1990: 30, 31; Stenroos et al. 2011: 146.

Primary thallus squamulose, persistent, squamules conspicuous, large (ca. 1–3 × 0.5–1 cm), revolute when dry, underside clearly yellow, with thick, fluffy layer of short, entangled hyphae. Podetia rare, to 1 cm tall, unbranched, tips subulate or with narrow, indistinct scyphi. Surface ecorticate, entirely cottony-arachnoid, without soredia and podetial squamules. Apothecia very rare, at tips of podetia, ochre-yellow (observed at juvenile stage only). Pycnidia at tips of podetia; colour of internal slime not seen.

Chemistry. K–, P– (rarely P+ red), UV– (rarely UV+ white). Four chemotypes, perhaps deriving from apparent host lichens, all containing abundant usnic acid (sometimes with isousnic acid): 1) Zeorin, porphyrilic and "conporphyrilic" acids; 2) squamatic acid, with accessory didymic acid; 3) barbatic acid, with accessory 4–*O*-demethylbarbatic acid; 4) fumarprotocetraric acid complex. Chemotype 1 is most widespread.

Habitat. On other lichen species (senile podetia of red-fruited *Cladonia* species), on mosses, plant debris, thin soil or peat, even in snow-bed communities. Usually in open habitats but sometimes in shade.

Distribution. Rather common in Norway, especially at higher elevations, but elsewhere usually scarce or absent. **Fa. Gr. F:** *A V OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Te VA Ro Ho SF ST NT SNo NNo Tr ØFi.* **AI:** *Sb.* **S:** *Srm Vrm Dlr Ång Jmt ÅsL TL.* Western and northern Europe, East Asia and Himalayas, northern North America, southern South America.



Arctic to boreal (mainly northern), with oceanic tendencies.

Note. An unusual *Cladonia,* growing in association with other lichen species. Usually easily recognized by fairly large, below conspicuously yellow squamules.

51. Cladonia macilenta Hoffm.

Deutschl. Fl. 2: 126 (1796), *nom. cons.* – Type *(cons.)*: Germany, Niedersachsen, Oldenburg, Litteler Fuhrenkamp, 1919 Sandstede, Cladon. Exs. no. 477 (UPS).

Syn. *Cladonia bacillaris* (Ach.) Genth, *nom. cons.*, *Cladonia floerkeana* var. *bacillaris* (Ach.) Leight., *Cladonia macilenta* var. *bacillaris* (Ach.) Schaer., *Cladonia macilenta* subsp. *bacillaris* (Ach.) Boist., *Cladonia berghsonii* Asperges

D: indsvunden bægerlav **F:** tappitorvijäkälä **I:** rauðbroddar **N:** melrødtopp, pulverrödtopp **S:** mager bägarlav

Literature. Ahti 2000: 208–213; Ahti & DePriest, Taxon 54: 183–184, 186 (2005); Christensen, Lichenologist 19: 61–69 (1987).

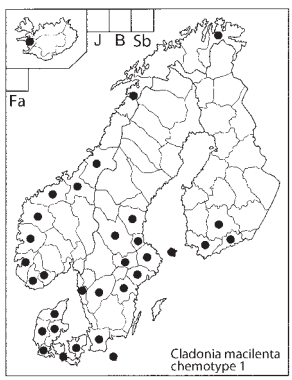
Figs. Carlin 1981: figs 2A, 2F; Galløe 1954: pls 33–36, 39–42; van Herk & Aptroot 2004: 149; Hinds & Hinds 2007: 189; Krog et al. 1994: 148, 160; Stenroos et al. 2011: 147.

Primary thallus persistent, squamulose, squamules 0.5–1 mm long, esorediate to mainly secondarily sorediate. Podetia 0.5–1.5(4) cm tall, 0.3–1–5(2.5) mm thick, pale grey, unbranched to little branched at apex, axils closed, shortly subulate to bluntish, somewhat swollen (clavate) when bearing apothecia, ascyphose but sometimes forming scyphoid axils. Surface mostly ecorticate, abundantly farinose sorediate, but occasionally, especially when fertile, smoothly corticate at base and below the hymenial discs (rarely almost throughout). Apothecia usually scarce, red (rarely ochraceous) to 4 mm diam. Pycnidia on primary squamules, sessile to shortly stalked, usually ovoid, hardly constricted at base, containing red slime.

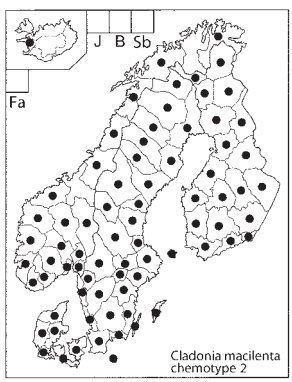
Chemistry. K+ yellow, P+ yellow, UV–. Two major chemotypes: 1) K+ yellow, P+ yellow; thamnolic and decarboxythamnolic acids, sometimes with barbatic acid; 2) K–, P–; barbatic and 4–*O*-demethylbarbatic acids. Both chemotypes can occasionally contain didymic acid complex or rarely squamatic acid as minor or major compounds. Rarely small amounts of usnic acid.

Habitat. Primarily on rotting wood, on stumps, logs, thin twigs and bases of trees, but also on dying mosses, peat, humus-rich soil on pine forest floors, especially in postfire stages and road verges, and on thin soil over rock outcrops.

Distribution. Chemotype 1: Common in coastal areas of southern and central Norway up to Nord-Trøndelag, also widespread in Denmark, South Sweden and SW Finland, otherwise rare or absent. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **F:** *A V U EH.* **I:** *IVe.* **N:** *AA VA Ro Ho SF MR ST NT NNo ØFi.* **S:** *Sk Bh Vg Ög Srm Vsm Upl Dlr Gst Hls.* Worldwide but not transcontinental in northern Eurasia and North America but confined to areas close to coasts.



Chemotype 2: Very common throughout most of the Nordic countries but infrequent in the alpine and arctic zones. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IVe.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR NT SNo NNo Tr ØFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Transcontinental in boreal and temperate Eurasia and North America, widespread also in the southern hemisphere.



Note. This species was earlier usually divided into two species, *C. macilenta* and *C. bacillaris.* They were recognized by presence or absence of thamnolic acid (K-reaction), although subtle morphological features were reported (e.g., *C. macilenta* was thought to be more robust). It was primarily Christensen (1987) who finally pointed out that such differences scarce-

ly exist. However, according to Stenroos et al. (2002) the populations of *C. macilenta* may not be uniform all over the world, and a more extensive study is required to clarify the situation. The chemotypes have major differences in distribution anyway. See also discussion under *C. floerkeana*.

In general, *C. macilenta* can be very similar to *C. coniocraea*, but differs by its P+ yellow or P– but not P+ red reaction. Brown colouration is not as readily developed on *C. macilenta* as on *C. coniocraea* and *C. ochrochlora*. Young colonies of *C. polydactyla* are similar but more glaucous, roughly sorediate and showing formation of narrow scyphi. The structurally similar *C. bacilliformis* and *C. cyanipes* have a yellowish tint due to usnic acid. A real problem is *C. norvegica*, which is P– and has ochraceous apothecia, but these are often absent; its very slender podetial tips are often the only character to help the identification.

Rarely globular, thick, white soralia may develop laterally on podetia (found in Dalarna, Sweden; called 'f. *sorediata*' Sandst.).

52. Cladonia macroceras (Delise) Hav.

Bergens Mus. Årbok, Naturvidensk. Rekke 1927(3): 12 (1928 '1927'). – *Cenomyce gracilis* var. *macroceras* Delise, Bot. Gall. 2: 624 (1830). – Type: France, "ad terram in Alpibus, monte Aureo, Pyrenaeis" (PC, not designated)

Syn. *Cladonia elongata* auct. p.p., *Cladonia gracilis* var. *abortiva* Schaer.

F: alppitorvijäkälä **I:** kryppukrókar **S:** långhornslav

Literature. Ahti, Ann. Bot. Fenn. 17: 215–219 (1980); Fontaine et al., Lichenologist 42: 329 (2010); Osyczka 2006: 222–224; Pino-Bodas et al., Org. Divers. Evol. 11: 347–355 (2011); Stenroos et al. 2002: 246.

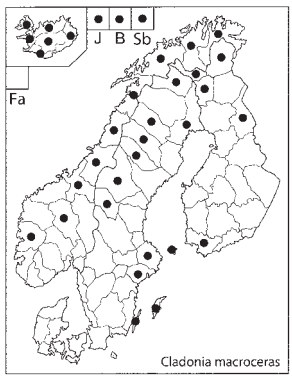
Figs. Ahti 1980: 217; Carlin 1981: fig. 11G; Hansen & Andersen 1995: 30; Osyczka 2006: figs 3C-D; Stenroos et al. 2011: 148; Wirth 1995: 311.

Primary thallus squamulose, persistent or soon disappearing, sometimes becoming bullate, thick and forming continuous, adnate crust. Podetia to 10(–15) cm tall, brownish green to dark brown, at base becoming reddish brown to almost black, often fairly robust (1–4 mm thick), sparsely and irregularly dichotomously branched, axils closed, tips subulate or scyphose; scyphi to 1 cm wide, regular or irregular, shallow or deep, with marginal teeth and often several proliferations. Surface of podetia continuously corticated, smooth to somewhat areolate, generally undulate or lacunose to wrinkled and longitudinally ridged, glossy, near base often white-cracked, even tuberculose, podetial squamules common, soredia absent. Apothecia brown, uncommon. Pycnidia at scyphal margins, ovoid, containing hyaline slime

Chemistry. P + red, K– or K+ yellow (or brownish), UV–. Fumarprocetraric acid complex and sometimes additional atranorin. The Gotland and Öland populations seem to have atranorin constantly.

Habitat. Mainly alpine and arctic heaths and rock fields in the north, extending to forests in rocky places, like by water falls and river beds, especially on calcareous soil. In Gotland, Öland, Åland and adjacent coasts restricted to calcareous alvars and rock outcrops.

Distribution. **Gr. F:** *A V Ks KiL EnL InL*. **I:** *ISu IVe IMi IAu INv INo.* **N:** *Op Ho ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb.* **S:** *Öl Gtl Srm Upl Hrj Jmt Nb ÅsL LyL PL TL.* Europe, Asia, North America, circumpolar, mainly arctic to northern boreal and more southern arid regions, especially in Asia and some mountain ranges (common in the Alps).



Note. On the calcareous alvars of Öland and Gotland this species is very robust and easily recognized. In the mountains and the Arctic (and the Alps) however, this morphology ranges from robust to thin. Then it can be very difficult to distinguish from *C. gracilis* subsp. *elongata*. Useful characters to distinguish them are common presence of podetial or primary squamules in *C. macroceras*, strongly blackening necrotic parts in subsp. *elongata*, shiny, tough and thick cortex in *C. macroceras,* and rarity of atranorin (in most areas) in *C. macroceras.* The existing molecular data are still not representative to solve the taxonomy of this group but it may turn out to be paraphyletic, in part nested within *C. gracilis* s. lat.

53. Cladonia macrophylla (Schaer.) Stenh.

Lich. Suec. Exs., ed. 2, Fasc. 7: [3] (1865). – *Cladonia ventricosa* var. *macrophylla* Schaer., Lich. Helv. Spic. 1(6): 316 (1833). – TYPE: Switzerland, Canton Berne, Grimsel Pass, Handeck & Susten Pass, Gadmen, Schaerer, Lich. Helv. Exs. no. 279 (G lectotype, Ahti, Regnum Veg. 128: 83, 1993).

Syn. *Cladonia alpicola* (Flot.) Vain.

D: fjeld-bægerlav **F:** paakkutorvijäkälä **N:** trevlelav **S:** fjällig bägarlav

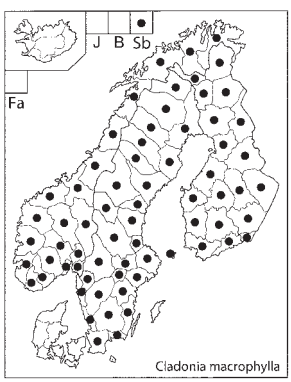
Literature. Ahti, Bryologist 70: 105 (1967); Huovinen et al., Ann. Bot. Fenn. 26: 299–304 (1989); Litterski & Ahti 2004: 213–314, 231.

Figs. Galløe 1954: pls 117–120; Hansen & Andersen 1995: 30; Hinds & Hinds 2007: 189; Holien & Tønsberg 2006: 90; Moberg & Holmåsen 1990: 144; Stenroos et al. 2011: 148.

PRIMARY THALLUS squamulose, persistent or disappearing, squamules large, 3–10 mm long, 5–8 mm wide, upper surface verruculose or checkered, often in large colonies. PODETIA common (sometimes scarce, although primary squamules abundant), 1–6 cm tall, 0.8–5 mm thick, glaucous to brown, pale or yellowish towards base, unbranched, clavate to somewhat branched, axils closed, ascyphose. Surface very rough due to small, peltate, curved squamules and longitudinal cracks, esorediate. APOTHECIA common, especially at ends of unbranched podetia, often large, to 5 mm diam. PYCNIDIA rather infrequent, at tips of podetia or more rarely on basal squamules, usually ampullaceous, well constricted at base, containing hyaline slime.

Chemistry. K–, P+ yellow, UV–. Psoromic acid, rangiformic and norrangiformic acids and minor unknown compounds.

Habitat. On mineral soil in tundra, mountain heaths, northern pine forests and rock outcrops.



Distribution. Widespread in central and northern Fennoscandia, rare in south (not in Gotland, Öland, Færoe Islands and Iceland!). **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America. Mainly arctic to southern boreal, extending to mountains, such as the Alps, outlier in Papua New Guinea.

Note. The early Danish records turned out to be erroneous.

54. Cladonia macrophyllodes Nyl.

Flora 58: 447 (1875). – TYPE: Austria, Tyrol, Kühtai (Kühthei), 1874 Arnold 23 (H-NYL 38748 lectotype, Ahti, Regnum Veg. 128: 83, 1993).

Syn. *Cladonia lepidota* var. *macrophyllodes* (Nyl.) Du Rietz

F: paljakkatorvijäkälä **I:** snæbikar **N:** krittskjell **S:** storfjällig bägarlav

Literature. Dahl 1950: 103–104; Osyczka 2006: 224–226.

Figs. Brodo et al. 2001: 260; Hansen & Andersen 1995: 30; Stenroos et al. 2011: 149; Osyczka 2006: 225; Thomson 1968: pl. 11, fig. 63.

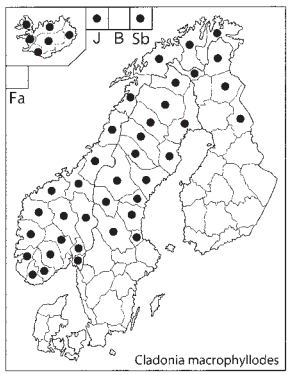
PRIMARY THALLUS squamulose, persistent, dominant, large, 8–15 mm long, 2–8 mm wide, glaucous and areolate-verruculose above, conspicuously white below, but basal parts strongly melanotic. PODETIA sparsely produced, often absent even from well-developed colonies, stout, 7–15 mm tall, 0.5–2 mm thick, glaucous grey, melanotic at base, scyphose, proliferating from centre of scyphi, but often without proliferations; scyphi 2–7 mm wide, shallow, regular to later irregularly lobed. Surface areolate-corticate, with white ecorticate interspaces, younger parts slightly tomentose, sometimes large podetial squamules abundant at scyphus margins. APOTHECIA rare, where present numerous at scyphal margins, brown. PYCNIDIA produced on basal squamules or at scyphal margins, large, pyriform, often stalked, containing hyaline slime.

Chemistry. K+ yellow, P+ red, UV–. Atranorin and fumarprotocetraric acid complex.

Habitat. In late snow-beds, on rock outcrops and also in arctic heaths.

Distribution. Common in Svalbard and Iceland and central and eastern mountains of Norway, scattered in northern Sweden and Finland. **F:** *Ks SoL EnL InL.*

I: *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Sb.* **S:** *Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America, northern Andes, Tierra del Fuego. Arctic-alpine, circumpolar, extending to high mountains such as the Alps, Caucasus, Altay, Rocky Mts. (Colorado) in the Northern Hemisphere.



Note. Recognized by the large, glaucous squamules and short podetia, each usually producing only one flat scyphus. The sterile squamules are usually bigger than those of *C. trassii* or *C. ecmocyna,* which are often associated and have the same colour.

55. Cladonia maxima (Asahina) Ahti

Ann. Bot. Fenn. 15: 12 (1978). – *Cladonia gracilis* var. *elongata* f. *maxima* Asahina, Atlas Japan. Cladonia: 19, f. 95 (1971). – Type: Japan, Hokkaido, Abashiri District (Prov. Kitami), Shiretoko Peninsula, Mt. Rausu, 1970 Togashi (TNS holotype).

F: isotorvijäkälä **N:** storsyl **S:** slät syl-lav

Literature. Ahti, Ann. Bot. Fenn. 15: 222–225 (1980); Fontaine et al., Lichenologist 42: 323–338 (2010); Huovinen et al., Biblioth. Lichenol. 38: 221–222 (1990); Litterski & Ahti 2004: 214, 232.

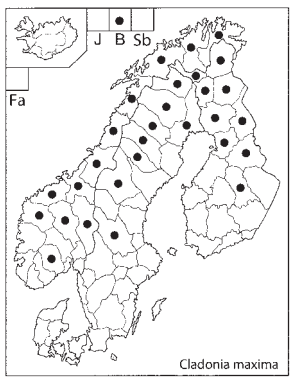
Figs. Ahti 1980: 223; Brodo et al. 2001: fig. 147; Carlin 1981: fig. 12B; Hinds & Hinds 2007: 191; Krog et al. 1994: 161; Stenroos et al. 2011: 150.

Primary thallus squamulose, evanescent (extremely rarely seen!). Podetia slender, stout, to 12(–18) cm tall, 2 mm thick, pale green to glaucescent grey, often browned near tips, necrotic bases turning yellowish, unbranched or slighly, dichotomously branched, axils closed, tips subulate or more rarely scyphose; scyphi to 6 mm wide, regular to somewhat irregular, often oblique, shallow to deep, often with perforations. Surface of podetia continuously smoothly corticate, esorediate, podetial squamules very rare. Apothecia fairly common, on margins of scyphi, often aggregate, 1–3.5 mm wide, usually pale brown. Pycnidia common, at tips of podetia, turbinate, constricted at base, containing hyaline slime.

Chemistry. K– or K+ brownish, P+ orange red, UV–, yellow pigment at base K+ purple. Fumarprotocetraric acid complex, very rarely also atranorin.

Habitat. A typical habitat is mesic to moist, open woodland or bog but also in drier forests and open alpine habitats.

Distribution. Very common in Finnish, Swedish and Norwegian Lapland, with southern outposts in the middle boreal zone, probably less frequent southwards in Norway. Absent from Iceland, Færoe Islands, Spitsbergen and Greenland, but one collection from Bjørnøya and some doubtful specimens are known. **F:** *PS Kn OP PeP Ks KiL SoL EnL InL.* **N:** *He Op Te SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Bi.* **S:** *Dlr Jmt Nb ÅsL LyL PL LuL TL.* Northwestern Europe, eastern and western North America (especially common in the Atlantic provinces of Canada), Northeast Asia, somewhat oceanic and therefore not continuously circumpolar.



Note. It is distinguished from *C. macroceras* by the less glossy, thin podetial wall (easily broken with razor blade) and virtual absence of squamules, and from *C. ecmocyna* by absence of lead-grey colour, podetial squamules and high amount of atranorin. *C. gracilis* subsp. *elongata* may grow immixed and be very similar but its necrotic bases are turning blackish.

56. Cladonia merochlorophaea Asahina

J. Jap. Bot. 16: 713 (1940). – Type: Germany, Niedersachsen, Oldenburg, Oldenburger Sand, 1918 Sandstede in Sandstede, Cladon. Exs. no. 389 (TNS lectotype, Ahti, Regnum Veg. 128: 85, 1993).

Syn. *Cladonia merochlorophaea* f. *inactiva* Asahina

D: brungrøn bægerlav **F:** mantutorvijäkälä **I:** brúnbikar **N:** brunbeger **S:** mörk bägarlav

Literature. Ahti, Ann. Bot. Fenn. 3: 384–385 (1966); Arup & Ekman, Svensk Bot. Tidskr. 85: 295 (1991); Culberson

et al., Bryologist 88: 380–387 (1985); Riipinen, *Cladonia chlorophaea*-ryhmä Suomessa (M. Sc. Thesis, Univ. Helsinki, 1965); Holien & Tønsberg, Gunneria 51: 19–22 (1985).

Figs. Carlin 1981: fig. 11K; Holien & Tønsberg 2006: 94; Krog et al. 1994: 162; Osyczka 2006: 225; Stenroos et al. 2011: 151;

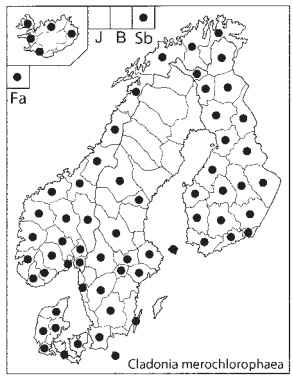
Primary thallus persistent, squamulose, squamules small, 1–3 mm diam., esorediate. Podetia 1–3.5 cm tall, greenish brown to greenish grey, at base strongly melanotic, scyphose, usually simple, rarely proliferating from margins (very rarely from centre) to form additional scyphi; scyphi 3–9 mm wide, gradually flaring, with stalk 1–2 mm thick. Surface at first areolate-corticate but soon becoming verruculose with wide interspaces and outer surface of scyphi largely denuded, not truly sorediate, but cortical verruculae (50–200 µm in size) transforming into rough, soredioid granules, schizidia, phyllidia and microsquamules, less frequently macrosquamules, also supracortical secondary phyllidia frequent. Apothecia infrequent, usually separate on short stalks on scyphal margins, dark brown. Pycnidia infrequent, on scyphal margins, pyriform; constricted at base, containing hyaline slime.

Chemistry. K–, P+ red or P–, C– or weakly red, KC+ red, UV+ whitish with faint bluish tinge. Two major chemotypes: 1) Merochlorophaeic and 4'-*O*-methylcryptochlorophaeic acids, and fumarprotocetraric acid complex are major, constant substances, but trace amounts of several other acids may occur. 2) The same but fumarprotocetraric acid complex absent, while, other, minor substances may occur.

Both chemotypes are common in the area, with some geographic differences, which are not well known.

Habitat. On acid humus in forests, e.g., very abundant on dead moss-floor in cut-over areas, on bog hummocks, dead coniferous wood, mossy rock outcrops, tundra heaths.

Distribution. Common to scattered throughout the area, but details little known. Rare in Svalbard. **D:** *NJy ØJy Vjy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *Sb.* **S:** *Sk Öl SmI Bh Vg Nrk Srm Vrm Vsm Upl Dlr Mpd Jmt.* Europe, Macaronesia, Asia, North America, South America, South Africa, Hawaii, Australasia. Arctic to temperate, probably circumpolar in the north, in high mountains in mid-latitudes, in many areas exact distribution poorly known.



Note. This species has often been included in *C. chlorophaea* as a chemotype or united with *C. novochlorophaea,* but there are slight diagnostic characters in morphology and it is distinguishable with molecular characters, although its status is still under investigation. The presence of merochlorophaeic acid (TLC), is its main characteristics, however.

57. **Cladonia mitis** Sandst.

Cladon. Exs. no. 55 (1918). – Type: Germany, Niedersachsen, Oldenburg, Kronsberge near Bösel, 1916 Sandstede in Sandstede, Cladon. Exs. no. 55 (BRNU lectotype, Ruoss, Bot. Helv. 97: 260, 1987).

Syn. *Cladina arbuscula* subsp. *mitis* (Sandst.) Burgaz, *Cladina mitis* (Sandst.) Mong., *Cladonia arbuscula* subsp. *mitis* (Sandst.) Ruoss, *Cladonia arbuscula* var. *mitis* (Sandst.) Sipman, *Cladonia sylvatica* subsp. *subsylvatica* Stirt.

D: mild rensdyrlav **F:** mietoporonjäkälä **I:** hreindýrakrókar **N:** fjellreinlav **S:** mild renlav

Literature. Ahti 1961: 116–125; Luonnon Tutkija 66: 38–39 (1962); 92: 148–149 (1988); Huovinen & Ahti, Ann. Bot. Fenn. 23: 103 (1986); Myllys et al., Molec. Phylogen. Evol. 27: 58–69 (2003); Piercey-Normore et al., Botany 88: 397–408 (2010); Ruoss, Biblioth. Lichenol. 25: 197–206 (1987); Bot. Helvet. 97: 239–263 (1987).

Figs. Ahti 1961: pl. 41; 1962: 39; Galløe 1954; pls 8–10, 14–15; Hansen & Andersen 1995: 23; Krog et al. 1994: 82; Stenroos et al. 2011: 152.

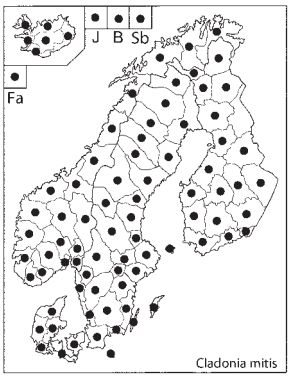
Primary thallus crustose, evanescent. Podetia 5–12 cm tall, 0.5–0.8 mm thick, greyish white to yellowish grey, not melanotic at base, forming dense mats with indeterminate growth, densely branched, branching type anisotomic trichotomy (40–60%) with some dichotomy and tetrachotomy, main axes distinct but rarely robust, axils closed or open, crowns 1–1.5 cm

wide, not very dense, terminal branchlets usually combed to all sides. Surface ecorticate, smooth, fairly compact, little verruculose, maculate, esorediate, esquamose. Apothecia rather uncommon, brown, very small, in groups near tops. Pycnidia common, subcylindrical to ovoid, containing hyaline slime.

Chemistry. K–, P–, KC+ yellow, UV–. Chemotypes : 1) (+)Usnic, (+)isousnic, rangiformic and norrangiformic acids, with traces of the fumarprotocetraric acid complex (often not recognizable with spot reagents or TLC but only HPLC). Chemotype 2) Usnic and isousnic acids only, no rangiformic or traces of fumarprotocetraric acid complex. The former one is probably dominant in the Nordic countries, but the latter one may also be widespread. Additional, unidentified minor subtances are also present. In Australasia *C. arbuscula* subsp. *stictica* Ruoss, which is probably conspecific with *C. mitis*, contain the stictic acid complex. Taste mild (this character used in the protologue to distinguish *C. mitis* from *C. arbuscula*!).

Habitat. Forest floor in drier pine forests (often dominant or codominant), very open rock outcrops, sand fields, drier bog hummocks, alpine and arctic heaths, generally prevalent in more exposed habitats than the common associate *C. arbuscula.*

Distribution. Throughout the Nordic countries but most common in middle boreal to arctic/alpine comditions. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America, southern South America, Australasia (chemically deviating), Subantarctic and Antarctic, continuously circumpolar in the north, extending to High Arctic in Greenland and high elevations in the mountains. In northern boreal and continental areas usually most abundant.



Note. A very critical taxon, which is still incompletely understood. It is tentatively (and traditionally) here recognized as a distinct species, although ITS and β-tubulin sequences indicate that it is nested within *C. arbuscula*, but as a monophyletic clade. According to one molecular analysis also *C. arbuscula* subsp. *stictica* – in spite of different chemistry – is within *C. mitis*. In practice *C. mitis* and *C. arbuscula* commonly grow together in the same, extensive communities in boreal lichen woodlands, for instance, and are then usually clearly distinguishable by morphology and application of the reagent P. However, as pointed out by Ruoss (1987) there are problematic colonies, which show intermediate morphological and chemical characters. Whether these represent true hybrids of these species or not, has not been clarified. See also the discussion under *C. arbuscula.*

58. **Cladonia norvegica** Tønsberg & Holien

Nordic J. Bot. 4: 79 (1984). – Type: Norway, Sør-Trøndelag, Melhus, 1982 Tønsberg 6870 (TRH holotype).

F: norjantorvijäkälä **N:** bleiksyl **S:** rödfläckig bägarlav

Red-listed in: **F**

Literature. Kuusinen et al., Graphis Scripta 2: 128–131 (1989); Martin et al.,Bull. Assoc. Franç. Lichénol. 37: 104–106 (2012); Tønsberg & Holien, Nordic J. Bot. 4: 79–82 (1984); Timdal, Graphis Scripta 2: 125–127 (1989); Tønsberg & Goward, Evansia 9: 56–58 (1992).

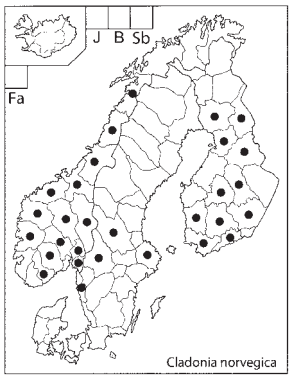
Figs. Martin et al. 2012: 105; McCune & Geiser 2009: 91; Randlane et al. 2011: 101; Stenroos et al. 2011: 153; Tønsberg & Holien 1984: figs 1–3.

Primary thallus squamulose, inconspicuous, squamules finely incised or narrowly lobed. Podetia slender, to 1.5(–2) cm tall, pale greenish, grey green or whitish, usually slenderly pointed, ascyphose or with tiny, shallow scyphi. Surface partly corticate at base but becoming covered by fine soredia, with occasional squanules. Apothecia subspherical or turban-like, ochraceous or pinkish. Pycnidia at tips of podetia, containing hyaline slime.

Chemistry. K–, P–, UV– or weakly UV+ pale. Barbatic and 4–*O*-demethylbarbatic acids. Rhodocladonic acid in red spots where mites have browsed, not in apothecia.

Habitat. Rotten wood, tree bases and lower tree trunks. Most frequent in humid oldgrowth conifer forests.

Distribution. Common on Middle Norvegian coastal areas, elsewhere more scattered, but the range not well known. However, it is scarcely reaching the northern boreal zone. **F:** *V U St EH ES PH PS Kn OP PeP Ks*. **N:** *Øf Ak He Op Bu Te AA Ho SF MR ST NT SNo NNo*. **S:** *Bh Vrm Upl Dlr.* Western Europe, Madeira, East Asia, eastern and western North America, Tierra del Fuego in Argentina and Chile. With oceanic tendencies.



Note. This species can be difficult to distinguish from *C. macilenta* var. *bacillaris,* which has the same chemistry but has red apothecia and pycnidia. But both taxa are usually sterile. In Northern Europe (especially Norway), however, *C. norvegica* is commonly characterized by bright red spots or colouring, caused by mite infection. It is remarkable that the species can produce red pigment, although its apothecia and pycnidia are lacking this pigment. The species is a member of the "red-fruited" *Cladoniae.* It is also very similar to its frequent associate, *C. coniocraea*, which is easily distinguished by its srong P+ red reaction, and its primary thallus is not as deeply incised.

59. **Cladonia novochlorophaea** (Sipman) Brodo & Ahti

Canad. J. Bot. 74: 1167 (1996). – *Cladonia merochlorophaea* var. *novochlorophaea* Sipman, Acta Bot. Neerl. 22: 496 (1973). – Type: Netherlands, Friesland, West Frisian Islands, Terschelling Island, Boschplaat, 1971 Sipman 4895 (U holotype).

Syn. *Cladonia merochlorophaea* var. *novochlorophaea* Sipman

D: brungrøn bægerlav **F:** kunttatorvijäkälä **S:** vårttrattlav

Literature. Ahti, Ann. Bot. Fenn. 3: 384–385 (1966); Brodo & Ahti, Canad. J. Bot. 74: 1167–1168 (1996); Culberson & Kristinsson, Bryologist 72: 431–433 (1969); Holien & Tønsberg, Gunneria 51: 19, 21 (1985, as chemotype II of *C. merochlorophaea*); Paus, Bibl. Lichenol. 66 (1997); Sipman, Acta Bot. Neerl. 22: 490–502 (1973).

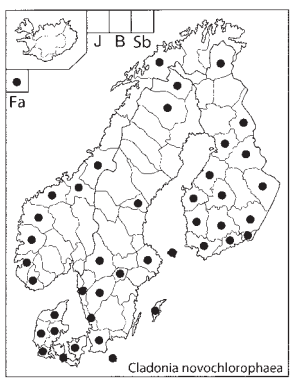
Figs. Stenroos et al. 2011: 154.

Primary thallus persistent, squamulose, squamules small (1–2 mm diam), esorediate. Podetia 1–3 cm tall, stalk 1–2 mm thick, usually a strong chocolate or blackish brown, with melanotic tendency toward base, scyphose; scyphi 3–6 mm wide, simple to rarely proliferating from margins. Surface of podetia roughly corticate, densely verruculose, verruculae often extending to margins of scyphi, but scyphal margins and inside scyphi somewhat eroded, revealing darkened medulla, sorediod granules scarce or absent, on older podetia secondary schizidia and cortical plates becoming abundant, macrosquamules common on lower podetial stalks. Apothecia very common, stalked, to 3 mm wide, dark brown. Pycnidia common, on scyphal margins, broadly pyriform, containing hyaline slime.

Chemistry. C–, KC–, K–, P– or P+ red, UV– or UV+ pale. Two chemotypes can be distinguished: 1) Homosekikaic and sekikaic acids, with minor amounts of 4'-*O*-methylnorhomosekikaic and 4'-*O*-methylnorsekikaic acids, occasionally also hyperhomosekikaic acid. 2) Fumarprotocetraric acid complex in addition to the other cited compounds. Both chemotypes are apparently common in the area, but 1) is often more frequent.

Habitat. Often abundant on acid humus over rock outcrops near the coast, but also in floor of lichen woodlands, on bog hummocks and coastal and arctic-alpine heaths, more rarely on rotting wood.

Distribution. Probably present in all provinces but the range not well known, not in Iceland, however. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PK KP Kn OP Ks InL*. **N:** *VA Ro Ho SF MR ST NT Tr*. **S:** *Sk Gtl Hl Bh Vg Nrk Vrm Upl Mpd LuL TL*. Western and northern Europe, North America (rare), South America



(especially Tierra del Fuego), New Zealand, subantarctic islands, Antarctic; uncertain reports also from northern Asia and East Africa (distribution not well known).

Note. Usually identified by TLC, but seems to have morphological tendencies as well, although apparently closer to *C. merochlorophaea* than the other species of the *C. grayi* complex. It is never clearly sorediate but has a well-developed, verrucose cortex, and very dark (often blackish-brown) colour.

60. Cladonia ochrochlora Flörke

De Cladon.: 75 (1828), *nom. cons*. – Type (*cons.*): Germany, Lower Saxony (Niedersachsen), Oldenburg, Oldenburger Sand, 1918 Sandstede in Sandstede, Cladon. Exs. no. 241 (UPS).

Syn. *Cladonia fimbriata* var. *ochrochlora* (Flörke) Schaer.

D: stød-bægerlav **F:** kaitatorvijäkälä **N:** stubbestav **S:** skuggbägarlav

Red-listed in: **D**

Literature. Ahti & DePriest, Taxon 54: 186–187 (2005); Fontaine et al., Lichenologist 42: 334 (2007); Huovinen et al., Biblioth Lichenol. 38: 222–223 (1990); Pino-Bodas et al., Org. Divers. Evol. 11: 343–355 (2011); Vainio 1922: 113–114.

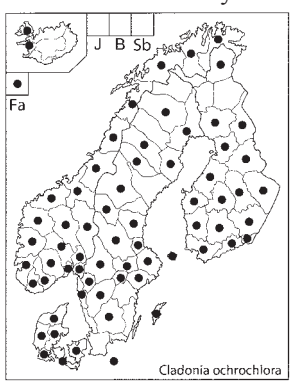
Figs. Carlin 1981: fig. 13A; Galløe 1954: 160–163; Hinds & Hinds 2007: 193, 194; Holien & Tønsberg 2006: 91; Randlane et al. 2011: 103; Stenroos et al. 2011: 155.

Primary thallus persistent, squamulose, squamules rather large, 2–12 mm long, 1–5 mm wide, esorediate or sparsely sorediate below. Podetia 2–7 cm tall, 0.5–4 mm thick, glaucous grey to greenish, sometimes slightly yellowish toward base, unbranched to little branched, at first subulate but finally narrowly scyphose, often from rather early stages; scyphi 1–6 mm wide, occasionally 1–2 times marginally proliferating. Surface largely corticate, clearly maculate, often areolate, in part farinose to granulose sorediate, cortex especially well-developed in basal parts, extending upward, even to interior and outside of scyphi, and corticate patches may be found elsewhere in the otherwise sorediate distal parts of the podetia. Apothecia infrequent, shortly stalked on scyphal margins, pale to dark brown, 1–4 mm wide. Pycnidia common on scyphal margins, ovoid, not or slightly constricted at base, containing hyaline slime.

Chemistry. K– (to yellow brown), P+ red. Fumarprotocetraric acid complex, including ± quaesitic acid and succinprotocetraric acid

Habitat. On rotten wood or tree bases, both on deciduous trees and spruce, most abundant on the coast but reaching the mountain birch woodlands in the mountains and Iceland. Also on mossy cliffs and stones, occasionally on bare soil on road verges and other earth banks.

Distribution. Common in the southern and coastal provinces, otherwise scattered, reaching the timberline areas in mountain birch woodland. Much collected in *Vg* and *Hls* in Sweden, for instance, but probably much overlooked. In Iceland and Greenland very rare. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks InL.* **I:** *IVe INv.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk? Gtl SmI Bh Dls Vg Nrk Srm Vrm Vsm Upl Dlr Gst Hls Hrj Jmt Vb Nb ÅsL LyL LuL.* Widespread in the world, primarily temperate, circumpolar in the north, but with oceanic tendencies, extending to the boreal and subtropical areas and common in tropical mountains, also widespread in the Southern Hemisphere (incl. Hawaii), but essentially absent from the Arctic and Antarctic (only on periantarctic islands).



Note. Very difficult to distinguish from *Cladonia coniocraea*, and sometimes united with that. *C. ochrochlora* has always a distinct basal cortical sheath, which may extend high, often in patches, and also occurs on bottoms of well-developed scyphi. It is also more robust, taller and with larger squamules than *C. coniocraea.* See also notes under *C. coniocraea.*

61. Cladonia parasitica (Hoffm.) Hoffm.

Deutschl. Fl. 2: 127 (1796). – *Lichen parasiticus* Hoffm., Enum. Lich.: 39 (1784). – Type: Germany, Bavaria (Bayern), Munich (München), W of Deisenhofen, Grünwald, 1892 Arnold in Rehm, Cladon. Exs. no. 410 (M neotype,

Ahti, Regnum Veg. 128: 87, 1993).

Syn. *Cladonia delicata* (Ehrh. ex Ach.) Flörke

D: dværg-bægerlav **F:** hongantorvijäkälä **N:** furuskjell **S:** dvärgbägarlav

Red-listed in: **D F N**

Literature. Arup et al., Skyddsvärda lavar i SV Sverige: 171, 174 (1997); Huovinen & Ahti, Ann. Bot. Fenn. 25: 376, 380 (1988); Thor & Arvidsson 1999: 124; Tønsberg, Blyttia 38: 160–161 (1980); Tønsberg & Øvstedal, Blyttia 40: 61 (1982); Vainio 1922: 69–70.

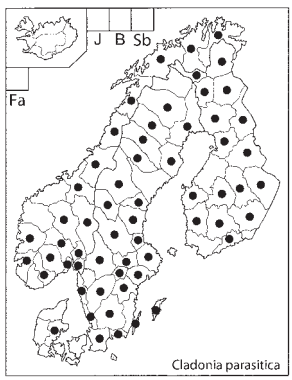
Figs. Arup et al. 1997: fig. 69H; Carlin 1981: figs 5 A–C; Galløe 1954: pls 110–113; Hinds & Hinds 2007: 195; Holien & Tønsberg 2006: 90; Randlane et al. 2011: 105; Stenroos et al. 2011: 156.

Primary thallus persistent, consisting of very densely crowded, erect, 2 mm long and narrow (0.8–1 mm) squamules, which are fragile, granular sorediate and branched in a coralloid manner. Podetia to 0.2–3(8) mm tall, 0.5–1 mm thick, greyish green to brown, unbranched to slightly branched at tip, axils closed; tips ascyphose. Surface at first smoothly corticate but soon becoming ecorticate, uneven, squamulose, slightly sorediate. Apothecia frequent, very small, dark brown, often aggregate. Pycnidia on primary thallus or tips or squamules of podetia, doliiform, constricted at base, containing hyaline slime.

Chemistry. K+ yellow, P+ yellow, UV–. Thamnolic acid, often with traces of decarboxythamnolic acid, in fertile specimens also barbatic acid, rarely (Finland) also squamatic acid.

Habitat. On rotting logs and stumps of *Quercus* and *Pinus,* primarily in oldgrowth forests, in the south only on *Quercus,* in the north on *Pinus*.

Distribution. In pine woodlands in Lapland widely common, but elsewhere rare and disappearing, although another major area in southern oak woodlands. **D:** *ØJy.* **F:** *U St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA Ro Ho ST NT SNo NNo Tr VFi ØFi*. **S:** *Sk Bl Öl Gtl SmI Hl Bh Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Hrj Jmt Vb Nb ÅsL LyL PL LuL.* Europe, Asia, North America, circumpolar, boreal to temperate, with continental tendencies.



Note. Easily recognized by densely packet brownish colonies which react strongly P+ yellow. The occurrence in two largely separate areas on pine and oak is peculiar. Many older Danish records could not be confirmed.

62. *Cladonia peziziformis* (With.) J.R.Laundon

Lichenologist 16: 223 (1984). – *Lichen peziziformis* With., Bot. Arr. Veg. Great Brit.: 720 (1776), as '*pezizaeformis'*. – Type: England, Middlesex (v.c. 21), London, Camden, Hampstead Heath, icon in Dillenius, Hist. Musc.: t. 14, f. 2 (1742) holotype; [England], Herb. Sherard, sheet 1774 (OXF epitype, Ahti, Fl. Neotrop. Monogr. 78: 256, 2000).

Syn. *Cladonia capitata* (Michx.) Spreng., *Cladonia leptophylla* (Ach.) Flörke, *Cladonia leptophylloides* Harm., *Cladonia mitrula* Tuck. ex Michener

N: lyngbruntopp **S:** huvudbägarlav

Red-listed in: **N**

Literature. Ahti, Fl. Neotrop. Monogr. 78: 256–257 (2000); Arup, Länstyrelsen Hallands län, Meddel. 2006(5): 69; Arup & Ekman, Graphis Scripta 4: 84–85 (1992); Culberson, Bryologist 72: 377–379 (1969); Laundon, Lichenologist 16: 223 (1984); Stenroos et al. 2002: 246; Thor & Arvidsson, 1999: 125; Tønsberg & Øvstedal, Graphis Scripta 7: 11–12 (1995).

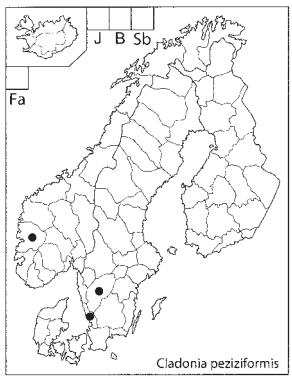
Figs. Carlin 1981: figs 9G, 9H; Hinds & Hinds 2008: 196; Krog et al. 1994: 164; Thomson 1968: fig. 32.

Primary thallus squamulose, persistent, squamules very small, 0.5–1 mm diam., but forming contiguous, flat crusts with convex areolae. Podetia frequent, often very abundant, 0.5–1.5(–2.2) cm tall, 0.3–0.8 mm thick, pale grey, usually slender, simple or with a few apical branchlets, blunt, in part flattened, ascyphose. Surface longitudinally grooved and cracked, almost continuously areolate-corticate and verruculose. Apothecia constantly present at tips of podetia from an early stage, dark brown to pale ochraceous, forming aggregations 1–3 mm wide. Pycnidia on primary thallus, ampullaceous to ovoid or conical, constricted at base, subsessile, containing hyaline slime.

Chemistry. K– (or brownish), P+ rapidly red, UV–. Fumarprotocetraric acid complex.

Habitat. Bare mineral soil in early stages of succession in *Calluna* heaths after fire or disturbance on not too acid soils, rather ephemeral. Existence threatened by changes in management of *Calluna* heathlands.

Distribution. Very rare, known only from a few records in southern Sweden and Norway. **N:** *Ho*. **S:** *Hl Vg*. A widespread temperate species. Europe (rare everywhere, mostly France), Macaronesia, South Africa, East Asia, SE Asian islands, eastern North America (where extremely common!), Middle and South America.



Note. A tiny, easily overlooked lichen of disturbed habitats. It is curious that this lichen is rare in Europe but a very common, weedy lichen in the eastern United States. According to phylogenetic analyses (Stenroos et al. 2002) it is not closely related to *C. caespiticia* or *C. cariosa*, as previously thought, but has its closest relatives outside Europe.

63. Cladonia phyllophora Hoffm.

Deutschl. Fl. 2: 123 (1796). – Type: Germany, Niedersachsen, Hannover, Herrenhausen, Ehrhart in Ehrhart, Pl. Crypt. Exs. no. 287 (GOET lectotype, Ahti, Regnum Veg. 128: 88, 1993).

Syn. *Cladonia degenerans* (Flörke) Spreng.

D: sortfodet bægerlav **F:** täplätorvijäkälä **I:** huldubikar **N:** svartfotlav **S:** svartfotslav

Red-listed in: **D**

Literature. Huovinen et al., Biblioth. Lichenol. 38: 223 (1990); Stenroos et al. 2002: 246; Vainio 1922: 95–97.

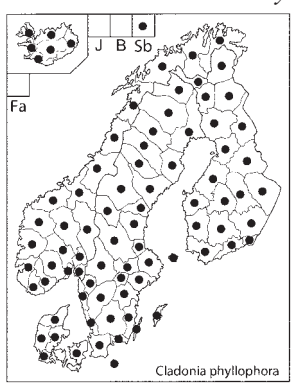
Figs. Galløe 1954: pls 135–138; Hansen & Andersen 1995: 31; Holien & Tønsberg 2006: 92; Krog et al. 1994: 164; Osyczka 2006: 225; Stenroos et al. 2011: 157.

Primary thallus squamulose, usually evanescent. Podetia 3–8(–10) cm tall, often somewhat deformed and slightly swollen, pale greenish grey to dark brown, sometimes browned when sun-exposed, basal necrotic part characteristically with strongly melanotic medulla, in upper part of the base black interspaces visible between cortical plates, giving the lichen a variegated appearance; irregularly sparsely branched, axils closed, tips blunt or usually scyphose; scyphi 1–3 mm wide, regular or usually rather irregular, often deep and although closed, with age producing numerous small perforations. Surface of podetia corticate but areolate-maculate, dull, minutely arachnoid or pruinose, often squamulose, squamules characteristically produced at scyphal margins. Stereome well-developed. Apothecia not uncommon, forming 1–2 mm wide compound discs. Pycnidia common, mainly on margins of scyphi, ovoid, subglobose or mamilliform, often constricted at base, containing hyaline slime.

Chemistry. K–, P+ red, UV– Fumarprotocetraric acid complex, including hypoprotocetraric acid and quaesitic acid and rarely zeorin, plus traces of unknowns.

Habitat. On bare mineral soil, also acidic forest humus, rock outcrops, arctic and alpine tundra heaths, often on sun-exposed slopes, railroad and highway embankments and other slightly arid places, very rarely on wood or peat.

Distribution. Very common through most of the area but rare in Denmark and much of Iceland. **D:** *NJy ØJy VJy SJy Sjæ Brn.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo TR VFi ØFi*. **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL*. Circumpolar, arctic to temperate, with continental tendencies, bipolar. Europe (south to the Alps and Spain), Asia (south to Turkey, Caucasus, central China), North America (south to West Virginia, Colorado), South America (Argentina, Chile, South Georgia).



Note. Unusually variable in morphology and therefore frequently confused with other species. From

C. gracilis subsp. *turbinata* it is distinguished by its pale, subtomentose, matt surface and from *C. stricta* by absence of numerous subulate tips of podetia. The blackening dead tissue visible at base is also a good character.

64. Cladonia pleurota (Flörke) Schaer.

Enum. Crit. Lich. Eur.: 186 (1850). – *Capitularia pleurota* Flörke, Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk. 2: 217 (1808). – TYPE: Germany or Austria, "data a Flörke Berolini 1811" (UPS neotype, Ahti, Regnum Veg. 128: 89, 1993).

Syn. *Cladonia coccifera* var. *pleurota* (Flörke) Schaer., *Cladonia coccifera* subsp. *pleurota* (Flörke) Vain.

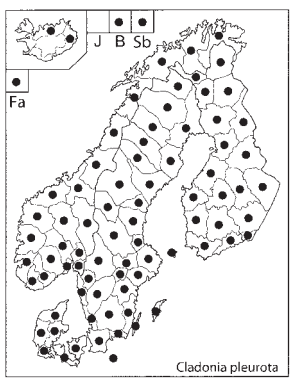
D: skarlagenrød bægerlav **F:** suppilotorvijäkälä **N:** pulverrødbeger **S:** mjölig kochenillav

Red-listed in: **D**

Literature. Stenroos, Ann. Bot. Fenn. 26: 164–166, 313 (1989); Stenroos et al. 2002: 247; Vainio 1922: 35–38.

Figs. Carlin 1981: figs 3D, 3G; Krog et al. 1994: 92, 164; Osyczka 2006: 225; Stenroos 1989: 154–166; Stenroos et al. 2011: 158.

PRIMARY THALLUS squamulose, persistent. PODETIA to 3 cm tall, yellowish or whitish green, unbranched, scyphose; scyphi usually single, to 0.7(–1.5) cm wide, regular. Surface of podetia granulose sorediate (rarely almost farinose) inside and on upper margins of the scyphi, lower down continuously corticate (more corticate, even almost non-granulose, when fertile!), occasionally squamulose. Stereome well-developed. APOTHECIA infrequent, red, often compound, shortly stipitate. PYCNIDIA on margins of scyphi (rarely on squamules), red or black, ampullaceous, ovoid or conical, sometimes stipitate, containing red slime.



Chemistry. K–, P–, KC + yellow, UV–. (–)Usnic, (–)isousnic, porphyrilic (inconstant), rhodocladonic acids and zeorin (seen as crystals on thallus surface).

Habitat. On rotten wood and humus rich soil in woodlands and heathlands, also on peat and over rock outcrops.

Distribution. Throughout the area, in Iceland very rare. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IAu INo*. **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *Bi Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Macaronesia, Asia, Australasia, Hawaii, North America, southern South America, Antarctic. Widespread, arctic/antarctic to warm temperate.

Note. When abundantly fertile almost non-sorediate and then difficult to distinguish from chemically similar *C. coccifera*. From *C. borealis* it is distinguished by zeorin (visible as cystal needles on surface on herbarium specimens). Short morphs of *C. deformis* are difficult to distinguish but their soredia are generally more farinose. *C. carneola* is distinguished by its ochraceous apothecia, but when they are absent, some specimens are extremely difficult to distinguish, even though the soredia on *C. carneola* are usually more abundant and farinose. A phylogenetic analysis (Stenroos et al. 2002) has confirmed that it is distinct from *C. coccifera.*

65. Cladonia pocillum (Ach.) Grognot

Pl. Crypt. Saône-et-Loire: 82 (1863). – *Baeomyces pocillum* Ach., Methodus: 336 (1803). – TYPE: Sweden, Öland, alvar ('Allwarden Oelandiae Insulae'), Westring; icon in Acharius, Methodus: t. 8, f. 6B (1803) (lectotype, Ahti in Awasthi, Compendium Macrolich. India: 106, 2007; Sweden (Suecia), H-ACH 1656A (epitype, Ahti in Awasthi, Compendium Macrolich. India: 106, 2007).

Syn. *Cladonia pyxidata* var. *pocillum* (Ach.) Schaer., *Cladonia pyxidata* subsp. *pocillum* (Ach.) Vain.

D: kalk-bægerlav **F:** karvetorvijäkälä **I:** torfubikar **N:** kalkbeger **S:** kalkbägarlav

Red-listed in: **D**

Literature. Kotelko & Piercey-Normore, Mycologia 102: 534–545 (2010).

Figs. van Herk & Aptroot 2004: 151; Hinds & Hinds 2007: 199; Krog et al. 1994: 165; Osyczka 2006: 225; Stenroos et al. 2011: 159.

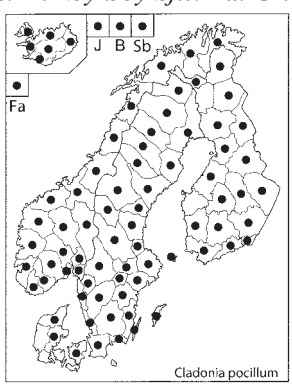
PRIMARY THALLUS persistent, often well-developed and

continuous, consisting of very thick (300–1000 µm), adnate to ascending squamules; upper surface glossy, greenish to dark brown, occasionally pruinose; lower side chalk white, medulla chalky soft. Podetia 0.7–3 cm tall, greenish brown, scyphose; scyphi 3–4 mm wide, usually single. Surface of podetia subcontinuously corticate, shiny, verruculose to squamulose in lower parts, upper parts becoming decorticate, phyllidiate and even granulose with age. Apothecia brown, with hymenial disc to 3 mm wide. Pycnidia on scyphal margins, pyriform, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex, sometimes including hypoprotocetraric acid, quaesitic acid or zeorin. Outside the study area also atranorin or psoromic acid have been detected.

Habitat. A very distinct colonizer of calcareous and basic habitats in general. Very common on limestone pavements in the alvar of Öland (type locality!) and Gotland, but throughout the area, also in the Arctic in suitable habitats. In areas without calcareous sites it can be found on man-made habitats, such as concrete walls.

Distribution. Present throughout the Nordic countries in habitats with basic soil, especially in Gotland, Öland and the Norwegian mountains. Rare in large areas of Finland and Sweden. In Iceland especially abundant in the inner parts. **D:** *NJy ØJy Sjæ.* **Fa. Gr. F:** *A V U EK St EH ES PH PS PK KP Kn OP PeP Ks SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Africa, Asia, New Zealand, North America, South America, Antarctic. Widespread, often very common in subarid, temperate to subtropical regions.



Note. Very similar to *C. pyxidata*, and often regarded as an ecotype on calcareous soils. Recent molecular studies have indicated that *C. pocillum* is unusually variable, and not sharply distinguished from some variants of *C. pyxidata,* which may be an assemblage of cryptic species. In the field however, these taxa often appear distinct, although problematic specimens exist in herbaria. The taxonomic status of *C. pocillum* requires further studies. It is also very similar to another calciphilous, much overlooked, species, *Cladonia magyarica* Vain., which differs by regularly containing atranorin and often producing pale, pruinose podetia; the squamules are also more divided.

66. Cladonia polycarpoides Nyl.

in Zwackh, Lich. Exs. nos. 626, 626bis [printed correction labels] (1892). –Type: Switzerland, Zürich, Ober-Riffersweil, 1884 Hegetschweiler in Zwackh, Lich. Exs. no. 626bis (H-NYL. p.m. 963, lectotype, Suominen & Ahti, Ann. Bot. Fenn. 3: 422–423, 1966).

Syn. *Cladonia subcariosa* auct.

N: sørlandspolster **S:** mångfruktig bägarlav

Red-listed in: **F N S**

Literature. Ahti, Fl. Neotrop. 78: 263–265 (2000); Carlin & Owe-Larsson, Graphis Scripta 6: 1–6 (1994); Culberson, Bryologist 72: 383–386 (1969); Suominen & Ahti, Ann. Bot. Fenn. 3: 422 (1966).

Figs. Carlin 1981: fig. 8F; Hinds & Hinds 2007: 200; Stenroos et al. 2011: 173.

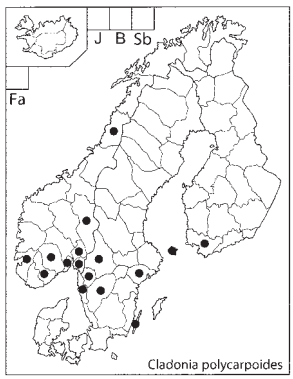
Primary thallus squamulose, persistent, to 5 mm long, 1–3 mm wide, often bluish on lower side. Podetia 0.5–2 cm tall, 1.5 mm thick, olive greenish to brown, unbranched to slightly branched at apex, ascyphose. Surface subcontinuously corticate, verruculose, indistinctly fissured, esorediate, rarely squamulose. Apothecia always present, becoming large aggregates, 5–8 mm diam., dark brown. Pycnidia on basal squamules, spherical, containing hyaline slime.

Chemistry. K+ yellow to red, P+ yellow to red, UV–. Norstictic acid, with traces of connorstictic acid, homoheveadride, and an unknown compound.

Habitat. Most collections derive from open pioneer habitats such as sandy roadsides but also rock outcrops. Avoids very acid soils, however; in Värmland on amphibolitic rocks. Some fairly stable populations have been reported from Sweden, but usually the localities are of short existence and their conservation is difficult.

Distribution. Rarely found in coastal SE Norway and

adjacent SW Sweden, as well as in SW Finland. **F:** *A V.* **N:** *Øf Ak He Vf Te AA Ro SNo*. **S:** Öl *Bh Dls Vg Srm Vrm.* Western Europe (mostly rare), East Asia, eastern North America (very common), South America, Australasia.



Note. Characterized by fairly large podetia, often bluish on lower side. Resembling those of *C. cariosa,* but are thicker and simpler. *C. polycarpoides* has also been included in *C. subcariosa*, a morphologically indistinguishable American species, which differs by producing atranorin in addition to norstictic acid and homoheveadride. However, some molecular evidence supports their recognition as distinct species. The same concerns another morphologically indistinguishable species, *Cladonia brevis* (Sandst.) Sandst., containing psoromic acid. That species has been reported from Norway and Finland but probably all these records belong to *C. macrophylla* or other species. In general, *C. polycarpoides* is difficult to identify (TLC is needed) because it is commonly without podetia and occurs in areas where the similar *C. cervicornis, C. subcervicornis,* and *C. symphycarpa* occur.

67. Cladonia polydactyla (Flörke) Spreng.

Syst. Veg. 4(1): 274 (1827). – *Cenomyce polydactyla* Flörke, Deutsche Lich. 10: 13 (1821), *nom. cons.* – Type (*cons.*): Germany, Mecklenburg-Vorpommern, Rostock, Flörke in Flörke, Deutsche Lich. no. 195A (UPS).

Syn. *Cladonia bouillennei* P.A.Duvign., *Cladonia flabelliformis* Vain., *Cladonia monguillonii* Harm.

D: vifte-bægerlav **F:** lännentorvijäkälä **N:** kystrødbeger **S:** grenbägarlav

Red-listed in: **F**

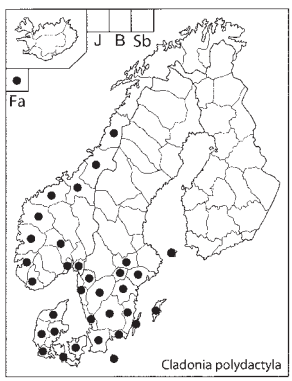
Literature. Ahti, Ann. Bot. Fenn. 15: 9 (1978); Ahti & DePriest, Taxon 54: 184–185.

Figs. Anders 1928: Taf. 7, figs 12–14; Galløe 1954: pls 43–45; van Herk & Aptroot 2004: 153; Krog et al. 1994: 165; Randlane et al. 2011: 107; Stenroos et al. 2011: 160.

Primary thallus squamulose, persistent or evanescent. Podetia slender, 1–3(–5) cm tall, 0.5–2 mm thick, glaucous green to green, unbranched or with few irregular branches, axils closed, tips blunt, usually producing narrow (2–3 mm) scyphi. Surface of podetia granulose sorediate, also corticate near base and often inside scyphi. Apothecia infrequent, red, on margins of scyphi or branch tips, often compound. Pycnidia uncommon, on margins of scyphi, ovoid, containing red slime.

Chemistry. K+ yellow, P+ yellow, UV–. Thamnolic acid, rarely with small amounts of usnic and rhodocladonic acids.

Habitat. On rotten wood, mossy rocks or soil.



Distribution. Widespread on western coastal lowlands north to Nordland, on the Balic to islands of SW Finland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. F:** *A.* **N:** *Øf Bu Vf VA Ro Ho SF MR ST NT SNo*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vsm.* Western Europe, Macaronesia. Oceanic, hemiboreal to warm temperate. Reports from Asia and North America probably erroneous, referring to similar species, such as *C. umbricola* or *C. vulcani*.

Note. Very similar to *C. umbricola* but reacts strongly yellow with K and P and soredia often form well-defined soralia.

68. Cladonia portentosa (Dufour) Coëm. [subsp. portentosa]

Bull. Acad. Roy. Sci. Belgique, ser. 2, 19: 43, 49 (1865). – *Cenomyce portentosa* Ann. Gén. Sci. Phys. 8: 69 (1821). – Type: France, Landes, Saint-Sever-sur-Adour, [1818] Dufour (PC-Herb. Desmazières lectotype, Ahti, Ann. Bot. Fenn. 15: 8, 1978).

Syn. *Cladina portentosa* (Dufour) Follmann, *Cladonia portentosa* f. *subimpexa* (P.A.Duvign.) Ahti, *Cladonia impexa* Harm., *nom. illeg*., *Cladina impexa* de Lesd., *Cladonia spumosa* (Flörke) Schade, *Cladonia condensata* (Aigret) Zahlbr., *Cladonia laxiuscula* auct.

D: hede-rensdyrlav **F:** lännenporonjäkälä **N:** kystre-

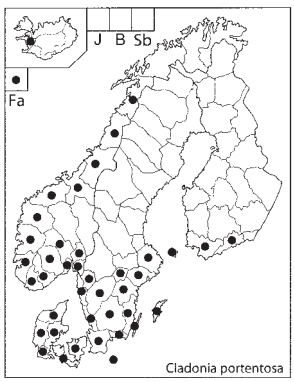
inlav **S:** hedrenlav

Literature. Ahti 1961: 74–79; Luonnon Tutkija 66: 37–38 (1962); Ann. Bot. Fenn. 15: 8 (1978); Lichenologist 12: 127–128 (1980); 1984: 36–38; Burgaz & Martínez, Bot. Complut. 32: 24–25; Huovinen & Ahti, Ann. Bot. Fenn. 23: 97–98 (1986); Schiefelbein, Arch. Naturwiss. Dissert. 16: 142–145, 208–209 (2006); Stenroos et al. 2002: 248.

Figs. Ahti 1961: pl. 26; Galløe 1954: pls 18–24; van Herk & Aptroot 2004: 127; Hørnell et al. 2004: 43; Krog et al. 1994: 166; Stenroos et al. 2011: 161.

Primary thallus crustose, soon evanescent. Podetia to 11 cm tall, pale yellowish to greenish or ash grey, tips browned or bluish in exposed habitats, slender to robust, usually richly branched by anisotomic trichotomy (c. 60%), with some dichotomy and tetrachotomy and tendency to isotomy, main axes usually distinct in lower parts, apical branchlets erect or deflexed in various directions, axils closed or perforated, tips subulate, often curved. Surface of podetia ecorticate, fibrose, fairly loose, often somewhat verruculose, esorediate, esquamose. Apothecia infrequent, brown, discs small, spherical, in groups. Pycnidia frequent, ovoid to cylindrical, containing hyaline slime.

Chemistry. K–, P–, UV+ whitish. (–)Usnic, (–)isousnic and perlatolic acid, rarely usnic acid lacking ("f. *subimpexa* (P.A.Duvign.) Ahti*"*).



Distribution. Along the lowlands of the Atlantic and southern Baltic coasts up to the southern boreal zone. In Finland only on the SW islands. From Iceland only one collection known. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. F:** *A V U.* **I:** *IVe.* **N:** *Øf Ak Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Upl.* Oceanic, essentially temperate, western Europe, Macaronesia and North America (as subsp. *pacifica* (Ahti) Ahti).

Note. Poor specimens may be difficult to distinguish from *C. mitis*, which is UV– (lacking perlatolic acid). In general, the curly appearance of the tops of the podetia serves to distinguish *C. portentosa* from the common associates *C. ciliata* and *C. arbuscula*. In a phylogenetic analysis (Stenroos et al. 2002) it was placed into the *C. stellaris* group.

69. **Cladonia pulvinata** (Sandst.) van Herk & Aptroot

Biblioth. Lichenol. 86: 200 (2003). – *Cladonia verticillata* f. *pulvinata* Sandst., Cladon. Exs. no. 233 (1918). – Type: Germany, Niedersachsen, Oldenburg, Markhausen, 1916, Sandstede in Sandstede, Cladon. Exs. no. 233 (H lectotype, Ahti, Ann. Bot. Fenn. 20: 5, 1983)

Syn. *Cladonia cervicornis* subsp. *pulvinata* (Sandst.) Ahti, *Cladonia rappii* auct.

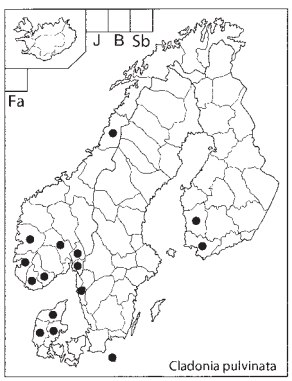
D: tue-bægerlav **S:** bollbägarlav

Red-listed in: **D**

Literature. Ahti, Lichenologist 12: 125–126; Ann. Bot. Fenn. 20: 5 (1983); Burgaz & Ahti 2009: 65–66; Carlin & Owe-Larsson, Graphis Scripta 6: 4 (1994); Görlitz 39(14): 1–39 (1964, as *C. rappii*); van Herk & Aptroot, Biblioth. Lichenol. 86: 193–203 (2003); Pino-Bodas et al., Syst. Biodiversity 8: 575–586 (2010); Schade, Nova Hedwigia 2: 407–423 (1960, as *C. rappii*); Abh. Ber. Naturkundemus.

Figs. Barreno & Pérez-Ortega, Líquenes Reserva Muniellos: lám. 33 (2003); Burgaz & Ahti 2009: lám. 13C; van Herk & Aptroot 2003: 195, 197; 2004: 153.

Primary thallus squamulose, persistent, squamules 4–7 mm long, deeply incised, upcurled, lower side with yellowish hue. Podetia to 2 cm tall, brownish green, strongly melanotic at base, remaining slender, scyphose; scyphi to 4 mm wide, proliferating from centre (usually with on 1–2 tiers), often stunted. Surface continuously areolate-corticate. Apothecia uncommon, brown. Pycnidia on scyphal rims, pyriform, containing hyaline slime.



Chemistry. K–, P+ bright yellow, UV–. Psoromic and 2'-*O*-demethylpsoromic acids, rarely with additional fumarprotocetraric acid.

Habitat. On rock outcrops or acid sandy soil in coastal areas.

Distribution. Mainly on

west coast of Denmark and Norway, also found on SW coasts of Sweden and Finland, but range poorly known. **D:** *NJy ØJy VJy Brn.* **F:** *V St.* **N:** *Øf Ak Bu AA VA Ro Ho SNo*. **S:** *Bh.* Europe, from Norway through British Is., Germany and France to Iberian Peninsula. Coastal, oceanic.

Note. Often as sterile, epodetiate brown "balls" especially on coastal rocks in Bohuslän. Earlier regarded as a chemotype of *Cladonia cervicornis* or conspecific with the American species *C. rappii* A. Evans. It is distinguished from *C. cervicornis* by presence of psoromic acid (P+ bright yellow) and more slender podetia. A molecular analysis has supported is distinction from *C. cervicornis* (Pino-Bodas et al. 2010).

70. Cladonia pyxidata (L.) Hoffm.

Deutschl. Fl. 2: 121 (1796). – *Lichen pyxidatus* L., Sp. Pl.: 1151 (1753). – Type: [Italy?], icon in Micheli, Nova Pl. Gen.: t. 41, f. 1L p.p. (1729) lectotype, Jørgensen et al., Bot. J. Linn. Soc. 115: 380, 1994; corresponding specimen, FI-Micheli epitype, Jørgensen et al., Bot. J. Linn. Soc. 115: 380, 1994).

Syn. *Cladonia monomorpha* Aptroot, Sipman & van Herk

D: tragt-bægerlav (incl. storskællet bægerlav) **F:** ruskotorvijäkälä **I:** grjónabikar **N:** kornbrunbeger **S:** trattlav

Literature. Aptroot et al, Lichenologist 33: 271–283 (2001); Kotelko & Piercey-Normore, Mycologia 102: 534–545 (2019).

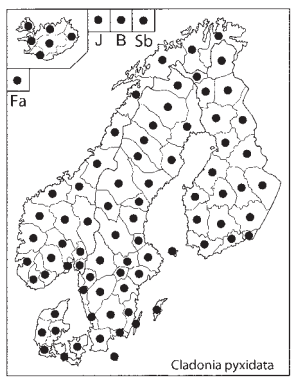
Figs. Brodo et al. 2001: 268; Hansen & Andersen 1995: 32; van Herk & Aptroot 2004: 151 (as *C. monomorpha*); Holien & Tønsberg 2006: 93; Krog et al. 1994: 166; Osyczka 2006: 225; Stenroos et al. 2011: 162; Wirth 2005: 305.

Primary thallus squamulose, persistent, squamules often fairly large, 2–7 mm long, rounded, thin, ascending (cf. *C. pocillum*). Podetia 0.5–3 cm tall, green, greyish green or brownish, slightly melanotic toward base, simple, stout, regularly scyphose. Surface continuously corticate but often soon becoming bare in upper parts, sometimes areolate and phyllidiate, also forming secondary phyllidia on cortex and inside the scyphi, not sorediate or granulose, but granular structures can occur especially where cortex has disintegrated, sometimes also squamulose. Apothecia fairly common, dark brown. Pycnidia common on margins of scyphi (rarely on basal squamules), dark brown, ovoid to verruciform, often constricted at base, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex, including hypoprotocetraric and quaesitic acids, rarely traces atranorin, often unknown fatty acids. In Central America and rarely in Europe (Andorra, Poland) also homosekikaic acid complex has been reported.

Habitat. Typically inhabiting strongly to medium acidic mineral soils and thin soil and mosses over rock outcrops. In lichen woodlands however, it is uncommon, because it avoids organic soils, like humus, peat and rotting wood. Common habitats are stones, rocks, grasslands and highway embankments in man-made environments. Also on soil in alpine and arctic heaths.

Distribution. Common throughout the Nordic countries, perhaps increasing northwards. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St Eh ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Widespread, on all continents, but essentially temperate to arctic/antarctic. At tropical latitudes only in the higher mountains.



Note. Difficult to distinguish from *C. libifera, C. pocillum, C. novochlorophaea,* and *C. chlorophaea*, see discussions under those species. Recent molecular data – based on rather small-scale studies – indicate that *C. pyxidata* is more variable than perhaps most of the other species of *Cladonia* and its taxonomic status is in need of further studies. From *C. pyxidata* Aptroot et al. (2001) segregated *C. monomorpha*, which was also reported from Denmark, Finland and Sweden (and later from Iceland). One of its characters is production of bullate squamules on podetia, especially in scyphi, but otherwise the lichen is rather smoothly corticate. Even after studies on much of the original

material we could not definitely separate *C. monomorpha* from *C. pyxidata*. Actually most "*C monomorpha*"-specimens much resemble the very common Nordic morph which is traditionally regarded as typical *C. pyxidata*. Much of the material (mainly Dutch and German) called *C. pyxidata* by Aptroot et al. is rather *C. chlorophaea* in the Nordic usage. However, no modern lichenologist has studied the Italian type material of *C. pyxidata,* preserved in Florence, and therefore the status of the name is very uncertain. In recent phylogenetic and other studies the taxonomic status of the species *C. chlorophaea* and *C. pocillum* has also been questioned. It is possible that even they have to be included in *C. pyxidata*. Although usually distinct, their exact delimitation from *C. pyxidata* is very difficult in many cases.

71. Cladonia ramulosa (With.) J.R.Laundon

Lichenologist 16: 225 (1984). – *Lichen ramulosus* With., Bot. Arr. Veg. Great Brit.: 723 (1776). –Type: Icon in Dillenius, Hist. Musc.: t. 15, f. 20 (1742) holotype; England, Surrey (v.c. 17), London, Greenwich, Woolwich Heath, Dillenius (OXF-Dillenius epitype, Ahti, Fl. Neotr. Monogr. 78: 149, 2000).

Syn. *Cladonia anomaea* Ahti & P.James, *Cladonia pityrea* (Flörke) Fr.

D: kliddet bægerlav **F:** ryynitorvijäkälä **N:** piggbeger **S:** grynig bägarlav

Red-listed in: **D F**

Literature. Ahti, Lichenologist 12: 128 (1980); Laundon, Lichenologist 16: 225 (1984); Osyczka et al., Polish Bot. J. 51: 234–235 (2006).

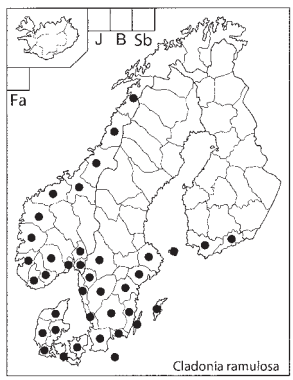
Figs. Galløe 1954: pls 170–177; van Herk & Aptroot 2004: 155; Hinds & Hinds 2007: 201; Hørnell et al. 2004: 46; Krog et al. 1994: 166; Osyczka et al. 2006: fig. 2B; Stenroos et al. 2011: 163.

Primary thallus squamulose, squamules small (0.5–2 mm long), much incised. Podetia 1–4 cm tall, 0.5–1.5 mm thick, greenish brown to brown, pale towards base, unbranched or sparsely branched at tops, usually scyphose, simple; scyphi irregular, dentate and often proliferating from margin, occasionally ascyphose, subulate. Surface roughly corticate, often somewhat granulose to subsorediate. Apothecia fairly common, usually light brown, small. Pycnidia common at margins of scyphi or tips of podetia, but also on basal squamules, usually briefly pedicellate, ampulliform, constricted at base, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex, sometimes including quaesitic acid. Homosekikaic acid reported especially in East Asian populations and rarely atranorin elsewhere.

Habitat. Heathlands, grasslands, rock outcrops, on rotten wood in moist forests and open seashores.

Distribution. Coastal lowland areas from Denmark and Skåne to Nordland, Uppland and SW Finland, common in the south. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **F:** *A V U.* **N:** *Øf Ak Vf Te AA VA Ro Ho SF MR ST NT SNo NNo*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Srm Vrm Upl.* Western Europe (clearly oceanic), East Asia (common), eastern North America (infrequent), Central and South America, Africa, Australasia, Hawaii. Range not well known.



Note. The worldwide taxonomy of *C. ramulosa* has not been studied. It is probably a complex of distinct taxa. The European *C. ramulosa* may be one species but is highly variable and often deformed and stunted, being difficult to distinguish from *C. phyllophora* (which has melanotic bases) and other species.

72. Cladonia rangiferina (L.) F. H. Wigg. [subsp. rangiferina]

Prim. Fl. Holsat.: 90 (1780). – *Lichen rangiferinus* L., Sp. Pl.: 1153 (1753). – Type: Sine loco (LINN 1273.240 lectotype, Nourish & Oliver, Biol. J. Linn. Soc. 6: 259, 1974).

Syn. *Cladina conspicua* Ahti, *Cladonia conspicua* (Ahti) Ahti

D: askegrå rensdyrlav **F:** harmaaporonjäkälä **I:** grákrókar **N:** grå reinlav **S:** grå renlav

Literature. Ahti 1961: 86–93; 1984: 46–47; Ann. Bot. Fenn. 23: 223–224 (1986, as *C. conspicua*); Huovinen, Acta

Pharm. Fenn. 94: 113–123 (1985); Huovinen & Ahti, Ann. Bot. Fenn. 23: 100–101 (1986); Ruoss 1990: 34–36.

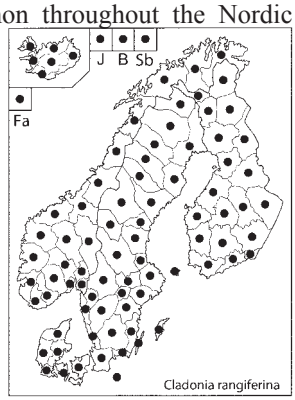
Figs. Ahti 1986: 223 (as *Cladina conspicua*); Galløe 1954: pls 1–5; Hansen & Andersen 1995: 24; Holien & Tønsberg 2006: 81; Moberg & Holmåsen 1995: 149; Rikkinen 2008: 61; Stenroos et al. 2011: 164; Wirth 1995: 295.

PRIMARY THALLUS crustose, rarely visible. PODETIA 5–15 cm tall, main axes 0.7–1.5 mm thick, ash grey, bluish grey or very pale grey, paler toward base, only secondarily somewhat melanotic, extreme tips browned; branching anisotomic trichotomy (c. 55%) or tetrachotomy, less with dichotomy, always with distinguishable main axes, which have rather regular, annually initiated internodes (5–8 mm long when mature), tips ascyphous, slender, usually unilaterally deflexed, extreme tips hardly tapering, clearly felty. Surface ecorticate, minutely felty, fibrose, not or little verruculose. APOTHECIA fairly common, inconspicuous, in groups on lateral branchlets just below the top, very small, red brown, spherical. PYCNIDIA ovoid, containing hyaline slime.

Chemistry. K+ yellow, P+ orange red, UV–. Atranorin and fumarprotocetraric acid complex, sometimes ursolic acid, and unknown fatty acids or traces of unknown compounds. Atranorin rarely absent (e.g., Norway and Finland) or fumarprotocetraric acid rarely absent (e.g., Greenland).

Habitat. In forest floor in open forests (codominant in lichen woodlands), on thin soil over rock outcrops and stones, in bogs, alpine and coastal heaths, dry grasslands and road embankments.

Distribution. Very common throughout the Nordic countries, but less frequent in Denmark. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Eurasia, North America, South America, Antarctic. Widely common in temperate to arctic/antarctic regions, rarely in warm temperate areas, except in higher mountains. Along the northern Andes and in Middle America branching predominantly dichotomous and referred to subsp. *abbayesii* (Ahti) Ahti & DePriest. In East Asia another doubtfully distinct race, subsp. *grisea* Ahti.



Note. One of the important winter forage lichens for the reindeer, and heavily grazed in much of Lapland. Usually recognized by grey colour and robust structure from the other reindeer lichens. The similar *C. stygia* differs in producing black pigment in necrotic medulla at base and has red pigment in pycnidia. *C. ciliata* f. *ciliata* is much more slender in structure and the top branchlets are intensively brown. A segregate almost without brown colour at the thickish extreme tips, *C. conspicua,* described from Newfoundland, has been reported from Sweden (*Vrm, Vsm*), but it is probably only a rare, occasional variant (e.g., with almost no black colour on extreme tips) rather than a distinct taxon.

73. **Cladonia rangiformis** Hoffm., *nom. cons.*

Deutschl. Fl. 2: 114 (1796). – TYPE *(cons.)*: Germany, Niedersachsen, Hannover, Wenden, 1921 Sandstede in Sandstede: Cladon. Exs. no. 803 (H).

Syn. *Cladonia aberrans* (Abbayes) Klement, *nom. inval.*, *Cladonia klementii* Oxner, *nom. inval.*, *Cladonia muricata* (Delise) Rabenh., *Cladonia pungens* (Ach.) Gray

Literature. Ahti & DePriest, Taxon 54: 187 (2005); Huovinen et al., Biblioth. Lichenol. 38: 230 (1990); Litterski & Ahti 2004: 215–216, 233; Pino-Bodas et al., Org. Divers. Evol. 11: 343–355 (2011); Schade, Abh. Ber. Naturkundemus. Görlitz 40(8): 1–30 (1965).

D: spættet bægerlav **F:** meritorvijäkälä **I:** strandkrókar **N:** tuegaffel **S:** falsk renlav

Red-listed in: **D**

Figs. Carlin 1981: figs 6F, 6H; Galløe 1954: pls 81, 82, 85, 86, 88; van Herk & Aptroot 2004: 155; Krog et al. 1994: 167; Stenroos et al. 2011: 165; Wirth 1995: 309.

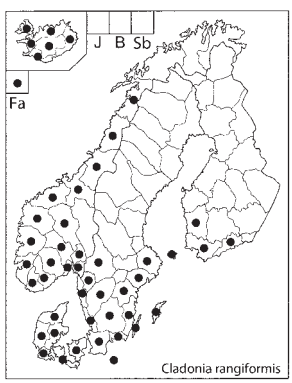
PRIMARY THALLUS squamulose, squamules small, usually evanescent. PODETIA 2–5 cm tall, 0.5–1 mm thick, whitish to greenish grey, at tops strongly browned,

with violet tinge, whitish toward base; forming very dense cushions, much branching, branching anisotomic, irregular dichotomy, axils mostly open, extreme tips straight, ascyphose. Surface continuously corticate, maculate-areolate, smooth to sometimes squamulose, esorediate (extremely rarely with some soralia). Apothecia very rare, in groups at apices of podetia, dark brown. Pycnidia common at tips of podetia, cylindrical to ovoid, hardly constricted at base, containing hyaline slime.

Chemistry. K+ yellow, P–, rarely P+ red, UV–. Atranorin, rangiformic and norrangiformic acids, rarely (up to *NNo* in Norway) additional fumarprotocetraric acid complex or bourgeanic acid.

Habitat. Mainly on rock outcrops or sand dunes along seashores, but also on calcareous soil.

Distribution. Mostly along coasts of the Atlantic (Norway up to Lofoten Is.) and the Baltic up to the southern boreal zone, in southern Sweden also inland, mainly on calcareous habitats. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. F:** *A V U St.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Srm Vrm Upl*. Largely Mediterranean in subarid regions, Western Eurasia, North Africa, eastern Canada (Newfoundland, recent record, very rare).



Note. Similar to *Cladonia furcata* but distinguished by pale greyish colour and usually by the P– reaction. *Cladonia rangiferina* and *C. ciliata* are distinguished by absence of hard cortical layer. In phylogenetic analysis (Stenroos et al. 2002, Pino-Bodas et al. 2011) *C. rangiformis* turned out to be rather distantly related to the *C. furcata* group.

74. Cladonia rei Schaer.

Lich. Helv. Spic. 1(1): 34 (1823). – Type: Italy, Re 124 (G holotype).

Syn. *Cladonia nemoxyna* (Ach.) Arnold

D: grumset bægerlav **F:** piennartorvijäkälä **N:** grynstav **S:** grov hornbägarlav

Red-listed in: **D**

Literature. Dolnik et al., Lichenologist 42: 373–386 (2010); Suominen & Ahti, Ann. Bot. Fenn. 3: 418–421 (1966); Østhagen, Blyttia 33: 223–227 (1975); Bryologist 79: 242–246 (1976); Paus et al., Biblioth. Lichenol. 53: 191–200 (1993); Pišút, Acta Fac. Rerum Nat. Univ. Comenianae 6(8–10): 520–523 (1961); Spier & Aptroot, Lichenologist 39: 57–60 (2007); Syrek & Kukwa, Biologia 63: 493–497 (2008); Pino-Bodas et al., Mycotaxon 113: 311–326 (2010).

Figs. Carlin 1981: fig. 13I; Dolnik et al. 2010: 376; van Herk & Aptroot 2004: 157; Hinds & Hinds 2007: 203; Stenroos et al. 2011: 166.

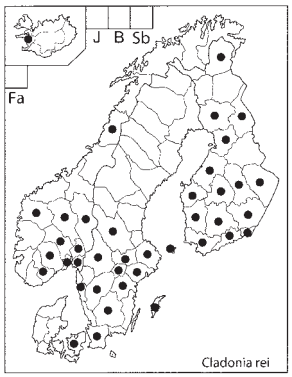
Primary thallus squamulose, inconspicuous, evanescent. Podetia 2–5 cm tall, grey but soon turning brownish, rarely melanotic, straight, unbranched or slightly branched near tips, branchlets mostly very short, axils closed, tips acute, often producing narrow scyphi even in young podetia, mature scyphi 1–3 mm wide, often with perforated bottom. Surface at base roughly and discontinuously corticate and often squamulose, upper part ecorticate or corticate in patches, granulose to finely sorediate. Apothecia rather frequent, in groups at branch tips, reddish to blackish brown, finally forming compound discs to 2 mm wide. Pycnidia frequent, at tips of podetia, ovoid, containing hyaline slime.

Chemistry. K–, P– or P+ yellow slowly turning orange red, UV–. Two major chemotypes: 1) homosekikaic acid, usually with the minor satellites sekikaic and hyperhomosekikaic acids (then P–); 2) homosekikaic acid complex plus additional fumarprotocetraric acid complex (then P+). Some local geographic differentiation has been observed in the frequency of these chemotypes, but the latter type seems to be less frequent in the Nordic countries.

Habitat. Terricolous, on humus or often on almost bare mineral soil, seems to prefer basic or weakly acid soils. Often found on railway and highway embankments, even in polluted environments like harbours or other industrial areas (in some mining areas found to stand high concentrations of heavy metals), typically also on house ruins, in park lawns or other grasslands, i.e., almost always on anthropogenous habitats. Calcareous rocks apparently represent its native habitats but few collections are from such places. Occasion-

ally on rotting wood. The habitats are usually very open, often warm and xeric, and in subarid conditions (like on esker slopes or alvars).

Distribution. Fairly common in the southern and central lowlands, rarely coastal (not found in the Arctic). Northwards becoming rare but scattered even in Lapland. **D:** *Sjæ.* **F:** *A V U EK St EH ES EP PH PS PK KP OP PeP Ks InL.* **I:** *IVe.* **N:** *Øf Ak He Op Bu Vf Te AA SF SNo.* **S:** *Sk Gtl SmI Bh Vg Ög Nrk Srm Vrm Vsm Upl Dlr.* Circumpolar, temperate-boreal, with continental preferences. Europe, Macaronesia, East Africa, Asia, North America (especially common in northeastern U.S.A.).



Note. Older Danish records not confirmed. In earlier times and even presently much overlooked due to its similarity to *Cladonia subulata,* which is much more frequent, paler gray, more branched, more finely sorediate, little corticate and normally gives instant P+ red reaction. Their distinction was not accepted by some authors, but quite recently DNA analyses have indicated that they are distinct species and not even very close relatives. *C. rei* is unexpectedly closer to *C. fimbriata* than *C. subulata. Cladonia glauca* is also similar to *C. rei* but UV+ stronger whitish due to squamatic acid and never with scyphi.

75. **Cladonia scabriuscula** (Delise) Nyl.

Compt. Rend. Hebd. Séances Acad. Sci. 83: 88 (1876). – *Cenomyce scabriuscula* Delise in Duby, Bot. Gall.: 623 (1830). – Type: France (PC-Delise lectotype, Ahti, Fl. Neotrop. Monogr. 78: 172, 2000).

Syn. *Cladonia furcata* var. *scabriuscula* (Delise) Coem., *Cladonia surrecta* (Flörke) Sandst.

D: ru bægerlav **F:** rosotorvijäkälä **N:** gryngaffel **S:** sträv bägarlav

Literature. Ahti 2000: 172–173; Carlin 1981: 376; Sandstede 1931: 214–221; Stenroos, Ann. Bot. Fenn. 25: 128–129 (1988); Stenroos et al. 2002: 246; Østhagen, Blyttia 34: 193 (1976).

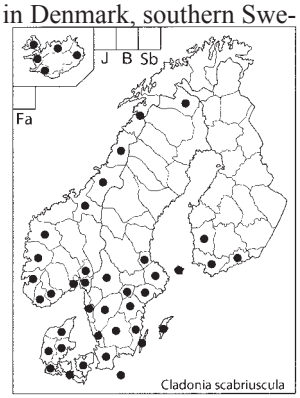
Figs. Carlin 1981: figs 6A, 6D; Galløe 1954: pls 80–85; Krog et al. 1994: 168; van Herk & Aptroot 2004: 157; Stenroos et al. 2011: 167.

Primary thallus squamulose, soon evanescent. Podetia 3–9 cm tall, 0.5–2 mm thick, greenish to whitish grey, browned at tops, very pale toward base, mostly very slender, somewhat branched by dichotomy, axils mostly open, tips divergent straight, ascyphose. Surface smoothly corticate but toward tips scabrose due to granules (sometimes appearing sorediate), microsquamules and disintegrating cortex. Apothecia uncommon, brown, small, crowded. Pycnidia common, at tips, subcylindrical, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex, rarely traces of additional atranorin, ursolic or bourgeanic acid.

Habitat. On soil over rock outcrops or on grasslands, particularly near sea.

Distribution. Widespread in Denmark, southern Sweden (especially in *Bh, Vg*), coastal Norway (up to Nordland), and Iceland, elsewhere rare or absent. **D:** *NJy ÖJy VJy SJy Fyn Sj Brn.* **F:** *A V U St.* **I:** *ISu IVe IAu INv INo.* **N:** *Øf Ak Vf AA VA Ro Ho SF ST NT SNo NNo.* **S:** *Sk Öl Gtl Klm SmI Hl Bh Vg Ög Nrk Srm Vrm Upl Gst TL.* Western Eurasia, East Asia, eastern and western North America, South America, Australasia, Oceania, Subantarctic islands. With oceanic tendencies, temperate to subtropical, not continuously circumpolar in the north.



Note. Reported from the Færoe Is. and Greenland, but no correctly identifed specimens seen. Sometimes difficult to distinguish from squamulose morphs of *C. furcata,* which however, tends to be more robust and has more corticate patches. The Greenland material was referred to *C. farinacea,* a very closely related, widespread species (not known from Europe!) with distinctly farinose soredia. It is possible that the latter species may turn up also elsewhere in the Nordic countries. All three are very closely related, and their distinction was not fully solved in the first phyloge-

netic analyses (Stenroos et al. 2002).

76. **Cladonia squamosa** Hoffm.

Deutschl. Fl. 2: 125 (1796). – Type: Italy ('Tirolia orientalis'), Trentino-Alto Adige, Prov. Bolzano, Val di Pusteria, Casteldarre (Ehrenburg), Kernstock in Fritsch, Fl. Exs. Austro-Hung. no. 3525 (H neotype, Ahti, Regnum Veg. 128: 95, 1993).

Syn. *Cladonia squamosa* var. *allosquamosa* Hennipm., *Cladonia squamosa* var. *subsquamosa* (Nyl. ex Leight.) Vain., *Cladonia subsquamosa* (Nyl. ex Leight.) Cromb., *nom. illeg.*

D: skælklædt bægerlav **F:** suomutorvijäkälä **I:** hreisturbikar **N:** fnaslav **S:** fnaslav

Red-listed in: **D**

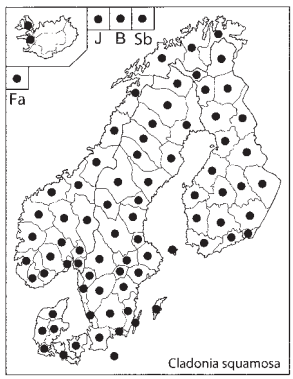
Literature. Ahti, Ann. Bot. Fenn. 15: 10–11 (1978); 2000: 308–312; Dahl 1950: 90–91; Vainio 1922: 63–69.

Figs. Galløe 1954: pls 98–101; van Herk & Aptroot 2004: Holien & Tønsberg 2006: 88, 159; Huovinen & Ahti, Ann. Bot. Fenn. 25: 377–378, 380 (1988); Moberg & Holmåsen 1990: 145; Rikkinen 2008: 125; Stenroos et al. 2011: 168.

Primary thallus usually persistent, squamulose, often well-developed, squamules highly dissected, 2–10 mm long, esorediate but occasionally granulose below. Podetia 3–9(–14) cm tall, 0.5–2.5(–5) mm thick, greenish-grey to strongly brown, not melanotic at base; unbranched to little branched, axils open, usually dilated to form gaping funnels, which have, radiate proliferations, but also very slender morphs with narrow funnels are found. Surface totally or mostly decorticate, densely covered with smaller (to 1 mm) and larger (to 8 mm) squamules and granules, esorediate. Stereome fairly strong. Apothecia infrequent, on funnel margins, small (0.5–0.7 mm), brown. Pycnidia terminal on podetia, rarely basal on primary thallus, doliiform, containing red or hyaline slime.

Chemistry. Two major chemotypes: 1) K– P–, UV+ white. Squamatic acid, often (when fertile) also barbatic acid, and unknown terpenoids; in addition, minor unknown compounds, including one provisionally named consquamatic acid; 2) K+ yellow, P+ yellow, UV–. Thamnolic acid, (when fertile) barbatic acid, often decarboxythamnolic acid (trace) and unknown terpenoids.

Habitat. On rotten wood, mossy rock outcrops or humus rich soil, usually in shaded or moist habitats, but northwards also on drier soil in lichen woodlands and alpine or arctic heaths, then usually less abundant. Also in wet hollows of open raised bogs.



Distribution. Chemotype 1: Very common throughout southern and central parts of the Nordic countries, northwards and in mountains getting scattered or rare. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IVe INv.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Eurasia, Macaronesia, East and South Africa, North America, South America, Hawaii, Antarctic.

Distribution. Chemotype 2 ("var. *subsquamosa*"): Along outer south coast of Norway and west coast of Sweden. In Denmark and Finland very rare. **D:** *Brn.* **Fa. F:** *EH.* **N:** *Øf Ak AA VA Ro Ho SF MR*. **S:** *Bh Srm Upl.* Western Europe, East Asia, Macaronesia, East Africa, western and eastern North America, South America, Subantarctic islands. Distinctly oceanic.

Note. Extremely variable, but usually distinguished by abundance of podetial squamules. Locally (particularly in raised bogs) difficult to distinguish from squamulose morphs of *C. crispata*. The highly squamulose, pale morphs of southern, moist forests can be very different from the blackish morphs in open bogs or the slender, little squamulose morphs of arctic and timberline habitats. It is possible that the species is not taxonomically uniform, although the numerous infraspecific names proposed usually refer to clearly environmental modifications. It is also interesting that it is reported that the pycnidia may contain either red or hyaline slime, which in other cases in *Cladonia* indicates a specific difference. In the past the chemotype 2 was often recognized as a different species because of its distinct, oceanic range. However, the often used name *C. subsquamosa* (Nyl. ex Leight.) Cromb. is an

illegitimate homonym of the tropical species *C. subsquamosa* Kremp. *Cladonia squamosa* urgently needs a phylogenetic, worldwide study.

77. Cladonia stellaris (Opiz) Pouzar & Vězda

Preslia 43: 196 (1971). – *Cenomyce stellaris* Opiz, Böh. Phan. Crypt. Gew.: 141 (1823), *nom. cons.* TYPE *(cons.)*: Herb. Dillenius no. 107.29E (OXF).

Syn. *Cladonia aberrans* (Abbayes) Stuckenb., *Cladonia alpestris* (L.) Rabenh., *Cladina alpestris* (L.) Nyl., *Cladina stellaris* var. *aberrans* (Abbayes) Ahti

D: stjerne-rensdyrlav **F:** palleroporonjäkälä **N:** kvitkrull **S:** fönsterlav

Red-listed in: **D**

Literature. Ahti 1961: 47–55; Ahti, Luonnon Tutkija 66: 37–38 (1962); Ahti & DePriest, Taxon 54: 183–186 (2005); Huovinen, Acta Pharm. Fenn. 94: 113–123 (1985); Huovinen & Ahti, Ann. Bot. Fenn. 23: 96, 98 (1986); Litterski & Ahti 2004: 216, 234; Pouzar & Vězda, Preslia 43: 193–197 (1971).

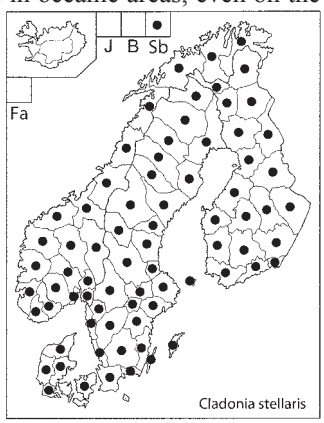
Figs. Ahti 1961: 145; Galløe 1954: pls 25–26; Holien & Tønsberg 2006: 82; Krog et al. 1994: 81, 168; Moberg & Holmåsen 1990: 149; Rikkinen 2008: 61; Stenroos et al. 2011: 169.

PRIMARY THALLUS crustose, evanescent. PODETIA 5–13 cm tall, forming dense, semiglobose heads, 3–5 cm diam., whitish to greenish yellow, darkening but not melanotic towards base, tips of exposed parts not normally embrowned; predominant branching isotomic tetrachotomy (c. 50%), with less trichotomy and even pentachotomy, axils closed or open, ultimate branchlets divergent in star-like manner, little tapering. Surface minutely arachnoid, ecorticate, smooth, algal glomerules scarcely elevated, esorediate, esquamose. APOTHECIA infrequent, brown, very small, in groups at extreme tips. PYCNIDIA common at tips, black, cylindrical, containing red slime.

Chemistry. K–, P– or (in chemotype 2) bright yellow (only at extreme tips of podetia!), KC+ yellow, UV+ white. Chemotype 1: (–)Usnic, (–)isousnic, perlatolic and pseudonorrangiformic acids; chemotype 2: with additional psoromic acid. Chemotype 1 is dominant, while chemotype 2 is known from Norway (rare) and Greenland (but the only chemotype in Japan and widespread along North Pacific coast). Perlatolic acid is rarely absent.

Habitat. Dominant in over 80 years old successional stages in pine woodlands and alpine heathlands in continental, middle boreal to low alpine regions, but is often heavily grazed by domesticated or wild reindeer so that this lichen is replaced by *C. rangiferina, C. arbuscula* and other reindeer lichens. In more southern, lower and in oceanic areas *C. stellaris* is less frequent to abundant. Also grows on thin soil over rocks and in bogs. Absent or rare in early successional stages after fire or other disturbance.

Distribution. Common in most of Finland, Sweden and Norway, but scarce in oceanic areas, even on the islands of the Baltic Sea and especially along the North Sea, being absent from Iceland and the Færoe Is. Also absent from high altitudes and only one old record is from Svalbard (but widespread in Greenland). **D:** *NJy VJy* ØJy *SJy Sjæ*. **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL*. **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *Sb*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL*. Northern Eurasia and North America, outliers in mountain ranges such as the Alps (in western parts ± extinct), Caucasus, Himalayas, northern Appalachians. Mainly boreal, extending to the southern Arctic and northern temperate zones.



Note. The psoromic acid chemotype has sometimes been regarded as a distinct species, *Cladonia aberrans,* but it seems to have no special morphological characters, neither is it distinct in DNA analyses. *Cladonia stellaris* is collected commercially in certain areas in northern Finland, Norway and Sweden. It is primarily exported to Germany, where it is much used in ornamental wreaths and other structures in winterly decoration of graves in cemeteries. It is used in the

Nordic countries for the same purpose, traditionally also in window insolation ("fönsterlav"). It is also used as cover of flower pots (often stained and dipped in glycerol) and as tree models in architectural exhibits, and therefore exported especially to East Asia.

78. Cladonia straminea (Sommerf.) Flörke

De Cladon.: 87 (1828). – *Cenomyce straminea* (Sommerf.) Suppl. Fl. Lapp.: 128 (1826). – TYPE: Norway, Nordland, Saltdalen, Sommerfelt (O-L838, lectotype, Timdal & Tønsberg, Graphis Scripta 24: 35, 2012).

Syn. *Cenomyce floerkeana* Sommerf., *nom. illeg*. (non Fr.), *Cladonia metacorallifera* Asahina, *Cladonia metacorallifera* var. *reagens* Asahina.

F: vihertorvijäkälä **N:** skjellrødbeger **S:** korallbägarlav

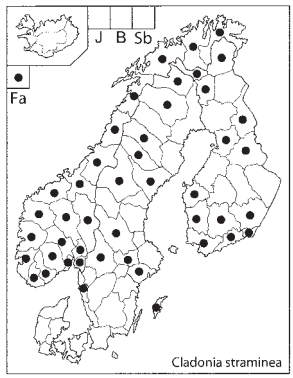
Literature. Holien & Hilmo, Gunneria 65: 16–18 (1991); Osyczka et al., Polish Bot. J. 51: 233–234; Stenroos, Ann. Bot. Fenn. 26: 307–309 (1989); Timdal & Tønsberg, Graphis Scripta 24: 35 (2012); Tønsberg, Norweg. J. Bot. 22: 129–132 (1975), Blyttia 37: 129–130 (1979); Wirth, Herzogia 8: 313–315 (1990).

Figs. Burgaz & Ahti 2009: lám. f–i; Krog et al. 1994: 162; Osyczka et al. 2006: fig. 2; Stenroos et al. 2011: 150; Timdal & Tønsberg 2012: fig. 1; Wirth 1995: 332.

PRIMARY THALLUS squamulose, persistent, squamules inconspicuous, 2–4 mm long. PODETIA 1–3 cm tall, greenish to yellowish grey, necrotic parts melanotic; slender, scyphose; scyphi narrow (1–5 mm diam), fairly regular, margins entire to somewhat dentate, occasionally with marginal proliferations. Surface rough, subcontinuously corticate in basal parts, otherwise verruculose to microsquamulose, esorediate but slightly granulose. APOTHECIA uncommon, red. PYCNIDIA on margins of scyphi, ovoid, containing red slime.

Chemistry. Chemotype 1: K–, P–, UV+ white, usnic, didymic and squamatic acids; chemotype 2: K+ yellow, P+ yellow, UV–, usnic, didymic and thamnolic acids. Chemotype 1 is dominant and usually the only one present; chemotype 2 is known from Norway (*ST, NT*) and Sweden (*Jmt)*, as well as from Japan and Spain.

Habitat. On big boulders and rock outcrops in moist situations, often near shores, in gorges or in seepages, more rarely on wood, apparently chionophobous (occurs in habitats with no or little snow in winter).



Distribution. Common in Norway, both on the coast and in the mountains, also widespread in Finland and Sweden, except for the extreme south. Probably most frequent in northern and middle boreal zones. Not seen from Iceland and the Arctic. **Fa. Gr. F:** *V U EK St EH ES EP Kn OP Ks KiL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **S:** *Gtl Bh Srm Vrm Vsm Dlr Ång Jmt ÅsL LyL LuL TL.* Europe, Asia, North America. Boreal, incompletely circumpolar, oceanic, most frequent along east and west coasts, but also in more southern mountains, such as the European Alps, Khamar-Daban Range in Buryatia, Rocky Mountains S to Montana and the northern Appalachians. All the records from the Southern Hemisphere appear to be erroneous (in South America usually referable to *C. lepidophora* Ahti & Kashiw.).

Note. Usually cited as *C. metacorallifera* (described from Japan), but *C. straminea* is an older name. Var. *reagens* is not recognized because it seems to be a typical thamnolic-acid chemotype without morphological characters, although it has a distinct, more restricted range. *C. straminea* is usually recognized by its characteristic greenish tinge, rough podetia, which have narrow, in part blackish scyphi and are UV+ white.

79. Cladonia strepsilis (Ach.) Grognot

Pl. Crypt. Sâone-et-Loire: 85 (1863). – *Baeomyces strepsilis* Ach., Methodus, Suppl.: 52 (1803). – TYPE: Sweden (H-ACH 1723A lectotype, Ahti, Regnum Veg. 128: 95, 1993).

D: pude-bægerlav **F:** nummitorvijäkälä **I:** seltulauf **N:** polsterlav **S:** kuddbägarlav

Red-listed in: **D**

Literature. Ahti (2002: 317–318); Görlitz 24(11): 1–16

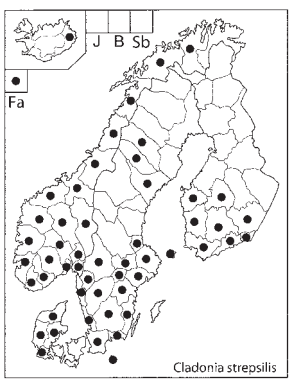
(1969); Huovinen et al., Ann. Bot. Fenn. 26: 303–304 (1989); Litterski & Ahti 2004: 217, 234; Schade, Abh. Ber. Naturkundemus.

Figs. Carlin 1981: figs 10B, 10C; Galløe 1954: pls 178–187; van Herk & Aptroot 2004: 159; Hinds & Hinds 2007: 209; Holien & Tønsberg 2006: 94; Rikkinen 2008: 41; Stenroos et al. 2011: 170.

PRIMARY THALLUS persistent, well developed, usually dominant, consisting of greenish grey, elongate, crenate, stiff squamules 5–30×0.5–3.5(–5) mm, which form dense, often convex cushions to 10 cm wide, below rather compact, corticate. PODETIA infrequent, 0.3–2.1 cm tall, 1–3 mm thick, irregularly cylindrical to clavate, often with short apical branchlets, tips blunt, never scyphose. Surface continuously corticate, somewhat rugulose. Stereome poorly developed. APOTHECIA normally present on podetia, with 0.3–2 mm wide, brown discs, often forming corymbose aggregations. PYCNIDIA basal, on or near margins of primary squamules, ovoid to doliiform, slightly constricted at base, containing hyaline slime.

Chemistry. K–, P+ yellow, C+ blue green. Squamatic, baeomycesic, barbatic (trace), 4–*O*-demethylbarbatic (trace) acids, strepsilin, at least three unknown substances (traces). The C+ blue green reaction is caused by strepsilin, a dibenzofuran.

Habitat. On thin soil over open rock outcrops, usually in seepages (often with *Pycnothelia papillaria*), also in heathlands, occasionally even in alpine heaths on oceanic mountains.



Distribution. Widespread in southern parts, especially along the coasts, reaching *Ång* and *EP* along the Gulf of Bothnia and *VFi* along the North Sea, also occurring up to timberline on oceanic mountains (e.g., to 750 m in Åsele Lapp-mark). **D:** *NJy ØJy VJy SJy Brn.* **Fa. Gr. F:** *A V U EK St EH ES EP PH.* **I:** *IAu.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi.* **S:** *Sk Bl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Gst Ång ÅsL LyL.* Western Europe, East Asia, eastern North America, Middle and South America. Oceanic, not transcontinental but the range consisting of several separate outliers.

Note. Easily recognized with the reagent C, which gives a strong bluish green reaction. Usually forming conspicuous, dense cushions, with very stiff, elongate squamules, but since it usually lacks podetia in its Nordic range, it may be difficult to recognize without chemistry. The diagnostic dibenzofuran, strepsilin, is only found in this *Cladonia* species and is very rare in lichens in general.

80. *Cladonia stricta* (Nyl.) Nyl.

Flora 52: 294 (1869). – *Cladonia degenerans* var. *stricta* Nyl. in Middendorff, Reise Sibir. 4, Anh. 6(2): 4 (1867). – TYPE: Russia, Krasnoyarsk Territory, Taimyr Peninsula, 1843 von Middendorff (H-NYL 38841 lectotype, Ahti, Ann. Bot. Fenn. 15: 11, 1978).

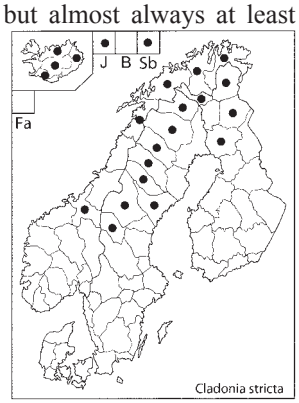
Syn. *Cladonia cerasphora* Vain., *nom. illeg*.

F: tundratorvijäkälä **I:** fjallabikar **S:** glatt svartfotslav

Literature. Ahti, Folia Cryptog. Estonica 32: 7–8 (1998); Osyczka 2006: 230–231.

Figs. Ahti 1998: 6; Osyczka 2006: 231; Stenroos et al. 2011: 171.

PRIMARY THALLUS often persistent, 1–3 mm long, little divided, underside somewhat floccose, white to slightly bluish, PODETIA greenish-grey to pale or dark brown, sometimes bluish towards tips, at base melanotic, 2–4 cm tall, 0.5–1 mm thick, slender, straight, almost unbranched, usually only with one terminal scyphus, 0.2–1 mm wide, which has a few (2–4) very short proliferations from the margins, more rarely from the centre; scyphus usually with many small perforations and one larger, occasionally the tips flattened, usually scyphose, but almost always at least with some a- scyphose, subulate tips. Surface subarachnoid, slightly pruinose towards tips, rugulose, black-checkered towards base, rarely squamulose. APOTHECIA rare, on rims or proliferation of scyphi, blackish brown. PYCNIDIA scarce, conical to subglobose, on scyphi or their prolifera-



tions, containing hyaline slime.

Chemistry. K+ yellow, P+ red, UV–. Atranorin, fumarprotocetraric acid complex.

Habitat. On acid, alpine and coastal soil over rocks.

Distribution. In the northern provinces of Finland, Norway and Sweden, also in Iceland. **F:** *PeP SoL EnL InL*. **Gr. I:** *ISu IMi IAu INo.* **N:** *ST NNo Tr VFi ØFi.* **AI:** *Sb JM.* **S:** *Ång Hrj Jmt ÅsL LyL PL LuL TL*. Eurasia, North America. Circumpolar, primarily arctic but distribution deficiently known.

Note. Much misunderstood for a long time. The epithet *stricta* has been much applied to what is now called *C. trassii.* It seems actually to be very close to *C. phyllophora.* The presence of many perforation on the scyphi is a characteristic feature of *C. stricta*.

81. Cladonia stygia (Fr.) Ruoss

Bot. Helv. 95: 241 (1985). – *Cladonia rangiferina* Fr. f. *stygia* Fr., Sched. Crit. Lich. Suec. 8–9(3): 22 (1826). – Type: Sweden, Södermanland, St. Malm, Sörgölet, 1918 Malme in Malme, Lich. Suec. Exs. no. 726 (H neotype, Ahti & Hyvönen, Ann. Bot. Fenn. 22: 223, 1985).

Syn. *Cladina stygia* (Fr.) Ahti

D: styg rensdyrlav **F:** sysiporonjäkälä **N:** svartfotreinlav **S:** svart renlav

Red-listed in: **D**

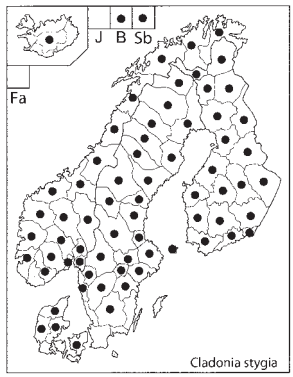
Literature. Ahti 1984: 45–46; Ahti & Hyvönen, Ann. Bot. Fenn. 22: 223–229 (1985); Huovinen & Ahti, Ann. Bot. Fenn. 23: 100–101 (1986); Pallas et al., Ber. Bayer. Bot. Ges. 66–67: 314–315 (1996); Ruoss, Bot. Helvet. 95: 239–245 (1985); Ruoss & Ahti, Lichenologist 21: 39–40; Oset et al., Bot. Lithuan. 14: 43–48 (2008).

Figs. Ahti 1984: fig. 5; Ahti & Hyvönen 1985: 224; Hinds & Hinds 2007: 209; Holien & Tønsberg 2006: 82; Krog et al. 1994: 82, 170; Stenroos et al. 2011: 172.

Primary thallus crustose, evanescent. Podetia 5–15 cm tall, 0.5–2 mm thick, dark ash-grey, olive-grey or bluish grey to brown (sometimes strongly blackish-brown), inside becoming coal-black towards base, slender, much branched, predominant branching anisotomic trichotomy (c. 60 %), with some tetrachotomy and dichotomy, axils open or closed, main axes distinct, apical branchlets divaricate or often nodded in one direction, extreme tips subulate, browned. Surface ecorticate, arachnoid, somewhat areolate towards base, esorediate, esquamose. Apothecia fairly common, red brown, small. Pycnidia at tips of apical branchlets, ovoid to cylindrical, containing red slime.

Chemistry. K+ yellow, P+ orange red, UV–. Atranorin (very rarely absent) and fumarprotocetraric acid complex, plus traces of unidentified compounds.

Habitat. Most common in wooded or open peatlands, even in wet hollows, but especially northwards it is also common in forest floors, arctic-alpine heaths or rock outcrops, occasionally dominant among reindeer lichen vegetation, but usually playing minor role.



Distribution. Common in northern and middle boreal parts of Finland, Norway and Sweden, decreasing southwards. Very scattered and poorly recorded in the south. Uncertain records from Iceland, although widespread in Svalbard and Greenland. **D:** *NJy VJy ØJy Sjæ.* **Gr. I:** *IMi.* **F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Bi Sb.* **S:** *SmI Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Eurasia and North America. Circumpolar in arctic to temperate zones, with outliers in the mountains, most frequent in the northern boreal zone. Range poorly known in details, because not always recognized.

Note. Characters distinguishing this species from *C. rangiferina* are the strongly blackening necrotic basal parts, red slime in the pycnidia (rarely visible!) and the usually more strongly embrowned tips. It is also primarily growing on peatlands or other moist places.

82. Cladonia subcervicornis (Vain.) Kernst.

Jahresber. Staatsoberrealschule Klagenfurt 43: 25, 32 (1900). – *Cladonia verticillata* var. *subcervicornis* Vain.,

Acta Soc. Fauna Fl. Fenn. 10: 197 (1894). – TYPE: Not typified.

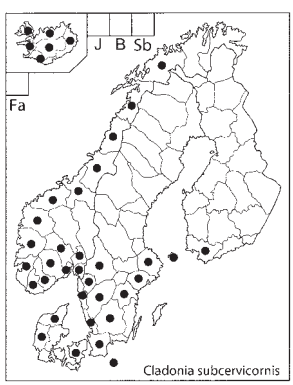
D: kyst-bægerlav **F:** kimpputorvijäkälä **I:** skorulauf **N:** kystpute **S:** kustbägarlav

Red-listed in: **D F**

Literature. Burgaz & Ahti, Fl. Liquenól. Ibér. 4: 76 (2009); Du Rietz, Bot. Not. 1922: 217–222 (1922); Litterski & Ahti 2004: 217–218, 235; Printzen & Ekman, Mycologia 95: 399–406 (2003).

Figs. Carlin 1981: figs 10A, 10D, 10E; Galløe 1954: pls 130–134; Holien & Tønsberg 2006: 95; Krog et al. 1994: 170; Stenroos et al. 2011: 174.

PRIMARY THALLUS dominating, squamulose, persistent, to 3(–4) cm long, 0.5–4 mm wide, usually strongly melanotic, necrotic bases present, forming large cushions, underside at first snow-white, soon changing into grey or brownish, morely rarely violet. PODETIA inconspicuous, irregular, often phyllopodiate, 0.5–3 cm tall, 1–2 mm thick, lead grey to greyish green, melanotic towards base, slightly branching, scyphose or not; scyphi irregular, often dentate and squamulose at margins, slightly proliferating from margins or centre. APOTHECIA not uncommon, often aggregate, dark brown. PYCNIDIA common on margins of scyphi, subglobose to ovoid, containing hyaline slime.



Chemistry. K+ yellow, P+ red. Atranorin and fumarprotocetraric acid complex.

Habitat. On open rock outcrops and soil in coastal positions.

Distribution. Common along west coasts of Sweden, Denmark and Norway, and in Iceland, rare farther from the coast. **D:** *NJy VJy Sjæ Brn.* **F:** *A V.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr.* **S:** *Sk SmI Hl Bh Dls Vg Ög Srm Vrm Upl.* Western Europe, Macaronesia, temperate to boreal, clearly oceanic, frequent in the British Isles, for instance. Reports from North America are incorrect.

Note. All the Greenland specimens seen under this name were referred to *C. macrophyllodes*.

83. *Cladonia subfurcata* (Nyl.) Arnold

in Rehm, Cladon. Exs. no. 263 (1885). – *Cladonia degenerans* f. *subfurcata* Nyl. in Norrlin, Not. Sällsk. Fauna Fl. Fenn. Förh. 13: 320 (1874) – TYPE: Finland, Kittilän Lappi, Muonio, 1867 Norrlin (H-NYL 38313 lectotype, Ahti, Bryologist 70: 104, 1967).

Syn. *Cladonia delessertii* Vain., *nom. illeg.*

D: mose-bægerlav **F:** suotorvijäkälä **N:** fjellgaffellav **S:** mossebägarlav

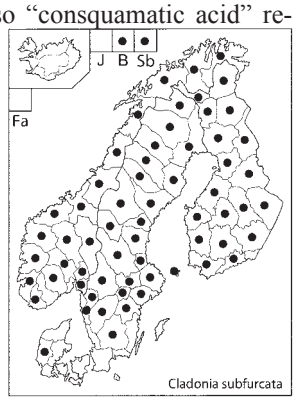
Red-listed in: **D**

Literature. Ahti, Bryologist 70: 104–105 (1967); Du Rietz, Svensk Bot. Tidskr. 16: 69–72 (1922); Hasselrot, Acta Phytogeogr. Suec. 33: 46–50, 132–134 (1953); Huovinen & Ahti, Ann. Bot. Fenn. 25: 378, 380 (1988); Lynge, Vidensk-Akad. Skr. 1938(6): pl. 4 (1938); Osyczka & Flakus, Fragm. Florist. Geobot. Polon. 16: 188–190 (2009); Vainio 1922: 61–63.

Figs. Carlin 1981: figs 7B, 7F, 7G; Galløe 1954: pls 92, 95–97; Stenroos et al. 2011: 175.

PRIMARY THALLUS squamulose, inconspicuous, soon evanescent. PODETIA 5–12 cm tall, 0.5–2.5 mm thick, dark or pale brown, strongly melanotic towards base, erect, usually forming very dense tufts, usually having many very short branchlets, axils gaping open, not forming distinct funnels, tips acute, ascyphose. Surface smoothly corticate, areolate at base, glossy, squamules extremely rare, esorediate. APOTHECIA very rare, dark brown. PYCNIDIA at tips of uppermost branchlets, conical to cylindrical, at base often constricted, containing red slime.

Chemistry. K–, P–, UV+ white. Squamatic acid and barbatic acid (minor), also "consquamatic acid" reported.



Habitat. Characteristically in wet bogs, but also in seepages on rock outcrops and even on dry soil in arctic and mountain heaths, more rarely in lichen woodlands.

Distribution. Widespread in northern parts and

mountains of Norway, Sweden and Finland, rarer southwards (one old locality in Denmark), absent from Iceland. **D:** *VJy.* **Gr. F:** *A V U St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Te VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Bi Sb.* **S:** *SmI Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb Åsl LyL PL LuL TL.* Eurasia, North America, circumpolar, mostly arctic and northern boreal but rarely extending to hemiboreal and northern temperate regions.

Note. All specimens of *"C. subfurcata"* from Iceland and the Færoe Is. and all but one from Denmark were referred to *C. crispata* subsp. *cetrariiformis*. These taxa can be extremely similar, and some material (especially in timberline areas of the Scandes) could possibly represent their intermediates.

84. Cladonia subrangiformis Sandst.

Abh. Naturwiss, Vereine Bremen 25: 165 (1922). – Type: Germany, Baden-Württemberg, Wertheim, Kahlberg, 1921 Kneucker in Sandstede, Cladon. Exs. no. 784 (H lectotype, Ahti, Regnum Veg. 128: 97, 1993).

Syn. *Cladonia furcata* subsp. *subrangiformis* (Sandst.) Abbayes, *nom. illeg.*, non *Cladonia furcata* f. *subrangiformis* Vain. ex Zahlbr., *Cladonia furcata* var. *subrangiformis* (Sandst.) Hennipm., *nom. illeg.*

D: hvidvortet bægerlav **F:** alvaritorvijäkälä **N:** kystgaffel **S:** alvar-rislav

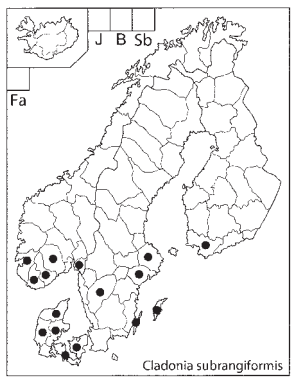
Red-listed in: **D F N**

Literature. Burgaz & Ahti 2009: 76, 78–79; Schade, Nova Hedwigia 11: 285–308 (1966); Sussey & Baubet, Bull. Ass. Franç. Lichénol. 35(1): 34–35 (2010); Tønsberg et al., Sommerfeltia 23: 61 (1996).

Figs. Burgaz & Ahti 2009: 78; Carlin 1981: fig. 6I; Stenroos et al. 2011: 175; Sussey & Baubet 2010: 34 (as *C. furcata* var. *palamaea*).

Primary thallus squamulose, evanescent. Podetia 3–7 cm tall, often robust, 0.5–2 mm thick, chocolat brown or greenish, towards base yellowish brown, somewhat branched by dichotomy, axils usually open, tips subulate, divergent, ascyphose. Surface smoothly corticate, in part areolate and maculate, in basal parts often with white bursting tubercles. Apothecia very rare, in corymbose groups at ends of thickened branchlets, dark brown. Pycnidia common at tips, ovoid, constricted at base, containing hyaline slime.

Chemistry. Chemotype 1: K+ yellow, P+ red, UV–. Atranorin, fumarprotocetraric acid complex. Chemotype 2: K+ yellow, P+ yellow, UV–. Atranorin (rarely absent), psoromic and 2'-*O*-methylpsoromic acids. Rarely also bourgeanic, hypoprotocetraric or physodalic acids. Chemotype 2 only in Norway (*Øf*) and Sweden (*Öl*) in the area (widespread in the Mediterranean).



Habitat. On calcareous soil, also basic sand dunes.

Distribution. In Denmark mainly on Møn, otherwise rare or specimens uncertain. In Gotland and Öland common, otherwise rare on east coast of Sweden. In Norway and Finland very rare, coastal. **D:** *NJy VJy ØJy Fyn Sjæ*. **F:** *V* (Jurmo). **N:** *Øf Te AA VA Ro*. **S:** *Öl Gtl Vg Srm Upl*. Europe, Morocco, Turkey, Caucasus, Iran, SW Siberia, Kazakhstan, Xinjiang. Primarily in arid, Mediterranean or temperate regions.

Note. Very close to *C. furcata* and their distinction has been questioned. Usually *C. subrangiformis* is more robust and less branched and contains atranorin, and the habitat is clearly calcareous. However, there are specimens which are difficult to identify. The tubercle-like thickenings may be caused by high accumulation of calcium oxalate. The common use of the name "*C. furcata* subsp. *subrangiformis"* is not correct due to nomenclatural reasons.

85. Cladonia subulata (L.) F.H.Wigg.

Prim. Fl. Holsat.: 90 (1780). – *Lichen subulatus* L., Sp. Pl.: 1153 (1753). – Type: Icon in Tabernaemontanus, Eicones Pl., t. 809, [upper] f. 1. 1590 (lectotype, Jørgensen et al., Bot. J. Linn. Soc. 115: 381, 1994; sine loco (LINN 1273.249, epitype, Jørgensen et al., Bot. J. Linn. Soc. 115: 382, 1994).

Syn. *Cladonia cornutoradiata* (Leight.) Sandst., *Cladonia fimbriata* var. *cornutoradiata* (Leight.) Vain.

D: spids bægerlav **F:** sormitorvijäkälä **I:** stúfbikar **N:** hornlav **S:** hornbägarlav

Red-listed in: **D**

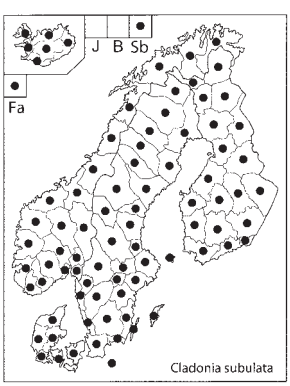
Literature. Spier & Aptroot, Lichenologist 39: 57–60 (2007); Dolnik et al., Lichenologist 42: 373–386 (2010); Paus et al., Biblioth. Lichenol. 53: 191–200 (1993); Pino-Bodas et al., Mycotaxon 113: 311–326 (2010).

Figs. Dolnik et al. 2010: 376 (2010); Galløe 1954: pls 165–169; Hinds & Hinds 2007: 212; Moberg & Holmåsen 1990: 146; Osyczka 2006: 231; Rikkinen 2008: 41; Stenroos et al. 2011: 176.

Primary thallus squamulose, squamules small, evanescent. Podetia 4–10 cm tall, 0.3–1.5 mm thick, ash-grey to greenish or whitish grey, slightly melanotic toward base, slender, flexuose, unbranched or usually slightly branching, some branchlets becoming characteristically arching and antler-like, tips subulate or narrowly scyphose at least when fertile; scyphi 0.5–2(–4) mm wide, usually grossly dentate and with long proliferations at margins. Surface usually totally or almost ecorticate, sorediate, usually esquamose. Apothecia rare, brown, at scyphal margins. Pycnidia scarce, at tips of podetia, ovoid to conical, usually somewhat constricted at base, containing hyaline slime.

Chemistry. K–, P+ (fast) red, UV–. Fumarprotocetraric acid complex.

Habitat. Usually on bare mineral soil in recently disturbed habitats, such as road verges, gravel pits, and young postfire stages, more rarely on humus or rotting wood, also on rocks. Mainly in anthropogenic habitats and on clearly acidic soils



Distribution. Common in the Nordic countries but absent from high elevations and much of the Arctic. Also scarcer in the the northern boreal zone. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi*. **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Circumpolar in Eurasia and North America, also in Macaronesia, primarily in boreal and temperate zones. Outliers in mountain ranges, such as the Himalayas, also at southern end of South America, in Australasia and Antarctic. Perhaps more frequent in continental rather than oceanic regions.

Note. Difficult to distinguish from *C. rei*, which contains homosekikaic acid acid (UV+ whitish) and often reacts P–. *C. subulata* is taller and has characteristic hook-like branchlets, it is often ascyphous, but when present the scyphi have long marginal proliferations. Occasionally it is short, with wide scyphi, and looks like *C. chlorophaea*. Recent molecular analyses have confirmed that *C. subulata* and *C. rei* are distinct and not even very closely related.

86. Cladonia sulphurina (Michx.) Fr.

Lichenogr. Eur. Reform.: 237 (1831). – *Scyphophorus sulphurinus* Michx., Fl. Bor.-Amer. 2: 328 (1803). – Type: 'America Septentrionalis' (Canada, Québec?), Michaux (PC lectotype, Ahti, Ann. Bot. Fenn. 15: 9, 1978).

Syn. *Cladonia gonecha* (Ach.) Asahina

D: opblæst bægerlav **F:** keltatorvijäkälä **I:** raufarbikar **N:** fausklav **S:** trasig pöslav

Red-listed in: **D**

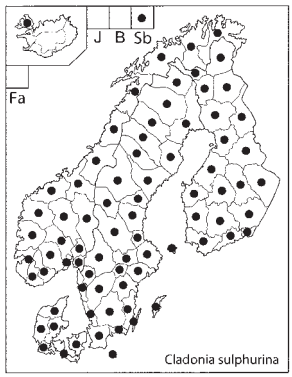
Literature. Ahti, Ann. Bot. Fenn. 15: 9 (1978); Østhagen, Norweg. J. Bot. 18: 87–92 (1971); Schade, Abh. Ber. Naturkundemus. Görlitz 38(17): 1–28 (1969).

Figs. Brodo et al. 2001: 274; Hansen & Andersen 1995: 33; van Herk & Aptroot 2004: 161; Holien & Tønsberg 2006: 86; Moberg & Holmåsen 1990: 139; Rikkinen 2008: 173; Stenroos et al. 2011: 177; Wirth 1995: 301.

Primary thallus squamulose, squamules persistent, often large, 2–8 mm long, sometimes sorediate. Podetia 3–8 cm tall, greyish yellow to distinctly pale yellow, ochraceous toward base, unbranched, subulate to scyphose, but usually much deformed and longitudinally split so that scyphi indistinct, but often proliferating from margin. Surface areolate-corticate on basal third, upwards abundantly farinose sorediate, also squamulose at base. Apothecia rather common, red. Pycnidia on margins of scyphi, subglobose, containing red slime.

Chemistry. K–, P–, KC+ yellow, UV+ white. (+)Usnic and squamatic acid, plus fatty acids.

Habitat. Especially common on bare peat on drained peatlands, also in intact bog hummocks, and rotten wood, humus in forest floor, alpine and arctic heaths, on rock outcrops, and on bare mineral soil on road banks.



Distribution. Common in much of the area, decreasing southwards, rare in Iceland. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL*. **I:** *INv.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL*. Circumpolar in Eurasia and North America, also at southern tip of South America, New Zealand and Antarctic. In the Northern Hemisphere primarily boreal and arctic, but extending to northern temperate zone, outliers in more southern mountains.

Note. Separated from the very similar *C. deformis* by the UV– fluorescence and the absence of cystal needles on surface, also more intensely yellowish scyphi and podetia. It is in general more deformed and ragged, so that it is usually recognizable by habit alone. Mixed colonies are common in forest floors, for instance.

87. *Cladonia symphycarpa* (Flörke) Fr.

Sched. Crit. Lich. Suec. 8–9: 20 (1826). – *Capitularia symphycarpa* Flörke, Beitr. Naturk. 2: 281 (1810). – Type: Germany, Flörke in Arnold, Lich. Exs. [icones] No. 1484 [photo] (H lectotype, Burgaz & Ahti, Fl. Liquenól. Ibér. 4: 81, 2009); Germany, Thüringen, Harz, Nordhausen, Alter Stolberg, 1920 Sandstede & Wein in Sandstede, Cladon. Exs. No. 689 (UPS epitype, Burgaz & Ahti, Fl. Liquenól. Ibér. 4: 81, 2010).

Syn. *Cladonia cariosa* subsp. *hungarica* Vain., *Cladonia dahliana* Kristinsson, *Cladonia hungarica* (Vain.) Szatala, *Cladonia 'symphycarpia'*

D: kalkhede-bægerlav **F:** kalkkitorvijäkälä **I:** svarðlauf **N:** kalkpolster **S:** kalkhedslav

Red-listed in: **D**

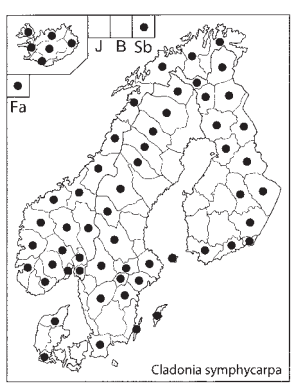
Literature. Ahti, Fl. Neotrop. 78: 265–267 (2000); Culberson, Bryologist 72: 385–386 (1969); Du Rietz, Svensk Bot. Tidskr. 16: 72–75 (1922); Hansen & Ahti, Graphis Scripta 23: 61–62 (2011); Huovinen et al., Ann. Bot. Fenn. 26: 301–302, 304 (1989); Osyczka & Skubala, Nova Hedwigia 93: 368–371 (2011).

Figs. Brodo et al. 2001: 275; Krog et al. 1994: 172; Moberg & Holmåsen 1990: 146; Osyczka 2006: 235; Stenroos et al. 2011: 178; Wirth 1995: 341.

Primary thallus squamulose, persistent, often dominant, flat to ascending, forming large colonies; squamules large, 0.5–2 cm long, 0.5–1 cm wide, glaucous to greenish grey above, brown mainly at margins, conspicuously white below. Podetia usually absent or scarce, stout, 1–2 cm tall, 0.3–0.8 cm thick, often clearly clavate, little branched. Surface corticate, at least in part very smooth, longitudinally cracked or split, pruinose, squamulose at base, esorediate. Apothecia always present on podetia, dark brown, pruinose, to 1 cm diam. Pycnidia common, laminally on squamules, rather large, ampullaceous, stipitate, containing hyaline slime.

Chemistry. UV–. Several chemotypes: 1) K+ yellow to slowly red, P+ yellow. Atranorin, norstictic, connorstictic acids, fatty acids; 2) K+ yellow, P+ yellow. Atranorin. 3) K+ yellow, P+ red. Atranorin, fumarprotocetraric acid (10 provinces in Norway). 4) K+ yellow, P+ yellow. Atranorin, psoromic acid (in all prov. in Iceland and Svalbard). 1 and 2 widespread.

Habitat. Primarily on calcareous soil, often over and among mosses (such as *Tortella tortuosa, Ditrichum flexicaule*) in meadows and pastures, but also on bare soil or on thin soil over rock outcrops, on both primary habitats and secondary ones, such as concrete walls, by cement works and limestone quarries.



Distribution. Widespread throughout the area but mainly in the calcareous areas. **D:** *SJy NJy.* **Fa. Gr. F:** *A V U EK ES PS PK Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IMi IAu INv INo.* **N:**

Øf Ak He Op Bu Vf Te AA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi. **AI:** *Sb.* **S:** *Sk Öl Gtl Vg Ög Nrk Srm Vrm Vsm Upl Dlr Hrj Jmt ÅsL LyL PL LuL TL.* Europe, North Africa, Canary Is., Northern and Middle Asia, Iran, China, North America, South America.

Note. Hansen & Ahti (2011) recently segregated *Cladonia scotteri* from this species. It is distinguished by brownish colour, thick, broadly clavate podetia, and chemical contents, often including homosekikaic and rangiformic acids. *C. scotteri* is widespread in Greenland and elsewhere in North America and also Eurasia, and could be expected in northern Europe. In addition *C. symphycarpa* is difficult to distinguish from *C. cariosa*, which has smaller squamules and thinner podetia and is not as strongly calciphilous as *C. symphycarpa.* Many authors have distinguished the psoromic acid chemotype as a distinct species, *C. dahliana*, which has been reported to be always sterile. However, fertile "*C. dahliana*" is known from many places in North America, and provisional DNA analyses support inclusion of the psoromic chemotype into *C. symphycarpa.*

88. Cladonia trassii Ahti

Folia Cryptog. Estonica 32: 7 (1998). – Type: Sweden, Torne Lappmark, Gällivare, Mt. Patjanen, 1922 Stenholm in Sandstede, Cladon. Exs. no. 1134 (H holotype).

Syn. *Cladonia cerasphora* auct., *Cladonia lepidota* auct., *Cladonia stricta* auct. plur.

F: tundratorvijäkälä **I:** bleðlabikar **S:** blågrå svartfotslav

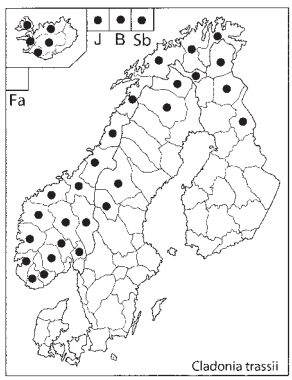
Literature. Ahti, Folia Cryptog. Estonica 32: 7 (1998); Biblioth. Lichenol. 96: 16 (2007); Osyczka 2006: 233–235.

Figs. Hansen & Andersen 1995: 33 (as *C. stricta*); Krog et al. 1994: 169 (as *C. stricta)*; Osyczka 2006: 235; Stenroos et al. 2011: 179

Primary thallus squamulose, persistent, squamules 1–3 mm long, little divided, melanotic at base. Podetia 0.5–8 cm tall, 0.5–3 mm thick, whitish or bluish grey, little browned, strongly melanotic and checkered toward base, very variable, often deformed and crooked, slender to fairly robust, somewhat branched, axils closed, subulate or scyphose; in principle scyphi centrally proliferating, but this is often not easily observed, since scyphi are scarce, irregular and shallow. Surface fairly smooth, slightly pruinose, but cortex discontinuous and areolate, with blackened medullary patches visible throughout, usually in part provided with scattered, fairly large squamules, especially on scyphus margins. Apothecia uncommon, dark brown. Pycnidia common at apices, ovoid to subglobose, constricted at base: containing hyaline slime.

Chemistry. K+ yellow, P+ red, UV–. Atranorin, fumarprotocetraric acid complex.

Habitat. Primarily in late snow-beds above timberline and in tundra, but also in upper woodlands in mountains.



Distribution. Common in Svalbard and Greenland, also in Scandinavian mountains. **Gr. F:** *Ks SoL EnL InL.* **I:** *ISu IVe IMi INv INo.* **N:** *Ak He Op Bu Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb.* **S:** *Hrj Jmt LuL TL.* Circumpolar in Eurasia and North America, arctic to northern boreal, isolated occurrences in mountains such as the Alps and Carpathians, Altay, N. China, Japan, Colorado and New England, also in Argentine Tierra del Fuego.

Note. Excessively variable and difficult to distinguish from *C. uliginosa*, which produces numerous, rather regularly scyphose and centrally proliferating tiers on tall podetia. They have often been united under *C. stricta* or other untenable names. *C. stricta* s. str. is actually a rather different brown species, which is closer to *C. phyllophora* and rarely produces central proliferations.

89. Cladonia turgida Hoffm.

Deutschl. Fl. 2: 124 (1796). – Type: Sweden, Uppland, Uppsala, Ehrhart in Ehrhart, Pl. Cryptog. Exs. no. 297 (GOET lectotype, Ahti & Stenroos, Nordic Lichen Flora 5: 91, 2010).

F: paksutorvijäkälä **I:** digurkrókar **N:** narreskjell **S:** späll-lav

Literature. Litterski & Ahti 2004: 218, 235; Vainio 1887: 494–501; 1922: 75–76.

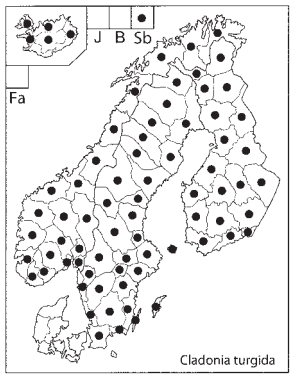
Figs. Carlin 1981: figs 5H, 5I; Hinds & Hinds 2007: 215; Moberg & Holmåsen 1990: 147; Stenroos et al. 2011: 180.

PRIMARY THALLUS squamulose, persistent to evanescent, squamules large, conspicuous, 0.5–2.5 cm long, 2–7 mm wide, lobate, often with incurved margins, upper side green to glaucescent, lower side usually chalk white, darkening but not melanotic at base. PODETIA often sparse, robust, 0.5–7(–12) cm tall, 2–3(–5) mm thick, grey to green, somewhat browned, irregularly turgescent, little branched, scyphose, but many podetia ascyphose, acute; scyphi narrow, irregular, with coarse teeth. Surface smoothly corticate but checkered, often with irregular, longitudinal cracks or perforations, also on bottom of scyphi. APOTHECIA rare, brown, 0.2–0.5 mm wide, aggregated. PYCNIDIA common on both basal squamules and at tips of podetia, ovoid to doliiform, sessile, containing hyaline slime.

Chemistry. K+ yellow, rarely K–, P+ red, rarely P–, UV–. Atranorin (sometimes very scarce or absent) and fumarprotocetraric acid complex (very rarely scarce or absent).

Habitat. On soil or stones in mesic or richer forests, on moist rock outcrops and (in Lapland) in alluvial riverine woodlands.

Distribution. Common in southern boreal and hemiboreal regions, more scattered further north and south. Absent from Denmark and rare in Svalbard and Greenland. **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **I:** *IVe IMi IAu INv INo.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Eurasia, North America (in east extending south to Pennsylvania, in west lacking south of Alaska). Circumpolar, low arctic to northern temperate but primarily boreal.



Note. Usually easily identified by the large squamules and thick podetia. However, sterile states are occasionally (e.g. on windy rocks of outer islands) difficult to distinguish from other squamulose species.

90. *Cladonia uliginosa* (Ahti) Ahti

Folia Cryptog. Estonica 32: 7 (1998).– *Cladonia stricta* var. *uliginosa* Ahti, Ann. Bot. Fenn. 15: 11 (1978). – TYPE: Russia, Murmansk Region (formerly Finland, Koillismaa, Salla), Korja, at base of Mt. Nurmitunturi, 1937 Laurila in Räsänen, Lich. Fenn. Exs. no. 475 (H holotype).

Syn. *Cladonia gracilescens* auct., *C. lepidota* var. *gracilescens* auct.

F: tunturitorvijäkälä **S:** svartfotad hjorthornslav

Literature. Ahti, Ann. Bot. Fenn. 15: 11–12 (1978); Folia Cryptog. Estonica 32: 7–8 (1998); Biblioth. Lichenol. 96: 16 (2007); Hansen & Ahti, Graphis Scripta 23: 63 (2011).

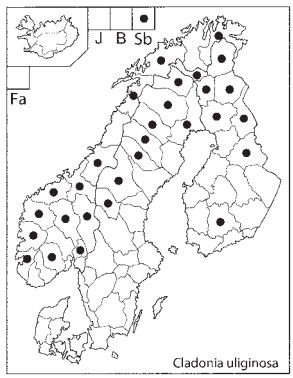
Figs. Carlin 1981: fig. 10K; Krog et al. 1994: 84 (as *C. stricta*); Stenroos et al. 2011: 181.

PRIMARY THALLUS squamulose, inconspicuous, soon evanescent. PODETIA to 8 cm tall, whitish-grey to brownish, medulla strongly melanotic, not only in basal parts but high up on living podetium, slightly branched, all tips scyphose; scyphi to 10 mm wide, deep, repeatedly (3–9 times) proliferating from centre to form successive scyphi. Surface continuously to discontinuously corticate, in part areolate, checkered, minutely pruinose, squamules usually present, especially on margins of scyphi but rarely abundant. APOTHECIA uncommon, on margins of scyphi, brown. PYCNIDIA common, on margins of scyphi, pyriform, constricted at base, containing hyaline slime.

Chemistry. K+ yellow, P+ red, UV–. Atranorin and fumarprotocetraric acid complex.

Habitat. On wet acid soil along brooks, mainly in forested situations, also scattered on rocks by lakes and sea.

Distribution. In alpine and subalpine areas, perhaps more common eastwards. Rare in Greenland. **Gr. F:** *EH Kn PeP Ks KiL SoL EnL InL.* **N:**



Ak He Op Te Ro Ho SF MR ST NT NNo Tr ØFi. **AI:** *Sb*. **S:** *Hrj Jmt Nb ÅsL LyL PL LuL TL.* Eurasia, North America. Probably circumpolar, subarctic, continental, not in the Alps or other more southern mountains, but range poorly known.

Note. Easily recognized in forested areas due to the rather regular, wide scyphi forming many successive scyphi. However, in open alpine and arctic areas the podetia tend to be more slender and scyphi are often narrower and not as regularly produced, then not easily distinguish from the similar species *C. trassii* although its scyphi are very narrow and deformed.

91. Cladonia umbricola Tønsberg & Ahti

Norweg. J. Bot. 27: 307 (1980). – Type: Norway, Sør-Trøndelag, Klæbu, Ramgåa SW of Selbusjøen, 1976 Hjelmstad (TRH holotype).

Syn. *Cladonia polydactyla* var. *umbricola* (Tønsberg & Ahti) Coppins

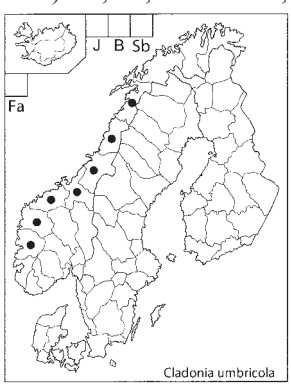
N: melrødbeger

Literature. Brodo & Ahti, Canad. J. Bot. 74: 1174–1176 (1995); Burgaz & Ahti 2009: 81, 83; Tønsberg & Ahti, Norweg. J. Bot. 27: 307–309 (1980).

Figs. Brodo et al. 2001: 777; Holien & Tønsberg 2006: 85.

Primary thallus squamulose, often persistent, squamules 3–6 mm long, esorediate or sparsely sorediate below. Podetia 1–3 cm tall, 0.5–1.5 mm thick, pale greyish green or whitish grey, simple, ascyphose or usually scyphose; scyphi 1–2 mm wide. Surface smooth, finely sorediate down to base, usually esquamose. Apothecia rare, red. Pycnidia at tips of podetia, containing red slime.

Chemistry. Two chemotypes: 1) K–, P–, UV+ white, squamatic acid; 2) K+ yellow, P+ yellow, UV–, thamnolic acid. Chemotype 2) is rarer. In North America also other chemotypes, including usnic and barbatic acids.



Habitat. On rotten logs and bases of trees in oceanic spruce forests, especially in moist valleys.

Distribution. Along Atlantic coast in Norway, mainly in coastal Trøndelag. **N:** *Ho SF MR ST NT SNo NNo.* In Europe only in Norway, the British Isles and Spain (NW and NE). Widespread in western North America and also reported from Chile and Argentina. A characteristic oceanic, boreal rainforest species in the north.

Note. Resembles *C. polydactyla,* but that species has coarser soredia, more glaucous colouration, wider scyphi and corticate patches above basal sheath of cortex. It is apparently also very close to *Cladonia ustulata* (Hook.f. & Taylor) Leight. in the Southern Hemisphere.

92. Cladonia uncialis (L.) F.H.Wigg.

Prim. Fl. Holsat.: 90 (1780). – *Lichen uncialis* L., Sp. Pl.: 1153. (1753), *nom. cons.* – Type *(cons.)*: Sweden, Dalarna, Stora Kopparberg, Rotneby ['Rottneby prope urbem Fahlun Dalekarliae'], Stenhammar in Stenhammar, Lich. Suec. Exs., ed. 2, no. 210 (UPS).

D: pigget bægerlav **I:** gulkrókar **N:** pigglav **S:** pigglav

Literature. Ahti, Ann. Bot. Fenn. 15: 9 (1978); Huovinen & Ahti, Ann. Bot. Fenn. 23: 184–185 (1986); Leuckert et al., Herzogia 5: 466–469 (1981); Kärenlampi, Ann. Bot. Fenn. 1: 220–223 (1964); Kärenlampi & Pelkonen, Repts. Kevo Subarctic Res. Sta. 7: 47–56 (1971); Litterski & Ahti 2004: 218–219, 236; Schade, Ber. Deutsch. Bot. Ges. 79: 463–473 (1966); Stenroos et al. 2002: 248, 256, 265.

92a. subsp. uncialis

Syn. *Cladonia uncialis* var. *obtusata* (Ach.) Räsänen

F: okatorvijäkälä **S:** liten pigglav

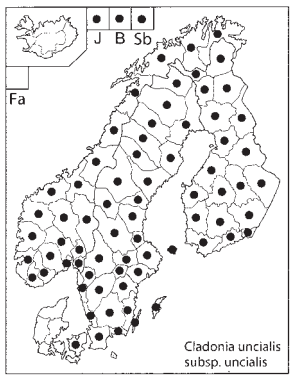
Figs. Carlin 1981: figs 1A, 1B; Galløe 1954: pls 67–70 (spec. 1, 6); van Herk & Aptroot 2004: 163; Osyczka 2006: 235; Rikkinen 2008: 61; Stenroos et al. 2011: 183.

Primary thallus squamulose, subcrustose, evanescent (very rarely seen). Podetia 3–12 cm tall, 0.1–2 mm wide, yellowish to greenish and whitish grey, paler towards the base, rather densely branched, fragile, branching type predominantly polytomous (mainly trichotomous or tetrachotomous, but even with higher level of polytomy) anisotomy (with tendencies towards isotomy), axils mostly perforate, often gaping, usually in tufts with erect podetia, main axes stoutish, tips acute, spiny, not very long and slender, ascyphose. Surface smoothly corticate, maculate, cov-

erage of green algal layer c. 30% of surface, surface of central canal not pulverulent. Apothecia common, brown, to 2 mm diam. Pycnidia very common, at tips of podetia, cylindrical, containing hyaline slime.

Chemistry. K–, P–, KC+ yellow, UV–, rarely UV+ white. (+)Usnic acid, rarely squamatic acid.

Habitat. Forest floor in lichen woodlands (sometimes codominant with reindeer lichens), open rock outcrops, open bogs, alpine and arctic heaths.



Distribution. Common through all the inland areas but avoiding exposed coastal positions, rare in Denmark. **D:** *Sjæ.* **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *JM Bi Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Eurasia, North America, Hispaniola (the reports from New Zealand are probably erroneous). Circumpolar, arctic to temperate.

Note. This is the only or dominant subspecies in areas which are not clearly oceanic. The diagnostic dominance of polytomous axils is rather variable and not always easily separated from predominant dichotomous axils.

92b. subsp. biuncialis (Hoffm.) M. Choisy

Bull. Mens. Soc. Linn. Lyon 20: 9 (1951). – *Cladonia biuncialis* Hoffm., Deutschl. Fl. 2: 116 (1796). – Type: [Germany?], Hoffmann s.n. (MW-Hoffmann 8614, neotype, Ahti, Ann. Bot. Fenn. 15: 9 (1978, as 'lectotype', corr. Ahti, Regnum Veg. 128: 100, 1993).

Syn. *Cladonia uncialis* f. *integerrima* Vain., *Cladonia uncialis* var. *turgescens* (Delise) Fr., *Cladonia uncialis* var. *dicraea* (Ach.) Räsänen, *Cladonia uncialis* subsp. *dicraea* (Ach.) D.Hawksw.

F: piikkitorvijäkälä **S:** gaffelpigglav

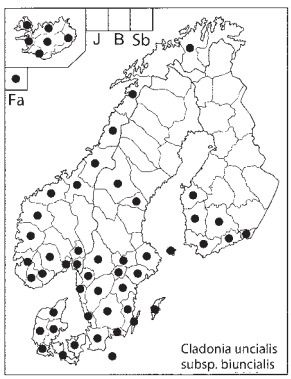
Red-listed in: **D**

Figs. Carlin 1981: figs 1C, 1D; Galløe 1954: pls 67–70 (excl. spec. 1, 6); Holien & Tønsberg 2006: 83; Hørnell et al. 2004: 44; Moberg & Holmåsen 1990: 136; Stenroos et al. 2011: 182.

Primary thallus subcrustose, granular or microphylline, evanescent (rarely seen). Podetia 3–8 cm tall, 0.5–10 mm thick, yellowish to greenish grey, at base pale grey, not melanotic, usually in tufts with ascending, arcuate podetia, slender, little to moderately branched, very fragile (broken tips common), branching predominantly anisotomic dichotomous, axils perforated or (c. 40%) closed, tips usually with long, pointed branchlets, ascyphous. Surface smoothly corticate, maculate, coverage of green algal layer up to 50%, surface of central canal finely pulverulent. Apothecia rare, small, brown. Pycnidia rare, at tips of podetia, cylindrical, containing hyaline slime.

Chemistry. K–, P–, KC+ yellow, UV+ white (medulla). (+)Usnic and (usually) squamatic acid, perhaps very rarely traces of barbatic acid.

Habitat. Open rock outcrops, also coastal heaths and bogs.



Distribution. Common along coasts of North Sea and the southern Baltic. **D:** *NJy ØJy VJy SJy Fyn Sjæ Brn.* **Fa. Gr. F:** *A V U EK St EH EP.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Øf Ak Vf Te AA VA Ro Ho SF MR ST NT SNo NNo VFi.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Mpd Jmt.* Western Europe, Canada (Maritime provinces). Range insufficiently known.

Note. This subspecies if often easily recognized by the dichotomous terminal branchlets. Its distinction is also supported in the phylogenetic analysis by Stenroos et al. (2002). However, the dichotomous populations vary from extremely slender morphs to highly turgid morphs (these mainly on superhumid coasts, often in bogs). In addition, as pointed out by Kärenlampi & Pelkonen (1971), the two subspecies show considerable geographic variation and appear to

intergrade in areas where they co-occur, like in SW Finland. Also the production of squamatic acid does not fully follow the morphological variation. All this needs further studies, also the variation outside Europe. *C. uncialis* subsp. *biuncialis* has occasionally been confused with *C. amaurocraea,* which has more strongly brown tips and contains barbatic acid.

93. Cladonia verticillata (Hoffm.) Schaer.

Lich. Helv. Spic. 1(1): 31 (1823). – *Cladonia pyxidata* [unranked] *verticillata* Hoffm., Deutschl. Fl. 2: 122 (1796). – Type: Icon in Dillenius, Hist. Musc.: t. 14, f. 6h (1742) lectotype, Ahti, Biblioth. Lichenol. 96: 17, 2007; sine loco (Germany?) (MW-Herb. Hoffmann 8642 epitype, Ahti, Biblioth. Lichenol. 96: 17, 2007).

Syn. *Cladonia verticillata* var. *evoluta* (Th. Fr.) Stein, *Cladonia cervicornis* var. *verticillata* (Hoffm.) Flot., *Cladonia cervicornis* subsp. *verticillata* (Hoffm.) Ahti

D: etage-bægerlav **F:** kerrostorvijäkälä **S:** kransbägarlav

Red-listed in: **D**

Literature. Ahti, Lichenologist 12: 126–127 (1980); Biblioth. Lichenol. 96: 17–18 (2007); van Herk & Aptroot, Biblioth. Lichenol. 86: 193–203 (2003).

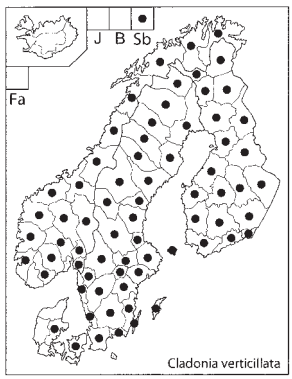
Figs. Galløe 1954: pls 121, 122; 124–127; Hansen & Andersen 1995: 27; van Herk & Aptroot 2004: 196, 198; Hinds & Hinds 2007: 217; Krog et al. 1994: fig. 11A; Rikkinen 2008: 41; Stenroos et al. 2011: 184.

Primary thallus squamulose, squamules often erect, rather small, to 6 mm long, not much incised or curled, without bluish hue below, evanescent. Podetia to 8 cm tall, 0.5–3 mm thick, greyish green to brown, melanotic towards the base, stout, erect, usually unbranched but with scyphi that are centrally proliferating forming 2–5(–7) tiers; scyphal plate ± flat, almost imperforate, 2–9 mm diam. Surface smoothly corticate, slightly arachnoid (dull), clearly maculate, in older parts areolate, esquamose or slightly squamulose, esorediate. Apothecia uncommon, brown (very rarely ochraceous), small, rarely aggregated. Pycnidia common on margins or at centres of apical scyphi, subglobose to ovoid, sessile, scarcely constricted at base, containing hyaline slime.

Chemistry. K–, P+ red, UV–. Fumarprotocetraric acid complex.

Habitat. On bare, sandy, acid soils on road and railway embankments, early postfire stages and heavily grazed (by reindeer) spots in pine forests, occasionally on rock outcrops.

Distribution. Scattered to fairly common in boreal forests, especially in Lapland. Rare at higher elevations and coastal areas, as well as in Denmark and Greenland (absent from Iceland). **D:** ØJy Sjæ. **Gr. F:** *A V U EK St EH ES EP PH PS PK KP Kn OP PeP Ks KiL SoL EnL InL.* **N:** *Øf Ak He Op Bu Te AA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Europe, Asia, North America, Australasia.



Note. Total distribution not reliably known due to taxonomic problems (similar material from the southern hemisphere often included in *Cladonia rappii* A. Evans). Also in the Nordic countries the limit towards *C. cervicornis* is in need of further studies. *C. verticillata* is usually easily recognized by numerous, rather tall, brown, verticillate (with at least 4 tiers) podetia and poorly developed basal squamules.

94. Cladonia vulcani Savicz

Izv. Imp. Bot. Sada Petra Velikago 14: 124 (1914) [& in Lichenoth. Ross. no. 38 (1914)]. – Type: Russia, Kamchatka, Kronotskiy Natl. Park, crater of volcano Uzon ('Uson'), 1909 Savicz 6413 (LE holotype).

Syn. *Cladonia hitatiensis* Asahina, *Cladonia polydactyla* var. *theiophila* (Asahina) Asahina, *Cladonia pseudomacilenta* Asahina, *Cladonia theiophila* Asahina

I: goskrókar

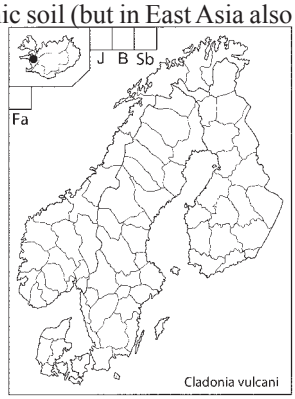
Literature. Ahti, Ann. Bot. Fenn. 11: 223–224 (1974); Ahti & Stenroos, Bot. Complut. 35: 326 (2012); Asahina, J. Jap. Bot. 15: 619–620 (1939); Stenroos & Ahti, J. Hattori Bot. Lab. 75: 313–315 (1994).

Figs. Asahina 1939: fig. 3; 1971: figs 28–32; Stenroos, Ann. Bot. Fenn. 23: figs 3a–b (1986).

Primary thallus squamulose, persistent, inconspicuous. Podetia to 3 cm tall, pale yellowish to whitish, at base occasionally orange, unbranched or with few irregular branchlets near top, axils closed, tips blunt or scyphoid; scyphoid structures 0.5–2.5 mm wide, deformed, irregularly proliferating from the margins. Surface of podetia discontinuously corticate at base, on young branchlets and inside the scyphi, otherwise granulose to microsquamulose, esorediate, podetial squamules occasional. Apothecia rather common, red. Pycnidia common at tips of podetia and at margins of scyphi, containing red slime.

Chemistry. K–, P–, UV+ white. Usnic and squamatic acids. Elsewhere (mainly Japan and Kamchatka) chemotypes with thamnolic acid or without usnic acid.

Habitat. On alpine, volcanic soil (but in East Asia also in other habitats).



Distribution. Rarely found in interior of Iceland. **I:** *IVe*. Common on volcanic soil in Japan and Kamchatka, in Japan also extending to other habitats, such as rotten wood. Also known from Korea, Taiwan and Papua New Guinea.

Note. New to Europe. Probably close to *C. polydactyla*, but usually containing usnic acid and specialized to volcanic (even hot) soil, growing even in sphere of sulphuric fumes.

95. Cladonia zopfii Vain.

Meddeland. Soc. Fauna Fl. Fenn. 45: 4, 306 (1920). – Type: Germany, Niedersachsen, Oldenburg, Zwischenahn, Ohrwege, Kehnmoor, 1886 Sandstede in Zwackh, Lich. Exs. no. 996 (TUR-V 13875 lectotype, Ahti, Regnum Veg. 128: 102, 1993).

Syn. *Cladonia destricta* auct., *Cladonia kanewskii* auct. norv.

D: klit-bægerlav **N:** blåpigglav **S:** hedpigglav

Red-listed in: **D**

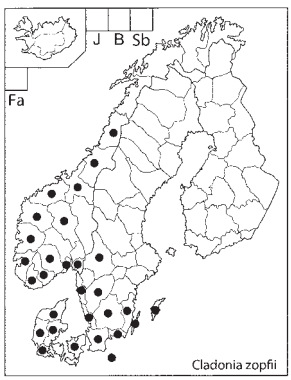
Literature. Ahti, Ann. Bot. Fenn. 10: 170, 176–177 (1973); Bøcher & Christiansen, Bot. Tidsskr. 45: 420 (1941); Holien & Tønsberg, Graphis Scripta 6: 70 (1994); Huovinen & Ahti, Ann. Bot. Fenn. 23: 184–185 (1986); Vainio 1922: 44–46.

Figs. Carlin 1981: figs 9I, 9J; Galløe 1954: pls 68, 71–73; van Herk & Aptroot 2004: 165; Hørnell et al. 2004: 46; Krog et al. 1994: 173.

Primary thallus inconspicuous, squamulose, subentire, very rarely observed. Podetia to 7 cm tall, 3(–5) mm thick, yellowish green, base pale, decumbent or erect, irregularly dichotomously branched, axils closed, tips ascyphose, subulate, scarcely browned, but (in herbarium) bluish due to cystal needles. Surface matt, smoothly and thinly corticate but becoming rugulose with age, without squamules, surface of central canal clearly fibrose. Apothecia not observed. Pycnidia rather rare, turbinate, constricted at base, containing hyaline slime.

Chemistry. K–, KC+ yellow, P–, UV–. (–)Usnic and destrictinic acid plus other terpenoids. A terpenoid substance is causing deposition of cystal needles on surface within a few years in herbarium.

Habitat. On sandy soil, particularly wind-breaks in dunes, or maritime, open rock outcrops near sea, also in *Calluna* heaths and on pine-clad coastal rocks.



Distribution. Widespread on southern coasts of Norway up to Nordland, especially in Østfold, also in southern Sweden and Denmark. **D:** *NJy ØJy VJy SJy Sjæ Brn.* **N:** *Øf Op Vf Te AA VA Ro Ho SF MR ST NT SNo*. **S:** *Sk Bl Öl Gtl Klm SmI Hl Bh Vg Vrm.* Western Europe, extending to Poland and Slovakia. Clearly oceanic.

Note. Very similar to *C. uncialis* subsp. *biuncialis* but has closed axils and lacks squamatic acid, further, crystal needles at tips of podetia soon develop in herbarium specimens. Some populations in coastal Norway (in *NT SNo)* have provisionally been included by Norwegian authors in *Cladonia kanewskii* Oxner, which is widespread in East Asia and western North America. However, *C. kanewskii* is more robust, al-

though undoubtedly closely related to *C. zopfii*. Two other closely related species, *Cladonia labradorica* Ahti & Brodo and *Cladonia dimorphoclada* Robbins, are known in eastern North America.

Pilophorus

T. Ahti & S. Stenroos

Pilophorus Th.Fr.

Stereoc. Piloph. Comm.: 40 (1857). – Type: *Pilophorus robustus* Th. Fr.

Syn. '*Pilophoron*'

F: tappijäkälät **I:** stubbar **N:** kolvelav **S:** kolvlavar

Literature. Alstrup, Lichenologist 8: 96–97 (1976); Ammann & Ammann, Herzogia 1: 87–94 (1969); Foucard, Svenska skorplavar, ed. 2: 283–284 (2001); Frey, Rabenh. Krypt.-Fl., ed. 2, 9(4) Abt. 1: 54–61 (1932); Galløe, Nat. Hist. Danish Lich. 10: pls 82–84 (1972); Harada & Yoshimura, Lichenology 3: 11–15 (2004); Jahns, Lichenologist 4: 199–213 (1970); Mycotaxon 13: 289–330 (1981); Stenroos et al., Mycol. Progr. 1: 267–282; Wedin et al., Lichenologist 32: 171–187 (2000).

Horizontal thallus crustose, granular or areolate, greyish white to pale yellow. Vertical thallus composed of pin-like pseudopodetia, to 5 cm tall, 3 mm thick, unbranched to slightly branched, cylindrical, solid when young but often becoming hollow. Cephalodia present on the primary thallus and podetia, irregularly shaped, light to dark brown. Ascomata apothecia, commonly present, lecideine, sessile or terminal on pseudopodetia, black, spherical to obconical, immarginate, some species with a cone-like, vegetative columella extending upwards into the apothecium. Hymenium colourless, I–, epihymenium and exciple dark, often olive-green (N+ red), hypothecium dark brown, paraphyses slender, little branched and anastomosing, with slightly swollen apices. Asci 8–spored, clavate, tholus of *Porpidia* type. Spores simple, hyaline, spherical, ellipsoid or fusiform. Conidiomata pycnidia, bottle-shaped, on tips of small, sterile pseudopodetia or on horizontal thallus, conidia falcate, 5–6 × 1 µm. Photobiont of *Chlorococcus* type in most of thallus but in cephalodia *Nostoc* or *Stigonema.*

Chemistry. Atranorin, zeorin.

Note. This small genus, which comprises about 10 species in the world, was for a long time included in the family Stereocaulaceae. It resembles *Stereocaulon* in having ashy colour, pseudopodetia and cephalodia. In phylogenetic analyses, however, it clearly nests in Cladoniaceae near *Cladia* and *Neoramalea.* The pseudopodetia are very short or are totally lacking. They are mostly solid while in *Cladonia* the podetia are normally hollow.

1. Horizontal thallus yellowish white, pseudopodetia absent ..... 2. *P. dovrensis*
– Horizontal thallus ashy grey, pseudopodetia present ... 2
2. Sorediate ..... 1. *P. cereolus*
– Esorediate 3
3. Primary thallus persistent, pseudopodetia not exceeding 1 cm, unbranched ..... 4. *P. strumaticus*
– Primary thallus evanescent, pseudopodetia to 3 cm, usually branched near tips. ..... 3. *P. robustus*

1. **Pilophorus cereolus** (Ach.) Hellb.

Öfvers. Kongl. Vetensk.-Akad. Förhandl. 1875(3): 60 (1875). – *Lichen cereolus* Ach., Lichenogr. Suec. Prodr.: 89 (1799, '1798'). – Type: Sweden (Suecia) (H-ACH 1756D lectotype, Jahns, Lichenologist 4: 206 (1970), as "holotype").

Syn. *Pilophorus robustus* subsp. *cereolus* (Ach.) Th.Fr., *Stereocaulon cereolinum* Ach., *nom. illeg.*

F: jauhetappijäkälä **I:** hraufustubbar **N:** grynkolve **S:** grynig kolvlav

Literature. Ammann & Ammann 1969: 90, 92; Elvebakk, Bryologist 87: 311–312 (1984); Jahns 1970: 206–207; 1981: 302–308; Myllys et al., Taxon 54: 609–614 (2005).

Figs. Galløe 1972: pl. 82; Holien & Tønsberg 2006: 96; Jahns 1981: fig. 3; Moberg & Holmåsen 1990: 150; Stenroos et al. 2011: 366.

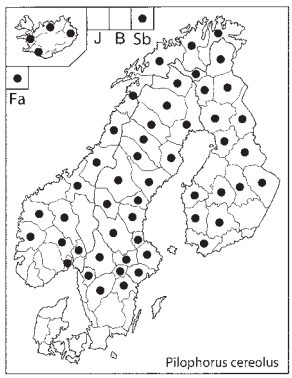
Horizontal thallus persistent, greyish white, granulose or clearly sorediate, with brown cephalodia. Pseudopodetia 0.3–1 cm tall, 1–1.5 mm thick, greyish green, unbranched or rarely slightly divided at apex, often curved, broadest in the middle, solid, central column white. Surface granulose sorediate, soralia in part capitate and spreading over much of the pseudopodetial stalk, otherwise corticate, often granulose toward base, but fertile podetia esorediate. Cephalodia on horizontal thallus, clustered, brown, with *Nos-*

toc more rarely *Stigonema*. Apothecia rare, brown, at tips of pseudopodetia, solitary, semiglobose; spores 14,5–21 × 5.5–6.5 µm. Pycnidia common at tips of pseudopodetia, often several together.

Chemistry. K+ yellow, P–. Atranorin, isousnic acid, zeorin.

Habitat. On siliceous stones and rocks in very shaded, moist places, often in forests but in Svalbard in rocky snow-beds, avoiding calcareous habitats.

Distribution. Scattered to rare through most of the rocky provinces in the Nordic countries, apparently avoiding oceanic coasts. **Gr. Fa. F:** *V St EH EP PH PS PK Kn OP PeP Ks KiL SoL EnL InL.* **I:** *ISu IVe IAu INo.* **N:** *Ak Op Bu Vf Ho SF ST NT SNo NNo Tr VFi ØFi.* **AI:** *Sb.* **S:** *Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Mpd Ång Hrj Jmt Vb Nb ÅsL LyL PL LuL TL.* Northern and Central Europe, Azores, Asia and North America, incompletely circumpolar. Colombia.



Note. Can be confused with *Stereocaulon pileatum* which has exclusively capitate soralia. When lacking pseudopodetia recognizable by the characteristic cephalodia.

2. **Pilophorus dovrensis** (Nyl.) Timdal, Hertel & Rambold

in Hertel & Rambold, Pl. Syst. Evol. 158: 309 (1988). – *Lecidea dovrensis* Nyl., Bot. Not. 1853: 182 (1853). – Type: Norway, Oppland, Dovre, [1842] Torssell (H-NYL, holotype?).

Syn. *Lecidea pallida* Th. Fr., *Lecidea ursina* Lynge, *Pilophorus pallidus* (Th.Fr.) Timdal

I: körtustubbar **N:** skorpekolve **S:** dvärgkolvlav

Red-listed in: **F**

Literature. Hertel, Mitteil. Bot. Staatssamml. München 30: 321 (1991); Hertel & Rambold, Pl. Syst. Evol. 158: 249–310 (1988); Timdal, Lichenologist 20: 93–96 (1988); Vainio, Acta Soc. Fauna Fl. Fenn. 57(2): 382 (1934).

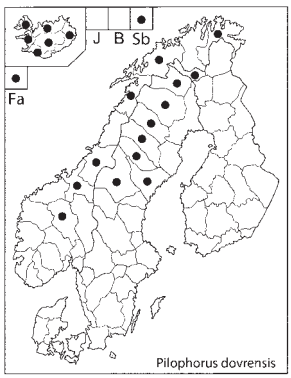
Figs. Stenroos et al. 2011: 367; Timdal 1988: 94.

Thallus crustose, granulose but esorediate, persistent, straw-yellow or yellowish white. Cephalodia brown, smooth (when with *Nostoc*) or granulose (when with *Stigonema*). Pseudopodetia absent. Apothecia black, 0.5–1.4 mm diam., sessile, hemispherical, slightly pruinose when young; epithecium and exciple olive-green. Spores 16–22 × 6–9 um, oblong. Pycnidia unknown.

Chemistry. K–, P–, KC–. Isousnic acid.

Habitat. On rocks or rocky soil.

Distribution. Rare in alpine regions, more frequent in central Iceland. **Gr. Fa. F:** *EnL.* **I:** *ISu IVe IMi IAu INv INo.* **N:** *Op ST NT NNo Tr ØFi.* **AI:** *Sb.* **S:** *Ång Jmt ÅsL LyL PL LuL TL.* Northern Europe, Russian Far East, Alaska, Greenland. Arctic-alpine.



Note. Traditionally included in *Lecidea,* but was later found to belong to *Pilophorus*. It may resemble the soil lichen *Lecidea alpestris* Sommerf., but differ by wider spores and the presence of cephalodia.

3. **Pilophorus robustus** Th.Fr.

Stereoc. Piloph. Comm.: 41 (1857). – Type: Norway, Hedmark, Østerdal, Åmot, Austaelv, 1837 M. N. Blytt (UPS holotype).

F: haaratappijäkälä **N:** fjellkolve **S:** stor kolvlav

Red-listed in: **F S**

Literature. Alstrup, Lichenologist 8: 96–97 (1976); Ammann & Ammann 1969: 88–89, 92; Elvebakk, Bryologist 87: 312–313 (1984); Jahns 1970: 205; 1981: 317–321; Krog, Norsk Polarinst. Skr. 144: 56 (1968); Thor & Arvidsson, Rödlistade lavar i Sverige: 424–425 (1999).

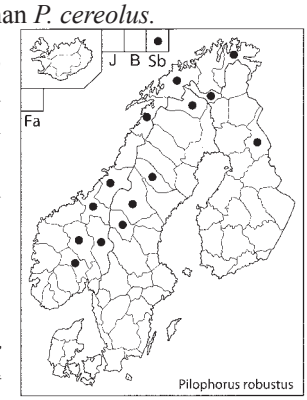
Figs. Galløe, 1972: pls 83, 84; Holien & Tønsberg 2006: 6; Jahns 1981: 317; Stenroos et al. 2011: 367.

Horizontal thallus granulose to pulverulent or indistinctly squamulose, evanescent. Pseudopodetia to

2.5(–5) cm tall, to 3 mm thick, greyish green, stout, unbranched or irregularly branched in upper parts appearing umbellate, usually solid, central, white columella present. Surface discontinuously corticate, granulose, decorticate when old. Cephalodia on horizontal thallus or basal parts of pseudopodetia, large, lumpy, brown to orange, with *Nostoc*. Apothecia common, at tips of pseudopodetia, numerous, often clustered, spherical, brown, spores 18–24 × 4–6.5 µm. Pycnidia at tips of pseudopodetia, bottle-shaped.

Chemistry. K+ yellow, P–. Atranorin, zeorin.

Habitat. On siliceous rocks and small stones, apparently less acidophilous than *P. cereolus*.



Distribution. Rare to scattered in low and middle alpine zones in mountains of Norway, northern Sweden and Finland, rarely in middle to northern boreal zones, both on coasts and inland. **Gr. F:** *Ks EnL.* **N:** *He Op Bu ST NT NNo Tr ØFi.* **AI:** *Sb.* **S:** *Hrj Jmt ÅsL TL.* Northern Europe, East Asia, western North America, Greenland.

Note. This species is characterized by rather stout, tall, branched and abundantly fertile pseudopodetia.

4. **Pilophorus strumaticus** Nyl. ex Cromb.

Monogr. Lich. Britain: 115 (1894). – Type: Scotland, South Aberdeenshire, Braemar, Morrone, 1869 Crombie (BM lectotype, designated by Jahns, Mycotaxon 13: 321, 1981).

Syn. *Pilophorus cereolus* f. *distans* (Hulting) H.Magn., *Pilophorus distans* (Hulting) H. Magn.

N: kystkolve **S:** västlig kolvlav

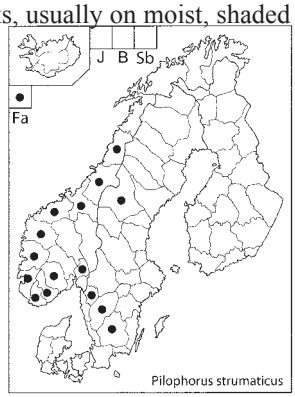
Literature. Ammann & Ammann 1969: 91–94; Arup et al., Skyddsvärda lavar i SV Sverige: 234–235 (1997); Jahns 1970: 207–208; Ber. Deutsch. Bot. Ges. 85: 615–622 (1972); Bryologist 76: 414–418 (1973); 1981: 321–324; Magnusson, Bot. Not. 108: 298–299 (1955); Thor & Arvidsson, Rödlistade lavar i Sverige: 426 (1999).

Figs. Jahns 1973: 415–417; 1981: 320.

Horizontal thallus crustose, granulose to nearly squamulose, persistent, granules often forming clusters. Pseudopodetia to 2–5(–10) mm tall, 0.5 mm thick, greyish green, unbranched or slightly divided near top, very rarely in upper half, pin-like, solid, with a short, distinct columella present inside. Surface discontinuously corticate, covered by granules or squamules, not truly sorediate. Cephalodia on horizontal thallus, granular, with irregular surface, brown, with *Stigonema*. Apothecia at tips of pseudopodetia, solitary, spherical, brown, spores 14–19 × 6.5–8.5 um. Pycnidia at tips of very short pseudopodetia.

Chemistry. K+ yellow, P–. Atranorin and zeorin.

Habitat. On siliceous rocks, usually on moist, shaded rock faces or on pebbles in shallow depressions.



Distribution. Along the west coast from Halland to Nordland, unconfirmed records from the Baltic coast, apparently descreased in recent decades. **Fa. N:** *Ak Te AA VA Ro Ho SF MR ST NT SNo.* **S:** *SmI (Hl Bh) Dls Vg Jmt.* British Isles, Norway, Sweden, NW Russia, Transbaykal. Oceanic.

Note. This species is characterized by very short, esorediate, usually fertile pseudopodetia, which have a columella inside.

Pycnothelia

T. Ahti & S. Stenroos

Pycnothelia Dufour

Ann. Gén. Sci. Phys. 8: 45 (1821). – Type: *Pycnothelia papillaria* Dufour

D: knoplav **F:** hammasjäkälät **N:** nuddlav **S:** papilllavar

Literature. Ahti, Fl. Neotrop. Monogr. 78: 345–347 (2000); Galløe in Biologiske Arbejder tilegnede E. Warming: 175–182 (1911); Galloway & James, Notes Roy. Bot. Gard. Edinburgh 44: 561–578 (1987); Jahns, Nova Hedwigia 20: 68–71 (1970).

Primary thallus persistent, crustose, consisting of

discrete to contiguous, convex, occasionally subsquamulose granules, often forming large patches. Podetia 0.5–2 cm tall, 0.5–3 mm thick, white, brown or blackening in part, hollow, esorediate, Ascomata apothecia, brown or black, convex, immarginate, asci cylindrical-clavate, apical tholus I+ dark blue with ring, spores ellipsoid to fusiform, hyaline, simple to 1–3 septate. Conidiomata pycnidia, on apices or sides of podetia, more rarely on primary thallus, often briefly stalked, usually cylindrical, conidia falciform, 4.5–14 × 0.5 µm, simple. Photobiont *Trebouxia* (?).

Chemistry. Atranorin, chloroatranorin, aliphatic acids, including protolichesterinic acid.

Note. There are probably only two species in this genus, but the status of *"Cladonia" trapezuntica* J. Steiner, described from Turkey (podetia very thin, slender) is still unsolved. Besides *P. papillaria* there is *Pycnothelia caliginosa* D.J.Galloway & P.James in New Zealand and Tasmania. The interpretation of the ontogeny is somewhat disputed; some authors have claimed that the podetia are actually pseudopodetia.

1. Pycnothelia papillaria Dufour

Ann. Gén. Sci. Phys. 8: 46 (1821). – Type: England, Surrey, Bagshot, icon in Dillenius, Hist. Musc:. t. 16, f. 28 (1742) lectotype, Laundon, Lichenologist 18: 172, 1986; corresponding specimen in Herb. Dillenius (OXF epitype, Ahti, Fl. Neotrop. Monogr. 78: 345, 2000).

Syn. *Cladonia papillaria* Hoffm., *nom. illeg*.

D: blødvortet knoplav **F:** hammasjäkälä **N:** nuddlav **S:** papill-lav

Red-listed in: **D**

Literature. Ahti 2000: 345–347; Galloway & James 1987: 563, 576; Laundon, Lichenologist 18: 172–173 (1986); Vainio 1922: 26–28.

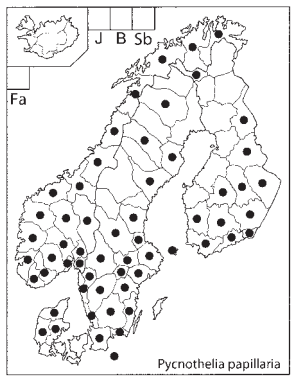
Figs. Galløe, Nat. Hist. Danish Lich.: pls 27–33(1954); Galloway & James 1987: 575; van Herk & Aptroot 2004: 329; Hinds & Hinds 2007: 432; Holien & Tønsberg 2006: 95; Moberg & Holmåsen 1990: 147; Stenroos et al. 2011: 389.

Primary thallus crustose, persistent, consisting of continuous granules, which are occasionally subsquamose. Podetia erect or decumbent, 1–20 mm tall, whitish, with brown colour at tops, tooth- or barrel-like, often appearing swollen, with constricted bases, tips blunt, rarely slightly branched, ascyphose. Surface smoothly corticate, matt, esorediate. Apothecia uncommon, at tips of podetia, brown; spores fusiform, simple to 1–3 septate, 9–15 × 2–4.5 µm. Pycnidia common, conical, up to ten at each podetium tip, containing hyaline slime.

Chemistry. K+ yellow, P–. Atranorin, chloroatranorin, lichesterinic and protolichesterinic acids and unidentified minor substances; additional squamatic probably rarely present.

Habitat. Mineral soil, on sand or more usually on thin soil over rock outcrops, preferably on seepages.

Distribution. In southern and western coastal parts of Scandinavia and Finland, occasionally even as high as at timberline, but not in Iceland or the Arctic. **D:** *NJy ØJy VJy Brn.* **F:** *A V U EK St EH ES PH PS PK Kn Ks EnL.* **N:** *Øf Ak He Op Bu Vf Te AA VA Ro Ho SF MR ST NT SNo NNo Tr VFi ØFi.* **S:** *Sk Bl Klm SmI Hl Bh Dls Vg Ög Nrk Srm Vrm Vsm Upl Dlr Gst Hls Ång Vb LyL LuL.* Western Europe, Turkey, East Asia, eastern North America, Alaska, mainly coastal, oceanic.



Note. Usually easily recognized by the tooth-like podetia, which are easily broken. When lacking podetia however, it is easily mistaken for crustose lichens.

APPENDIX
Nomenclatural novelties

Cladonia
T. Ahti & S. Stenroos

Cladonia botrytes (K.G.Hagen) Willd.

Fl. Berol. Prodr.: 365 (1787). – *Lichen botrytes* K.G.Hagen, Tent. Hist. Lich.: 121, t. 2, fig. 9 (1782). – TYPE: [Poland] "in silua Wilky [Wilke] et prope Tieffensee [Tiefensee]", icon in Hagen, Tent. Hist. Lich.: t. 2, fig. 9 (first specimen from left, specified here) (1782) (lectotype, Ahti, Regnum Veg. 128: 69, 1993); Poland, Bydgoscz District, 30 km NE of Chojnice, near Wiele, Tuchola Forest, 1990 Faltynowicz & Miadlikowska in Faltynowicz & Miadlikowska, Lich. Polon. Exs. no. 6 (H epitype, designated here).

Cladonia ciliata Stirt. f. **flavicans** (Flörke) Ahti & DePriest

Mycotaxon 78: 501 (2001). – *Cladonia rangiferina* f. *flavicans* Flörke, De Cladon.: 164 (1828). – TYPE: Without locality, Flörke in Herb. Persoon (L neotype, designated here).

Cladonia foliacea (Huds.) Willd.

Fl. Berol. Prodr.: 363 (1787), – *Lichen foliaceus* Huds., Fl. Angl.: 457 (1762). – TYPE: Icon in Dillenius, Hist. Musc.: tab. 14, fig. 12A (1742) (lectotype designated here); England, Shropshire (= Salop), Haughmond Hill, Leighton, Lich. Brit. Exs. no. 15 (BM epitype, designated here; incorrectly designated as "neotype" by Ahti, Regnum Veg. 128: 77, 1993).

Cladonia turgida Hoffm.

Deutsch. Fl. 2: 24 (1796). – TYPE: [Sweden] Upsaliae, Ehrhart in Ehrhart, Pl. Crypt. Exs. no. 297 (GOET lectotype, designated here).

Cladonia acuminata

Cladonia alaskana

Cladonia albonigra

Cladonia alpina

Cladonia amaurocraea

Cladonia angustiloba

Cladonia arbuscula

Cladonia asahinae

Cladonia bacilliformis

Cladonia bellidiflora

Cladonia borealis

Cladonia botrytes

Cladonia caespiticia

Cladonia callosa

Cladonia cariosa

Cladonia carneola

Cladonia cenotea

Cladonia cervicornis

Cladonia chlorophaea

Cladonia ciliata f. *ciliata*

Cladonia ciliata f. *flavicans*

Cladonia coccifera

Cladonia coniocraea

Cladonia conista

Cladonia cornuta subsp. *cornuta*

Cladonia cornuta subsp. *groenlandica*

Cladonia crispata var. *cetrariiformis*

Cladonia crispata var. *crispata*

Cladonia cryptochlorophaea

Cladonia cyanipes

Cladonia cyathomorpha

Cladonia decorticata

Cladonia deformis

Cladonia digitata

Cladonia diversa

Cladonia ecmocyna

Cladonia farinacea

Cladonia fimbriata

Cladonia floerkeana

Cladonia foliacea

Cladonia furcata

Cladonia galindezii

Cladonia glacialis

Cladonia glauca

Cladonia gracilis subsp. *elongata*

Cladonia gracilis subsp. *gracilis*

Cladonia gracilis subsp. *turbinata*

Cladonia granulans

Cladonia grayi

Cladonia homosekikaika

Cladonia humilis

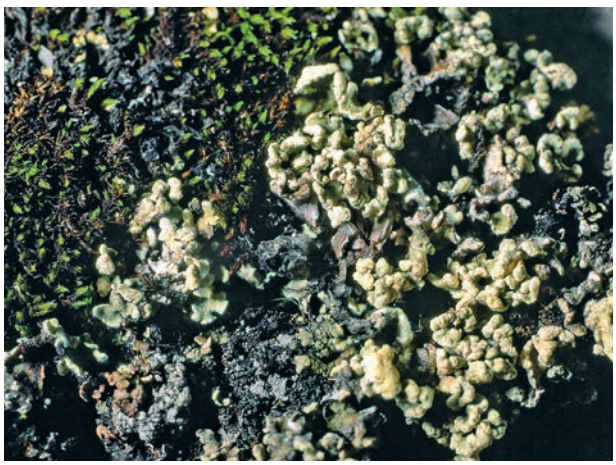
Cladonia imbricarica

Cladonia incrassata

Cladonia islandica

Cladonia krogiana

Cladonia libifera



Cladonia luteoalba

Cladonia macilenta

Cladonia macroceras

Cladonia macrophylla

Cladonia macrophyllodes

Cladonia maxima

Cladonia merochlorophaea

Cladonia mitis

Cladonia norvegica

Cladonia novochlorophaea

Cladonia ochrochlora

Cladonia parasitica

Cladonia peziziformis

Cladonia phyllophora

Cladonia pleurota

Cladonia pocillum

Cladonia polycarpoides

Cladonia polydactyla

Cladonia portentosa

Cladonia pulvinata

Cladonia pyxidata

Cladonia ramulosa

Cladonia rangiferina

Cladonia rangiformis

Cladonia rei

Cladonia scabriuscula

Cladonia scotteri

Cladonia squamosa

Cladonia stellaris

Cladonia straminea

Cladonia stygia

Cladonia strepsilis

Cladonia stricta

Cladonia subcervicornis

Cladonia subfurcata

Cladonia subrangiformis

Cladonia subulata

Cladonia sulphurina

Cladonia symphycarpa

Cladonia trassii

Cladonia turgida

Cladonia uliginosa

Cladonia umbricola

Cladonia uncialis subsp. *biuncialis*

Cladonia uncialis subsp. *uncialis*

Cladonia verticillata

Cladonia vulcani

Cladonia zopfii

Pilophorus cereolus

Pilophorus dovrensis

Pilophorus robustus

Pilophorus strumaticus

Pycnothelia papillaria

Index to colour pictures (if no herbarium cited, then no specimens preserved).

Cladonia acuminata, Norway, Telemark, Vinje, 2003 E. Timdal (O-L122951). Photo E. Timdal.

Cladonia alaskana, Canada, Northwest Territories, Five Hundred Lake, 1966 G. W. Scotter 8637 (H). Photo S. Velmala.

Cladonia albonigra, Norway, Nord-Trøndelag, Namdalseid, 2003 H. Holien. Photo H. Holien.

Cladonia alpina, Norway, Sør-Trøndelag, Klæbu, 1977 T. Tønsberg 2500 (H). Photo S. Velmala.

Cladonia amaurocraea, Norway, Vest-Finnmark, Kautokeino, 2003 E. Timdal. Photo E. Timdal.

Cladonia angustiloba, Madeira, Ribeira do Taborada, 1969 L. Tibell 3625 (H). Photo S. Velmala.

Cladonia arbuscula, Finland, Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia asahinae, Finland, Varsinais-Suomi, Pargas, Nagu, Nötö, 1981 G. Kvist (H). Photo K. Lohtander & S. Lommi.

Cladonia bacilliformis, Norway, Vest-Finnmark, Kautokeino, 2003 E. Timdal (O-L123250). Photo E. Timdal.

Cladonia bellidiflora, Norway, Buskerud, Sigdal, 2011 E. Timdal (O-L175423). Photo E. Timdal.

Cladonia borealis, Finland, Etelä-Häme, Lahti, 2010 V. Haikonen. Photo V. Haikonen.

Cladonia botrytes, Norway, Akershus, Oslo, 2003 R. Haugan. Photo R. Haugan.

Cladonia caespiticia, Norway, Rogaland, Hjelmeland, 2007 E. Timdal (O-L149090). Photo E. Timdal.

Cladonia callosa, Norway, Nord-Nordland, Bodø, R. Haugan (O-L147907). Photo R. Haugan.

Cladonia cariosa, Norway, Hedmark, Hamar, 2005 E. Timdal (O-L149341). Photo E. Timdal.

Cladonia carneola, Norway, Buskerud, Sigdal, 2005 E. Timdal. Photo E. Timdal.

Cladonia cenotea, Norway, Hedmark, Ringsaker, 2007 R. Haugan. Photo R. Haugan.

Cladonia cervicornis, Finland, Etelä-Savo, Pertunmaa, 2011 V. Haikonen 28468 (H) . Photo V. Haikonen.

Cladonia chlorophaea, Finland, Varsinais-Suomi, Lohja, H. Toppari (H). Photo S. Stenroos.

Cladonia ciliata f. *ciliata,* Norway, Hordaland, Fjell, 1957 T. Ahti B814 (H). Photo S. Velmala.

Cladonia ciliata f. *flavicans,* Norway, Akershus, Oslo, 2012 M. Bendiksby et al. (O-L176519). Photo E. Timdal.

Cladonia coccifera, Norway, Buskerud, Sigdal, 2001 E. Timdal. Photo E. Timdal.

Cladonia coniocraea, Norway, Telemark, Vinje, 2005 E. Timdal (O-L138600). Photo E. Timdal.

Cladonia conista, Sweden, Lule lappmark, Jokkmokk, Muddus, 1959 T. Ahti 12685, E. Uggla & F. Skuncke (H). Photo K. Lohtander & S. Lommi.

Cladonia cornuta subsp. *cornuta,* Norway, Oppland, Gran, 2003 E. Timdal. Photo E. Timdal.

Cladonia cornuta subsp. *groenlandica,* Norway, Buskerud, Sigdal, 2003 E. Timdal (O-L122969). Photo E. Timdal.

*Cladonia crispata v*ar. *cetrariiformis,* Finland, Varsinais-Suomi, Kimitoön, Rugnola, 1981 P.-G. Wikström 1177 (H). Photo K. Lohtander & S. Lommi.

Cladonia crispata var. *crispata,* Norway, Telemark, Vinje, 2007 E. Timdal (O-L149099). Photo E. Timdal.

Cladonia cryptochlorophaea, Finland, Kainuu, Puolanka, Askankylä, 1980 T. Ahti 37976 (H). Photo K. Lohtander & S. Lommi.

Cladonia cyanipes, Norway, Hedmark, Sør-Odal, 2006 R. Haugan. Photo R. Haugan.

Cladonia cyathomorpha, Iceland, Vestur-Ísland, Borgarfjarðarsýsla, 1975 H. Kristinsson (H). Photo S. Velmala.

Cladonia decorticata, Norway, Oppland, Vang, 2003 E. Timdal (O-L123266). Photo E. Timdal.

Cladonia deformis, Norway, Akershus, Enebakk, 2001 E. Timdal (O-L97883). Photo E. Timdal.

Cladonia digitata, Norway, Telemark, Vinje, 2006 E. Timdal. Photo E. Timdal.

Cladonia diversa, Finland, Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia ecmocyna, Norway, Buskerud, Sigdal, 2001 E. Timdal. Photo E. Timdal.

Cladonia farinacea, Canada, Nova Scotia, Queens Co., East Side Port l'Hébert, 1999 T. Ahti et al. 57105 (H). Photo S. Velmala.

Cladonia fimbriata, Finland, Etelä-Häme, Iitti, 2011 V. Haikonen 28468 (H). Photo V. Haikonen.

Cladonia floerkeana, Norway, Sør-Trøndelag, Ørland, 2005 R. Haugan. Photo R. Haugan.

Cladonia foliacea, Norway, Akershus, Oslo, 2002 E. Timdal. Photo E. Timdal.

Cladonia furcata, Finland, Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia galindezii, Sweden, Torne lappmark, Jukkasjärvi, Abiskojokk, 1945 G. Degelius (H). Photo S. Velmala.

Cladonia glacialis, Iceland, Mið-Ísland, Arnarfellsmúlar, 1971 H. Kristinsson 24629 (AMNH). Photo H. Kristinsson.

Cladonia glauca, Finland, Uusimaa, Espoo, Nuijala, 1979 T. Ahti 37792 (H). Photo S. Stenroos.

Cladonia gracilis subsp. *elongata,* Norway, Buskerud, Sigdal, 2002 E. Timdal. Photo E. Timdal.

Cladonia gracilis subsp. *gracilis,* Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia gracilis subsp. *turbinata,* Finland, Etelä-Häme, Hartola, V. Haikonen 28468 (H). Photo V. Haikonen.

Cladonia granulans, Greenland, Uummannaq, 1997 H. Bültmann (H). Photo H. Bültmann.

Cladonia grayi, Finland, Etelä-Häme, Lahti, 2010 V. Haikonen. Photo V. Haikonen.

Cladonia homosekikaica, Iceland, Nordvestur-Ísland, Ísafjörður, 1968 H. Kristinsson 10527 (H). Photo S. Velmala.

Cladonia humilis, Spain, Badajoz, Castuera, 1991 E. Fuertes L. (H). Photo S. Velmala.

Cladonia imbricarica, Iceland, Mið-Ísland, Eystri-Jökulsá, H. Kristinsson (AMNH). Photo H. Kristinsson.

Cladonia incrassata, Finland, Uusimaa, Espoo, Mankkaa, K. Jääskeläinen. Photo K. Jääskeläinen.

Cladonia islandica, Iceland, Suður-Ísland, Árnessýsla, Herdísarvik, 1999 H. Kristinsson LA-27456 (AMNH). Photo H. Kristinsson.

Cladonia krogiana, Norway, Østfold, Rakkestad, 2002 B. P. Løfall & E. Timdal (O-L746). Photo E. Timdal.

Cladonia libifera, Sweden, Torne lappmark, Abisko Research Station, 2002 Z. Palice 7542 (H). Photo S. Velmala.

Cladonia luteoalba, Finland, Varsinais-Suomi, Houtskär, 1992 H. Bruun (H). Photo V. Haikonen.

Cladonia macilenta (chemotype 2)*,* Norway, Akershus, Enebakk, 2001 E. Timdal. Photo E. Timdal.

Cladonia macroceras, Finland, Enontekiön Lappi, Enontekiö, Kilpisjärvi, 1964 M. Haapasaari 2080 (H). Photo K. Lohtander & S. Lommi.

Cladonia macrophylla, Norway, Oppland, Sel, 2005 E. Timdal. Photo E. Timdal.

Cladonia macrophyllodes, Norway, Oppland, Dovre, 2005 E. Timdal (O-L148952). Photo E. Timdal.

Cladonia maxima, Norway, Buskerud, Sigdal, 2003 E. Timdal (O-L122925). Photo E. Timdal.

Cladonia merochlorophaea, Finland, Koillismaa, Kuusamo, 1969 T. Ahti 26129 (H). Photo S. Velmala.

Cladonia mitis, Finland, Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia norvegica, Norway, Østfold, Spydeberg, 1982 E. Timdal (O-L25383). Photo E. Timdal.

Cladonia novochlorophaea, Norway, Buskerud, Sigdal, 2003 E. Timdal (O-L122898). Photo E. Timdal.

Cladonia ochrochlora, Norway, Nord-Trøndelag, Grong, 2003 E. Timdal (O-L123829). Photo E. Timdal.

Cladonia parasitica, Norway, Oppland, Vågå, 2002 E. Timdal. Photo E. Timdal.

Cladonia peziziformis, Norway, Hordaland, Lindås, 1996 J. Holtan-Hartwig & T. Tønsberg (O-L124245). Photo E. Timdal.

Cladonia phyllophora, Greenland, Kujalleq, Narsaq, 2005 E. Timdal (O-L139078). Photo E. Timdal.

Cladonia pleurota, Norway, Buskerud, Sigdal, 2006 E. Timdal (O-L149409). Photo E. Timdal.

Cladonia pocillum, Norway, Opland, Vang, 2002 E. Timdal. Photo E. Timdal.

Cladonia polycarpoides, Switzerland, Zürich, Riffersweil, J. Hegetschweiler in Rehm, Cladoniae Exsiccatae no. 315 (H). Photo S. Stenroos.

Cladonia polydactyla, Norway, Rogaland, Hjelmeland, 2007 E. Timdal (O-L149091). Photo E. Timdal.

Cladonia portentosa, Norway, Sør-Trøndelag, Ørland, 2003 E. Timdal (O-L123845). Photo E. Timdal.

Cladonia pulvinata, Østfold, Halden, 2000, B.P Løfall (O-L78133). Photo E. Timdal.

Cladonia pyxidata, Norway, Telemark, Vinje, 2004 E. Timdal. Photo E. Timdal.

Cladonia ramulosa, Norway, Sør-Trøndelag, Ørland, 2004 E. Timdal (O-L129358). Photo E. Timdal.

Cladonia rangiferina, Norway, Buskerud, Sigdal, 2003 E. Timdal. Photo E. Timdal.

Cladonia rangiformis, Norway, Sør-Trøndelag, Ørland, 2005 E. Timdal (O-L149357). Photo E. Timdal.

Cladonia rei, Norway, Telemark, Vinje, 2003 E. Timdal (O-L122937). Photo E. Timdal.

Cladonia scabriuscula, Greenland, Kujalleq, Narsaq. 2005 E. Timdal (O-L139161). Photo E. Timdal.

Cladonia scotteri, Canada, Northwest Territories, Nahanni National Park, Virginia Falls, 1977 T. Ahti & G. W. Scotter (CANL). Photo I. M. Brodo.

Cladonia squamosa, Norway, Akershus, Enebakk, 2003 E. Timdal. Photo E. Timdal.

Cladonia stellaris, Finland, Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia straminea, Norway, Telemark, Vinje, 2002 E. Timdal. Photo E. Timdal.

Cladonia strepsilis, Norway, Akershus, Enebakk, 2001 E. Timdal. Photo E. Timdal.

Cladonia stricta, Sweden, Torne lappmark, 1959 T. Ahti (H). Photo S. Stenroos.

Cladonia stygia, Norway, Oppland, Sel, 2001 E. Timdal. Photo E. Timdal.

Cladonia subcervicornis, Norway, Sør-Trøndelag, Ørland, 2005 E. Timdal (O-L149364). Photo E. Timdal.

Cladonia subfurcata, Norway, Buskerud, Sigdal, 2002 E. Timdal. Photo E. Timdal.

Cladonia subrangiformis, Norway, Aust-Agder, Tvedestrand, 2005 E. Timdal (O-L136161). Photo E. Timdal.

Cladonia subulata, Norway, Sør-Trøndelag, Snåsa, 2001 H. Holien. Photo H. Holien.

Cladonia sulphurina, Norway, Buskerud, Sigdal, 2003 E. Timdal. Photo E. Timdal.

Cladonia symphycarpa, Norway, Oppland, Dovre, 2004 E. Timdal (O-L129374). Photo E. Timdal.

Cladonia trassii, Norway, Buskerud, Sigdal, 2003 E. Timdal (O-L122968). Photo E. Timdal.

Cladonia turgida, Finland, Etelä-Savo, Taipalsaari, K. Jääskeläinen. Photo K. Jääskeläinen.

Cladonia uliginosa, Russia, Murmansk Region, Kutsajoki, Pyhäkuru, 1939 M. Laurila (H). Photo K. Lohtander & S. Lommi.

Cladonia umbricola, Norway, Nord-Trøndelag, Namdalseid, H. Holien. Photo H. Holien.

Cladonia uncialis subsp. *biuncialis,* Finland, V. Haikonen. Photo H. Haikonen.

Cladonia uncialis subsp. *uncialis,* Finland, Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia verticillata, Finland, Uusimaa, Kirkkonummi, 2010 S. Stenroos. Photo S. Stenroos.

Cladonia vulcani, Iceland, Vestur-Ísland, Köldunámur, H. Kristinsson (AMNH). Photo H. Kristinsson.

Cladonia zopfii, Norway, Sør-Trøndelag, Ørland, 2004 E. Timdal (O-L129367). Photo E. Timdal.

Pilophorus cereolus, Norway, Troms, Storfjord, 2003 E. Timdal. Photo E. Timdal.

Pilophorus dovrensis, Norway, Nord-Trøndelag, 1938 S. Ahlner (O-L39219). Photo E. Timdal.

Pilophorus robustus, Norway, Nord-Nordland, Rombaken, 1915 E. Häyrén (H). Photo S. Velmala.

Pilophorus strumaticus, Norway, Hordaland, Granvin, 1936 J. J. Havås, Lichenes Norvegiae Occidentalis no. 150 (H). Photo T. Timonen.

Pycnothelia papillaria, Finland, V. Haikonen. Photo V. Haikonen.

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The lichen flora of the Nordic countries, containing about 2000 species, is regarded as one of the best known in the world.Lichenological research of the region has been continuous since the time of Erik Acharius (1757–1819), the ”father of lichenology”, but it is a sad fact that there is no modern treatment of the region’s impressive lichen flora, the last attempt in the 1870s being that of Th. M. Fries, his major work, Lichenographia scandinavica, unfortunately remained unfinished.

A number of lichen specialists have united forces to produce this much needed Nordic Lichen Flora. The present fifth volume, dedicated to the family Cladoniaceae and edited by Teuvo Ahti, Soili Stenroos and Roland Moberg, includes treatments of 100 species representing three genera. T. Ahti and S. Stenroos, have examined thousands of collections in all the major Nordic herbaria in addition to extensive field work in all the Nordic countries. They have also conducted DNA analyses of numerous species. Their thorough work has resulted in many new findings, but also revealed new, often still unsolved problems, which are pointed out in the discussions after each species. The total distribution of each species is also carefully indicated, based on the authors’ worldwide database.

The Cladoniaceae play a prominent part in northern ecosystems, because they include the so-called reindeer lichens, the major ground floor dominants of the lichen woodlands of northern Fennoscandia, which provide staple food for the reindeers. Since members of the Cladoniaceae are morphologically extraordinarily variable, this volume is indispensable for anybody who wants to identify these beautiful organisms.