



Cladonia: a field guide

by

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Introduction

Cladonia is an extensive and difficult genus of lichens, but one that is extremely valuable in defining many plant communities, particularly heathlands. There is therefore a need for a fairly simple field guide for the use of the non-specialist. The original idea of writing this guide came about because I was having great difficulty identifying the species in the field and grew tired of having to collect copious specimens for later determination. A “first draft” was produced, which was distributed to whoever expressed an interest, mostly NCC personnel. This was a very rough and ready document, and clearly needed a great deal of modification, so this revised version was written.

The guide makes use of illustrations and relatively few simple characters to define the species, and to differentiate *Cladonia* from some superficially similar genera. There is a dichotomous key to distinguish the genera, but the rest of the guide is of the “multi-access” type. Species are arranged in seven main groups, which can be arrived at using the short key on page 10. Some of these groups are subdivided further to make them more manageable. Once a specimen has been assigned to a group, the illustrations and descriptions should be examined to determine the species. As a useful shortcut for identifying species with red fruits, all these are marked “Red fruits” in emboldened type.

Some of the very rare species, and species whose British records are dubious, are not included, as their presence would only serve to confuse. Several species appear more than once: these are variable species which may key out to more than one section. Some technical terms have been included, since

getting to know the terminology helps in getting to know the species. Chemical tests have also been included, as it is quite easy to use the appropriate chemicals in the field and they are useful in confirming identifications. There is a short glossary to explain the terms. Some *Cladonia* species fluoresce under ultra-violet light, and this has been mentioned in a few cases. Although a UV lamp is useful in determining certain species, it is not vital for the majority. However, a x10 hand lens is essential to see many of the characters used in identification.

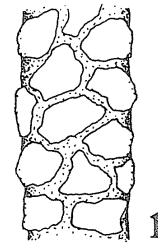
It must be remembered that this is only a field guide to a difficult group of plants. There will be occasions when a specimen has to be taken for more detailed examination, using the species descriptions provided in floras. Indeed, it would be sensible to check all specimens identified with this guide by referring to other literature until one is reasonably familiar with the taxa.

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Glossary

Arachnoid: With fine, cottony, gossamer-like coating.

Areolate: Divided into areolae, i.e. small areas of cortex surrounded by cracks, often resembling crazy paving when wet. (Smaller areas of cortex usually referred to as corticate granules). (**fig. 1**)



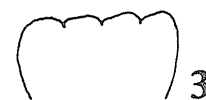
Basal squamules: Small plates or overlapping scales which comprise the primary thallus (see below). (**fig. 2**)



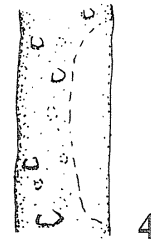
C: Calcium hypochlorite (Domestic bleach). Chemical test for lichens. e.g. C+ bright green means the thallus turns bright green when C is applied.

Corticate: Having a cortex (outer layer of thallus, consisting of fungal hyphae). Corticate podetia appear smooth rather than sorediate. It is important to realise that firmly attached corticate granules are quite different from loose granular soredia.

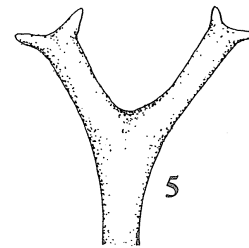
Crenulate: Scalloped with small notches. (**fig. 3**)



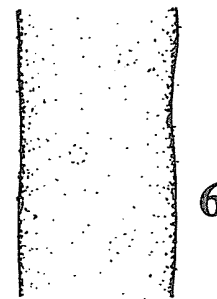
Decorticate: Having some of the cortex missing, exposing the underlying fungal layer which is white, sometimes becoming blackened. (**fig. 4**)



Dichotomous: Forked once, i.e. branches in clusters of 2. (**fig. 5**)



Farinose: Flour-like (use x10 hand lens). i.e. very fine grains. Used to describe soredia. (**fig. 6**)



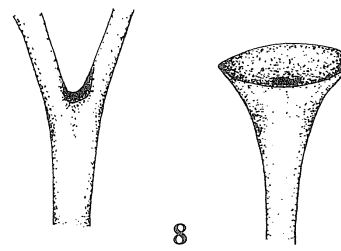
Granular: Like grains of castor sugar (x10). (**fig. 7**)

K: Potassium hydroxide (10% solution in water). Chemical test for lichens. e.g. K + y means the thallus turns yellow when K is applied. K - means no reaction.

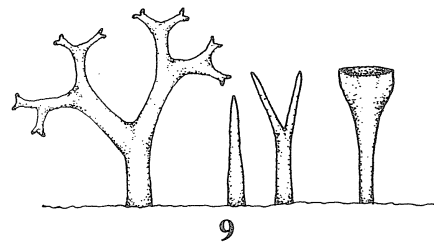
P: Paraphenylenediamine. Chemical test for lichens. e.g. P+Y-o means the thallus turns yellow-orange when P is applied. P- means no reaction. To make stable solution use the following recipe: 1g paraphenylenediamine + 10g sodium sulphite + 0.5ml detergent + 100ml water. Lasts about 3 years. **CAUTION** P may be carcinogenic. It also damages paper, so it is advisable to discard pieces of lichen that have been tested.



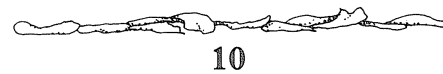
Perforate: Pierced. Usually refers to openings in axils or inside cups leading directly to interior of podetia. (fig. 8)



Podetia (sing. Podetium): Secondary stalk-like outgrowths arising from the primary thallus, often bearing fruiting bodies. Podetia can be simple or richly-branched, and with or without cups. (fig. 9)

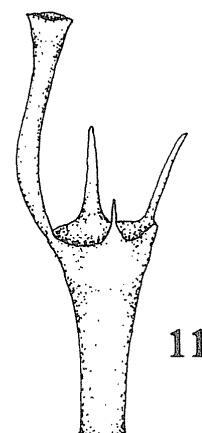


Primary thallus: The part of the thallus +/- closely appressed to the substrate from which the podetia arise. Usually composed of squamules in *Cladonia*, but crustose and soon disappearing in subgenus *Cladina*. In *Pycnothelia* it is a persistent crust. (fig. 10)



Proliferating: Growing offshoots at apex, usually around rim of cups. (fig. 11)

Pycnidia (sing. Pycnidium): Small dark raised spots which produce tiny spore-like propagules.



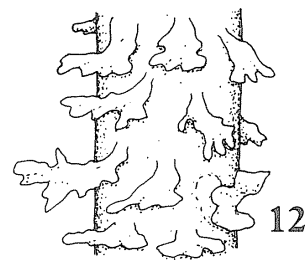
Scabrid: With a roughened surface caused by peeling of the cortex (see *C. scabriuscula*).

Secondary thallus: The part of the thallus arising from the primary thallus, bearing the fruiting bodies. Composed of podetia in *Cladonia*.

Soredia: Loose powdery granules containing a few algal cells and fungal hyphae which propagate the plant vegetatively. Produced by the breakdown of the cortex.

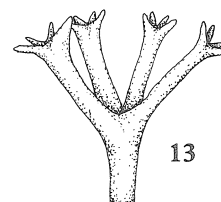
Sorediate: Having soredia.

Squamules: Scales or plates of tissue which often form the primary thallus. They can also occur on podetia, where they either consist of outgrowths from the surface or result from peeling of the cortex (see also “scarabrid”). (fig. 12)

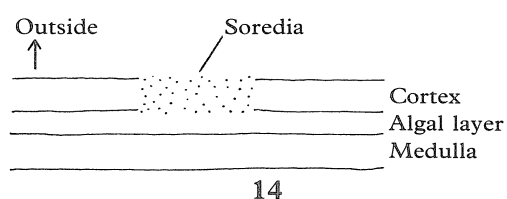


Squamulose: Having, or consisting of, squamules.

Tetrachotomous: Branches in clusters of four. (fig. 13)



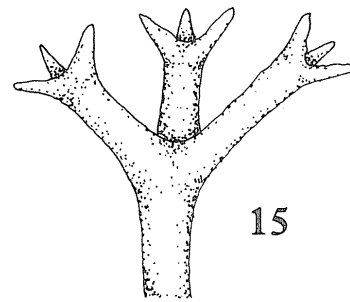
Thallus: The body of the lichen. (fig. 14)



Trichotomous: Branches in clusters of three. (**fig. 15**)

uv: Ultra-violet. Because of the presence of certain lichen acids, some species fluoresce under ultra-violet light. This can be a useful aid to identification. Small ultra-violet lamps are available at a modest cost from specialist suppliers.

Verrucose: Cortex irregular, giving the plant a warty or knobby appearance.



What is a Cladonia?

Cladonia has a primary thallus which is crustose (and which soon disappears) or squamulose (and +/- persistent) and a secondary thallus consisting of hollow stalk-like podetia which bears the fruits. Several other genera of lichens show a superficially similar arrangement, or have branching patterns reminiscent of some *Cladonia* species. These genera need to be differentiated to avoid confusion. The lichens in the following key nearly all have a thallus that is more or less round in cross-section: plants with a flattened thallus (e.g. *Cetraria* and *Evernia*) are not included and are quite easily distinguished from *Cladonia* by this character, although a few such as *Cetraria nivalis* are superficially similar at first sight. *Usnea* is also readily distinguished, with a more or less filamentous cylindrical thallus and a tough central strand that is not easily broken.

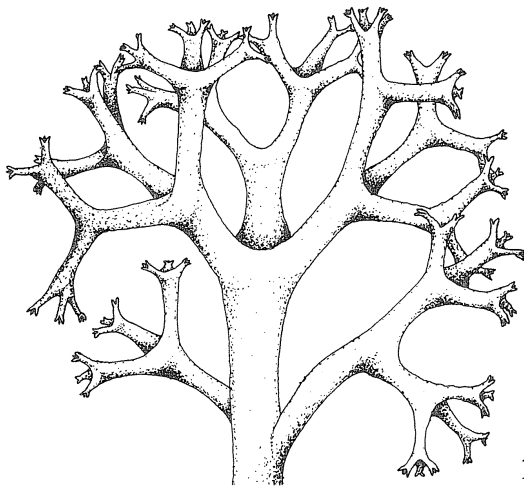
Key to similar genera

1. a) Podetia (or similar-looking structures)
 hollow or dark brown and spiky;
 primary thallus often composed of
 squamules. 2
- b) Podetia (or similar-looking structures)
 solid, not usually dark brown; primary
 thallus crustose, granular or absent. 5
2. a) Thallus much-branched, dark brown,
 shining; hard and spiky when dry. *Coelocaulon*
- b) Thallus not as above 3
3. a) Primary thallus white, crustose-granular,
 dominant; podetia short, white, like
 small molar teeth with brown tips;
 simple or branched. *Pycnothelia*
papillaria

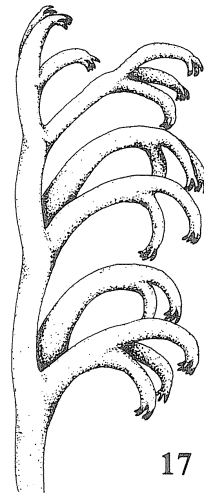
- b) Primary thallus squamulose or absent; podetia usually larger. 4
4. a) Primary thallus absent; thallus consisting of +/- white, sparsely branched or unbranched tubes, +/- prostrate on the ground, with no squamules; common at high altitudes, especially in dwarf shrub heath; fruit unknown. *Thamnolia vermicularis*
- b) Primary thallus present, squamulose, or if absent then podetia much branched or yellow-green and dichotomous at apices. *Cladonia*
5. a) Primary thallus crustose, dominant; secondary thallus short, unbranched; fruit sometimes black. 6
- b) Primary thallus, if present, granular, disappearing early; (secondary) thallus usually tall, much branched; fruit always brown. 7
6. a) Fruits black, on short verrucose-granular opaque podetia. *Pilophorus*
- b) Fruits red-brown or pink on short, +/- translucent podetia. *Baeomyces*
7. a) Branches of thallus smooth, without squamules or outgrowths. *Sphaerophorus*
- b) Branches of thallus +/- thickly covered with small flap-like or finger-like outgrowths. *Stereocaulon*

Key to main groups

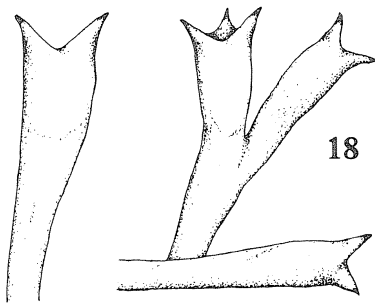
1. Basal squamules absent; podetia dying from the base, richly branched, without cups (subgenus *Cladina*). (**figs 16, 17** page 13) Page 16
2. Basal squamules absent; podetia spiky, relatively little branched, +/- swollen, without cups. (**fig. 18** page 13) Page 17
3. Basal squamules dominant; podetia absent or very small and inconspicuous. (**fig. 19** page 13) Page 18
4. Cups present, wider than the podetia. (**figs. 20, 21** page 13) Page 23
5. Podetia without cups, +/- sorediate, not squamulose, or squamulose only at base. (**fig. 22** page 14) Page 32
6. Podetia without cups, not sorediate, corticate, not (or only slightly) squamulose. (**fig. 23** page 14) Page 35
7. Podetia without cups, corticate, +/- densely squamulose, not sorediate. (**figs. 24, 25** page 14) Page 39



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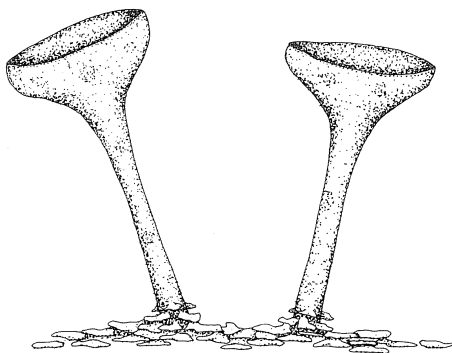
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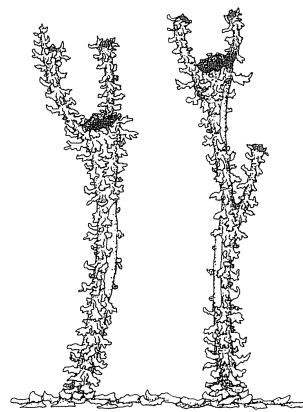
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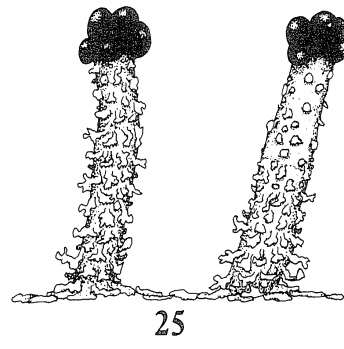
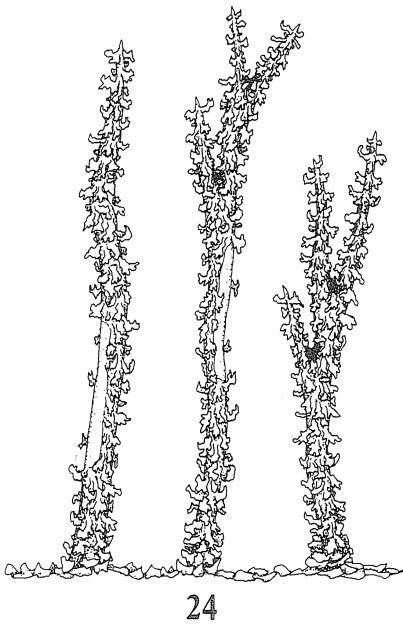
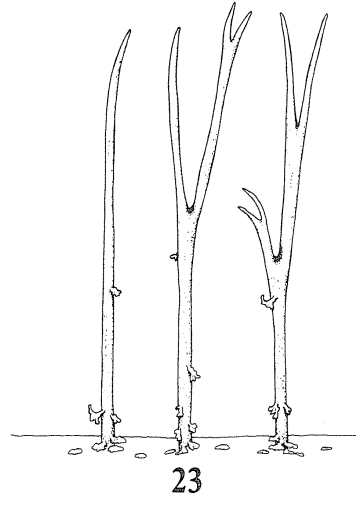
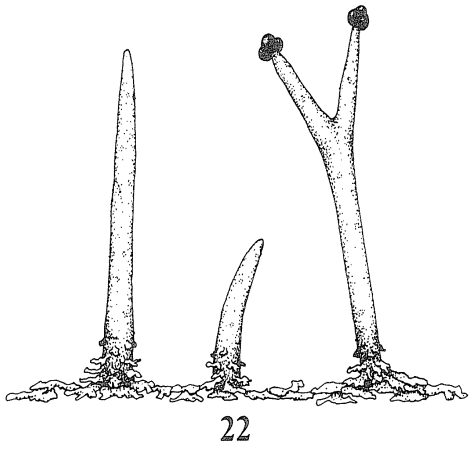
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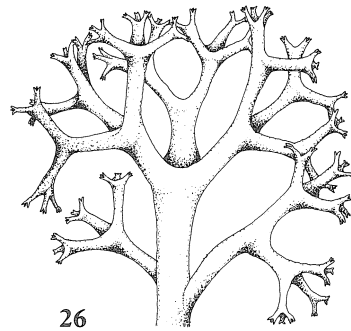
21



Basal squamules absent; podetia dying from the base, richly branched, without cups. Subgenus *Cladina*

Cladonia portentosa (= *C. impexa*)

Richly branched, +/- uniformly pale yellow-green, forming +/- globose “heads”; branchlets spreading in all directions, dichotomous or trichotomous at tips. Frequent. K-, P-. (fig. 26)

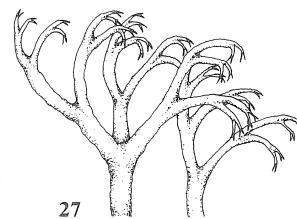


C. mediterranea

Similar to *C. portentosa* but forming low, laterally spreading, straggling clumps; branchlets mostly dichotomous at tips, often +/- turned in one direction. Confined to the Lizard, Cornwall. (fig. 26)

C. ciliata var. *ciliata*

Slender, richly branched, white with +/- brownish-mauve tinge towards tips, branchlets +/- turned in one direction, with 2(-3) points at tips (dichotomous-trichotomous); surface not arachnoid. Uncommon. K-, P+r. (fig. 27)



C. ciliata var. *tenuis*

As above but greenish-yellow-grey.

Frequent. (**fig. 27**)

C. arbuscula

Robust, richly branched, branchlets turned strongly in one direction, with 3-5 points at tips; surface grey-green, not arachnoid. Frequent. K-, P+r. (**fig. 28**)

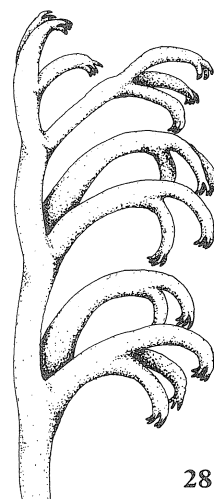
C. mitis

As *C. arbuscula* but P-. Acid dune heath in E. Scotland and S. E. England. (**fig. 28**)

C. rangiferina

As *C. arbuscula* but +/- white with a mauve-brown tinge towards tips; surface arachnoid. Coastal and upland areas, local. K+y, P+r. (**fig. 28**)

(See also *C. rangiformis* (p. 35), which is superficially similar to *C. portentosa*, but with a different branching pattern and with some stem and basal squamules usually present. K+y, P+r or -.)

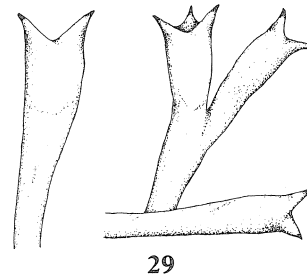


28

Basal squamules absent; podetia spiky, relatively little branched, +/- swollen, without cups

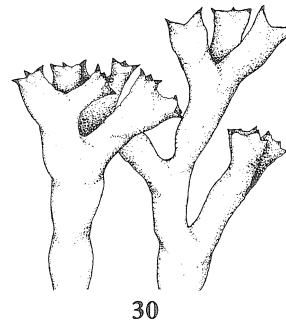
Cladonia uncialis ssp. *biuncialis*)

Podetia swollen, yellow-grey-green, sparingly branched, dichotomous at tips with 2-4 sharp points, giving plant a spiky appearance. Very variable in size, common. K-, P-. (**fig. 29**)



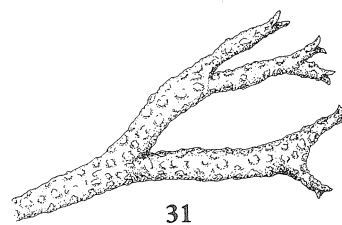
C. uncialis ssp. *uncialis*

As ssp. *biuncialis* but podetia more tri-, tetra- or polychotomously branched. Dunes in N.E. Scotland, very rare. (**fig. 30**)



C. zopfii

As *C. uncialis* but podetia +/- verrucose, more bluish-green, more prostrate. Acid sandy heaths in N.E. Scotland, local. (**fig. 31**)



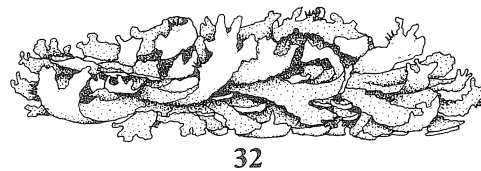
Basal squamules dominant; podetia absent or very small and inconspicuous

- a Basal squamules relatively large, thick and tough; fruits usually absent
- i Squamules yellow-green, and/or with pink or yellow-brown veins on lowers surface

Cladonia foliacea

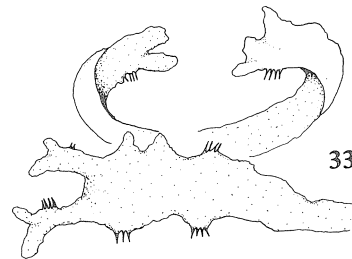
Squamules 4-10mm x 1-3mm, yellow-green, indented, recurved to reveal a pale yellow, smooth undersurface; often with clusters of black marginal hairs.

Common in coastal areas. K-, P+r. (fig. 32)



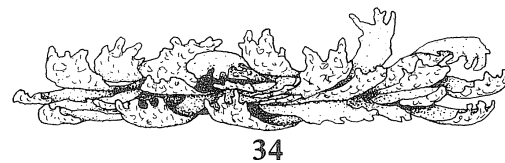
C. convoluta

As *C. foliacea* but squamules 15-25mm x 2-8mm. Loose clumps on sunny limestone and sand dunes, S. and S.W. England, rare. (fig. 33)



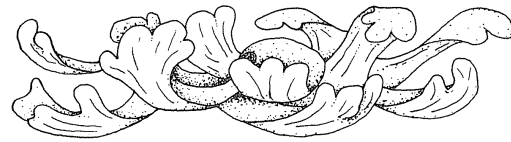
C. luteoalba **Red fruits**

Squamules 2-10mm wide, rounded, greenish-yellow above, yellow and arachnoid below; fruits red, borne on squamules or on small deformed podetia, rare. On peaty soil and mossy rocks on exposed heaths and mountain summits, widespread in upland areas but not common. K-, P-. (fig. 34)



C. cyathomorpha

Squamules 5-10mm wide, rounded, indented, pale yellow or grey-green above, white with radiating pink or pale yellow-brown veins below. Usually on vertical mossy boulders in montane areas, very rare. K+y, P+r. (fig. 35)

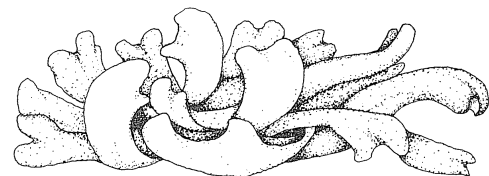


35

ii **Squamules grey-white, grey-green, lead or bronze-coloured:
no trace of yellow**

C. cervicornis

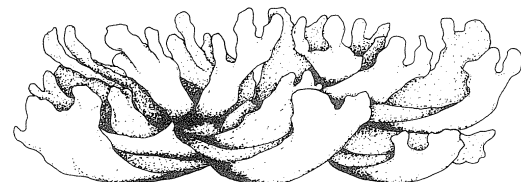
Squamules 2-5mm long, grey-green, +/- rounded, indented; lower surface grey-white, sometimes tinged mauve, not blackened at base. +/- calcicolous, common. K-, P+r. (fig. 36)



36

C. subcervicornis

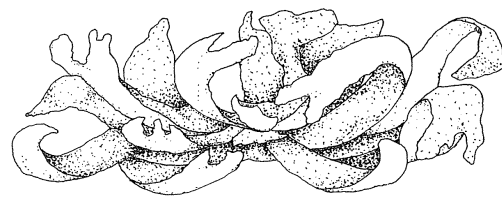
As *C. cervicornis* but squamules larger (5-20mm long) and more elongated, lead grey above, with a white lower surface becoming blackened towards the base. Pockets of humus among acid rocks, common. K+y, P+r. (fig. 37)



37

C. firma

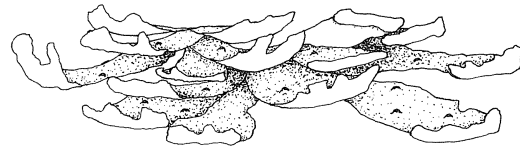
As *C. cervicornis* but squamules larger (4-10mm long) grey-green above, pale to dark grey-violet below. Coastal, western, +/- calcicolous, locally frequent. K+y, P+r. (**fig. 38**)



38

C. symphicarpa

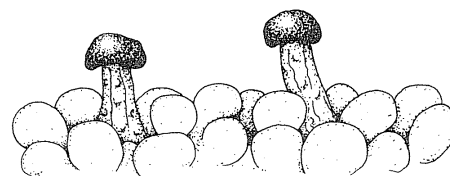
Squamules small (2-3mm), grey-green above, starkly white below, +/- horizontally spreading, often with dark black-brown pycnidia on the upper surface. Calcicolous, rare. K+y-r, P+y. (**fig. 39**)



39

C. peziziformis

Squamules crowded, rounded, ear-like, somewhat ascending, greyish; podetia short, longitudinally fissured, granular, with decorticate areas between granules; fruits brown, wider than podetia. On peaty soil, rare. K-, P+r. (**fig. 40**)



40

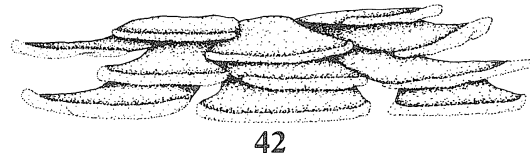
C. strepsilis

Squamules lead or bronze-coloured above, white below, up to 4mm long, flattened. Damp peaty soils. C+ bright green (unique reaction in British lichens). K-, P+y. (**fig. 41**)



41

C. digitata **Red fruits**
 Squamules large (up to 10mm),
 grey-green, margins raised; lower
 surface and margin densely
 white-pale green farinose-
 soresdiate, tinged orange towards
 the base; fruits red, rather rare.
 Rotting wood and peaty soil,
 common in old woodland. K+y,
 P+o. **(fig. 42)**



b Basal squamules small (up to about 1.5mm wide), thin and delicate (small but thick and tough in *C. incrassata*), often deeply divided, sometimes granular-soresdiate; fruits often present.

Cladonia parasitica
 Granular-soresdiate; squamules
 tiny, dense, compacted, erect,
 narrowly lobed, grey-green;
 fruits, if present, brown, elevated
 on irregular deformed podetia.
 Decorticated oak in old
 woodland, S. and S.W. England,
 local (mainly New Forest). K+y,
 P+o. **(fig. 43)**



C. caespiticia
 Not soresdiate; forming neat
 cushions; squamules with crisped
 appearance, grey-green with
 pycnidia on upper surface; fruits
 brown, +/- sessile on squamules.
 Mossy trees and earth banks in
 western woodland. K-, P+r.
(fig. 44)



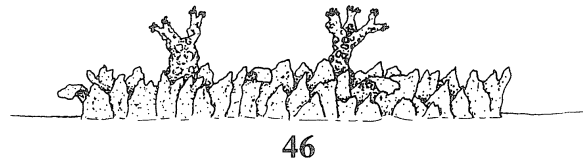
C. incrassata **Red fruits**

Often granular-sorediate; squamules crenulated, very small, yellow-grey, relatively thick and tough; fruits red, on very short deformed podetia or directly on squamules. On rotting wood, or occasionally on acid soil and peat, in S. and W. England, Wales and Scotland, local. K-, P-. (**fig. 45**)



C. fragilissima

Not sorediate; squamules very brittle, grey-green or bronze-coloured; fruits brown, borne on short, irregular podetia that are +/- simple or branched at the apices. Forming swards on acid peaty soils. N. England and Scotland. K-, P-. (**fig. 46**)



[See also *C. ramulosa* p. 37, 40), which can occur without podetia, forming mats of brittle squamules on sea cliffs and amongst heather. P+.]

Cups present, wider than the podetia

a Podetia grey-green or brown; fruits brown or absent, never red. K-, P+r, unless otherwise stated

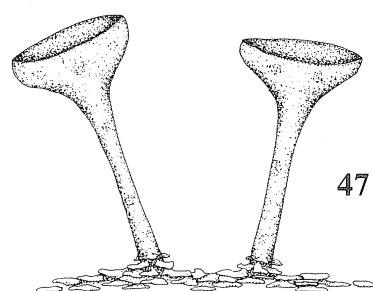
i Podetia farinose or granular-sorediate

Cladonia fimbriata

Podetia 5-15mm tall; podetia and cups entirely farinose-sorediate, golf-tee or goblet shaped.

Common on loose soil over rocks and other disturbed habitats, particularly in urban areas.

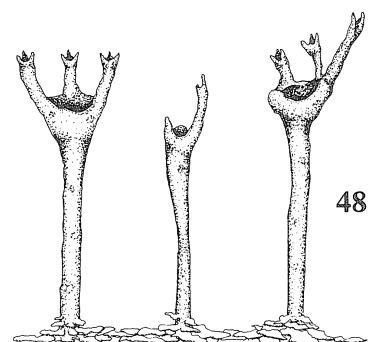
(fig. 47)



C. cenotea

Podetia 10-25mm tall, farinose-sorediate, with all cups

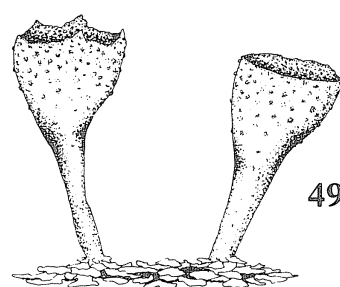
perforate, often proliferating from margins; podetia occasionally with small squamules, particularly towards the base. Confined to rotting wood and stumps in Caledonian pinewoods. K-, P-. (fig. 48)



C. chlorophaea

Podetia 5-30mm tall; podetia and cups with small granules (like castor sugar) or granular sorediate, gradually narrowing into +/- well defined stalk.

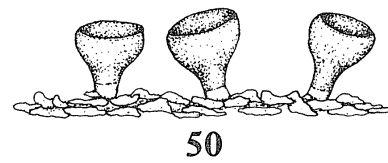
(Podetia sometimes partially corticate, with soredia only present inside cups). Common in a variety of habitats. (fig. 49)



N.B. There are a number of chemical races of *C. chlorophaea* which have sometimes been given specific status (see Purvis *et al* in prep.).

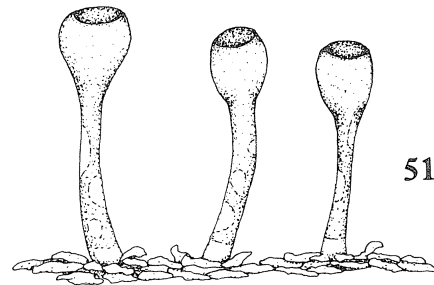
C. humilis

Similar to *C. fimbriata* but podetia very short stalked (5-7mm tall), corticate towards the base, farinose-sorediate inside and outside cups. Recently disturbed soil on roadside banks, cliffs, etc., common. K+y. **(fig. 50)**



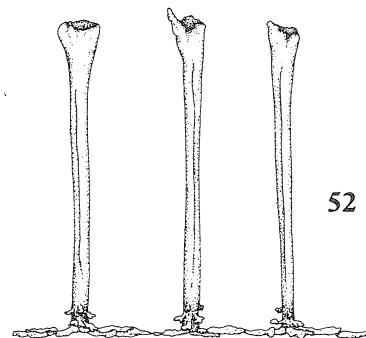
C. ochrochlora

Podetia 20-40mm tall, farinose-sorediate above, decorticate in patches towards the base; cups narrow, grey-green, often proliferating from margins. Rotting stumps and peaty soil, common. Intergrades with *C. coniocraea* (p. 33) **(fig. 51)**



C. rei

Podetia 10-50mm tall, longitudinally slit; cups deformed, +/- entirely farinose-sorediate or granular-sorediate, with +/- corticate area at base. On earth-banks in woods in S.E. England. P+y or -. **(fig. 52)**

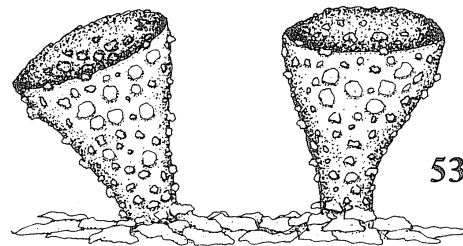


N.B. It is necessary to use thin-layer chromatography to identify this species with complete confidence. [See also *C. ramulosa* (p. 37, 40) on exceptionally variable species which can sometimes have structures approaching cups on the podetia.]

ii Podetia not sorediate, +/- smooth or with large corticated granules or squamules

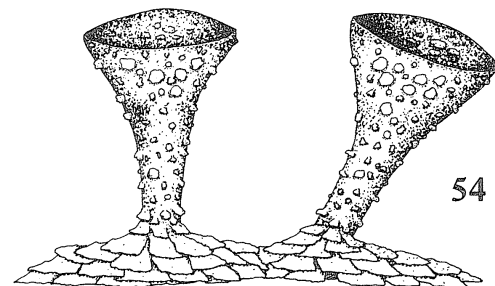
Cladonia pyxidata

Podetia 5-25mm tall, +/- granular or squamulose; cups with large corticate granules (like granulated sugar) inside, never sorediate; gradually tapering towards base, without well-defined stalk; basal squamules +/- ascending, scattered or clustered. Common in a variety of habitats. (**fig. 53**)



C. pocillum

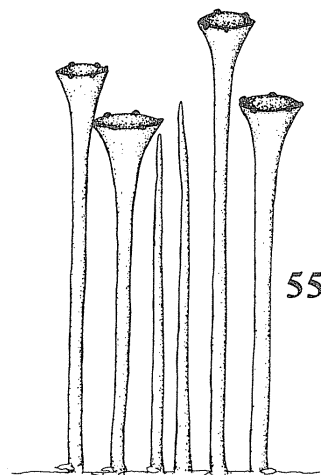
Similar to *C. pyxidata* but basal squamules +/- horizontally-spreading, overlapping and +/- continuous, with lower surface hidden, forming pavement-like rosettes. Calcicolous, common. (**fig. 54**)



C. gracilis

Podetia 10-60mm tall; cups narrow (0.5-1.5mm across), intermixed with pointed podetia; surface entirely smooth or +/- areolate, olive-brown, not soredate or perforate; squamules sparse or absent. Frequent in a variety of habitats, but particularly characteristic of moorland, under *Calluna*.

(fig. 55)



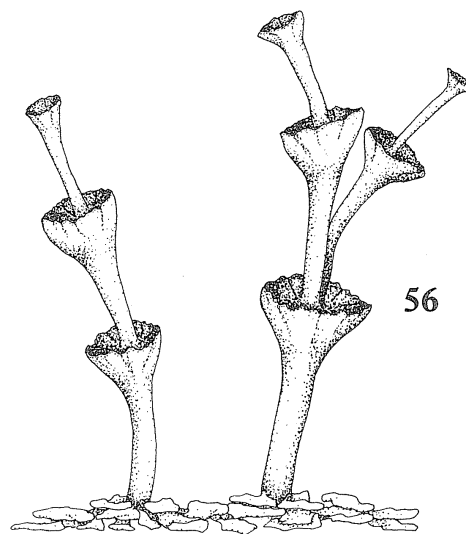
C. maxima

Similar to *C. gracilis* but stouter (cups to about 3mm across), and podetia forked towards the apex. Cairngorms, often near late snow-lie. K+y.

C. cervicornis ssp. *verticillata*
(= *C. verticillata*)

Podetia to 50mm tall, unbranched; cups dark olive-brown, proliferating from the **centre** to form tiers (unique feature, apart from *C. stricta*). Widespread on heathland.

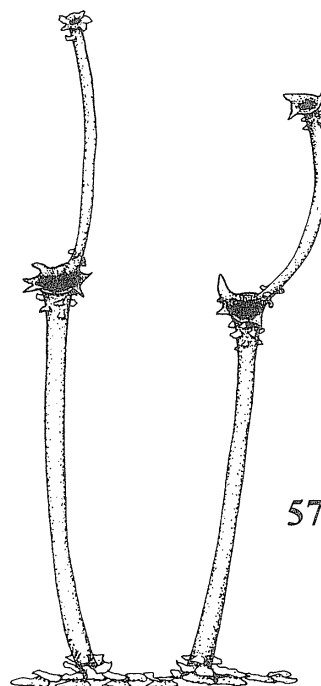
(fig. 56)



C. stricta

Podetia 5-20mm tall, sparingly branched, blackened at base; cups narrow, occasionally proliferating from **centre**. Near snow patch in Cairngorms. K+y, P+r.

C. crispata var. *cetrariiformis*
Podetia 20-60mm tall, irregularly branched above, olive green-brown; cups very poorly defined, **perforate** (i.e. opening into interior of podetia), with spine-like projections on rim, often proliferating; squamules often sparse or scattered on podetia. Frequent in heathland and montane areas. P-, uv+. (**fig. 57**)



C. crispata var. *crispata*

As above, but podetia not proliferating. E. Scotland and Yorkshire, very rare.

C. squamosa var. *squamosa*

Podetia 20-50mm tall, green to grey-brown and partly decorticate, +/- thickly covered with **peeling** squamules; cups irregular, perforate. A variable species, common in a variety of habitats. P-, uv+. (**fig. 58**)

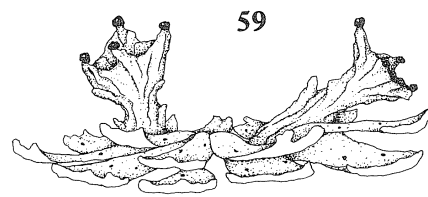


C. squamosa var. *subsquamosa*

As above, but often more robust. K+y, P+o, uv-.

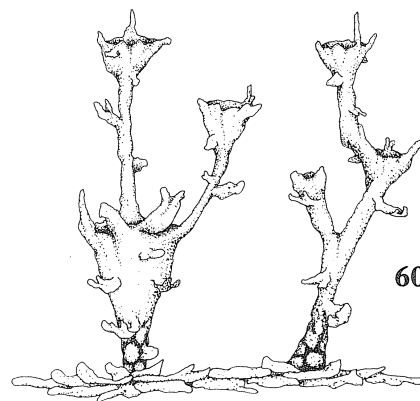
C. symphycarpa

Podetia short (< 10mm tall); cups irregular, +/- continuously areolate-corticate, often longitudinally furrowed; fruits brown. Calcicolous, rare. K+y-r, P+y. (fig. 59)



C. phyllophora

Podetia 10-50mm tall, with blackened, decorticate areas below, contrasting with pale areoles; cups irregular, proliferating at margins, +/- squamulose. On montane rocks, rare. (fig. 60) [See also *C. ramulosa* (p.37, 40), an exceptionally variable species which can sometimes have structures approaching cups on the podetia; also *C. strepsilis* (p.20) which rarely produces deformed cups but is C+ bright green.]

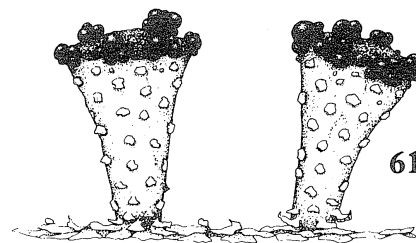


b Podetia yellowish or yellow-green and/or fruits red

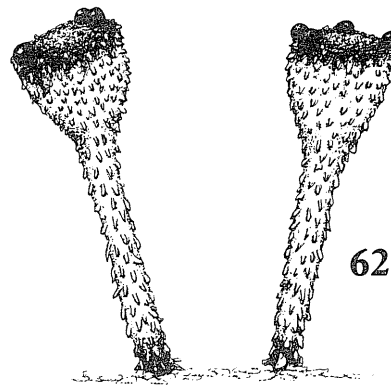
C. coccifera

Red fruits

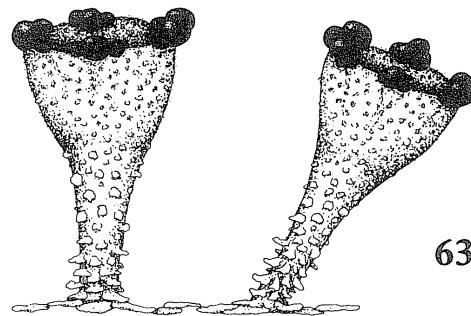
Fruits red; podetia 10-20mm tall, yellow-green, with large corticate granules; cups gradually tapering towards base (like *C. pyxidata*); soredia absent. Common in a variety of habitats. K-, P-. (fig. 61)



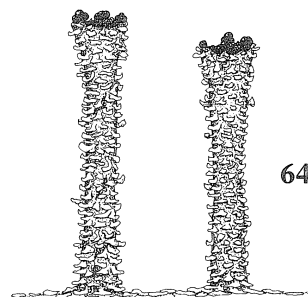
C. metacorallifera **Red fruits**
 Similar to *C. coccifera* but cups
 more abruptly narrowing into
 stalk (like *C. chlorophaea*) and
 covered with minute descending
 squamules, giving plant a scabrid
 appearance; blackened
 decorticate areas towards
 margins of cups. On boulders in
 Cairngorms and in Shropshire,
 very rare. (**fig. 62**)



C. pleurota **Red fruits**
 Similar to *C. coccifera* but with
 coarse granular **soredia** on upper
 parts of podetia and inside cups;
 podetia patchily corticate below,
 may be squamulose at base. On
 heathlands in N. Wales and N.E.
 Scotland and near areas of late
 snow-lie in Cairngorms, rare.
 (**fig. 63**)

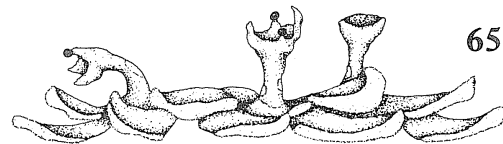


C. bellidiflora **Red fruits**
 Fruits red; podetia taller than
 those of *C. coccifera* (30-50mm
 tall), yellowish-grey, with
peeling squamules and
 decorticate areas, not perforate.
 K-, P-. (**fig. 64**)



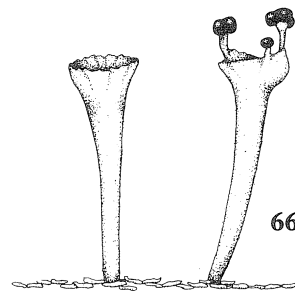
C. digitata **Red fruits**

Fruits red, rather rare; podetia short (to 10mm tall), often curved, grey-green, farinose-sorediate, +/- corticate towards the base; cups small, +/- deformed, irregular, often proliferating; basal squamules large (to 10mm across), densely white-pale green farinose below and on the margins. Rotting wood and peaty soil, common in old woodland. Not to be confused with *C. polydactyla*. K+y, P+o. (fig. 65)



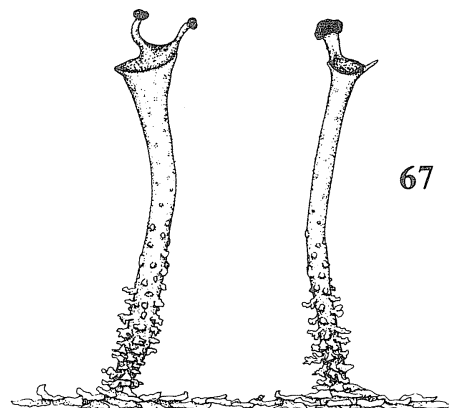
C. deformis **Red fruits**

Fruits red; podetia to 50mm tall, farinose-sorediate, yellow-green; cups +/- regular. Cairngorms, very rare. P-, uv- (c.f. *C. sulphurina*, p. 34). (fig. 66)



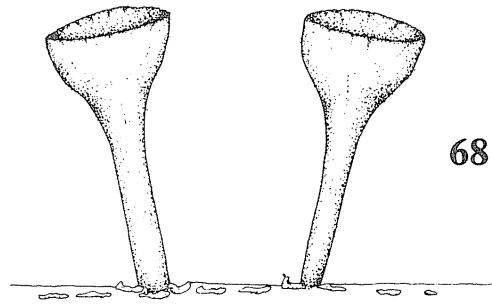
C. polydactyla **Red fruits**

Fruits red; podetia up to 50mm tall, branched, squamulose below, farinose-sorediate above, pale grey; cups narrow (to 5mm wide), irregular, abruptly tapered into stalk, often proliferating from margins. Very variable and frequent in a variety of habitats. K+y, P+o, uv-. (fig. 67) N.B. There is a form of *C polydactyla* that is uv+ and is sometimes given specific rank as *C. umbricola*.



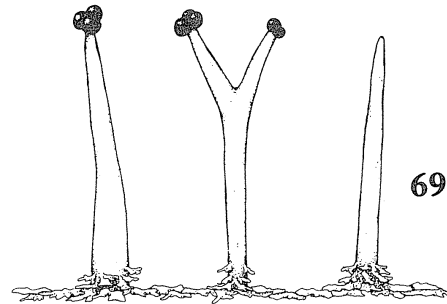
C. carneola

Like a yellow *C. fimbriata*; fruits entirely pale brown; podetia 5-20mm tall, entirely farinose-sorediate, cups broad, yellowish, abruptly narrowing into stalk. Rotting wood and humus. Cairngorms, local. P-. (**fig. 68**)

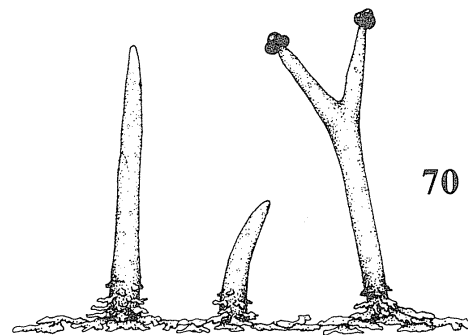


Podetia without cups, +/- sorediate, not squamulose, or squamulose only at base; fruits brown or absent, unless otherwise stated

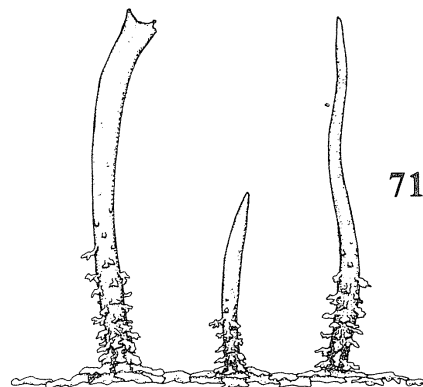
Cladonia bacillaris **Red fruits**
 Fruits red; podetia 15-30mm tall, entirely white farinose-sorediate
 Dune sand sandy heaths, widespread but not common. K-, P-. (**fig. 69**) N.B. May only be a form of *C. macilenta*.



C. macilenta **Red fruits**
 Fruits red; podetia 15-30mm tall, slender, mostly unbranched, blue-grey, squamulose below, farinose-sorediate above; squamules bluish-grey. Common in a variety of habitats. K+y, P+o. Intergrades with *C. polydactyla*. (**fig. 70**)



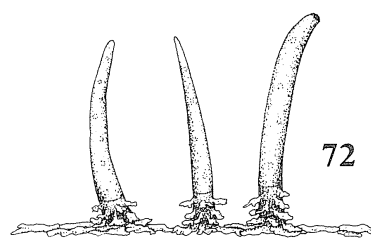
C. polydactyla **Red fruits**
 Fruits red; podetia 10-30mm tall, slender, branched, pale grey, squamulose below, farinose-sorediate above; cups sometimes present. Very variable and frequent in a variety of habitats. K+y, P+o. Intergrades with *C. macilenta*. (**fig. 71**)



C. coniocraea

Podetia 10-30mm tall, dark grey-green, tapering to tips, +/- curved, +/- unbranched, +/- corticate and sometimes squamulose at base.

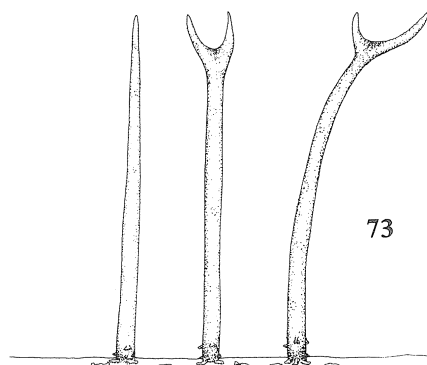
Very common on wood and peaty soil. K-, P+r. (fig. 72)



C. subulata

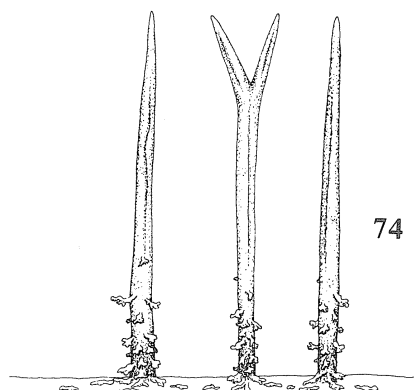
Podetia 10-60mm tall, grey-green, antler-like, simple or +/- branched at apex, sometimes +/- squamulose towards base; sometimes forming very narrow and distorted cups.

Common in a variety of habitats, particularly heathland and acid soil. K-, P+r. (fig. 73)



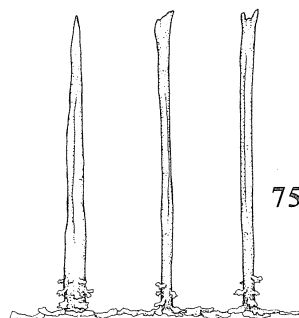
C. glauca

As *C. subulata* but podetia glaucous pale grey, inconspicuously longitudinally fissured, often densely squamulose below. Rotting wood and peat on heathland, mainly in S. and E. England and E. Scotland. K-, P-. (fig. 74)



C. rei

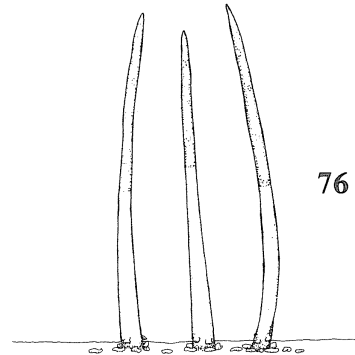
As *C. glauca* but green-brown, occasionally with deformed apical cups, often +/- entirely farinose-sorediate or granular-sorediate, with corticate basal area. On earth-banks in woods in S.E. England. K-, P+y or -. (fig. 75)



N.B. It is necessary to use thin-layer chromatography to identify this species with complete confidence.

C. cornuta

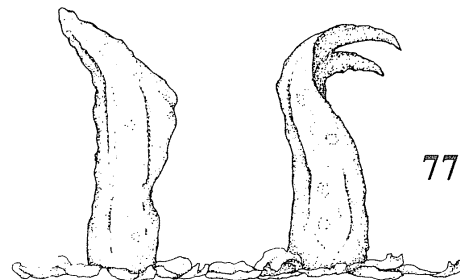
Podetia 10-40mm tall, grey-white and soresiate in upper half, brown-green and areolate-corticate in lower half. Upland heaths, mainly northern. Widespread in Scotland. K-, P+r. (**fig. 76**)



C. sulphurina

Red fruits

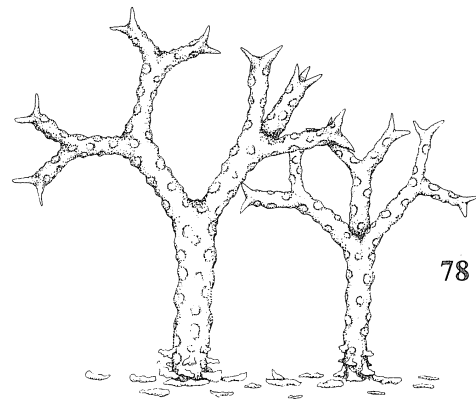
Fruits red, rare; podetia c. 50mm tall, yellowish, relatively thick, turgid and deformed, longitudinally fissured, especially towards apex. Heath and moorland, mainly in northern montane areas, occasional. K-, P-, u/v+ (c.f. *C. deformis* p. 30). (**fig. 77**)



Podetia without cups, not sorediate, corticate, not (or only slightly) squamulose. Fruits never red

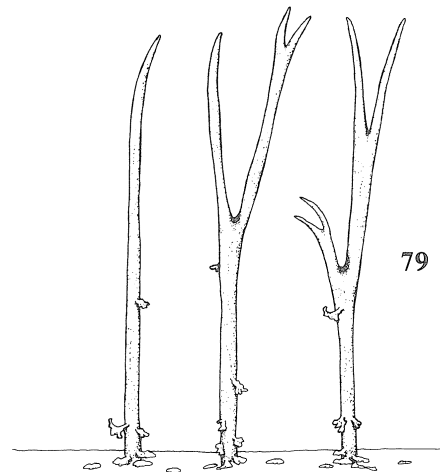
Cladonia rangiformis

Podetia 20-60mm tall, richly and divergently branched, knobbly; some basal and lower stem squamules usually present, podetia areolate with green spots or “islands”. Common in a variety of habitats but tending to be calcicolous. K+y, P+r or -. (fig. 78)



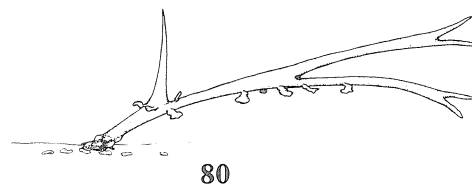
C. furcata ssp. *furcata*

Podetia 20-70mm tall, +/- erect, little branched, but often forked (branching not divergent, smooth, faintly areolate, brownish (green in shade), often with perforated axils. Common in a variety of habitats. Calcifuge. K-, P+r. (fig. 79)



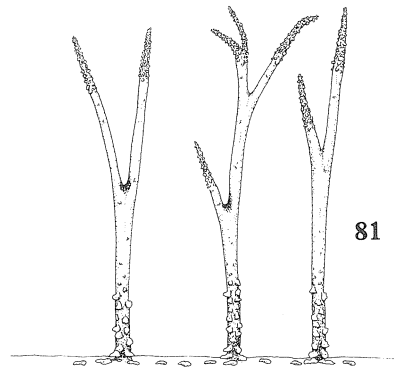
C. furcata ssp. *subrangiformis*

As ssp. *furcata* (and doubtfully distinct from it) but +/- prostrate with circular raised white spots near base of podetia. Calcicole; mainly on chalk in S.E. England. K+y. (fig. 80)



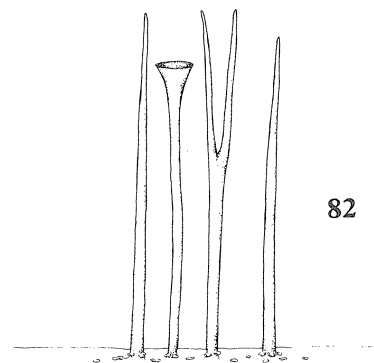
C. scabriuscula

Similar to *C. furcata* but paler, greenish-white, with a partially peeling surface, becoming continuously scabrid, particularly towards tips. Montane areas, occasional. (fig. 81)



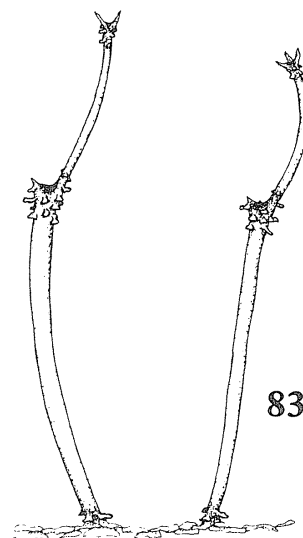
C. gracilis

Similar to *C. furcata* but podetia mostly unbranched, with at least a few shallow cups; axils not perforated. Frequent in a variety of habitats. K-, P+r, uv-. (fig. 82)



C. crispata var. *cetrariiformis*

Similar to *C. furcata* but tips of podetia with spine-like projections, one of which often proliferates; axils perforate; squamules often sparse or scattered on podetia. Frequent in heathland and montane areas. K-, P-, uv+. (fig. 83)

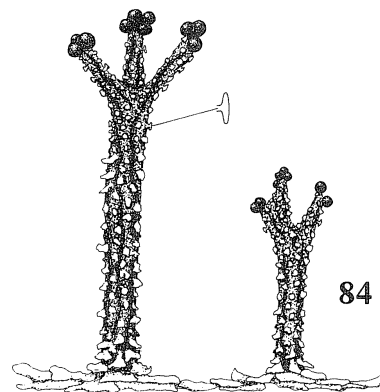


C. Crispata var. *crispata*

As above, but podetia not proliferating. Very rare, E. Scotland and Yorkshire.

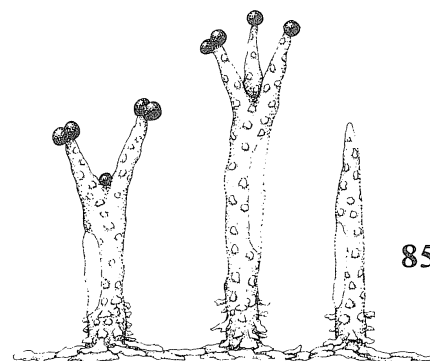
C. macrophylla

Podetia 20-50mm tall, slender, tapering, grey-green or brown, longitudinally fissured, verrucose, granular or squamulose, the granules often +/- button-like; fruits brown. Mineral-rich sites in the Scottish Highlands. K-, P+r, uv+. (**fig. 84**)



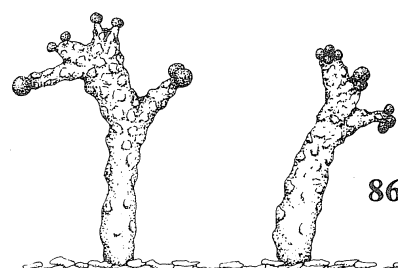
C. ramulosa (= *C. pityrea* = *C. anomaea*)

Podetia 5-35mm tall, green-brown, with corticate granules and decorticate areas; fruits frequent, brown, often forming convex clusters at tips of podetia. Very variable and frequent in a wide variety of habitats e.g. rotting wood, moorland and coastal cliffs. K-, P+r. (**fig. 85**)



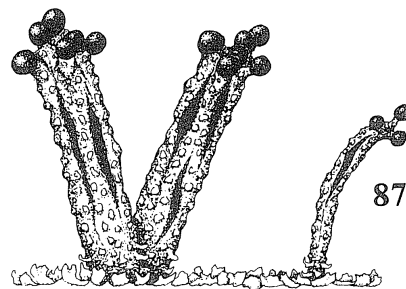
C. botrytes

Podetia to 5mm tall, yellow-green, short, smooth, corticate at base to verrucose-areolate above; fruits pale brown. On cut surface of dead pine stumps and (rarely) on heather stems in the Cairngorms, rare. K+y, P-. (**fig. 86**)



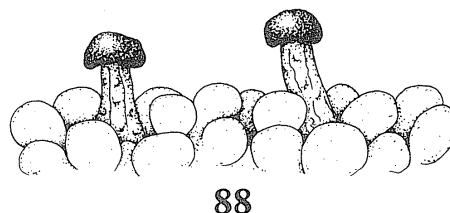
C. cariosa

Podetia 5-20mm tall, grey-green, granular or verrucose-areolate, partly decorticate, longitudinally fissured, usually abundantly fertile; fruits dark brown. Sandy places, calcareous heaths and mine spoil heaps, widespread but rare. K+y, P+y. (fig. 87)



C. peziziformis

Basal squamules crowded, rounded, ear-like, somewhat ascending, greyish; podetia short, longitudinally fissured, granular, with decorticate areas between the granules; fruits brown. On peaty soil, rare. K-, P+r. (fig. 88)



C. fragilissima

Podetia to 15mm tall, greenish-olive, grey-white below, perforate, with a distinctive reticulate pattern; squamules very brittle, forming swards. Boggy places and edges of peat hags, N. England and Scotland. K-, P-. (fig. 89) [See also *C. strepsilis*, (p. 20) which rarely produces deformed podetia but is C+ bright green.]



Podetia without cups, corticate, +/- densely squamulose, not soresciate; fruits brown or absent, unless otherwise stated

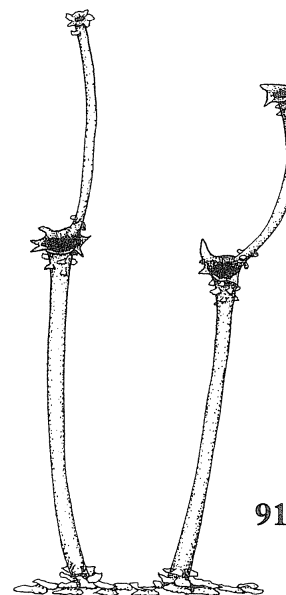
Cladonia squamosa var. *squamosa*

Podetia 20-50mm tall, green to grey-brown, often perforate and partly decorticate, +/- thickly covered with peeling squamules. Very variable and common in a wide variety of habitats. K-, P-, uv+. (fig. 90)



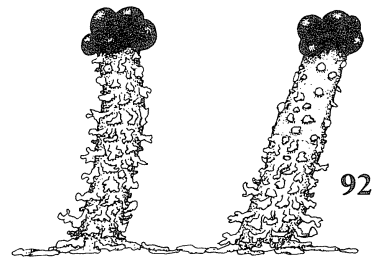
C. squamosa var. *subsquamosa*
As above, but often more robust. K+y, P+o, uv-. (fig. 90)

C. crispata var. *cetrariiformis*
Squamulose near axils and cups; apices of podetia with spine-like projections, one of which often proliferates; axils perforate. Frequent in heathland and montane areas. K-, P-, uv+. (fig. 91)

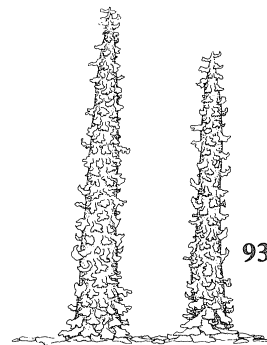


C. crispata var. *crispata*
As above but podetia not proliferating. Very rare, E. Scotland and Yorkshire.

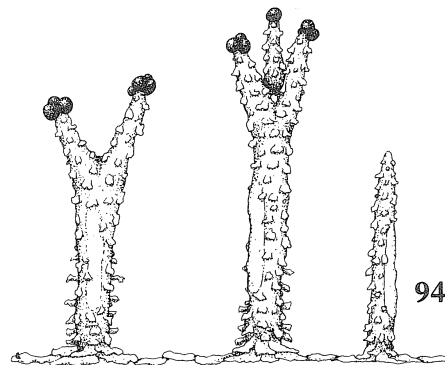
C. floerkeana **Red fruits**
 Fruits red, usually present; podetia
 15-30mm tall, grey, +/-
 squamulose in lower half, +/-
 granular-corticate above, often
 partially decorticate. Common on
 wood and in heathlands. K+y or -,
 P+o or -. (**fig. 92**)



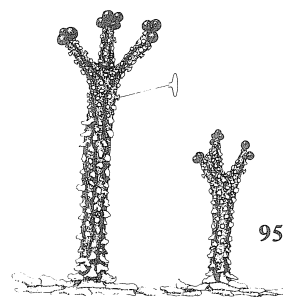
C. bellidiflora **Red fruits**
 Fruits red; podetia 30-50mm tall,
 yellowish-grey, with **peeling**
 squamules and decorticate areas,
 not perforate. Montane areas,
 widespread in Scotland, rare in N.
 England and Wales. K-, P-.
 (**fig. 93**)



C. ramulosa (= *C. pityrea* =
C. anomaea)
 Podetia relatively short (5-35mm
 tall) and slender, decorticate in
 patches; squamules small; fruits
 frequent, pale brown, often
 forming convex clusters at tips of
 podetia. Very variable and
 frequent in a wide variety of
 habitats. K-, P+r. (**fig. 94**)

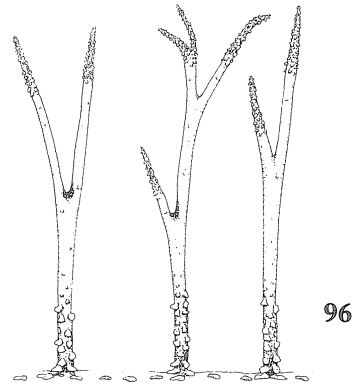


C. macrophylla
 Podetia 20-50mm tall, slender,
 tapering, grey-green or brown,
 longitudinally fissured, verrucose.
 Granular or squamulose, the
 granules often +/- button-like.
 Mineral-rich sites in the Scottish
 Highlands. K-, P+y. (**fig. 95**)



C. scabriuscula

Similar to *C. furcata* but paler, greenish-white, with a partially peeling surface, becoming +/- continuously scabrid, particularly towards tips. Montane areas, occasional. P+r. (**fig. 96**)



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