

KEY

for the identification of terricolous lichens occurring in Italy above the submediterranean belt on acid to subneutral substrata

by

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These keys were automatically produced by *ITALIC*. They are published in the internet in this preliminary form in order to be tested and corrected. The authors will be grateful for any critical remark. (nimis@units.it).

Warning! The characters used for the dichotomies do not necessarily represent a description of the taxa. For example, the character states "thallus from bright yellow to red" and "thallus dark" can be used to distinguish a *Candelariella* from a dark-coloured crustose lichen, which does not mean that the thallus of *Candelariella* can be "red". The true colour of the lichens is specified in their descriptions

The term "terricolous" is rather ambiguous: it includes lichens of mineral soil, those of humid organic soil, and those which live on "terricolous" bryophytes. This key includes all lichens which were hitherto reported from Italy on these types of substrata. Several species which are normally epiphytic or saxicolous can occasionally become "terricolous". Only a small selection of them is included in the key.

Structure of the keys

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FOLIOSE Lichens.....	Subkey B, pag.	20
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CRUSTOSE Lichens.....	Subkey D, pag.	40
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SUBKEY A - Fruticose lichens

1	Without primary thallus and without (pseudo)podetia	2
1	With a primary, crustose to squamulose thallus and erect to decumbent (pseudo)podetia (<i>Cladonia</i> , <i>Leprocaulon</i> , <i>Stereocaulon</i>)	20
2	Thallus neither dark- nor very bright-coloured	3
2	Thallus dark, from black to dark brown	11

- 3 Pseudocyphellae present 4
- 3 Pseudocyphellae absent 5
- 4 Medulla K+ yellow, C+ red, KC+ red, P+ yellow . Branches 0.5-1 mm wide. Thallus pinkish grey to pale grey brown at the base, dark grey-brown to grey-black at the apices

Alectoria nigricans

Thallus fruticose, pinkish grey to pale grey brown at the base, dark grey-brown to grey-black at the apices, loosely attached. Branches 0.5-1 mm wide, filamentous, ascending, anisotomic-dichotomous, subterete. Pseudocyphellae linear. Soredia P+ red. Medulla white, compact, K+ yellow, C+ red, KC+ red, P+ yellow. Photobiont chlorococcoid. - Note: on ground or on rocks in wind-exposed siliceous ridges in moss-lichen heaths, restricted to the Alps in Italy.

- 4 Medulla K-, KC-, C-, P-. Branches 1-2(3) mm wide. Thallus greenish grey to yellowish, the apices concolour or blackened

Alectoria ochroleuca

Thallus fruticose, greenish grey to yellowish, the apices concolour or blackened, shrubby. Branches 1-2(3) mm wide, filamentous, ascending, anisotomic-dichotomous. Pseudocyphellae linear. Medulla white, compact, K-, C-, KC-, P-. Photobiont chlorococcoid. - Note: on wind-exposed ridges in moss-lichen heaths, more frequent in areas with siliceous substrata, but sometimes also occurring in areas with dolomite, restricted to the Alps and the northern Apennines in Italy.

- 5 Lobe flat 6
- 5 Lobe somehow inflated 8
- 6 Marginal cilia present

Anaptychia ciliaris

Thallus fruticose, grey to grey-brown, bifacial, shrubby, loosely attached, with thin transparent hairs, K-, C-, P-. Lobes (2)3-6 mm wide, linear, ascending. Edge entire, with marginal cilia. Undersurface pale brownish white, channelled. Lower cortex absent. Apothecia frequent, lecanorine, substipitate, strongly constricted, up to 5 mm diam. Surface black, often faintly pruinose. Margin verrucose, grey to grey brown, smooth or crenulate. Ascospores 2-celled, not hyaline, ellipsoid, constricted at septa, thin-walled, ornamented, 8 per ascus, 40-45 x 18-24 μ. Pycnidia semi-immersed. Conidia bacilliform. Photobiont chlorococcoid. - A mainly epiphytic species, occasionally occurring on soil.

- 6 Marginal cilia absent 7
- 7 Thallus smooth, basal parts reddish. Lobes cucullate

Cetraria cucullata

Thallus fruticose, cream-coloured, deep red-purple at the base, smooth, loosely attached, KC-, P-. Lobes (2)3-6 mm wide, cucullate, concave, smooth, ascending, truncated. Edge dentate. Medulla K-, C-, KC-, P-. rare lecanorine. Photobiont chlorococcoid. - Note: a typical element of tundra-like vegetation of open, dry habitats above treeline, most frequent on basic siliceous substrata, in wind-exposed ridges.

- 7 Thallus reticulately wrinkled, basal parts brownish. Lobes non cucullate

Cetraria nivalis

Thallus fruticose, cream-coloured, yellowish brown at the base, wrinkled, loosely attached, KC-, P-. Lobes 6-10 mm wide, elongate, ascending, truncated. Edge dentate. Medulla K-, C-, KC-, P-. Photobiont chlorococcoid. - Note: a typical element of tundra-like vegetation of open, dry habitats above treeline, common throughout the Alps, this species is surprisingly abundant on the Gran Sasso Massif (central Apennines).

- 8 Thallus not yellowish green to green, max greenish grey 9
- 8 Thallus yellowish green (like *Parmelia caperata*) to bright green 10
- 9 Thallus P+ orange, UV -. With thamnolic acid. Thallus becoming pinkish in the herbarium

Thamnotia vermicularis

Thallus fruticose, white, becoming pinkish in the herbarium, K+ yellow, P+ orange. Branches (2)3-6 mm wide, bacilliform, smooth, ascending, subterete, non squamulose. Medulla UV -. Photobiont chlorococcoid. With thamnotic acid. - Note: a common element of open, wind-exposed Alpine tundras, found both on calcareous and siliceous substrata.

- 9 Thallus P+ yellow, UV +. With baeomycic and squamatic acids. Thallus not becoming pinkish in the herbarium

Thamnotia vermicularis v.subuliformis

Thallus fruticose, white, remaining white in the herbarium, K+ yellow, P+ yellow. Branches (2)3-6 mm wide, bacilliform, smooth, ascending, non squamulose. Medulla UV +. Photobiont chlorococcoid. With baeomycic and squamatic acids. - Note: a common element of open, wind-exposed Alpine tundras, found both on calcareous and siliceous substrata.

- 10 Medulla lax, P-. Thallus yellowish green

Dactylina madreporiformis

Thallus fruticose, yellowish green, shrubby. Branches 1-2(3) mm wide, elongate, ascending, isotomic-dichotomous, subterete. Medulla lax, P-. Photobiont chlorococcoid. - Note: in open Alpine grasslands and in wind-exposed ridges, widespread throughout the Alps, the record from Abruzzi is the southernmost in Europe for this mainly Arctic-Alpine species.

- 10 Medulla hollow, P+ orange. Thallus yellowish green spotted brownish yellow and pale violet

Dactylina ramulosa

Thallus fruticose, yellowish green spotted brownish yellow and pale violet, shrubby. Branches 1-2(3) mm wide, elongate, ascending, subterete. Medulla hollow, P+ orange. Photobiont chlorococcoid. - Note: on soil developing from calcareous schists.

- 11 Thallus filamentous 12
- 11 Thallus non filamentous 16
- 12 With soredia or isidia 13
- 12 Without soredia or isidia 14
- 13 Branches 0.5-1 mm wide. Main branches much thicker than the others (0.5-1 mm)

Bryoria chalybeiformis

Thallus fruticose, black to dark brown, without lateral spinules, smooth, filamentous, loosely attached, K-, C-, KC-, P-. Branches 0.5-1 mm wide, elongate, adpressed to the substratum, isotomic-dichotomous, subterete. Soredia farinose. Soralia punctiform, prominent. Medulla K-, C-, KC-, P-. Main branches much thicker than the others (0.5-1 mm). - Note: on wind-exposed rocks, but also on soil, mosses and plant remains in exposed habitats with frequent fog.

- 13 Branches <0.5 mm wide. Main branches not much thicker than the others (up to 0.3 mm)

Bryoria lanestris

Thallus fruticose, black to dark brown, without lateral spinules, filamentous, K-, C-, KC-, P-. Branches <0.5 mm wide, elongate, isotomic-dichotomous. Soredia farinose, P+ red. Soralia punctiform, prominent. Medulla K-, C-, KC-, P-. Main branches not much thicker than the others (up to 0.3 mm). - Note: on bark of conifers, and on hard wood in rather humid areas, the only Italian record needs re-confirmation, but the presence of this species in the Alps is probable.

- 14 Photobiont cyanobacterial

Polychidium muscicola

Thallus fruticose, brown-black, filamentous, shrubby, loosely attached, K-, C-, KC-, P-. Branches cylindrical, smooth, ramified. Apothecia rare, without a thalline margin, lateral, sessile, strongly constricted, up to 2 mm diam. Surface red-brown, plane. Margin distinct, thin, smooth, paler than disk. Paraphyses simple, distinctly thickened

above. Asci cylindrical. Ascospores 2-celled, hyaline, fusiform-elongate, 8 per ascus, 22-29 x 5-7 μ . Pycnidia dark. Conidia bacilliform. Photobiont cyanobacterial. - Note: on soil and amongst bryophytes, more rarely on basal parts of ancient trees.

- 14 Photobiont chlorococcoid 15
15 Medulla K+ yellow, KC+ red, C+ red

Alectoria nigricans

Thallus fruticose, pinkish grey to pale grey brown at the base, dark grey-brown to grey-black at the apices, filamentous, shrubby, loosely attached. Branches 0.5-1 mm wide, filamentous, ascending, anisotomic-dichotomous, subterete. Pseudocyphellae linear. Medulla white, compact, K+ yellow, C+ red, KC+ red, P+ yellow. Photobiont chlorococcoid. - Note: on ground or on rocks in wind-exposed siliceous ridges in moss-lichen heaths, restricted to the Alps in Italy.

- 15 Medulla K-, KC-, C-

Bryoria bicolor

Thallus fruticose, black to brownish black, with olive-grey to pale brown apices, and dark, often arcuated lateral spinules, shiny, smooth, filamentous, loosely attached. Branches 0.5-1 mm wide, elongate, smooth, ascending, irregular. Pseudocyphellae linear. Soredia P+ red. Medulla white, compact, K-, C-, KC-, P+ red. Photobiont chlorococcoid. - Note: esp. on mossy trunks of old, more or less isolated trees in areas with frequent fog, sometimes on mossy rocks.

- 16 Lobes width > 3 mm. Medulla P+orange

Cetraria islandica

Thallus fruticose, dark grey-brown to grey-green in shade, sometimes pitted, the basal parts often reddish, bifacial, loosely attached, K-, C-, KC-. Lobes elongate, smooth, ascending, up to 3 cm wide, moderately branched. Edge dentate. Pseudocyphellae maculiform, on lower surface. Undersurface generally paler than upper surface. Medulla K-, C-, KC-, P+ orange. Medulla UV -. Apothecia rare, lecanorine, on the lower surface of thallus, substipitate. Ascospores 1-celled, hyaline, 8 per ascus. Photobiont chlorococcoid. - Note: on mineral and organic soil, amongst thick moss carpets, exceptionally on bark or lignum near the ground, with optimum near treeline, less common in the mountains of the south.

- 16 Lobes width < 3 mm. Medulla P- 17
17 Lobes flat

Cetraria ericetorum

Thallus fruticose, dark brown, bifacial, loosely attached, K-, C-, KC-. Lobes 0.5-1 mm wide, cucullate, concave, smooth, ascending, strongly channelled, incurved, more or less tubular, the pseudocyphellae restricted to the margins. Edge dentate. Pseudocyphellae maculiform, on lower surface. Undersurface paler than upper surface. Medulla K-, C-, KC-, P-. Medulla UV -. Apothecia lecanorine, on the lower surface of thallus, substipitate. Ascospores 1-celled, hyaline, 8 per ascus. Pycnidia dark, stipitate. Photobiont chlorococcoid. - Note: optimum on wind-exposed ridges on siliceous substrata, common throughout the Alps, but much rarer than *C. islandica* in the Apennines.

- 17 Lobes somehow inflated 18
18 Medulla C+ yellow

Cetraria obtusata

Thallus fruticose, matt to glossy brown, loosely attached, K-, C-, KC-, P-. Branches 0.5-1 mm wide, ramified. Pseudocyphellae maculiform. Medulla pale yellow, K-, C+ yellow, KC-, P-. Medulla UV -. Apothecia rare, lecanorine, sessile. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, stipitate. Conidia clavate. Photobiont chlorococcoid. Main branches flattened, pseudocyphellae punctiform, often surrounded by black projections. - Note: ecologically similar to *C. ericetorum*, but much rarer, and perhaps more bound to dry-continental situations, this species is to be looked for in other localities of the Central Alps.

- 18 Medulla C- 19
19 Main branches flattened, uneven, to c. 1 mm diam., pseudocyphellae concave, elongate, branching open and coarse

Cetraria aculeata

Thallus fruticose, matt to glossy brown, shrubby, loosely attached, K-, C-, KC-, P-. Branches 0.5-1 mm wide, ramified. Pseudocyphellae maculiform. Medulla white, K-, C-, KC-, P-. Medulla UV -. Apothecia rare, lecanorine, sessile. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, stipitate. Conidia bifusiform. Photobiont chlorococcoid. Main branches flattened, uneven, to c. 1 mm diam., pseudocyphellae concave, elongate, branching open and coarse. - Note: on siliceous, often sandy mineral soil in clearings of Calluna-heathlands in more or less wind-exposed situations.

- 19 Main branches rounded, even, delicate, to c. 0.5 mm diam., pseudocyphellae flat, circular, branching dense and spinulose

Cetraria muricata

Thallus fruticose, matt to glossy brown, shrubby, loosely attached, K-, C-, KC-, P-. Branches ramified. Pseudocyphellae maculiform. Medulla white, K-, C-, KC-, P-. Medulla UV -. Apothecia rare, lecanorine, sessile. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, stipitate. Conidia bifusiform. Photobiont chlorococcoid. Main branches rounded, even, delicate, to c. 0.5 mm diam., pseudocyphellae flat, circular, branching dense and spinulose. - Note: optimum on wind-exposed siliceous ridges above treeline, the distinction from *C. aculeata* is not always clear to me, esp. in the south there are specimens which are difficult to assign to either taxon.

- 20 Podetia/pseudopodetia without a central cavity 21
20 Podetia/pseudopodetia with a central cavity 27
21 Thallus greenish, leprose-sorediose

Leprocaulon microscopicum

Thallus fruticose, consisting of bluish-green to yellowish granules and of delicate, white pseudopodetia, loosely attached, K-, C-, KC-, P-. Pseudopodetia <0.5 mm wide, cylindrical, granulose, ascending, terete, 2-4 mm tall, simple or sparingly branched, whitish, but densely covered by greenish, leprose-arachnoid granules. Soredia diffuse. Medulla UV -. Photobiont chlorococcoid. - Note: on basic siliceous rocks covered by a thin film of soil, very common on brick walls in archaeological areas of Tyrrhenian Italy, where it is also found on bark (e.g. of *Olea*), extremely rare along the E side of the peninsula, exceptionally reaching the montane belt in the W Alps.

- 21 Thallus not greenish, not leprose-sorediose 22
22 Thallus P+ orange

Stereocaulon tomentosum

Thallus fruticose, whitish grey, densely covered by wart-like to squamulose phyllocladia, loosely attached, with cephalodia, tomentose, K+ yellow, P+ orange. Pseudopodetia elongate, ascending, terete. Apothecia frequent, without a thalline margin, subterminal. Surface dark brown, convex. Margin indistinct. Paraphyses simple, slightly thickened above, with dark cap. Ascospores 4-8-celled, hyaline, fusiform, 8 per ascus. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: in open habitats, such as clearings of Pinus-stands with mineral soil.

- 22 Thallus P+ yellow 23
23 Primary thallus persistent 24
23 Primary thallus disappearing 25
24 Thallus non tomentose. Cephalodia with *Stigonema*, dark brown, with a rough surface. Ascomata rare

Stereocaulon condensatum

Thallus fruticose, grey, densely covered by squamulose, lobulate phyllocladia, loosely attached, with cephalodia, K+ yellow, P+ yellow. Pseudopodetia elongate, ascending, terete. Apothecia rare, without a thalline margin, subterminal. Surface dark brown, convex. Margin indistinct, thin. Paraphyses simple, slightly thickened above, with dark cap. Ascospores 4-8-celled, hyaline, fusiform, 8 per ascus. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Cephalodia with *Stigonema*, dark brown, with a rough surface. - Note: on sandy to gravelly, often disturbed soil in

open situations, probably restricted to the Alps in Italy, and often associated with *Pycnothelia papillaria*.

- 24 Thallus tomentose. Cephalodia with Nostoc, brown to bluish green, with a smooth surface. Ascomata frequent

Stereocaulon glareosum

Thallus fruticose, grey, densely covered by squamulose, lobulate phyllocladia, loosely attached, with cephalodia, tomentose, K+ yellow, P+ yellow. Pseudopodetia elongate, ascending, terete. Apothecia frequent, without a thalline margin, subterminal. Surface dark brown, convex. Margin indistinct, thin. Paraphyses simple, slightly thickened above, with dark cap. Ascospores 4-8-celled, hyaline, fusiform, 8 per ascus. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Cephalodia with Nostoc, brown to bluish green, with a smooth surface. - Note: on sandy or gravelly ground, such as on banks of streams, in snow-beds.

- 25 Pseudopodetia not dorsiventral, without an evident upper and lower surface

Stereocaulon incrustatum

Thallus fruticose, grey, densely covered by granulose phyllocladia, loosely attached, with cephalodia, tomentose, K+ yellow, P+ yellow. Pseudopodetia elongate, ascending, terete. Apothecia frequent, without a thalline margin, subterminal. Surface dark brown, convex. Margin indistinct, thin. Paraphyses simple, slightly thickened above, with dark cap. Ascospores 4-8-celled, hyaline, fusiform, 8 per ascus. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Cephalodia bluish green, with Nostoc, globose, localized in the parts free from phyllocladia. - Note: on mineral, nutrient-poor soil, in Pinus-woodlands, in the vicinity of glaciers and by rivers, certainly restricted to the Alps in Italy.

- 25 Pseudopodetia dorsiventral

26

- 26 Cephalodia bluish green, with Nostoc, globose

Stereocaulon alpinum

Thallus fruticose, grey, densely covered by squamulose, lobulate phyllocladia, loosely attached, with cephalodia, tomentose, K+ yellow, P+ yellow. Pseudopodetia elongate, ascending, terete. Undersurface with a pale pink tomentum. Apothecia frequent, without a thalline margin, subterminal. Surface dark brown, convex. Margin indistinct, thin. Paraphyses simple, slightly thickened above, with dark cap. Ascospores 4-8-celled, hyaline, fusiform, 8 per ascus. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Cephalodia bluish green, with Nostoc, globose. - Note: an early colonizer of mineral soil, esp. gravel and sand in the vicinity of glaciers, certainly restricted to the Alps in Italy.

- 26 Cephalodia violet brown, small, elongated, with a rough surface

Stereocaulon rivulorum

Thallus fruticose, grey, densely covered by squamulose, lobulate phyllocladia, loosely attached, with cephalodia, tomentose, K+ yellow, P+ yellow. Pseudopodetia elongate, ascending, terete. Apothecia frequent, without a thalline margin, subterminal. Surface dark brown, convex. Margin indistinct, thin. Paraphyses simple, slightly thickened above, with dark cap. Ascospores 4-8-celled, hyaline, fusiform, 8 per ascus. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Cephalodia violet brown, small, elongated, with a rough surface. Pseudopodetia very brittle. - Note: on gravel and sand in rather sheltered situations, e.g. in snow-beds or on banks of streams and near glaciers, sometimes on weakly calciferous schists.

- 27 Thallus densely ramified, shrub-like

28

- 27 Thallus not or scarcely ramified, never shrub-like

41

- 28 With cups

29

- 28 Without cups

30

- 29 Medulla UV -. Thallus pale yellowish. Squamules on podetia absent

Cladonia amaurocraea

Thallus fruticose, pale yellowish, K-, C-, P-. Podetia elongate, ramified, non squamulose, to 10 cm tall, apices pointed or terminating in narrow cups, often with brownish lateral projections. Medulla UV -. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per

ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Ramifications anisotomic, i.e. main branches thicker, top of podetia not dome-shaped. - Note: on soil and bryophytes in open habitats mostly in sites with a long snow lie, optimum in the subalpine belt, and probably restricted to the Alps.

- 29 Medulla UV + white. Thallus greenish grey to dark brown. Squamules on podetia present or not

Cladonia crispata

Thallus fruticose, greenish grey to dark brown, shrubby, K-, C-, P-. Podetia ramified, squamulose, to 6 cm tall, irregularly branched esp. above, terminating in a cup-like perforation with spinulose margins, the spines proliferating. Undersurface of squamules white. Medulla UV + white. Apothecia without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil, more rarely on lignum, in open habitats, in areas with siliceous substrata, restricted to the Alps in Italy.

- 30 With soredia or isidia

Cladonia scabriuscula

Thallus fruticose, greenish grey, shrubby, K+ brownish, C-, KC-, P+ red. Podetia corticate only at base, ramified, squamulose, slender, to 8 cm tall, forming irregular tufts, with pointed apices and a microsquamulose, partly decorticated surface. Soredia diffuse, granular. Soralia apical. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil and amongst mosses in humid-sheltered situations, such as open woodlands.

- 30 Without soredia or isidia

31

- 31 Thallus K+ brownish

Cladonia furcata

Thallus fruticose, greenish grey, shrubby, K+ brownish, C-, KC-, P+ red. Podetia cylindrical, ramified, to 8 cm tall, forming irregular tufts, with pointed apices and smooth surface, sparsely squamulose. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil, amongst mosses, sometimes on bark and lignum, in areas with more or less calcareous or siliceous base-rich rocks, surprisingly rare along the Adriatic part of the peninsula.

- 31 Not as above

32

- 32 Thallus K+ yellow

33

- 32 Thallus K-

36

- 33 Thallus P-

Cladonia rangiformis

Thallus fruticose, greenish grey to whitish grey, shrubby, K+ yellow, C-, KC-, P-. Podetia ramified, to 6 cm tall, richly branched, forming tuft, with pointed apices and a distinctly areolate surface, sparsely to densely squamulose. Undersurface of squamules white. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on more or less calcareous soil in open habitats, with optimum in dry grasslands, one of the most frequent and abundant species of Cladonia in Italy.

- 33 Thallus P+ red

34

- 34 Podetia without cortex, with arachnoid surface

Cladonia rangiferina

Thallus fruticose, grey, shrubby, K+ yellow, C-, P+ red. Podetia ramified, tetrachotomous, non squamulose. Primary squamules absent. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Ramifications anisotomic, i.e. main branches thicker, top of podetia not dome-shaped. Tips of ramifications mostly bent to one side. - Note: one of

the most abundant elements of lichen-rich tundra-like vegetation on mineral soil in exposed habitats, common only in the Alps.

- 34 Podetia at least in part corticate 35
35 Podetia thin, without evident, convex, white medullary outbursts at the base. Thallus greenish grey to whitish grey. Podetia to 6 cm tall, richly branched, forming tufts, with pointed apices and a distinctly areolate surface, sparsely to densely squamulose

Cladonia rangiformis

Thallus fruticose, greenish grey to whitish grey, shrubby, K+ yellow, C-, KC-, P+ red. Podetia ramified, to 6 cm tall, richly branched, forming tuft, with pointed apices and a distinctly areolate surface, sparsely to densely squamulose. Undersurface of squamules white. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Podetia thin, without evident, convex, white medullary outbursts at the base. - Note: on more or less calcareous soil in open habitats, with optimum in dry grasslands, one of the most frequent and abundant species of *Cladonia* in Italy.

- 35 Podetia stout, with evident, convex, white medullary outbursts at the base. Thallus brown, often dark. Podetia to 8 cm tall, forming irregular tufts, with pointed apices and smooth surface, non or very sparsely squamulose

Cladonia subrangiformis

Thallus fruticose, brown, often dark, shrubby, K+ yellow, C-, KC-, P+ red. Podetia ramified, to 8 cm tall, forming irregular tufts, with pointed apices and smooth surface, non or very sparsely squamulose. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Podetia stout, with evident, convex, white medullary outbursts at the base. - Note: on more or less mineral and calciferous soil, often amongst bryophytes, in my opinion, this species is well distinct both from *C. furcata* and *C. rangiformis*, although less abundant than the latter, it is widespread throughout Italy.

- 36 Thallus P+ red 37
36 Thallus P- 38
37 Thallus KC+ yellow. Podetia without cortex, surface arachnoid. Thallus pale yellowish white

Cladonia arbuscula ssp. arbuscula

Thallus fruticose, pale yellowish white, shrubby, K-, C-, KC+ yellow, P+ red. Podetia ramified, tetrachotomous, non squamulose, 4-10 cm tall, richly branched, with terminal branches strongly orientated in one direction, young apices blunt. Primary squamules absent. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Ramifications anisotomic, i.e. main branches thicker, top of podetia not dome-shaped. Tips of ramifications mostly bent to one side. - Note: one of the most abundant elements of lichen-rich tundra-like vegetation on mineral soil in exposed habitats, common in the Alps, very rare in the high mountains of central Italy, sometimes found on lignum.

- 37 Thallus KC-. Podetia corticate. Thallus greenish grey

Cladonia furcata

Thallus fruticose, greenish grey, shrubby, K-, C-, KC-, P+ red. Podetia cylindrical, ramified, to 8 cm tall, forming irregular tufts, with pointed apices and smooth surface, sparsely squamulose. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil, amongst mosses, sometimes on bark and lignum, in areas with more or less calcareous or siliceous base-rich rocks, surprisingly rare along the Adriatic part of the peninsula.

- 38 Podetia without cortex, with arachnoid surface 39
38 Podetia at least in part corticate 40
39 Ramifications anisotomic, i.e. main branches thicker, top of podetia not dome-shaped

Cladonia arbuscula ssp. mitis

Thallus fruticose, pale yellowish white, shrubby, K-, C-, KC+ yellow, P-. Podetia ramified, tetrachotomous, non squamulose, 4-10 cm tall, richly branched, with terminal branches weakly orientated in one direction. Primary squamules absent. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Ramifications anisotomic, i.e. main branches thicker, top of podetia not dome-shaped. - Note: more common at higher altitudes than the typical subspecies.

- 39 Ramifications isotomic, i.e. most branches of the same thickness, top of podetia regularly dome-shaped

Cladonia stellaris

Thallus fruticose, pale yellowish white, shrubby, K-, C-, KC+ yellow, P-. Podetia ramified, tetrachotomous, non squamulose. Primary squamules absent. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Ramifications isotomic, i.e. most branches of the same thickness, top of podetia regularly dome-shaped. - Note: in wind-protected sites with a long snow-lie, restricted to the Alps.

- 40 Thallus greenish grey to dark brown. Squamules on podetia sometimes present. Podetia to 6 cm tall, irregularly branched esp. above, terminating in a cup-like perforation with spinulose margins, the spines proliferating

Cladonia crispata

Thallus fruticose, greenish grey to dark brown, shrubby, K-, C-, P-. Podetia ramified, squamulose, to 6 cm tall, irregularly branched esp. above, terminating in a cup-like perforation with spinulose margins, the spines proliferating. Undersurface of squamules white. Medulla UV + white. Apothecia without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil, more rarely on lignum, in open habitats, in areas with siliceous substrata, restricted to the Alps in Italy.

- 40 Thallus pale yellowish, often with brownish tips. Squamules on podetia absent. Podetia to 6 cm tall, with pointed apices, forming tufts

Cladonia uncialis

Thallus fruticose, pale yellowish, often with brownish tips, shrubby, K-, C-, P-. Podetia ramified, tetrachotomous, non squamulose, to 6 cm tall, with pointed apices, forming tufts. Apothecia rare, without a thalline margin. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil and amongst mosses in very open habitats with a rather long snow-lie, common only in the Alps, the distribution, ecology and genetics of ssp. biuncialis, never reported from Italy but certainly present in the Italian Alps, are well worthy of further study.

- | | | |
|----|--|----|
| 41 | Without cups | 42 |
| 41 | With cups | 65 |
| 42 | With soredia or isidia | 43 |
| 42 | Without soredia or isidia | 53 |
| 43 | Ascomata red | 44 |
| 43 | Ascomata dark | 45 |
| 44 | Thallus KC+ yellow. Thallus yellowish grey. Primary squamules to 4 mm, crenulated-incised, often contorted, sorediate esp. below | |

Cladonia incrassata

Thallus fruticose, yellowish grey, K-, C-, KC+ yellow, P-. Podetia bacilliform, corticate only at base, simple, 2-10 mm, 0.2-0.5 cm tall, often deformed, more or less flattened, with a partly corticate partly sorediate surface. Primary squamules medium-sized (1-3mm), to 4 mm, crenulated-incised, often contorted, sorediate esp. below. Soredia diffuse, farinose. Apothecia frequent, without a thalline margin, stipitate. Surface red, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-

immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on peaty and humus-rich soil and on strongly weathered lignum.

- 44 Thallus KC-. Thallus greenish grey. Primary squamules elongated, divided, often orange below toward the base

Cladonia macilenta ssp. floerkeana

Thallus fruticose, greenish grey, K-, C-, KC-, P-. Podetia bacilliform, areolate, 1.5-3 cm tall, simple or sparingly branched above, often squamulose or granulose. Primary squamules medium-sized (1-3mm), elongated, divided, often orange below toward the base. Soredia diffuse, farinose. Apothecia frequent, without a thalline margin. Surface red. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on organic soil and peat, but also on sand, more rare on lignum, much rarer in Italy than the typical subspecies.

- 45 Thallus K+ orange

Cladonia parasitica

Thallus fruticose, grey, K+ orange, C-, P+ orange. Podetia granulose, densely squamulose, to 2 cm tall, irregular, deformed and very irregularly branched, often covered by isidioid granules and partly decorticate with scattered to numerous squamules, fissured with gaping holes. Primary squamules medium-sized (1-3mm), brownish, very finely divided, granulose-sorediose. Soredia diffuse, granular. Medulla UV -. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: normally lignicolous, on stumps, sometimes on basal parts of old trunks, optimum in Castanea plantations.

- 45 Not as above

46

- 46 Thallus K+ yellow changing to red

Cladonia acuminata

Thallus fruticose, grey, K+ yellow changing to red, C-, KC-, P+ yellow. Podetia bacilliform, corticate only at base, simple, areolate. Primary squamules medium-sized (1-3mm). Apothecia rare, without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on calciferous soil rich in humus in more or less open situations.

- 46 Thallus K-

47

- 47 Soredia granular

48

- 47 Soredia farinose

49

- 48 Thallus whitish grey. Squamules on podetia abundant. Axils of podetia closed

Cladonia decorticata

Thallus fruticose, whitish grey, K-, C-, KC-, P-. Podetia bacilliform, areolate, densely squamulose. Primary squamules medium-sized (1-3mm). Soredia diffuse, granular. Apothecia without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on mineral, more rarely on organic soil and rotting wood in open habitats, restricted to siliceous areas in the Alps.

- 48 Thallus pale grey. Squamules on podetia scarce to absent. Axils of podetia open

Cladonia glauca

Thallus fruticose, pale grey, K-, C-, KC-, P-. Podetia bacilliform, non- or scarcely squamulose, 1-5 cm tall, simple to sparingly branched above, with a single inconspicuous longitudinal fissure, often densely squamulose below. Primary squamules small, elongate and incised, greyish green above, white below. Soredia diffuse, granular, grey. Medulla UV + white. Apothecia without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on more or less acid soil in open habitats, all Italian records require reconfirmation.

- 49 Thallus KC+ yellow

Cladonia cyanipes

Thallus fruticose, greyish-green, K-, C-, KC+ yellow, P-. Podetia bacilliform, to 8 cm, non squamulose. Primary squamules medium-sized (1-3mm). Soredia diffuse, farinose, yellowish green. Medulla UV -. Apothecia frequent, without a thalline margin. Surface very pale brown, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. Podetia with short stalk and broad cups. - Note: amongst bryophytes and on organic soil, much more rarely on wood, in areas with siliceous substrata, in open heaths and forest glades, restricted to the Alps in Italy.

49 Thallus KC-

50

50 Podetia >4 cm tall

Cladonia cornuta

Thallus fruticose, brownish, K-, C-, KC-, P+ red. Podetia bacilliform, corticate only at base, non squamulose, 4-10 cm tall, eventually corticate below, sorediate above, with pointed apices, unbranched. Primary squamules rather small, rounded, scarcely incised. Soredia diffuse, farinose, brownish grey. Apothecia rare, without a thalline margin. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on mineral and organic soil, but also on wood, optimum in the subalpine belt in areas with siliceous substrata, probably restricted to the Alps in Italy.

50 Podetia <4 cm tall

51

51 Podetia phyllopodiate, i.e. arising from inflated primary squamules, pycnidia generally on the squamules

Cladonia pseudopityrea

Thallus fruticose, pale brownish grey, granulose, K-, C-, KC-, P+ red. Podetia densely squamulose, elongated, rarely with cups, densely squamulose. Edge dentate. Soredia diffuse, farinose. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. Podetia phyllopodiate, i.e. arising from inflated primary squamules, pycnidia generally on the squamules. With fumarprotocetraric acid. - Note: on lignum e.g. of Olea, Abies, Pinus, Fagus, but also on soil rich in humus in forests, esp. along creeks, a Mediterranean to Mediterranean-montane species, probably more widespread in the south.

51 Podetia not phyllopodiate, pycnidia mostly on the podetia

52

52 Podetia sorediate above, with a corticate and sometimes squamulose zone below

Cladonia coniocraea

Thallus fruticose, grey, K-, C-, KC-, P+ red. Podetia bacilliform, non proliferating, corticate only at base, non squamulose, 1-4 cm tall, unbranched, occasionally with very small cups, with a corticate and sometimes squamulose zone below. Soredia diffuse, farinose, grey. Medulla UV -. Apothecia without a thalline margin. Surface brown, convex. Ascospores hyaline, 8 per ascus. Photobiont chlorococcoid. Podetia not phyllopodiate, pycnidia mostly on the podetia. - Note: on a wide variety of organic substrata, incl. bark, and then mostly on basal parts of boles, but mostly on soil rich in humus and rotten wood.

52 Podetia squamulose-granular

Cladonia ramulosa

Thallus fruticose, greenish brown, K-, C-, KC-, P+ red. Podetia elongate, 1-3.5 cm tall, with pointed apices or irregular small cups, squamulose-granular to partly decorticate. Primary squamules small, elongated and indented, fragile. Soredia diffuse, farinose. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. With fumarprotocetraric acid. - Note: on epilithic bryophytes, rotting wood and organic soil.

53 Ascomata red

Cladonia bellidiflora

Thallus fruticose, yellowish green, K-, C-, KC+ yellow, P-. Podetia elongate, non proliferating, corticate only at base, simple, 3-5 cm tall, pointed at apices or with small cups, becoming granular or decorticate towards apices, densely squamulose. Primary squamules small, inconspicuous, deeply indented. Undersurface of squamules white,

yellowish brown towards the base. Medulla UV + white. Apothecia frequent, without a thalline margin, subterminal, substipitate. Surface red, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on acid soil and mossy rocks in rather wind-protected and humid situations (e.g. in sites with a long snow lie).

- 53 Ascomata dark 54
54 Thallus K+ red

Cladonia polycarpoides

Thallus fruticose, grey, K+ red, C-, KC-, P+ red. Podetia areolate. Primary squamules large, forming dense mats. Undersurface of squamules white. Apothecia rare, without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on more or less calcareous mineral soil in open grasslands and on soil pockets on large isolated boulders, probably somehow overlooked in Italy and more widespread in the Alps.

- 54 Not as above 55
55 Thallus K+ yellow 56
55 Thallus K- 60
56 Thallus C+ bright green

Cladonia strepsilis

Thallus fruticose, brownish-greenish grey, K+ yellow, C+ bright green, P+ yellow. Podetia bacilliform, areolate, very rare, with irregular cups or turgid-branched. Primary squamules very large (>10 mm), to 4 mm long, rounded or elongate, indented, forming cushions, upper surface broze-green, white below. Undersurface of squamules white. Medulla UV -. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Podetia rare. - Note: on humous soil overlaying siliceous rocks and amongst bryophytes in humid depressions periodically filled by water, in more or less open situations, restricted to the Alps in Italy.

- 56 Thallus C- 57
57 Thallus P+ orange

Cladonia squamosa v. subsquamosa

Thallus fruticose, grey, shrubby, K+ yellow, C-, P+ orange. Podetia ramified, areolate, densely squamulose, to 5 cm tall, irregularly branched, with pointed apices or with irregular small perforate cups, the surface scabrid, densely squamulose and partly decorticated. Primary squamules medium-sized (1-3mm), non sorediose. Medulla UV + white. Apothecia frequent, without a thalline margin, subterminal. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Podetia very variable in shape and size. - Note: on organic substrata in sheltered situations, rarely on bark, on basal parts of trunks, a very polymorphic taxon.

- 57 Not as above 58
58 Thallus P+ red

Cladonia turgida

Thallus fruticose, greyish-green, K+ yellow, C-, P+ red. Podetia elongate, to 10 cm. Primary squamules large, dark green, 2-5 mm broad. Undersurface of squamules white. Medulla UV -. Apothecia rare, without a thalline margin, subterminal. Surface brown, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Podetia very rare. - Note: on acid soil in open habitats, a mainly boreal species, rare in the Alps.

- 58 Thallus P- 59
59 Primary thallus squamulose. Ascospores ellipsoid

Cladonia cariosa

Thallus fruticose, grey, K+ yellow, C-, KC-, P-. Podetia areolate, 0.5-2 cm tall, sparingly branched above, partly decorticate-granulose, longitudinally fissured.

Primary squamules medium-sized (1-3mm), erect, entire or incised. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on disturbed mineral, often sandy soil over more or less calcareous or base-rich substrata, most frequent in the Alps.

59 Primary thallus crustose. Ascospores fusiform

Pycnothelia papillaria

Thallus fruticose, developing from a primarythallus of grey-white granules, pseudopodetia grey to pale brown, thin, continuous, K+ yellow, C-, KC-, P-. Podetia <0.5 mm wide, bacilliform, smooth, contiguous, ascending, non squamulose. Medulla UV + blue-white. Apothecia rare, without a thalline margin, subterminal. Surface brown, convex. Ascospores 1-2-celled, hyaline, fusiform, thin-walled, 8 per ascus, 9-15 x 2-3.5 μ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on clay soil, often in Calluna-heaths, most frequent in the pre-Alps, becoming much rarer southwards.

60 Thallus P+ yellow

Cladonia macrophylla

Thallus fruticose, grey, K-, C-, KC-, P+ yellow. Podetia elongate, areolate, 2-4 cm tall, simple or branched, with blunt apices and a fissured surface with numerous peltate squamules and black-grey decorticated areas at the base. Primary squamules large, round or elongate, incised. Apothecia without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on more or less organic soil and weathered siliceous rocks, most Italian records need re-confirmation.

60 Not as above

61

61 Thallus P-

62

61 Thallus P+ red

63

62 Apothecia and pycnidia very pale yellowish brown. Medulla UV -. Thallus greyish-green

Cladonia botrytes

Thallus fruticose, greyish-green, K-, C-, KC+ yellow, P-. Podetia areolate, non squamulose, to 5 mm tall, simple or sparingly branched toward apices, corticate to the base, becoming verrucose-areolate. Primary squamules medium-sized (1-3mm), scattered, erect and incised. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal. Surface pale yellowish brown, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on decaying wood, mostly on horizontal faces of stumps and fallen trunks, esp. of conifers, more rarely on decaying bark.

62 Apothecia and pycnidia medium to dark brown. Medulla UV + white. Thallus greyish

Cladonia squamosa v. squamosa

Thallus fruticose, greyish, shrubby, K-, C-, P-. Podetia ramified, areolate, densely squamulose, to 5 cm tall, irregularly branched, with pointed apices or with irregular small perforate cups, the surface scabrid, densely squamulose and partly decorticated. Primary squamules medium-sized (1-3mm), brown to grey, finely divided. Medulla UV + white. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on organic substrata in sheltered situations, rarely on bark, on basal parts of trunks, a very polymorphic taxon.

63 Podetia >4 cm tall

Cladonia macroceras

Thallus fruticose, brownish grey to dark brown, shiny, K-, C-, P+ red. Podetia elongate, areolate, non- or scarcely squamulose, very tall, stout, simple or scarcely ramified below, with pointed apices or with narrow regular cups, sparsely or non-squamulose. Primary squamules medium-sized (1-3mm). Undersurface of squamules white. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface

brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: one of the most abundant species in Rhododendron heaths throughout the Alps, mostly deeply immersed amongst mosses.

- 63 Podetia <4 cm tall 64
 64 Primary squamules medium-sized (1-3mm). Undersurface of squamules white. Primary squamules to 7 mm long, irregularly incised and ascending, often forming low cushions

Cladonia caespiticia

Thallus fruticose, greenish grey, K-, C-, P+ red. Podetia elongate, to 3 mm tall, decorticate. Primary squamules medium-sized (1-3mm), to 7 mm long, irregularly incised and ascending, often forming low cushions. Undersurface of squamules white. Medulla UV -. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on mineral, generally sandy-clay soil, occasionally on rotting wood and on bases of ancient trunks, in rather sheltered situations.

- 64 Primary squamules very large (>10 mm). Undersurface of squamules yellowish. Primary squamules 4-15 x 1-3 mm, forming compact mats, sometimes with black hairs at the margins

Cladonia foliacea

Thallus fruticose, greenish grey, K-, C-, KC-, P+ red. Podetia to 1.5 cm tall, very rare. Primary squamules very large (>10 mm), 4-15 x 1-3 mm, forming compact mats, sometimes with black hairs at the margins. Undersurface of squamules yellowish. Apothecia rare, without a thalline margin, subterminal. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: an ecological vicariant of *C. convoluta* on more or less acid, but often base-rich ground.

- 65 With soredia or isidia 66
 65 Without soredia or isidia 76
 66 Ascomata red 67
 66 Ascomata dark 69
 67 Thallus K+ yellow

Cladonia polydactyla

Thallus fruticose, greenish grey, K+ yellow, C-, KC-, P+ orange. Podetia trumpet-shaped, corticate only at base, 1-2(3) cm tall, pointed or with narrow, irregular cups, often proliferating from margins or dentate, squamulose esp. toward the base. Primary squamules medium-sized (1-3mm), elongated, divided, 2-8 x 1-3 mm. Soredia diffuse, farinose. Apothecia frequent, without a thalline margin. Surface red. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on organic soil and rotting wood in woodlands, more rarely on bark, on basal parts of old trunks, certainly widespread in the Alps, becoming much rarer southwards, where it is mostly confined to old Castanea plantations.

- 67 Thallus K- 68
 68 Podetia with broad cups and short stalks. Cups non perforated

Cladonia pleurota

Thallus fruticose, yellowish green, K-, C-, KC+ yellow, P-. Podetia trumpet-shaped, corticate only at base, 1-2(3) cm tall, with wide cups with short stalk, sometimes sparsely squamulose at the base. Soredia diffuse. Apothecia frequent, without a thalline margin. Surface red. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With zeorin - Note: on soil, rotting wood, more rarely on basal parts of trunks in open habitats.

- 68 Podetia slender, with long stalk and narrow cups. Cups perforated

Cladonia sulphurina

Thallus fruticose, yellowish green, K-, C-, KC+ yellow, P-. Podetia corticate only at

base. Primary squamules medium-sized (1-3mm). Soredia diffuse, farinose. Apothecia without a thalline margin. Surface red. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. Cups irregular, lacerated Thallus UV+ white or UV-. - Note: on organic substrata in cold-shaded situations, most common on rotting wood, e.g. on stumps and decaying fallen trunks, to be looked for throughout the Alps.

- 69 Soredia farinose 70
 69 Soredia granular 73
 70 Thallus KC+ yellow

Cladonia carneola

Thallus fruticose, greyish-green, K-, C-, KC+ yellow, P-. Podetia trumpet-shaped, non squamulose, 0.5-2 cm tall, with regular cups abruptly tapering to stalk, entirely farinose-sorediate. Primary squamules small and often inconspicuous. Soredia diffuse, farinose, greyish-green. Medulla UV -. Apothecia frequent, without a thalline margin. Surface very pale brown, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on rotting wood and soil rich in humus in open woodlands.

- 70 Thallus KC- 71
 71 Thallus P-

Cladonia cenotea

Thallus fruticose, grey to greenish brown, K-, C-, KC-, P-. Podetia elongate, proliferating from margin, corticate only at base, non- or scarcely squamulose, 1-3 cm tall, unbranched or sparingly branched above, with narrow irregular cups. Edge dentate. Primary squamules small, indented. Soredia diffuse, farinose, grey. Medulla UV + white. Apothecia without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on rotting wood, mainly on old stumps, and on soil more or less rich in humus.

- 71 Thallus P+ red 72
 72 Podetia <4 cm tall, trumpet-shaped. Primary squamules medium-sized (1-3mm)

Cladonia fimbriata

Thallus fruticose, greyish-green, K-, C-, KC-, P+ red. Podetia trumpet-shaped, corticate only at base, non squamulose, 0.5-2 cm tall, with small regular cups and a long stalk, goblet-shaped, sorediate throughout. Primary squamules medium-sized (1-3mm), elongated and incised. Soredia diffuse, farinose, greyish-green. Medulla UV -. Apothecia frequent, without a thalline margin. Surface brown, convex. Ascospores hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on rotten wood, soil, on bases of trunks, a rather ephemeral species with a wide ecological range.

- 72 Podetia >4 cm tall, not trumpet-shaped. Primary squamules very small (<1mm)

Cladonia subulata

Thallus fruticose, grey to brownish green, K-, C-, KC-, P+ red. Podetia elongate, proliferating from margin, corticate only at base, non squamulose, 1-6 cm tall, with pointed apices, often irregularly branched above and antler-like, rarely with irregular cups proliferating from margins. Edge dentate. Primary squamules very small (<1mm), inconspicuous, elongate and deeply incised. Soredia diffuse, farinose, grey. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on more or less mineral soil on track sides and in clearings of light forests and heaths, more rarely on rotting wood, in areas with siliceous substrata.

- 73 Thallus K+ orange

Cladonia merochlorophaea

Thallus fruticose, brownish-green, K+ orange, C+ red, KC+ red, P+ red. Podetia trumpet-shaped, areolate, non squamulose, 0.5-4 cm tall, with broad cups gradually tapered to a short stalk, regular or proliferating marginally, sometimes granular-sorediate above and in the cups. Primary squamules medium-sized (1-3mm), thin, greenish grey, ascending, never forming a subrosulate crust. Soredia diffuse, granular, greyish-green. Medulla UV -. Apothecia frequent, without a thalline margin, substipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per

ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With merochlorophaeic and fumarprotocetraric acids. - Note: on humus-rich soil, distribution, ecology and taxonomic position of this lichen require further study, the indicator values are very tentative, perhaps better treated as a chemical strain of *Cladonia grayi*.

- 73 Not as above 74
74 Thallus K+ red

Cladonia cryptochlorophaea

Thallus fruticose, brownish-green, K+ red, C+ red, KC+ red, P+ red. Podetia trumpet-shaped, areolate, non squamulose, 0.5-4 cm tall, with broad cups gradually tapered to a short stalk, regular or proliferating marginally, granular-sorediate above and in the cups. Primary squamules medium-sized (1-3mm), thin, greenish grey, ascending, never forming a subrosulate crust. Soredia diffuse, granular, greyish-green. Medulla UV -. Apothecia frequent, without a thalline margin, substipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With cryptochlorophaeic and fumarprotocetraric acids - Note: on soil rich in humus, on peat, etc., probably a western lichen in Europe, perhaps better treated as a chemical strain of *Cladonia grayi*.

- 74 Thallus K- 75
75 With fumarprotocetraric acid only. Thallus greyish-green

Cladonia chlorophaea

Thallus fruticose, greyish-green, K-, C-, KC-, P+ red. Podetia trumpet-shaped, areolate, non squamulose, 0.5-4 cm tall, with broad cups gradually tapered to a short stalk, regular or proliferating marginally, granular-sorediate above and in the cups. Primary squamules medium-sized (1-3mm). Soredia diffuse, granular, greyish-green. Medulla UV -. Apothecia frequent, without a thalline margin, substipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With fumarprotocetraric acid only. - Note: on soil rich in humus, on peat, etc., probably a western lichen in Europe, perhaps better treated as a chemical strain of *Cladonia grayi*.

- 75 With grayanic acid. Thallus brownish-green

Cladonia grayi

Thallus fruticose, brownish-green, K-, C-, KC-, P+ red. Podetia trumpet-shaped, areolate, non squamulose, 0.5-4 cm tall, with broad cups gradually tapered to a short stalk, regular or proliferating marginally, granular-sorediate above and in the cups. Primary squamules medium-sized (1-3mm). Soredia diffuse, granular, greyish-green. Medulla UV -. Apothecia frequent, without a thalline margin, substipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With grayanic acid. - Note: on soil rich in humus, peat and on rotting wood.

- 76 Ascomata red 77
76 Ascomata dark 80
77 Podetia >3 cm tall, densely squamulose

Cladonia bellidiflora

Thallus fruticose, grey-green to yellowish green, K-, C-, KC+ yellow, P-. Podetia non proliferating, 2-10 cm, densely squamulose, 3-5 cm tall, pointed at apices or with small cups, becoming granular or decorticate towards apices. Primary squamules medium-sized (1-3mm), small, inconspicuous, deeply intented, non sorediate. Undersurface white, yellowish brown towards the base. Medulla UV + white. Apothecia frequent, without a thalline margin, subterminal, substipitate. Surface red, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on acid soil and mossy rocks in rather wind-protected and humid situations (e.g. in sites with a long snow lie).

- 77 Podetia <3 cm tall 78
78 With barbatic acid

Cladonia borealis

Thallus fruticose, greenish, K-, C-, KC+ yellow, P-. Podetia trumpet-shaped, non proliferating, areolate, non- or scarcely squamulose, 1-2(3) cm tall, with wide cups with short stalk, corticate-areolate, sometimes sparsely squamulose at the base. Primary squamules medium-sized (1-3mm), variable in form, rounded or a little indented, lower surface often yellowish towards the base. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, substipitate. Surface red, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With barbatic acid. - Note: on mineral siliceous soil in open habitats, related to *C. coccifera*, and with a similar ecology, certainly more widespread in the Alps.

78 With zeorin

79

79 Squamules on podetia scarce to absent. Podetia 1-2(3) cm tall, with wide cups with short stalk, with conspicuous corticate, convex granules areolate, esp. within the cups, sometimes sparsely squamulose at the base

Cladonia coccifera

Thallus fruticose, greenish, K-, C-, KC+ yellow, P-. Podetia trumpet-shaped, non proliferating, areolate, non- or scarcely squamulose, 1-2(3) cm tall, with wide cups with short stalk, with conspicuous corticate, convex granules areolate, esp. within the cups, sometimes sparsely squamulose at the base. Primary squamules medium-sized (1-3mm), variable in form, rounded or a little indented, lower surface often yellowish towards the base. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, substipitate. Surface red, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With zeorin. - Note: on soil in open situations, such as in dry tundra-like habitats, more rarely on wood, with optimum in the subalpine belt.

79 Squamules on podetia abundant. Podetia to 2(3) cm tall, with broad cups gradually tapering to base, squamulose at the base, microsquamulose-granulose in upper part and inside the cups

Cladonia diversa

Thallus fruticose, greenish, K-, C-, KC+ yellow, P-. Podetia trumpet-shaped, non proliferating, areolate, densely squamulose, to 2(3) cm tall, with broad cups gradually tapering to base, squamulose at the base, microsquamulose-granulose in upper part and inside the cups. Primary squamules medium-sized (1-3mm). Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, substipitate. Surface red, convex. Asci bitunicate. Ascospores hyaline, ellipsoid, 8 per ascus. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. With zeorin. - Note: related to *C. coccifera* and *C. pleurota*, and with a similar ecology, but perhaps more bund to humid habitats, probably more widespread in the Alps.

80 Thallus K+ yellow

81

80 Thallus K-

84

81 Thallus P+ orange

Cladonia squamosa v. subsquamosa

Thallus fruticose, grey, K+ yellow, C-, P+ orange. Podetia ramified, areolate, densely squamulose, to 5 cm tall, irregularly branched, with pointed apices or with irregular small perforate cups, the surface scabrid, densely squamulose and partly decorticated. Primary squamules medium-sized (1-3mm). Medulla UV + white. Apothecia frequent, without a thalline margin, subterminal. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on organic substrata in sheltered situations, rarely on bark, on basal parts of trunks, a very polymorphic taxon.

81 Thallus P+ red

82

82 Podetia >4 cm tall

Cladonia ecmocyna

Thallus fruticose, grey, sometimes weakly pruinose, yellowish at the base, K+ yellow, C-, P+ red. Podetia elongate, areolate, squamulose, to more than 10 cm tall, pointed or with narrow cups, sparsely squamulose. Primary squamules medium-sized (1-3mm). Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia

dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on more or less organic soil and amongst bryophytes in cool depressions with a late snow lie, restricted to the Alps in Italy.

- 82 Podetia <4 cm tall 83
83 Undersurface of squamules white. Primary squamules greyish green with a bluish tinge, 5-10 mm broad, to 3 cm long. Podetia rare

Cladonia macrophyllodes

Thallus fruticose, greenish grey, K+ yellow, C-, P+ red. Podetia trumpet-shaped, proliferating from the center, continuous, rare. Primary squamules very large (>10 mm), greyish green with a bluish tinge, 5-10 mm broad, to 3 cm long. Undersurface of squamules white. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil in open sites with a long snow-lie, optimum in the siliceous Alps.

- 83 Undersurface of the squamules grey, with black spots at the base. Primary squamules to 2 cm long, ascending, contiguous, forming cushions, with indented margins. Podetia to 1.5 cm tall, with irregular cups, flared from the base

Cladonia subcervicornis

Thallus fruticose, greenish grey, K+ yellow, C-, P+ red. Podetia trumpet-shaped, proliferating from the center, continuous, to 1.5 cm tall, with irregular cups, flared from the base. Primary squamules very large (>10 mm), to 2 cm long, ascending, contiguous, forming cushions, with indented margins. Undersurface of the squamules grey, with black spots at the base. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on siliceous rocks and on soil rich in humus in open habitats, probably more widespread in Tyrrhenian Italy.

- 84 Thallus P-

Cladonia squamosa v. squamosa

Thallus fruticose, greyish, shrubby, K-, C-, P-. Podetia ramified, areolate, densely squamulose, to 5 cm tall, irregularly branched, with pointed apices or with irregular small perforate cups, the surface scabrid, densely squamulose and partly decorticated. Primary squamules medium-sized (1-3mm). Medulla UV + white. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on organic substrata in sheltered situations, rarely on bark, on basal parts of trunks, a very polymorphic taxon.

- 84 Thallus P+ red 85
85 Podetia <4 cm tall 86
85 Podetia >4 cm tall 87
86 Primary squamules very large (>10 mm), bluish grey below

Cladonia cervicornis ssp. cervicornis

Thallus fruticose, grey, K-, C-, P+ red. Podetia trumpet-shaped, proliferating from the center, continuous, to 1 cm tall, corticate, often sparingly squamulose. Primary squamules very large (>10 mm), to 1 cm long, the margins indented, contiguous, forming cushions, upper surface grey-green. Undersurface of the squamules bluish grey. Apothecia frequent, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on mineral siliceous soil in open grasslands and garrigues, most frequent in Tyrrhenian Italy.

- 86 Primary squamules medium-sized (1-3mm), white below

Cladonia pyxidata

Thallus fruticose, greyish-green, K-, C-, KC-, P+ red. Podetia trumpet-shaped, non proliferating, areolate, non squamulose, 0.5-3 cm tall, with broad cups and short stalks, gradually tapering toward base, regular or rarely proliferating from margin,

with contiguous to scattered corticate granules, esp. inside the cups. Cups 10. Primary squamules medium-sized (1-3mm), thin, greenish grey, ascending, never forming a subrosulate crust. Undersurface of squamules white. Medulla UV -. Apothecia frequent, without a thalline margin, substipitate. Surface brown, convex. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: a very polymorphic and almost trivial species in Italy, with an extremely wide ecological amplitude, whose taxonomy is still not clear to me, esp. with respect to *C. chlorophaea* and related taxa (e.g. *C. grayi*).

- 87 Thallus greenish grey, primary squamules grey below

Cladonia cervicornis* ssp. *verticillata

Thallus fruticose, greenish grey, K-, C-, P+ red. Podetia proliferating from the center, continuous, to 6 cm tall, frequent, corticate. Primary squamules not very abundant, to 10 mm long, with intented margins, upper surface grey-green. Undersurface of the squamules bluish grey. Apothecia frequent, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on acid soil in open habitats, more frequent in upland areas than the typical subspecies.

- 87 Thallus brownish grey to dark brown, primary squamules white below

88

- 88 Podetia thick (2-5 mm), very tall (to 12 cm)

Cladonia macroceras

Thallus fruticose, brownish grey to dark brown, matto ro somehow shiny, K-, C-, P+ red. Podetia elongate, areolate, non- or scarcely squamulose, very tall (to 12 cm), stout, simple or scarcely ramified below, with pointed apices or with narrow regular cups, sparsely or non-squamulose. Primary squamules medium-sized (1-3mm). Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: one of the most abundant species in Rhododendron heaths throughout the Alps, mostly deeply immersed amongst mosses.

- 88 Podetia 1-2 mm thick

89

- 89 Tips of podetia not tomentose. Squamules on podetia scarce to absent. Podetia to 6 cm tall, slender, unbranched or sparingly branched, pointed or with a small cup, smooth, corticate-areolate

Cladonia gracilis

Thallus fruticose, brownish grey to dark brown, K-, C-, P+ red. Podetia elongate, non proliferating, areolate, non- or scarcely squamulose, to 6 cm tall, slender, unbranched or sparingly branched, pointed or with a small cup, smooth, corticate-areolate. Primary squamules medium-sized (1-3mm). Upper cortex paraplectenchymatous. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on acid soil, more rarely on decaying wood, optimum in the siliceous Alps, very rare in the Apennines.

- 89 Tips of podetia faintly tomentose. Squamules on podetia abundant. Podetia t0 5 cm tall, with a subarachnoid surface, at the base with blackish decorticate areas, variously squamuloes, with irregular cups which often proliferate marginally

Cladonia phyllophora

Thallus fruticose, brownish grey to dark brown, K-, C-, P+ red. Podetia elongate, non proliferating, densely squamulose, t0 5 cm tall, with a subarachnoid surface, at the base with blackish decorticate areas, variously squamuloes, with irregular cups which often proliferate marginally. Primary squamules medium-sized (1-3mm), small, rounded, pale below. Medulla UV -. Apothecia rare, without a thalline margin, subterminal, substipitate. Surface brown, convex. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on acid mineral soil.

SUBKEY B - Foliose lichens

- | | | |
|---|--|---|
| 1 | Thallus dark, from black to dark brown | 2 |
| 1 | Thallus neither dark- nor very bright-coloured | 9 |
| 2 | With soredia or isidia | 3 |
| 2 | Without soredia or isidia | 5 |
| 3 | Thallus heteromerous | |

Nephroma parile

Thallus foliose, bluish grey to dark brown, K-, C-, KC-, P-. Lobes (2)3-6 mm wide, rounded, adpressed to the substratum, 3-8 mm wide. Edge crenulate. Soredia bluish-grey. Soralia marginal, prominent. Undersurface brown, smooth to wrinkled, naked or in part somehow pubescent. Medulla white, K-, P-. Apothecia rare, on the lower surface of thallus. Ascospores 4-celled, not hyaline, fusiform-elongate, 8 per ascus, 18-20 x 6-7 μ . Photobiont cyanobacterial. - Note: on bark, epiphytic mosses, basic siliceous rocks and soil in humid and sheltered situations.

- | | | |
|---|--|---|
| 3 | Thallus homeomerous | 4 |
| 4 | Lobes width > 3 mm. Isidia spatulate. Thallus thin | |

Collema crispum

Thallus foliose, homeomerous, olive green-brown to black, smooth or isidiate, thin. Lobes (2)3-6 mm wide, rounded, concave, contiguous, ascending, 1-6 mm wide, ear-like, ascending and crowded, forming colonies to 6 cm diam. Edge up-turned. Isidia spatulate, diffuse, simple. Undersurface dark, often with white rhizines. Apothecia rare, lecanorine, sessile, up to 2 mm diam. Surface brown to black. Margin distinct, thin, verruculose. Ascospores 4-7-celled, sometimes submuriform, hyaline, oblong-obtuse, 8 per ascus, 26-34 x 13-15 μ . Photobiont cyanobacterial. Excipulum euthyplectenchimatous. - Note: both on calcareous rocks and soil, often in rather disturbed habitats such as walls in small conurbations, most common in C and S Italy.

- | | | |
|---|---|--|
| 4 | Lobes width < 3 mm. Isidia granulose. Thallus thick | |
|---|---|--|

Collema tenax

Thallus foliose, homeomerous, dark olive-green to brownish black, thick. Lobes 1-2(3) mm wide, elongate, smooth, adpressed to the substratum, very variable in shape, from radiating to subterete and ascending, flattened or concave. Isidia granulose. Apothecia frequent, lecanorine, sessile, up to 3 mm diam. Surface brown to black. Margin distinct, thick, smooth. Ascospores many-celled, hyaline, ellipsoid, 8 per ascus, 15-20 x 6.5 μ . Photobiont cyanobacterial. Excipulum euthyplectenchimatous. Forms with 4-celled, smaller spores and isidia belong to var. *diffRACTOAREOLATUM* (Schaer.) Degel. Note: on more or less calciferous or base-rich soil (e.g. in dry grasslands), on consolidating sand and terricolous bryophytes, more rarely directly on rock, often in disturbed habitats such as track sides, also found in large urban settlements (e.g. in the very center of Rome), certainly the most common species of the genus in Italy.

- | | | |
|---|---------------------|--|
| 5 | Ascospores 4-celled | |
|---|---------------------|--|

Collema tenax

Thallus foliose, homeomerous, dark olive-green to brownish black, thick. Lobes 1-2(3) mm wide, elongate, smooth, adpressed to the substratum, very variable in shape, from radiating to subterete and ascending, flattened or concave. Apothecia frequent, lecanorine, sessile, up to 3 mm diam. Surface brown to black. Margin distinct, thick, smooth. Ascospores many-celled, hyaline, ellipsoid, 8 per ascus, 17-26(30) x 6.5-8.5 μ . Photobiont cyanobacterial. Excipulum euthyplectenchimatous. - Note: on more or less calciferous or base-rich soil (e.g. in dry grasslands), on consolidating sand and

terricolous bryophytes, more rarely directly on rock, often in disturbed habitats such as track sides, also found in large urban settlements (e.g. in the very center of Rome), certainly the most common species of the genus in Italy.

- 5 Ascospores more than 4-celled 6
6 Ascospores not hyaline

Collema bachmanianum

Thallus foliose, homeomerous, black, thick. Lobes elongate. Apothecia frequent, lecanorine, sessile, up to 3 mm diam. Surface brown to black. Margin distinct, thick, crenulate. Ascospores many-celled, not hyaline, ellipsoid, submuriform, 8 per ascus, 26-32 x 8.5-15 μ. Photobiont cyanobacterial. Excipulum euthyplectenchymatous. - Note: on more or less calciferous soil, a northern species, restricted to the Alps in Italy.

- 6 Ascospores hyaline 7
7 Ascospores per ascus 8

Collema tenax

Thallus foliose, homeomerous, dark olive green to brownish black, thick. Lobes 1-2(3) mm wide, elongate, convex, adpressed to the substratum, very variable in shape, from radiating to subterete and ascending, flattened or concave. Apothecia frequent, lecanorine, sessile, up to 3 mm diam. Surface brown to black. Margin distinct, thick, smooth. Ascospores many-celled, hyaline, ellipsoid, submuriform, 8 per ascus, 17-26(30) x 8.5-10.5(13) μ. Photobiont cyanobacterial. Excipulum euthyplectenchymatous. - Note: on more or less calciferous or base-rich soil (e.g. in dry grasslands), on consolidating sand and terricolous bryophytes, more rarely directly on rock, often in disturbed habitats such as track sides, also found in large urban settlements (e.g. in the very center of Rome), certainly the most common species of the genus in Italy.

- 7 Ascospores per ascus 4 8
8 Thallus thick. Lobes convex, ascending

Collema ceranicum

Thallus foliose, homeomerous, black, thick, lobulate. Lobes 1-2(3) mm wide, convex, smooth, contiguous, ascending, subterete. Edge lobed. Undersurface black. Apothecia frequent, lecanorine, sessile, up to 1 mm diam. Surface brown to black. Margin distinct. Ascospores many-celled, hyaline, ovoid, submuriform, 4 per ascus, 20-36 x 13-22 μ. Photobiont cyanobacterial. Excipulum euthyplectenchymatous. Young spores sometimes subcubical. - Note: over frost-disturbed ground on weakly calcareous substrata, a northern species, to be looked for throughout the Alps.

- 8 Thallus thin. Lobes plane, adpressed to the substratum

Collema limosum

Thallus foliose, homeomerous, black, thin, continuous. Lobes flattened, contiguous, adpressed to the substratum. Apothecia frequent, lecanorine, sessile, up to 3 mm diam. Surface brown to black. Margin distinct, thick, verruculose. Ascospores many-celled, hyaline, ellipsoid, submuriform, 4 per ascus, 26-34 x 10-15 μ. Photobiont cyanobacterial. Excipulum euthyplectenchymatous. - Note: a short-lived species of mineral, clay soil in disturbed habitats, certainly overlooked, but never common in Italy.

- 9 Photobiont chlorococcoid 10
9 Photobiont cyanobacterial 26
10 With soredia or isidia 11
10 Without soredia or isidia 12
11 With isidia

Parmelia saxatilis

Thallus foliose, grey, K+ yellow, C-. Lobes (2)3-6 mm wide, elongate, adpressed to the substratum, truncated. Edge angular. Pseudocyphellae linear, on upper surface. Isidia cylindrical, diffuse. Undersurface black. Rhizines dark, simple, abundant at margin. Medulla K+ yellow changing to red, C-, KC+ orange, P+ orange. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid.

11 With soredia

Parmelia sulcata

Thallus foliose, grey, K+ yellow, C-. Lobes (2)3-6 mm wide, elongate, flattened, adpressed to the substratum, truncated. Edge angular. Pseudocyphellae linear, on upper surface. Soredia grey. Soralia linear, laminar. Rhizines dark, simple, abundant at margin. Medulla K+ yellow changing to red, C-, KC+ orange, P+ orange. Medulla UV -. Apothecia rare, lecanorine, sessile, strongly constricted. Surface brown. Margin distinct, grey. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 11-15 x 6-8 μ . Photobiont chlorococcoid. - Note: certainly the most common and wide-ranging *Parmelia* in Italy, also present near large urban settlements in the north, rare only in the eu-Mediterranean belt.

12 Pseudocyphellae present

Parmelia omphalodes

Thallus foliose, grey to brownish in exposed situations, loosely attached, K+ yellow, C-. Lobes (2)3-6 mm wide, elongate, flattened, adpressed to the substratum, truncated. Edge angular. Pseudocyphellae linear, on upper surface. Undersurface black. Rhizines dark, simple, abundant at margin. Medulla K+ yellow changing to red, C-, KC+ orange, P+ orange. Photobiont chlorococcoid. - Note: on rocks, epilithic bryophytes, more rarely on soil, less common in the mountains of the south, and rarer in the Apennines for the scarcity of suitable substrata, the record from Umbria by Panfili (2000) is dubious.

12 Pseudocyphellae absent

13

13 Undersurface orange

Solorina crocea

Thallus foliose, brownish when dry, olive-green when wet, sometimes densely white-reticulated, with cephalodia, K-, C-, KC-, P-. Lobes (2)3-6 mm wide, rounded, concave, smooth, adpressed to the substratum. Undersurface orange, with brown veins, tomentose. Veins on undersurface flat, dark. Medulla orange, K+ red, C-, KC-, P-. Apothecia frequent, without a thalline margin, semi-immersed, up to 7 mm diam. Surface brown to black. Paraphyses not anastomosing, simple, not apically thickened, adglutinated. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, 8 per ascus, 35-45 x 10-12 μ . Photobiont chlorococcoid. The cephalodia are internal, immersed in the thallus. - Note: on mineral soil in sites with a long snow-lie, perhaps restricted to the Alps in Italy.

13 Undersurface pale

14

14 Marginal cilia present

Anaptychia ciliaris

Thallus foliose, grey to grey-brown, bifacial, shrubby, loosely attached, with thin transparent hairs, K-, C-, P-. Lobes (2)3-6 mm wide, linear, ascending. Edge entire, with marginal cilia. Undersurface pale brownish to white, channelled. Lower cortex absent. Apothecia frequent, lecanorine, substipitate, strongly constricted, up to 5 mm diam. Surface black, often faintly pruinose. Margin distinct, verrucose, grey to grey brown, smooth or crenulate. Ascospores 2-celled, not hyaline, ellipsoid, constricted at septa, thin-walled, ornamented, 8 per ascus, 40-45 x 18-24 μ . Pycnidia semi-immersed. Conidia bacilliform. Photobiont chlorococcoid.

14 Marginal cilia absent

15

15 Apothecia laminal, semi-immersed in the upper surface

16

15 Apothecia absent, or if present not semi-immersed in the thallus

19

16 Ascospores per ascus 4

Solorina saccata

Thallus foliose, pale greyish-green, tinged brown when dry, bright green when wet, very well developed, K-, C-, KC-, P-. Lobes (2)3-6 mm wide, rounded, adpressed to the substratum, sometimes densely white-pruinose. Undersurface white, densely tomentose, indistinctly veined, tomentose. Veins on undersurface flat, dark. Medulla white, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, semi-immersed. Surface brown to black, concave. Paraphyses not anastomosing, simple, not apically thickened, adglutinated. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, ornamented, 4 per ascus, 30-60 x 18-28 μ . Photobiont chlorococcoid. - Note: on soil

rich in humus and terricolous mosses, often found in cracks of the rock, common only in the Alps, becoming rarer southwards through the Apennines.

- 16 Not as above 17
17 Ascospores per ascus 8

Solorina octospora

Thallus foliose, pale greyish-green, tinged brown when dry, bright green when wet, very well developed, K-, C-, KC-, P-. Lobes (2)3-6 mm wide, rounded, flattened, contiguous, adpressed to the substratum. Undersurface white, tomentose. Veins on undersurface flat, dark. Medulla white, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, semi-immersed, up to 7 mm diam. Surface brown to black, concave. Paraphyses not anastomosing, simple, not apically thickened, adglutinated. Ascospores 2-celled, not hyaline, ellipsoid, 8 per ascus, 35-40 x 18-21 μ . Photobiont chlorococcoid. - Note: on soil rich in humus and terricolous mosses, often found in cracks of the rock.

- 17 Ascospores per ascus 2 18
18 Internal pseudo-cephalodia well-developed. Thallus pale grey to brown grey, often white-pruinose. Ascospores 60-100 x 27-60 μ

Solorina bispora ssp. bispora

Thallus foliose, pale grey to brown grey, often white-pruinose, K-, C-, KC-, P-. Lobes 0.5-1 mm wide, rounded, flattened, smooth, adpressed to the substratum, poorly developed, of irregular lobes with a single urceolate apothecium at the center of each lobe. Undersurface white, tomentose. Medulla white, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, semi-immersed, up to 5 mm diam. Surface brown to black, concave. Paraphyses not anastomosing, simple, not apically thickened, adglutinated. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, 2 per ascus, 60-100 x 27-60 μ . Photobiont chlorococcoid. Internal pseudo-cephalodia well-developed. - Note: on humid soil rich in humus in situations with a long snow-lie, common throughout the Alps, but occurring also, although more rarely, in the Apennines, several records could refer to *S. bispora* ssp. *macrospora*.

- 18 Internal pseudo-cephalodia scarce. Thallus pale grey to brown-grey, often white-pruinose. Ascospores 95-140 x 45-60 μ

Solorina bispora ssp. macrospora

Thallus foliose, pale grey to brown-grey, often white-pruinose, K-, C-, KC-, P-. Lobes 0.5-1 mm wide, rounded, flattened, adpressed to the substratum, poorly developed, of irregular lobes with a single urceolate apothecium at the center of each lobe. Undersurface white, tomentose. Medulla white, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, semi-immersed, up to 5 mm diam. Surface brown to black, concave. Paraphyses not anastomosing, simple, not apically thickened, adglutinated. Ascospores 2-celled, not hyaline, ellipsoid, 2 per ascus, 95-140 x 45-60 μ . Photobiont chlorococcoid. Internal pseudo-cephalodia scarce. - Note: distinguished by the larger spores, probably more widespread in the Alps.

- 19 Lobes < 3 mm wide 20
19 Lobes > 3 mm wide 22
20 Thallus pruinose

Physconia muscigena

Thallus foliose, grey to brownish grey, often densely white-pruinose, loosely attached, K-, C-, KC-, P-. Lobes 1-2(3) mm wide, elongate, flattened, imbricate. Edge entire. Undersurface whitish. Rhizines pale, squarrose. Upper cortex paraplectenchymatous. Medulla white, K-. Apothecia rare, lecanorine. Ascospores 2-celled, not hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on mosses and plant debris in open situations, such as in grasslands and on mosses growing on isolated calcareous boulders, from the subalpine and alpine belts of the Alps, throughout the Apennines.

- 20 Thallus non-pruinose 21
21 Substrata acid. Lobes <0.5 mm wide. Rhizines brown to black, spread through the whole lower surface

Anaptychia bryorum

Thallus foliose, brownish, bifacial, loosely attached, K-, C-, KC-, P-. Lobes <0.5 mm

wide, linear, flattened, smooth, ascending. Undersurface pale brown. Upper cortex paraplectenchymatous. Apothecia rare, lecanorine. Ascospores 2-celled, not hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. Rhizines brown to black, spread through the whole lower surface. - Note: amongst mosses and muribund plants on base-rich substrata, probably more widespread in the Alps.

- 21 Substrata subneutral to calcareous. Lobes 0.5-1 mm wide. Rhizines from white to blackish, mostly marginal

Phaeophyscia constipata

Thallus foliose, brownish, becoming distinctly greenish when wet, thin, loosely attached, K-, C-, KC-, P-. Lobes 0.5-1 mm wide, linear, flattened, ascending. Undersurface whitish, pale brown in the center. Rhizines from white to blackish, mostly marginal. Apothecia rare, lecanorine, sessile. Surface plane. Margin distinct. Ascospores 2-celled, not hyaline, ellipsoid, 8 per ascus, 17-23 x 7-11 μ. Photobiont chlorococcoid. - Note: on mosses and plant debris, sometimes on soil, in Italy probably restricted to the Alps, in dry-warm situations.

- 22 Veins on undersurface absent 23
 22 Veins on undersurface present 24
 23 Undersurface tomentose. Medulla P-. Thallus not yellowish green

Lobaria linita

Thallus foliose, pale green-brown to grey, shiny, thick, reticulately ridged, loosely attached, K-, C-, KC-. Lobes very broad, angular, flattened, truncated. Undersurface tomentose. Medulla K+ yellow, C-, P-. Apothecia rare. Pycnidia immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on bryophytes and soil rich in humus in the subalpine belt of the Alps.

- 23 Undersurface non tomentose. Medulla P+ orange. Thallus yellowish green (like *Parmelia caperata*)

Parmelia somloensis

Thallus foliose, yellowish green, smooth, loosely attached. Lobes (2)3-6 mm wide, elongate, flattened, adpressed to the substratum. Undersurface brownish. Rhizines simple, abundant at margin. Medulla K+ yellow, C-, KC+ orange, P+ orange, UV -. Apothecia rare, lecanorine, sessile, strongly constricted. Surface brown, plane. Margin distinct. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 6-10 x 4-5 μ. Photobiont chlorococcoid. - Note: on weathered siliceous rocks and mineral soil in open, dry situations, a variable species, which needs further study, although several Italian records require confirmation, this species is certainly widespread throughout the country.

- 24 Apothecia common, disc flattened-horizontal, lobes fan-shaped, small, attached by a single stout rhizine

Peltigera venosa

Thallus foliose, grey to greenish-grey, green when wet, smooth, loosely attached, with cephalodia, K-, C-, KC-, P-. Lobes fan-shaped, flattened, smooth, adpressed to the substratum. Edge entire. Undersurface pale, with a very evident network of dark veins, attached by a single stout dark rhizine. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface dark brown to black, plane. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (29)35-43 x 4-8 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont chlorococcoid. Cephalodia on the underside, along the veins, - Note: on soil rich in humus in cold-humid sites, more frequent in the Alps, becoming very rare southwards.

- 24 Apothecia rare, saddle-shaped, lobes elongated, very broad with numerous rhizines 25
 25 Apothecial cortex continuous to warted. Upper surface without hairs. Veins broad and flat, not very distinct

Peltigera apthosa

Thallus foliose, grey to greenish-grey, green when wet, smooth, loosely attached, with cephalodia, K-, C-, KC-, P-. Lobes very broad, elongate, concave, smooth, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Undersurface whitish at the margin, dark in the center. Veins on undersurface flat,

dark, broad, not very evident. Rhizines dark. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia rare, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, Ascospores (47)53-67(75) x 4-5 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont chlorococcoid. - Note: on terricolous mosses and soil rich in humus. An acidophytic ecological vicariant of *P. leucophlebia*, common in the Alps, much rarer in the Apennines.

- 25 Apothecial cortex disrupted into green patches. Upper surface with thin erect transparent hairs (use lens!). Veins narrow, reticulate, well-evident

Peltigera leucophlebia

Thallus foliose, grey to greenish-grey, green when wet, smooth, loosely attached, with cephalodia, with thin transparent hairs, K-, C-, KC-, P-. Lobes very broad, elongate, concave, smooth, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, undulate. Undersurface whitish at the margin, dark in the center. Veins on undersurface flat, dark, narrow, reticulate, very evident. Rhizines dark. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia rare, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, 50-70 x 4-6 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont chlorococcoid. - Note: this is the basiphytic vicariant of *P. aphthosa*, most common in the beech belt, but with a rather wide altitudinal range, to be looked for throughout the Apennines.

- 26 With soredia or isidia 27
 26 Without soredia or isidia 29
 27 With soredia

Peltigera didactyla

Thallus foliose, grey to brownish, with thin transparent hairs, K-, C-, KC-, P-. Lobes 6-10 mm wide, rounded, concave, smooth, dispersed, non imbricate, with rounded ends. Edge up-turned, entire. Soredia grey. Soralia maculiform, rounded, laminar, plane. Undersurface whitish. Veins on undersurface flat, pale. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia rare, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Ascospores 4-celled, hyaline, acicular, 8 per ascus, (36)45-65(80) x 3-5 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: an ephemeral lichen of disturbed mineral soil, most common in the Alps, becoming much rarer, and restricted to upland areas in the south.

- 27 With isidia 28
 28 Isidia peltate, diffuse. Lobes 6-10 mm wide

Peltigera lepidophora

Thallus foliose, grey brown to brown, often with a yellowish hue, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes 6-10 mm wide, elongate, flattened, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Isidia peltate, diffuse, simple. Undersurface whitish. Veins on undersurface flat, dark. Rhizines dark, simple. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia rare, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Ascospores 4-celled, hyaline, acicular, 8 per ascus, 49-59 x 5 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: a rather pioneer species of base-rich mineral soil in upland areas.

- 28 Isidia spatulate, clustered. Lobes >10 mm wide

Peltigera praetextata

Thallus foliose, brownish, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes very broad, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Isidia spatulate, clustered, simple, marginal and along cracks of the upper cortex. Undersurface whitish. Veins on undersurface raised, pale. Rhizines pale, simple. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (29)38-58(65) x 2.6-5.2 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial.- Note: an ecologically wide-ranging species, found both in open woodlands and in grasslands (but only in rather humid

areas), on mosses, mineral or organic soil.

- 29 Veins on undersurface absent 30
29 Veins on undersurface present 31
30 Upper surface without hairs. Thallus shiny. Ascomatal disk plane

Peltigera elisabethae

Thallus foliose, grey-brown, shiny, smooth, loosely attached, K-, C-, KC-, P-. Lobes very broad, elongate, contiguous, adpressed to the substratum, non imbricate, with rounded ends. Upper surface often cracked. Edge up-turned, phyllidiate. Undersurface blackish brown with rounded white spots. Rhizines dark, squarrose. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia rare, without a thalline margin. Surface brown, plane. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (24)27-34(44) x 3-7 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: on terricolous bryophytes and soil rich in humus in sheltered situations.

- 30 Upper surface with thin transparent hairs (use lens!). Thallus matt. Ascomatal disk convex

Peltigera malacea

Thallus foliose, bluish to greenish grey, dark green when wet, smooth, loosely attached, with thin transparent hairs, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, concave, smooth, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Undersurface pale at the margin, dark in the center. Rhizines dark, squarrose, sparse at margin. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia rare, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (47)53-67(75) x 4-5 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: in oligotrophic grasslands and shrublands near and above treeline, often found amongst mosses, probably restricted to the Alps.

- 31 Upper surface with thin transparent hairs (use lens!)

Peltigera kristinssonii

Thallus foliose, grey brown to brown, often with a yellowish hue, smooth, loosely attached, with thin transparent hairs, C-, KC-, P- Upper surface with sparse erect tomentum, brown, glossy towards centre. Lobes elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Undersurface whitish. Veins on undersurface flat, in the centre brown to black, tomentose, interstices rounded. Rhizines pale, squarrose. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (40)44-59(73) x 3-4(5.2) μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: a slightly calciphilous species, probably more widespread, both in the Alps and the Apennines.

- 31 Upper surface without hairs 32
32 Thallus wrinkled

Peltigera scabrosa

Thallus foliose, grey, dark green when wet, wrinkled, loosely attached, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, contiguous, adpressed to the substratum, with rounded ends. Edge entire. Undersurface whitish, dark in the center. Veins on undersurface raised, dark. Rhizines dark, irregular. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (52)75-90(95) x 3-5 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: on mossy soil and rocks, there is only an old record from Italy of this mainly Arctic species, which needs re-confirmation, however, this lichen is already known from a few non-Italian localities in the Alps, and from the Carpathians.

- 32 Thallus smooth 33
33 Thallus tomentose 34

- 33 Thallus non tomentose 38
 34 Lobes 6-10 mm wide 35
 34 Lobes >10 mm wide 36
 35 Rhizinae simple. Rhizines and raised veins long remaining pale. Thallus brownish

Peltigera ponojensis

Thallus foliose, brownish, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes 6-10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Undersurface whitish. Veins on undersurface raised, pale. Rhizines pale, simple. Rhizines and raised veins long remaining pale. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (29)38-58(65) x 2.6-5.2 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: often confused with *P. rufescens* in the past, this lichen is probably more widespread, also along the Apennines.

- 35 Rhizinae squarrose. Upper surface with thick grey, adpressed tomentum, veins narrow, interstices angular, rhizines confluent. Thallus brownish, often grey-whitish tomentose

Peltigera rufescens

Thallus foliose, brownish, often grey-whitish tomentose, smooth, loosely attached, K-, C-, KC-, P-. Lobes 6-10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Undersurface whitish. Veins on undersurface raised, pale, narrow, interstices angular. Rhizines pale, squarrose, confluent. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (29)38-58(65) x 2.6-5.2 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: most common in dry grasslands, esp. in upland areas, but also in the Mediterranean belt, where it is generally rare due to intensive grazing and trampling, one of the most common species of the genus throughout Italy.

- 36 Rhizinae simple

Peltigera praetextata

Thallus foliose, brownish, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes very broad, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Isidia simple, marginal and along cracks of the upper cortex. Undersurface whitish. Veins on undersurface raised, pale. Rhizines simple, in central part distant, soon darkened, veins becoming flattened and brownish towards the centre. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (29)38-58(65) x 2.6-5.2 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. Note: an ecologically wide-ranging species, found both in open woodlands and in grasslands (but only in rather humid areas), on mosses, mineral or organic soil.

- 36 Rhizinae squarrose 37
 37 Rhizines confluent, veins soon darkened towards center or smooth. Thallus grey to brownish grey. Ascomata dark brown to black

Peltigera canina

Thallus foliose, grey to brownish grey, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge down-turned, entire. Undersurface whitish, veins and rhizines dark towards the centre. Veins on undersurface raised, pale, but soon darkened towards center. Rhizines pale, squarrose, confluent. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface dark brown to black, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, Ascospores (36) 42-53(65) x 2.6-5.2 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: on terricolous mosses and soil in open forests, sometimes on bark on basal parts of old trees, certainly rarer than *P. praetextata*, with

which it was often confused in the past. N Amer,

- 37 Rhizines separate, veins conspicuously erect-tomentose also in thallus center. Thallus grey to to brownish grey, glabrescent and shiny towards centre. Ascomata brown to reddish brown

Peltigera membranacea

Thallus foliose, grey to to brownish grey, glabrescent and shiny towards centre, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes broad, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge down-turned, entire. Undersurface whitish. Veins on undersurface raised, conspicuously erect-tomentose also in thallus center. Rhizines squarrose, separate, slender, with densely squarrose but short ramifications. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown to reddish brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (40)49-64(80) x 2.5-5 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: on mossy rocks, at the base of boles in woodlands, on more or less base-rich substrata.

- 38 Veins on undersurface raised 39
38 Veins on undersurface flat 40
39 Rhizinae pale. Veins pale. Thallus bluish grey

Peltigera degenii

Thallus foliose, bluish grey, shiny, smooth, loosely attached, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge undulate. Undersurface whitish, pale brown in the center. Veins on undersurface raised, pale. Rhizines pale, simple. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface pale brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (40)45-60(68) x 2.5-5 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: on terricolous bryophytes, soil rich in humus and mossy rocks, sometimes on bark on basal parts of of trunks.

- 39 Rhizinae dark. Veins dark. Thallus bluish- to brownish grey

Peltigera neckeri

Thallus foliose, bluish- to brownish grey, smooth, loosely attached, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, undulate. Undersurface pale at the margin, darker in the center. Veins on undersurface > 2 mm broad, raised, dark, reticulate. Rhizines dark, separate. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface dark brown to black, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (31)49-61 x 3.9-5.2 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: in humid areas on soil, otherwise on terricolous, epiphytic and silicicolous mosses, most frequent in humid-warm beech forests.

- 40 Veins <1.5 mm broad 41
40 Veins >2 mm broad 42
41 Ascomatal disk plane. Rhizines fasciculate, separate, arranged in concentric lines. Undersurface pale, darker in the center

Peltigera horizontalis

Thallus foliose, bluish- to brownish grey, shiny, smooth, loosely attached, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge undulate. Undersurface pale, darker in the center. Veins on undersurface flat, dark. Rhizines dark, squarrose, fasciculate, separate, arranged in concentric lines. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, plane. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (25)33-41(47) x 3-7 μ . Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: on mosses (also epiphytic and epilithic) and humous soil in openings of humid broadleaved forests.

- 41 Ascomatal disk convex. Rhizines becoming confluent, not arranged in concentric lines. Undersurface brownish at the margin, darker in the center

Peltigera polydactyla

Thallus foliose, bluish- to brownish grey, shiny, smooth, loosely attached, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge dilacerate. Undersurface brownish at the margin, darker in the center. Veins on undersurface flat, dark. Rhizines squarrose, becoming confluent, not arranged in concentric lines. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (40)51-66(73) x 2.6-5.2 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: predominantly a forest floor species, occurring in more or less boreal forests amongst and over mosses, more rarely on rock or on bark, on basal parts of old trees.

- 42 Thallus matt. Rhizinae pale, mostly < 5 mm long. Veins pale

Peltigera hymenina

Thallus foliose, grey to brownish, often somehow maculate, smooth, loosely attached, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, undulate. Undersurface pale, with ochraceous veins. Veins on undersurface flat, pale. Rhizines pale, simple, mostly <5 mm long. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, (47)57-71(90) x 3-5 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: on mineral soil in rather open, but never fully sun-exposed habitats, often associated with mosses.

- 42 Thallus shiny. Rhizinae dark, mostly >5 mm long. Veins dark

Peltigera neopolydactyla

Thallus foliose, bluish- to brownish grey, shiny, smooth, loosely attached, K-, C-, KC-, P-. Lobes broad, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, undulate. Undersurface pale at the margin, darker in the center. Veins on undersurface flat, dark. Rhizines dark, simple, mostly >5 mm long. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin. Surface pale to dark brown, convex. Paraphyses simple, distinctly thickened above. Asci clavate. Ascospores 4-celled, hyaline, acicular, thin-walled, 8 per ascus, 50-90(100) x 3-5 μ. Pycnidia dark, immersed. Conidia fusiform. Photobiont cyanobacterial. - Note: predominantly a forest floor species, occurring in more or less boreal forests amongst and over mosses, more rarely on rock or on bark, on basal parts of old trees.

SUBKEY C- Squamulose lichens

- | | | |
|---|--|----|
| 1 | Thallus dark, from black to dark brown | 2 |
| 1 | Thallus neither dark- nor very bright-coloured | 13 |
| 2 | Photobiont chlorococcoid | 3 |
| 2 | Photobiont cyanobacterial | 8 |
| 3 | Pseudocyphellae present | |

Toninia physaroides

Thallus squamulose, greyish green to greyish brown, pruinose or not, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, cylindrical, contiguous, ascending, terete. Pseudocyphellae punctiform. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, plane, smooth. Margin distinct, smooth, concolorous with disk. Epihymenium grey, K+ violet, C-, P-, N+ violet, KC-. Subhymenium pale brown to colourless. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, fusiform, 8 per ascus, 11.5-18.5 x 3.5-5 μ. Pycnidia dark, immersed. Conidia filiform. Photobiont

chlorococcoid. - Note: most common on soil developing from calciferous sandstone, often found amongst mosses and associated to cyanobacterial lichens when young, rare in limestone areas.

- 3 Pseudocyphellae absent 4
4 Ascospores 1-celled

Toninia tristis ssp. pseudotabacina

Thallus squamulose, chestnut brown to dark brown, shiny, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, bullate, convex, contiguous, with rounded ends. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 2 mm diam. Surface black, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium bright green, K-, C-, P-, N+ violet, KC-. Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, ellipsoid, 8 per ascus, 10-15.5 x 4.5-6.5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on soil, sometimes it reaches the oromediterranean belt.

- 4 Not as above 5
5 Ascospores 2-celled 6
5 Ascospores 4-celled 7
6 Thallus without punctiform depressions. Ascospores ellipsoid-cylindrical. Thallus medium to dark olivaceous brown with grey rim

Toninia cinereovirens

Thallus squamulose, medium to dark olivaceous brown with grey rim, K-, C-, KC-, P-. Squamules contiguous, imbricate. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, rarely faintly pruinose, plane, smooth. Margin distinct, smooth, black, concolorous with disk. Epithymenium olivaceous brown to bright green, K-, C-, P-, N+ violet, KC-. Subhymenium pale brown to colourless. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores 2-4-celled, hyaline, ellipsoid-cylindrical, 8 per ascus, 13.5-30.5 x 3-4.5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on calciferous and basic siliceous rocks with some seepage of water after rain, on steeply inclined, somehow wheathered faces, in rock fissures and on colonies of cyanobacteria, rarely on soil.

- 6 Thallus with punctiform depressions. Ascospores narrowly ellipsoid. Thallus chestnut brown to dark brown

Toninia tristis ssp. tristis

Thallus squamulose, chestnut brown to dark brown, shiny, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, bullate, convex, contiguous, with rounded ends. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 2 mm diam. Surface black, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium brown, K-, C-, P-, N+ violet, KC-. Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, narrowly ellipsoid, 8 per ascus, 13.5-20.5 x 3.5-5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Hypothecium without orange and yellow pigments. - Note: in fine crevices of calciferous rocks.

- 7 Squamules imbricate. Ascospores ellipsoid-cylindrical, 2-4-celled

Toninia cinereovirens

Thallus squamulose, medium to dark olivaceous brown with grey rim, K-, C-, KC-, P-. Squamules contiguous, imbricate. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, rarely faintly pruinose, plane, smooth. Margin distinct, smooth, black, concolorous with disk. Epithymenium olivaceous brown to bright green, K-, C-, P-, N+ violet, KC-. Subhymenium pale brown to colourless. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores 2-4-celled, hyaline, ellipsoid-cylindrical, 8 per ascus, 13.5-30.5 x 3-4.5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on calciferous and basic siliceous rocks with some seepage of water after rain, on steeply inclined, somehow wheathered faces, in rock fissures and on colonies of cyanobacteria, rarely on soil.

- 7 Squamules adpressed to the substratum. Ascospores acicular, 4-8-celled

Toninia squalida

Thallus squamulose, medium to dark brown, with a greyish tinge, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, crenate, flattened, contiguous, adpressed to the substratum. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, plane, smooth. Margin distinct, smooth, black, concolorous with disk. Epihymenium olivaceous to bright green, K-, C-, P-, N+ violet, KC-. Subhymenium pale brown to colourless. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores 4-8-celled, hyaline, acicular, 8 per ascus, 23-41.5 x 2.5-4.5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on soil, more rarely on more or less weathered base-rich or weakly calciferous siliceous rocks in dry-warm areas, often associated to cyanobacteria or cyanobacterial lichen when young.

- 8 Thallus heteromerous 9
- 8 Thallus homeomerous 11
- 9 Apothecia lecanorine, with a thalline margin containing algal cells

Fuscopannaria praetermissa

Thallus squamulose, brown with a bluish tinge, edge of squamules white felted-tomentose, with erect, finger-like lobules, K-, C-, KC-, P-. Squamules 0.5-1 mm wide, rounded, flattened, contiguous, imbricate. Edge crenulate, paler than thallus. Upper cortex paraplectenchymatous. Apothecia rare, lecanorine. Surface brown. Margin (thalline) granulose, usually absent, proper margin very dark. Hymenium J+ brownish. Paraphyses simple, slightly thickened above. Ascospores hyaline, ellipsoid, thick-walled, 8 per ascus, 15-20 x 9-11 μ . Photobiont cyanobacterial. - Note: on more or less calciferous soil, mosses and plant debris.

- 9 Apothecia non lecanorine, without a thalline margin 10
- 10 Ascospores 1-celled. Hymenium J+ brownish. Squamules rounded

Fuscopannaria praetermissa

Thallus squamulose, brown with a bluish tinge, edge of squamules white felted-tomentose, with erect, finger-like lobules, K-, C-, KC-, P-. Squamules 0.5-1 mm wide, rounded, flattened, contiguous, adpressed to the substratum, imbricate. Edge crenulate, paler than thallus. Upper cortex paraplectenchymatous. Apothecia rare, without a thalline margin. Surface brown. Margin (thalline) granulose, usually absent, proper margin very dark. Hymenium J+ brownish. Paraphyses simple, slightly thickened above. Ascospores hyaline, ellipsoid, thick-walled, 8 per ascus, 15-20 x 9-11 μ . Photobiont cyanobacterial. - Note: on more or less calciferous soil, mosses and plant debris.

- 10 Ascospores 2-celled. Hymenium J+ violet. Squamules elongate

Massalongia carnosa

Thallus squamulose, brown to blackish brown, margin dissected by numerous flattened lobes or warts, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, elongate, flattened, contiguous. Edge lobed, paler than thallus. Upper cortex paraplectenchymatous. Apothecia rare, without a thalline margin. Surface red-brown to flesh-coloured. Margin pale brown. Hymenium J+ violet. Paraphyses simple, slightly thickened above. Ascospores hyaline, ellipsoid, thin-walled, 8 per ascus, 28-38 x 5-6 μ . Photobiont cyanobacterial. - Note: on bryophytes and soil rich in humus, on steeply inclined or underhanging faces near the ground level.

- 11 Thallus with thin transparent hairs

Leptochidium albociliatum

Thallus squamulose, homeomerous, dark brownish-greenish black, loosely attached, with thin transparent hairs, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, elongate, flattened, smooth, contiguous, ascending, to 5 mm, with rounded ends. Edge undulate. Apothecia frequent, lecanorine, sessile, up to 1 mm diam. Surface brown, smooth. Margin distinct, thick. Ascospores 2-celled, hyaline, narrowly ellipsoid, 8 per ascus, 20-24 x 5-6 μ . Photobiont cyanobacterial. - Note: amongst bryophytes on rocks or on soil in open shrublands and grasslands on basic siliceous substrata, much rarer in the Alps than in Mediterranean Italy, where it often reaches beyond treeline.

- 11 Thallus without thin transparent hairs 12
- 12 Squamules with entire edge

Leptogium gelatinosum

Thallus squamulose, homeomerous, bluish grey to dark brown, often paler in the basal, less exposed parts, shiny, thin, lobulate, wrinkled, loosely attached, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, elongate, contiguous, ascending, imbricate. Edge down-turned, entire. Apothecia rare, lecanorine, sessile, strongly constricted. Surface brown, concave, smooth. Margin distinct, thin. Ascospores many-celled, hyaline, broadly ellipsoid, submuriform, thin-walled, 8 per ascus. Photobiont cyanobacterial. - Note: most common on base-rich siliceous substrata, esp. in open grasslands, and apparently well distinguished from the more calcicolous *L. lichenoides*.

12 Squamules with deeply dilacerate edge

Leptogium lichenoides

Thallus squamulose, homeomerous, bluish grey to dark brown, often paler in the basal, less exposed parts, thin, lobulate, wrinkled, loosely attached, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, elongate, contiguous, ascending, imbricate. Edge dilacerate. Apothecia rare, lecanorine, sessile, strongly constricted. Surface brown, concave, smooth. Margin distinct, thin. Ascospores many-celled, hyaline, broadly ellipsoid, submuriform, thin-walled, 8 per ascus. Photobiont cyanobacterial. - Note: this is certainly the most common species of *Leptogium* throughout the country, esp. in dry grasslands, when epiphytic, it mostly occurs on basal parts of trunks, on mosses.

13 Photobiont cyanobacterial

14

13 Photobiont chlorococcoid

16

14 Apothecia non lecanorine, without a thalline margin

Heppia adglutinata

Thallus squamulose, yellowish-olive to brown, thick, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, concave, granulose, contiguous, adpressed to the substratum. Edge concolorous with thallus. Upper cortex paraplectenchymatous. Apothecia frequent, without a thalline margin, semi-immersed, not constricted, up to 2 mm diam. Surface dark reddish brown, concave. Margin indistinct. Epithymenium brownish, K-. Hymenium J+ red. Subhymenium colourless. Paraphyses simple, distinctly thickened above, free. Asci prototunicate. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, (15)18-24(30) x 6-10.5(12) μ . Pycnidia dark. Conidia bacilliform. Photobiont cyanobacterial. Lower cortex formed by periclinally arranged hyphae. - Note: an ephemeral lichen of disturbed calcareous soil in dry, open grasslands.

14 Apothecia lecanorine, with a thalline margin containing algal cells

15

15 Thallus margin effigurate. Squamules convex. Ascospores less than 19 μ long

Pannaria hookeri

Thallus squamulose, pale grey, sometimes tinged pale brownish, more or less white-maculate, effigurate, orbicular, lobulate, K-, C-, KC-. Squamules 1-2(3) mm wide, crenate, convex, contiguous, adpressed to the substratum. Hypo/prothallus present, dark. Apothecia frequent, lecanorine, sessile, up to 2 mm diam. Surface black to rarely dark brown, plane. Margin distinct, thick, crenulate. Ascospores hyaline, broadly ellipsoid, thin-walled, not ornamented, 8 per ascus, 11-15 x 8-11 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont cyanobacterial. - Note: on slightly calciferous soil (mostly deriving from metamorphic rocks) in sites with periodical water seepage, probably restricted to the Alps in Italy.

15 Thallus margin non effigurate. Squamules plane. Ascospores less than 19 μ long

Pannaria pezizoides

Thallus squamulose, pale grey to reddish brown, thick, lobulate, K-, C-, KC-, P-. Squamules <0.5 mm wide, crenate, flattened, contiguous, adpressed to the substratum. Apothecia frequent, lecanorine, sessile, up to 2 mm diam. Surface orange-brown to dark brown, plane. Margin distinct, thick, verruculose. Ascospores hyaline, ellipsoid, thick-walled, ornamented, 8 per ascus, 19-25 x 8-10, incl. perispore 25-30 x 9-12 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont cyanobacterial. - Note: on mosses, plant debris, organic soil in rather open habitats, most common in the Alps.

16 Squamules subfoliose, ascending, bifacial, without ascocarps (*Cladonia*)

17

16 Squamules of different form, but not thin, subfoliose, bifacial and ascending

29

17 With soredia or isidia

18

17 Without soredia or isidia

19

- 18 Thallus K+ yellow. Primary squamules large (5-10 mm). Thallus greenish grey

Cladonia digitata

Thallus squamulose, greenish grey, K+ yellow, C-, KC-, P+ orange. Podetia to 1 cm tall, pointed or with irregular small cups whose interior is corticate, otherwise fully sorediate or sparsely corticate toward the base. Primary squamules large, rounded, with sorediate margin. Soralia marginal. Pycnidia red, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on strongly weathered lignum, mosses, on the bases of trunks, sometimes on soil rich in humus, common only in the Alps.

- 18 Thallus K+ orange. Primary squamules medium-sized (1-3mm). Thallus grey to brownish

Cladonia parasitica

Thallus squamulose, grey to brownish, K+ orange, C-, P+ orange. Podetia to 2 cm tall, irregular, deformed and very irregularly branched, often covered by isidioid granules and partly decorticate with scattered to numerous squamules, fissured with gaping holes. Primary squamules medium-sized (1-3mm), brownish, very finely divided, granulose-sorediose. Soredia diffuse, granular. Undersurface of squamules white. Medulla UV -. Ascospores 8 per ascus. Pycnidia semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: normally lignicolous, on stumps, sometimes on basal parts of old trunks, optimum in Castanea plantations.

- 19 Thallus K+ red

Cladonia polycarpoides

Thallus squamulose, grey, K+ red, C-, KC-, P+ red. Primary squamules large, forming dense mats. Undersurface of squamules white. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on more or less calcareous mineral soil in open grasslands and on soil pockets on large isolated boulders, probably somehow overlooked in Italy and more widespread in the Alps.

- 19 Not as above

20

- 20 Thallus K+ yellow

21

- 20 Thallus K-

25

- 21 Thallus C+ bright green

Cladonia strepsilis

Thallus squamulose, brownish-greenish grey, K+ yellow, C+ bright green, P+ yellow. Podetia very rare, with irregular cups or turgid-branched. Primary squamules large, to 4 mm long, rounded or elongate, indented, forming cushions, upper surface bronze-green, white below. Undersurface of squamules white. Medulla UV -. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on humous soil overlaying siliceous rocks and amongst bryophytes in humid depressions periodically filled by water, in more or less open situations, restricted to the Alps in Italy.

- 21 Thallus C-

22

- 22 Thallus P+ orange

Cladonia squamosa v. subsquamosa

Thallus squamulose, grey, K+ yellow, C-, P+ orange. Podetia to 5 cm tall, irregularly branched, with pointed apices or with irregular small perforate cups, the surface scabrid, densely squamulose and partly decorticated. Primary squamules medium-sized (1-3mm). Medulla UV+ white. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on organic substrata in sheltered situations, rarely on bark, on basal parts of trunks, a very polymorphic taxon.

- 22 Thallus P+ red

23

- 23 Squamules not white below

Cladonia subcervicornis

Thallus squamulose, lead grey, K+ yellow, C-, P+ red. Podetia to 1.5 cm tall, with irregular cups, flared from the base. Primary squamules very large to 2 cm long, ascending, contiguous, forming cushions, with indented margins. Undersurface of squamules grey, with black spots at the base. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on siliceous rocks and on soil rich in humus in open habitats, probably more widespread in Tyrrhenian Italy.

- 23 Squamules white below 24
 24 Thallus glaucous grey with a bluish tinge. Primary squamules 8-15 x 1-8 mm

Cladonia macrophyllodes

Thallus squamulose, glaucous grey with a bluish tinge, K+ yellow, C-, P+ red. Podetia rare. Primary squamules large, to 3 cm long, white below. Ascospores ellipsoid. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil in open sites with a long snow-lie, optimum in the siliceous Alps.

- 24 Thallus greyish-green, without a bluish tinge. Primary squamules 5-20 x 2-5 mm

Cladonia turgida

Thallus squamulose, greyish-green, K+ yellow, C-, P+ red. Podetia rare. Primary squamules 2-5 mm broad, white below. Medulla UV -. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on acid soil in open habitats, a mainly boreal species, rare in the Alps.

- 25 Thallus P+ yellow

Cladonia macrophylla

Thallus squamulose, grey, K-, C-, KC-, P+ yellow. Podetia 2-4 cm tall, simple or branched, with blunt apices and a fissured surface with numerous peltate squamules and black-grey decorticated areas at the base. Primary squamules large. Undersurface of squamules white. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on more or less organic soil and weathered siliceous rocks, most Italian records need re-confirmation.

- 25 Not as above

26

- 26 Thallus P-

Cladonia squamosa v. squamosa

Thallus squamulose, greyish, K-, C-, P-. Podetia to 5 cm tall, irregularly branched, with pointed apices or with irregular small perforate cups, the surface scabrid, densely squamulose and partly decorticated. Primary squamules medium-sized (1-3mm). Undersurface of squamules white. Medulla UV + white. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on organic substrata in sheltered situations, rarely on bark, on basal parts of trunks, a very polymorphic taxon.

- 26 Thallus P+ red

27

- 27 Squamules white below

Cladonia caespiticia

Thallus squamulose, greenish grey, K-, C-, P+ red. Podetia to 3 mm tall, decorticate. Primary squamules to 7 mm long, irregularly incised and ascending, often forming low cushions. Undersurface of squamules white. Medulla UV -. Pycnidia semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on mineral, generally sandy-clay soil, occasionally on rotting wood and on bases of ancient trunks, in rather sheltered situations.

- 27 Squamules not white below

28

- 28 Squamules bluish grey below, grey above

Cladonia cervicornis ssp. cervicornis

Thallus squamulose, grey, K-, C-, P+ red. Podetia to 1 cm tall, corticate, often sparingly squamulose. Primary squamules to 1 cm long, the margins indented, contiguous, forming cushions, upper surface grey-green. Undersurface of squamules bluish grey. Ascospores 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on mineral siliceous soil in open grasslands and garrigues, most frequent in Tyrrhenian Italy.

- 28 Squamules pale yellowish below, greenish grey above

Cladonia foliacea

Thallus squamulose, greenish grey, K-, C-, KC-, P+ red. Podetia to 1 cm tall, very rare. Primary squamules 4-15 x 1-3 mm, forming compact mats, sometimes with black hairs at the margins. Undersurface of squamules yellowish. Ascospores 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: an ecological vicariant of *C. convoluta* on more or less acid, but often base-rich

ground.

- 29 With soredia or isidia. Thallus C+ red, KC+ red

Trapeliopsis wallrothii

Thallus squamulose, whitish to pale grey, thick, more or less effigurate, areolate, K-, C+ red, KC+ red, P-. Areolae angular, flattened, contiguous, adpressed to the substratum. Isidia spatulate, clustered, simple. Apothecia rare, without a thalline margin, sessile, up to 1.5 mm diam. Surface pink-brown to dull grey-green often faintly pruinose, plane. Margin distinct, thin. Epithymenium pale to brownish. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 8-14 x 4-5 μ . Pycnidia dark, immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on base-rich, non or weakly calcareous soil, sometimes overgrowing mosses, mostly in open situations.

- 29 Without soredia or isidia, Thallus C-, KC-

30

- 30 Pseudocyphellae present

Tonia physaroides

Thallus squamulose, greyish green to greyish brown, pruinose or not, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, bullate, convex, contiguous, ascending, terete. Pseudocyphellae punctiform. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium grey, K+ violet, C-, P-, N+ violet, KC-. Subhymenium pale brown to colourless. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, fusiform, 8 per ascus, 11.5-18.5 x 3.5-5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: most common on soil developing from calciferous sandstone, often found amongst mosses and associated to cyanobacterial lichens when young, rare in limestone areas.

- 30 Pseudocyphellae absent

31

- 31 With perithecia

32

- 31 With apothecia

42

- 32 Ascospores 2-celled

Placidiopsis pseudocinerea

Thallus squamulose, brownish grey, often faintly pruinose, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, rounded, flattened, smooth, adpressed to the substratum, non imbricate. Edge undulate. Undersurface dark. Perithecia frequent, laminal. Paraphyses absent. Asci unitunicate, clavate. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, (14)15-19(21) x (6.5)7.5-9(10) μ . Photobiont chlorococcoid. Some spores ovoid to clavate, sometimes curved, restricted at septum. - Note: on soil and on muribund bryophytes on siliceous, base-rich or slightly calciferous soil (e.g. developing from calcareous schist).

- 32 Not as above

33

- 33 Ascospores more than 4-celled

34

- 33 Ascospores 1-celled

36

- 34 Ascospores hyaline, squamules <0.5 mm

Agonimia tristicula

Thallus squamulose, greyish-green to green-brown, bright green when wet, K-, C-, KC-, P-. Squamules <0.5 mm wide, elongate, flattened, dispersed. Edge crenulate. Perithecia semi-immersed, up to 0.5 mm diam. Surface black. Paraphyses simple, not apically thickened. Asci clavate. Ascospores hyaline, ellipsoid, muriform, 2 per ascus, (60)80-120(150) x 25-50 μ . Photobiont chlorococcoid. Squamules 0.1-0.5 mm wide, perithecia plicate in upper part. - Note: on terricolous mosses, but also, albeit more rarely, on basal parts of old trunks in areas with calcareous rocks.

- 34 Ascospores not hyaline, squamules >0.5 mm

35

- 35 Ascospores per ascus 1. Squamules ascending. Perithecia half immersed

Endocarpon adscendens

Thallus squamulose, pale greenish grey to brownish, loosely attached, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, flattened, smooth, contiguous, ascending, imbricate. Edge lobed. Undersurface of squamules black with a pale border. Perithecia frequent,

half immersed, up to 0.4 mm diam. Perithecial wall light-coloured below. Ascospores not hyaline, ellipsoid, muriform, 1 per ascus, 28-50 x 12-22 μ . Pycnidia dark, immersed. Conidia crescent-shaped. Photobiont chlorococcoid. - Note: on terricolous mosses, often near and on cyanobacterial colonies, with optimum in upland areas with more or less base-rich siliceous rocks.

- 35 Ascospores per ascus 1-2. Squamules adpressed to the substratum. Perithecia fully immersed

Endocarpon pusillum

Thallus squamulose, pale greenish grey to brownish, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, crenate, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Undersurface of squamules dark throughout. Perithecia frequent, globose, fully immersed. Ascospores not hyaline, ellipsoid, muriform, 1-2 per ascus, 25-60(75) x 11-23 μ . Pycnidia dark, immersed. Conidia crescent-shaped. Photobiont chlorococcoid. - Note: the genus *Endocarpon* badly needs revision, *E. pusillum* in the sense of most European authors is heterogeneous, and perhaps could be subdivided into several species.

- 36 Perithecial wall pale throughout 37
36 Perithecial wall dark throughout 39
37 Cells of lower cortex not arranged in vertical rows

Catapyrenium imbecillum

Thallus squamulose, brownish, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, rounded, flattened, smooth, adpressed to the substratum. Edge up-turned, undulate. Undersurface black, brown at the periphery. Upper cortex paraplectenchymatous. Perithecia frequent, laminal, pyriform, half immersed, not flattened. Paraphyses absent. Perithecial wall pale throughout. Asci unitunicate, cylindrical. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, (12)14-18 x 6-8 μ . Conidia bacilliform. Photobiont chlorococcoid. Pycnidia marginal, prominent Cells of lower cortex not arranged in vertical rows, Conidia 3-5 μ long, Rhizohyphae pale. - Note: known from the Austrian Alps, and from several isolated stations in southern Europe, to be looked for in the Alps.

- 37 Cells of lower cortex arranged in vertical rows 38
38 Squamules >6 mm, margin of squamules thin. Thallus reddish brown. Ascospores 14-17 x 6-7.5 μ

Catapyrenium adami-borosi

Thallus squamulose, reddish brown, K-, C-, KC-, P-. Squamules rounded, flattened, smooth, adpressed to the substratum. Edge concolorous with thallus. Undersurface black. Upper cortex paraplectenchymatous. Perithecia frequent, laminal, half immersed, not flattened. Paraphyses absent. Perithecial wall pale throughout. Asci unitunicate, cylindrical. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 14-17 x 6-7.5 μ . Photobiont chlorococcoid. Pycnidia marginal, prominent Cells of lower cortex arranged in vertical rows, Conidia 5-7 μ long, Rhizohyphae pale. - Note: on soils derived from metamorphic base-rich rocks in dry grasslands.

- 38 Squamules <6 mm, margin of squamules thickened. Thallus dark reddish brown. Ascospores (13)14-17(19) x 6-8(9) μ

Catapyrenium lachneum

Thallus squamulose, dark reddish brown, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, rounded, flattened, smooth, adpressed to the substratum. Edge up-turned. Undersurface black. Upper cortex paraplectenchymatous. Perithecia frequent, laminal, pyriform, half immersed, not flattened. Paraphyses absent. Perithecial wall pale throughout. Asci unitunicate, cylindrical. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, (13)14-17(19) x 6-8(9) μ . Photobiont chlorococcoid. Pycnidia marginal, prominent Cells of lower cortex arranged in vertical rows, Conidia 5-7 μ long, Rhizohyphae pale. - Note: on humus and terricolous bryophytes on calciferous soil, certainly occurring throughout the Alps.

- 39 Perithecia without involucrellum

Catapyrenium michelii

Thallus squamulose, brown, thin, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, rounded, flattened, smooth, adpressed to the substratum. Edge concolorous with thallus. Undersurface black. Upper cortex paraplectenchymatous. Perithecia frequent,

laminal, pyriform, half immersed, not flattened. Paraphyses absent. Perithecial wall dark throughout. Asci unitunicate, cylindrical. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 11-15 x 5-6 μ . Photobiont chlorococcoid. Rhizohyphae pale. - Note: on mineral, esp. sandy soil in open grasslands.

39 Perithecia with involucrellum

40

40 Perithecia marginal

Catapyrenium tremniacense

Thallus squamulose, beige to pale brown, thin, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, crenate, flattened, smooth, contiguous, adpressed to the substratum. Edge crenulate. Hypo/prothallus present, pale. Undersurface dark. Upper cortex paraplectenchymatous. Lower cortex absent. Perithecia frequent, marginal, globose, protruding, not flattened, with apical involucrellum. Paraphyses absent. Perithecial wall dark throughout. Asci unitunicate, clavate. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 13-17 (18) x 6-7 (8) μ . Photobiont chlorococcoid. Rhizohyphae pale. - Note: a widespread species of open grasslands on calcareous substrata, probably more common throughout the country.

40 Perithecia laminal

41

41 Perithecia globose. Lower cortex present. Ascospores (15) 17-23 (25) x (6) 6.5-8.5 (9.5) μ

Catapyrenium cinereum

Thallus squamulose, brownish grey, often faintly pruinose especially towards the centre, thin, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, crenate, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Edge deeply incised, darker than thallus. Hypo/prothallus present, dark. Undersurface dark. Upper cortex paraplectenchymatous. Lower cortex paraplectenchymatous. Perithecia frequent, laminal, globose, half immersed, not flattened, with an involucrellum extending all around the perithecium. Paraphyses absent. Perithecial wall dark throughout. Asci unitunicate, clavate. Ascospores 1-celled, hyaline, clavate, thin-walled, 8 per ascus, (15) 17-23 (25) x (6) 6.5-8.5 (9.5) μ . Photobiont chlorococcoid. Rhizohyphae dark. - Note: on siliceous, base-rich soil with mica, or amongst terricolous bryophytes, a boreal-arctic species occurring also in more southern mountains.

41 Perithecia pyriform. Lower cortex absent. Ascospores (15) 17-22 (24) x (5) 6-8 (9) μ

Catapyrenium daedaleum

Thallus squamulose, brownish grey, often faintly pruinose especially towards the centre, thin, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Edge crenulate, concolorous with thallus. Hypo/prothallus present, dark. Undersurface dark. Upper cortex paraplectenchymatous. Lower cortex absent. Perithecia frequent, laminal, pyriform, half immersed, not flattened, with an involucrellum extending all around the perithecium. Paraphyses absent. Perithecial wall dark throughout. Asci unitunicate, clavate. Ascospores 1-celled, hyaline, clavate, thin-walled, 8 per ascus, (15) 17-22 (24) x (5) 6-8 (9) μ . Photobiont chlorococcoid. Asci 75-85 μ long, 17-20 μ broad. Rhizohyphae dark. - Note: on plant debris, mosses and bare, humus rich soil on more or less calcareous ground, perhaps less common than *C. cinereum* in the mountains of the south.

42 Apothecia lecanorine, with a thalline margin containing algal cells

Phaeorrhiza nimbose

Thallus squamulose, from brownish to pale ochraceous yellowish, sometimes faintly pruinose, thick, K-, C-, KC-, P-. Squamules rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Undersurface dark, with a dense mat of rhizohyphae. Upper cortex paraplectenchymatous. Apothecia frequent, lecanorine, sessile, 1.2 mm diam. Surface black, sometimes faintly pruinose. Margin thin. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, 8 per ascus, 18-22 x 8-10 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. Rhizohyphae dark. - Note: on naked earth, dead mosses and plant debris on more or less calciferous ground, often in wind-exposed situations, an arctic-alpine species, common in the Alps.

42 Apothecia non lecanorine, without a thalline margin

43

43 Ascospores 4-celled

44

- 43 Not as above 46
 44 Hypothecium dark

Toninia aromatica

Thallus squamulose, pale grey to greenish brown, often white-spotted, rarely faintly pruinose, K-, C-, KC-, P-. Areolae 1-2(3) mm wide, rounded, convex. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, 1.5 mm diam. Surface black, rarely faintly pruinose, plane, smooth. Margin distinct, smooth, black, concolorous with disk. Epihymenium dark green, K-, C-, P-, N+ violet, KC-. Subhymenium dark brown. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores 2-4-celled, hyaline, ellipsoid-cylindrical, 8 per ascus, 11-22.5 x 4-5.5 μ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: often found on walls in small settlements, but common in natural habitats as well, in the Mediterranean belt common only in Tyrrhenian Italy, rarer elsewhere, sometimes reaching beyond treeline.

- 44 Hypothecium pale to colourless 45
 45 Epihymenium N+ red. Squamules <0.5 mm wide. Apothecial margin indistinct

Mycobilimbia lobulata

Thallus squamulose, whitish grey to grey, darker in the centre of the squamules, K-, C-, KC-, P-. Squamules <0.5 mm wide, crenate, flattened, smooth, contiguous, adpressed to the substratum. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface dark brown to black, convex. Margin indistinct. Epihymenium pale greenish grey, K-, N+ red. Hymenium J+ violet. Subhymenium red-brown. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 1-4-celled, hyaline, fusiform, 8 per ascus, 14-20(26) x 3-5(6) μ. Photobiont chlorococcoid. - Note: on terricolous mosses and bare calciferous soil, from the Alps to the high Mediterranean mountains.

- 45 Epihymenium N+ violet. Squamules 1-2(3) mm wide. Apothecial margin distinct

Toninia squalida

Thallus squamulose, medium to dark brown, with a greyish tinge, epruinose, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, crenate, flattened, contiguous, adpressed to the substratum. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, 1.5 mm diam. Surface black, plane, smooth. Margin distinct, smooth, black, concolorous with disk. Epihymenium olivaceous to bright green, K-, C-, P-, N+ violet, KC-. Subhymenium pale brown to colourless. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores 4-8-celled, hyaline, acicular, 8 per ascus, 23-41.5 x 2.5-4.5 μ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on soil, more rarely on more or less weathered base-rich or weakly calciferous siliceous rocks in dry-warm areas, often associated to cyanobacteria or cyanobacterial lichen when young.

- 46 Ascospores 1-celled 47
 46 Ascospores 2-celled 50
 47 Epihymenium K+ red 48
 47 Epihymenium K- 49
 48 Squamules plane to convex, without a conspicuous white margin. Lower cortex present.

Psora globifera

Thallus squamulose, castaneous brown, rarely faintly white-pruinose, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, crenate, flattened, finely divided by small fissures, contiguous, ascending, imbricate. Edge up-turned, concolorous with thallus. Undersurface grayish. Apothecia frequent, without a thalline margin, sessile, up to 5 mm diam. Surface black, convex. Margin indistinct, thin. Epihymenium reddish brown, K+ red. Subhymenium pale brown. Paraphyses anastomosing, adglutinated. Asci clavate. Ascospores hyaline, ellipsoid, thin-walled, 8 per ascus, 10-13 x 5-7 μ. Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on slightly calciferous or base-rich soil and weathered siliceous rocks, most frequent in the Alps.

- 48 Squamules concave, with a conspicuous white margin. Lower cortex absent.

Psora vallesiaca

Thallus squamulose, brown, with white margins. Squamules (2)3-6 mm wide, concave, contiguous, non imbricate. Edge crenulate, whitish. Undersurface pale brown. Medulla K+ yellow changing to red, P+ yellow. Lower cortex absent. Apothecia frequent, without a thalline margin, sessile, up to 1.5 mm diam. Surface black, convex. Margin indistinct, thin. Epithymenium brownish, K+ red. Subhymenium pale brown. Paraphyses anastomosing, adglutinated. Asci clavate. Ascospores hyaline, fusiform, thin-walled, 8 per ascus, 9-13 x 5-7 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on bare soil and in fissures of the rock, not rare where suitable habitats are present (subcontinental conditions and base-rich, slightly calciferous siliceous substrata).

- 49 Squamules plane, densely imbricate, pale brown, without punctiform depressions. Apothecial margin indistinct

Lecidea lurida

Thallus squamulose, pale brown, becoming greenish when wet, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, flattened, smooth, imbricate. Edge undulate, concolorous with thallus. Undersurface very pale brown. Apothecia frequent, without a thalline margin, sessile, up to 5 mm diam. Surface dark brown to black, convex. Margin indistinct, thin. Epithymenium brownish, K-. Subhymenium pale brown. Paraphyses anastomosing, adglutinated. Asci clavate. Ascospores hyaline, narrowly ellipsoid, thin-walled, 8 per ascus, 11-14 x 6-8 μ . Pycnidia dark, sessile. Conidia narrow ellipsoid. Photobiont chlorococcoid. - Note: a calcicolous, ecologically and altitudinally wide-ranging species, whose development often starts in fissures of the rock.

- 49 Squamules convex, not imbricate, chestnut to dark brown, with punctiform depressions. Apothecial margin distinct

Tonia tristis ssp. pseudotabacina

Thallus squamulose, chestnut brown to dark brown, shiny, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, bullate, convex, contiguous, with rounded ends. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 2 mm diam. Surface black, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium bright green, K-, C-, P-, N+ violet, KC-. Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, ellipsoid, 8 per ascus, 10-15.5 x 4.5-6.5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on soil, sometimes it reaches the oromediterranean belt.

- 50 Thallus green. Medulla P+ orange

Catolechia wahlenbergii

Thallus squamulose, bright yellow-green, thick, wrinkled, K-, C-, KC-. Areolae convex, contiguous. Medulla C-, KC-, P+ orange. Apothecia frequent, without a thalline margin, sessile, up to 2 mm diam. Surface black, plane. Margin indistinct, thin, concolorous with disk. Epithymenium K-, N+ red. Hymenium J+ violet. Paraphyses anastomosing, ramified, slightly thickened above. Asci clavate. Ascospores 1-4-celled, not hyaline, ellipsoid, 8 per ascus, (12) 13-17(18) x 7-10 μ . Photobiont chlorococcoid. Ascospores 2-4 celled. - Note: on acid soil rich in humus and over bryophytes in fissures of siliceous rocks in cold, perennially humid situations, restricted to the Alps in Italy.

- 50 Thallus not green. Medulla P-

- 51 Epithymenium K-

51

Tonia tristis ssp. tristis

Thallus squamulose, chestnut brown to dark brown, shiny, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, bullate, convex, contiguous, with rounded ends. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 2 mm diam. Surface black, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium brown, K-, C-, P-, N+ violet, KC-. Subhymenium brownish, without orange and yellow pigments. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, narrowly ellipsoid, 8 per ascus, 13.5-20.5 x 3.5-5 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: in fine crevices of calciferous rocks.

- 51 Epithymenium K+ violet

52

- 52 Squamules more or less flat, with a white rim

Tonia albibrabra

Thallus squamulose, reddish brown, often with greenish tinge, white pruinose at margin, K-, C-, KC-, P-. Upper cortex thick, with deep cracks. Squamules 1-2(3) mm wide, flattened, contiguous. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, most often white-pruinose, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium grey, K+ violet, C-, P-, N+ violet, KC-. Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores 2-celled, hyaline, fusiform, 8 per ascus, 13.5-22.5 x 3-4 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on more or less calciferous ground and in fissures of rocks and walls, often on cyanobacteria or cyanobacterial lichens when young, common only in dry areas, incl. continental Alpine valleys.

- 52 Squamules bullate, or if flat without white rim

53

- 53 Squamules (2)3-6 mm wide, vertically flattened and imbricate. Thallus olivaceous brown to reddish brown, whitish pruinose at the tips

Tonia opuntioides

Thallus squamulose, olivaceous brown to reddish brown, whitish pruinose at the tips, K-, C-, KC-, P-. Upper cortex thin, sometimes with shallow cracks. Squamules (2)3-6 mm wide, bullate, convex, vertically flattened and imbricate, contiguous, ascending. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, sometimes weakly pruinose, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium grey, K+ violet, C-, P-, N+ violet, KC-. Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, fusiform, 8 per ascus, 16-24 x 3.5-4 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on rock and soil, often amongst bryophytes, and always associated to cyanobacterial lichens when young.

- 53 Squamules 1-2(3) mm wide, not vertically flattened. Thallus olivaceous green to brown, often white-pruinose

Tonia sedifolia

Thallus squamulose, olivaceous green to brown, often white-pruinose, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, convex to bullate, contiguous, with rounded ends. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, often pruinose, plane, smooth. Margin distinct, smooth, concolorous with disk. Epithymenium grey, K+ violet, C-, P-, N+ violet, KC-. Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, fusiform, 8 per ascus, 12-24 x 3-5 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Upper cortex thin, sometimes with shallow cracks - Note: on soil and weathered calciferous, more rarely basic siliceous rocks, often overgrowing mosses and associated with cyanobacteria or cyanobacterial lichens when young, most common in dry, open grasslands.

SUBKEY D - Crustose lichens

- 1 Thallus dark, from black to dark brown
- 1 Not as above
- 2 Photobiont trentepohlioid

10

Porina mammillosa

Thallus crustose, green-grey to dark grey, often tinged brown-purple, thick, continuous, K-, C-, KC-, P-. Perithecia frequent, immersed in thalline warts, globose, half immersed, not flattened, with apical involucrellum, up to 0.5 mm diam. Surface black. Paraphyses simple, not apically thickened, free. Asci cylindrical. Ascospores hyaline, fusiform, 8 per ascus, 25-40 x 4-6 µ. Pycnidia

dark, sessile. Conidia cylindrical. Photobiont trentepohlioid. - Note: on bryophytes and plant debris.

- | | | |
|---|--|---|
| 2 | Not as above | 3 |
| 3 | Photobiont cyanobacterial | 4 |
| 3 | Photobiont chlorococcoid | 5 |
| 4 | Thallus non granulose. Ascospores more than 4-celled. Ascospores per ascus 4. Ascomata sessile | |

Collema limosum

Thallus crustose, homeomerous, black, thin, continuous. Lobes flattened, contiguous, adpressed to the substratum. Apothecia frequent, lecanorine, sessile, up to 3 mm diam. Surface brown to black. Margin distinct, thick, verruculose. Ascospores many-celled, hyaline, ellipsoid, submuriform, 4 per ascus, 26-34 x 10-15 μ . Photobiont cyanobacterial. Excipulum euthyplectenchymatous. - Note: a short-lived species of mineral, clay soil in disturbed habitats, certainly overlooked, but never common in Italy.

- | | | |
|---|--|--|
| 4 | Thallus granulose. Ascospores 1-celled. Ascospores per ascus 8. Ascomata semi-immersed | |
|---|--|--|

Moelleropsis nebulosa

Thallus crustose, pale blue-grey to dark blue-black, granulose. Apothecia frequent, lecanorine, semi-immersed, not constricted, up to 1 mm diam. Surface brown. Margin distinct, granulose. Subhymenium brownish. Paraphyses simple, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, (11)13-15(20) x 6-8 μ . Photobiont cyanobacterial. Ascospores sometimes attenuated at one end, with a single oil droplet. - Note: an early colonizer of clay-sandy soil, esp. earth banks along unpaved roads, in humid areas with siliceous substrata, most frequent in Tyrrhenian Italy, from the lowlands (in very humid areas) to the mountains.

- | | | |
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| 5 | With soredia | |
|---|--------------|--|

Trapeliopsis gelatinosa

Thallus crustose, dark green-brown to dark green-grey, thin, continuous, granulose, K-, C-, KC-, P-. Soredia farinose, pale green-grey, K-, C-, KC-, P-. Apothecia frequent, sessile, up to 1.5 mm diam. Surface dark green-grey to grey-black, plane. Margin indistinct, crenulate. Epithymenium green, K+ brownish. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 8-14 x 4.5-6 μ . Pycnidia dark, immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: an early colonizer of on more or less mineral soil, sometimes overgrowing bryophytes and plant debris.

- | | | |
|---|-----------------|---|
| 5 | Without soredia | 6 |
| 6 | Thallus KC+ red | |

Placynthiella icmalea

Thallus crustose, black-brown to red-brown, granulose, K-, C+ red, KC+ red, P-. Apothecia rare, without a thalline margin, up to 0.6 mm diam. Surface blackish. Margin distinct, thin. Epithymenium K-, C+ red, KC+ red. Paraphyses ramified. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 8-12 x 4-5 μ . Photobiont chlorococcoid. Granules not very coarse (less than 150 μ), not becoming yellowish green when wet. Thallus of minutely coralloid granules, resembling a brown isidiate crust, not sub-gelatinous. Thallus reactions best seen in squash preparations. - Note: on disturbed soil, turf, decomposed lignum (common on stumps), much more rarely on acid bark, and then mostly on basal parts of trunks, most frequent in the Alps, but extending south to Calabria through the Apennines, where it is mostly found in open Castanea-stands.

- | | | |
|---|--|---|
| 6 | Thallus KC- | 7 |
| 7 | Ascospores more than 4-celled, 1 per ascus | |

Lopadium pezizoideum

Thallus crustose, brown to green-brown, granulose, K-, C-, KC-, P-. Apothecia without a thalline margin, sessile, strongly constricted, up to 1 mm diam. Surface black, concave. Margin distinct, thick, black, brownish in outer part. Epithymenium

K-, C-. Ascospores ellipsoid, muriform, 1 per ascus, 70-115 x 23-45 μ . Photobiont chlorococcoid. - Note: on bryophytes and plant remains in humid-sheltered situations, in areas with acidic siliceous rocks, probably restricted to the Alps.

- 7 Ascospores 1-celled, more than 1 per ascus 8
8 Thallus thick, lobulate

Lecidoma demissum

Thallus crustose, dark brown to grey-brown in shade, thick, lobulate, K-, C-, KC-, P-. Areolae (2)3-6 mm wide, rounded, convex, subsquamulose, contiguous, adpressed to the substratum. Edge crenulate. Apothecia frequent, without a thalline margin, sessile, up to 1.5 mm diam. Surface dull brown-black, convex. Margin indistinct. Epithymenium reddish brown. Hymenium J+ violet. Subhymenium colourless. Paraphyses distinctly thickened above, with dark cap, adglutinated. Asci clavate. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 12-16 x 5.5-7 μ . Photobiont chlorococcoid. - Note: terricolous, rarely saxicolous on acidic rocks, in clearings of Alpine grasslands with a rather long snow-lie.

- 8 Thallus thin, minutely granulose 9
9 Granules very coarse, wart-like (100-300 μ), becoming yellowish green when wet. Ascomata brownish black. Ascospores 10-14 x 4.5-6 μ

Placynthiella oligotropa

Thallus crustose, black-brown, granulose, granules very coarse, wart-like (100-300 μ), becoming yellowish green when wet, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, up to 0.4 mm diam. Surface brownish black. Margin indistinct. Epithymenium K-, C-, KC-. Paraphyses ramified. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 10-14 x 4.5-6 μ . Photobiont chlorococcoid. - Note: on soil and turf, mostly in clearings of woodlands, to be looked for throughout the Alps.

- 9 Granules not very coarse (less than 150 μ), not becoming yellowish green when wet. Ascomata dark reddish brown. Ascospores 9-14(16.5) x (4)5-6(7) μ

Placynthiella uliginosa

Thallus crustose, black-brown, of rounded, not very coarse (less than 150 μ) granules, not becoming yellowish green when wet, subgelatinous, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, up to 0.4 mm diam. Surface dark reddish brown. Margin indistinct. Epithymenium K-, C-, KC-. Paraphyses ramified, slightly thickened above. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 9-14(16.5) x (4)5-6(7) μ . Photobiont chlorococcoid. - Note: mostly on acid soil, more rarely on strongly decomposed lignum, most frequent in the Alps, rarer in the Apennines, where it is most common in old Castanea stands.

- 10 Thallus from bright yellow to red 11
10 Thallus neither dark- nor very bright-coloured 24
11 With soredia

Arthrorhaphis citrinella

Thallus crustose, bright yellow-green, thin, K-, C-, KC-, P-. Areolae 1-2(3) mm wide, rounded, convex, contiguous. Soredia diffuse, granular. Apothecia rare, without a thalline margin, sessile. Surface black, plane, smooth. Margin distinct, thin, smooth, black, concolorous with disk. Epithymenium K-. Hymenium interspersed. Paraphyses anastomosing, ramified, not apically thickened, free. Asci bitunicate, clavate. Ascospores 8-12-celled, hyaline, acicular, thin-walled, 8 per ascus, (40)55-80(100) x 2.5-3.5 μ . Photobiont chlorococcoid. epinecral layer absent. - Note: on mosses and soil rich in humus in sheltered situations, older thalli are lichenized, younger ones lichenicolous.

- 11 Without soredia 12
12 Thallus margin effigurate

Fulgensia subbracteata

Thallus crustose, orange-yellow, effigurate, orbicular, K+ red, C-, P-. Lobes 0.5-1 mm wide, flattened, contiguous, adpressed to the substratum. Apothecia rare, lecanorine, sessile. Surface orange, plane, smooth, K+ red. Margin distinct, thin, orange-yellow, K+ red. Epithymenium K+ red. Ascospores 1-celled, hyaline,

ovoid, thin-walled, 8 per ascus, 9-12 x 3.5-5 μ . Pycnidia orange-yellow, immersed. Conidia bacilliform. Photobiont chlorococcoid. Ascospores from ellipsoid to slightly pyriform. - Note: on more or less calciferous ground, in clearings of grasslands and shrublands, a critical taxon, characterized by the occurrence of schizidia, which, however, are also present in other, related species, a revision is badly needed.

- | | | |
|----|---|----|
| 12 | Thallus margin non effigurate | 13 |
| 13 | Apothecia lecanorine, with a thalline margin containing algal cells | 14 |
| 13 | Apothecia non lecanorine, without a thalline margin | 17 |
| 14 | Substrata acid. Thallus K- or K+ orange | 15 |
| 14 | Substrata calcareous to subneutral. Thallus K+red | 16 |
| 15 | Thallus of closely packed, granular elements. Ascomata rare | |

Candelariella kuusamoensis

Thallus crustose, orange-yellow, thick, granulose, K-. Apothecia rare, lecanorine, sessile, up to 1.5 mm diam. Surface orange-yellow, plane, K-. Margin distinct, thin, orange-yellow, concolorous with disk, K-. Epihymenium yellow, K-. Hymenium J+ violet. Subhymenium colourless. Margin (section) yellow. Ascospores 1(2)-celled, hyaline, oblong-obtuse, 12-16 per ascus, 9-14 x 4-5 μ . Photobiont chlorococcoid. - Note: on the top of poles and wooden fences, on plant debris and soil, more rarely on rocks, certainly more widespread in the Alps.

- 15 Thallus from granulose to small-lobulate, with flat lobules, never forming convex pillows of densely packed coralloid elements. Ascomata frequent

Candelariella vitellina

Thallus crustose, orange-yellow, K-. Apothecia frequent, lecanorine, sessile, up to 1.5 mm diam. Surface orange-yellow, plane, K-. Margin distinct, thin, orange-yellow, concolorous with disk, K-. Epihymenium yellow, K-. Hymenium J+ violet. Subhymenium colourless. Margin (section) yellow. Ascospores 1(2)-celled, hyaline, oblong-obtuse, 12-16 per ascus, 9-14 x 4-5 μ . Photobiont chlorococcoid. - Note: a lichen with a wide ecological range, found on a wide variety of siliceous rocks, on roofing tiles, brick, and sometimes on bryophytes, lignum and acid bark.

- 16 Ascospores 1-celled., 9-13 x 4-7 μ .. On soil and terricolous mosses.

Fulgensia bracteata

Thallus crustose, orange-yellow, K+ red, C-, P-. Areolae rounded, convex, contiguous, adpressed to the substratum. Apothecia frequent, lecanorine, sessile. Surface orange, plane, smooth, K+ red. Margin distinct, thin, orange-yellow, K+ red. Epihymenium K+ red. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 9-13 x 4-7 μ . Pycnidia orange-yellow, immersed. Conidia bacilliform. Photobiont chlorococcoid. Ascospores not restricted in the center Thallus thick, little dissected at margin, more or less pruinose. - Note: on more or less calcareous soil and terricolous mosses in open situations, sometimes in fissures of calcareous rocks.

- 16 Ascospores 2-celled, 15-23 x 5-8 μ . On epilithic mosses.

Fulgensia schistidii

Thallus crustose, orange-yellow, K+ red, C-, P-. Areolae 0.5-1 mm wide. Hypo/prothallus present. Apothecia frequent, lecanorine, sessile. Surface orange to brownish orange, plane, smooth, K+ red. Margin distinct, thin, orange-yellow, K+ red. Epihymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, constricted at septa, thin-walled, 8 per ascus, 15-23 x 5-8 μ . Pycnidia orange-yellow, immersed. Conidia bacilliform. Photobiont chlorococcoid. On epilithic mosses, esp. Schistidium. - Note: on pulvinate epilithic mosses (esp. Grimmia anomodon and Schistidium apocarpum) over more or less calcareous substrata.

- 17 Thallus P+ orange.

Epilichen scabrosus

Thallus crustose, yellow to yellowish green, thin, areolate, K-, C-, KC-, P+ orange. Areolae flattened, subsquamulose, contiguous, adpressed to the substratum. Apothecia frequent, without a thalline margin, sessile, up to 0.8 mm diam. Surface black, convex. Margin indistinct. Paraphyses ramified, not apically thickened.

Ascospores 2-celled, not hyaline, broadly ellipsoid, 8 per ascus, (9)11-17 x 6-10 μ . Photobiont chlorococcoid. - Note: restricted to cold-humid situations in upland areas, at first a parasite of *Baeomyces* species, becoming autotrophic when old.

- | | | |
|----|--|----|
| 17 | Thallus P- | 18 |
| 18 | Apothecial margin dark, apothecia at least 1 mm wide, never perithecioid | 19 |
| 18 | Apothecial margin bright yellow, apothecia <1 mm wide, perithecioid | 20 |
| 19 | Ascospores longer than 23 μ , 8-12-celled. | |

Arthrorhaphis alpina

Thallus crustose, bright yellow-green, with a rough surface, thick, areolate, farinose, K-, C-, KC-, P-. Areolae 1-2(3) mm wide, bullate, convex, contiguous. Apothecia rare, without a thalline margin, sessile. Surface black, plane, smooth. Margin indistinct, thin, smooth, black, concolorous with disk. Epihymenium dark grey green, K-. Hymenium inspersed. Subhymenium dark grey green. Paraphyses anastomosing, ramified, not apically thickened, free. Margin (section) dark grey-green. Asci bitunicate, clavate. Ascospores 8-12-celled, hyaline, acicular, thin-walled, 8 per ascus, (20)25-45(60) x 3-4.5 μ . Photobiont chlorococcoid. - Note: on weakly calcareous soil rich in humus, first parasymbiotic on *Baeomyces*, later an autonomous lichen.

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| 19 | Ascospores shorter than 23 μ , 4-5-celled. | |
|----|--|--|

Arthrorhaphis vacillans

Thallus crustose, bright yellow-green, thick, areolate, K-, C-, KC-, P-. Areolae 1-2(3) mm wide, convex, contiguous. Apothecia without a thalline margin, sessile. Surface black, plane, smooth. Margin indistinct, thin, smooth, black, concolorous with disk. Epihymenium dark grey green, K-. Hymenium inspersed. Subhymenium dark grey green. Paraphyses anastomosing, ramified, not apically thickened, free. Margin (section) dark grey-green. Asci bitunicate, clavate. Ascospores 4-5-celled, hyaline, acicular, thin-walled, 8 per ascus, 16-23 x 3 μ . Photobiont chlorococcoid. - Note: on humid soil in subalpine-Alpine situations, it starts the life-cycle as a parasite of *Baeomyces placophyllus*, later becoming autotrophic.

- | | | |
|----|--|----|
| 20 | Ascomatal disk not exposed | 21 |
| 20 | Ascomatal disk partly exposed | 22 |
| 21 | Ascospores oblong-obtuse. Paraphyses absent. Ascospores 3-4(5) x 1-1.5 μ | |

Thelocarpon intermediellum

Thallus crustose, bright yellow-pruinose, thin, verrucose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, immersed in thalline warts, semi-immersed, up to 0.3 mm diam. Surface concave, not exposed. Paraphyses absent. Asci globose. Ascospores 1-celled, hyaline, oblong-obtuse, thin-walled, more than 32 per ascus, 3-4(5) x 1-1.5 μ . Pycnidia immersed. Conidia oblong-obtuse. Photobiont chlorococcoid. - Note: a rarely collected, ephemeral species of siliceous rocks and, occasionally, rotten wood.

- | | | |
|----|---|--|
| 21 | Ascospores broadly ellipsoid. Paraphyses present. Ascospores 1.5-4(6) x 1.5-2 μ | |
|----|---|--|

Thelocarpon laureri

Thallus crustose, bright yellow-pruinose, thin, verrucose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, immersed in thalline warts, semi-immersed, up to 0.3 mm diam. Surface concave, not exposed. Paraphyses ramified, not apically thickened. Asci globose. Ascospores 1-celled, hyaline, broadly ellipsoid, thin-walled, more than 32 per ascus, 1.5-4(6) x 1.5-2 μ . Pycnidia immersed. Conidia oblong-obtuse. Photobiont chlorococcoid. Paraphyses present. Lichenized. - Note: an ephemeral early colonizer of different substrata, incl. roofing tiles, rotten wood, soil, probably more widespread, but very much overlooked.

- | | | |
|----|------------------------------|--|
| 22 | Ascospores broadly ellipsoid | |
|----|------------------------------|--|

Thelocarpon lichenicola

Thallus crustose, bright yellow-pruinose, thin, verrucose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, immersed in thalline warts, semi-immersed, up to 0.3 mm diam. Surface concave, partly exposed. Paraphyses ramified, not apically thickened. Asci globose. Ascospores 1-celled, hyaline,

broadly ellipsoid, thin-walled, more than 32 per ascus, 1.5-4(6) x 1.5-2 μ . Pycnidia immersed. Conidia oblong-obtuse. Photobiont chlorococcoid. Paraphyses absent. Non-lichenized. - Note: on clay soil in disturbed sites, often in *Calluna*-heaths, mostly on *Baeomyces rufus*, probably a commensalistic lichen, overlooked in Italy and to be searched for further, esp. in the Alps.

22 Ascospores oblong-obtuse

23

23 Asci I+ blue. Ascospores 4-5 x 1-2 μ

Thelocarpon citrum

Thallus crustose, bright yellow-pruinose, thin, verrucose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, immersed in thalline warts, semi-immersed, up to 0.15 mm diam. Surface concave, partly exposed. Paraphyses simple, not apically thickened. Asci globose. Ascospores 1-celled, hyaline, oblong-obtuse, thin-walled, more than 32 per ascus, 4-5 x 1-2 μ . Pycnidia immersed. Conidia oblong-obtuse. Photobiont chlorococcoid. - Note: a poorly-known ephemeral species of disturbed habitats, *Th. vicinellum* was described from Italy, the type was on decaying algae on porphyritic stones in a damp, shaded place, the relationships with *Th. superellum* Nyl. need to be clarified.

23 Asci I-. Ascospores 4-7(12)x 1.7-2.5(3) μ

Thelocarpon epibolum

Thallus crustose, bright yellow-pruinose, thin, verrucose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, immersed in thalline warts, semi-immersed, up to 0.15 mm diam. Surface concave, partly exposed. Paraphyses simple, not apically thickened. Asci globose. Ascospores 1-celled, hyaline, oblong-obtuse, thin-walled, more than 32 per ascus, 4-7(12)x 1.7-2.5(3) μ . Pycnidia immersed. Conidia oblong-obtuse. Photobiont chlorococcoid. - Note: an ephemeral species, found on foliose lichens, rotting wood, decaying bryophytes, peaty soil, overlooked, and certainly much more widespread in the Alps.

24 Photobiont cyanobacterial

Moelleropsis nebulosa

Thallus crustose, pale blue-grey to dark blue-black, granulose. Apothecia frequent, lecanorine, semi-immersed, not constricted, up to 1 mm diam. Surface brown. Margin distinct, granulose. Subhymenium brownish. Paraphyses simple, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, (11)13-15(20) x 6-8 μ . Photobiont cyanobacterial. Ascospores sometimes attenuated at one end, with a single oil droplet. - Note: an early colonizer of clay-sandy soil, esp. earth banks along unpaved roads, in humid areas with siliceous substrata, most frequent in Tyrrhenian Italy, from the lowlands (in very humid areas) to the mountains.

24 Not as above

25

25 Photobiont trentepohlioid

26

25 Photobiont chlorococcoid

31

26 With perithecia

27

26 With apothecia

28

27 Ascospores per ascus 8, fusiform. Conidia cylindrical

Porina mammillosa

Thallus crustose, green-grey to dark grey, often tinged brown-purple, thick, continuous, K-, C-, KC-, P-. Perithecia frequent, immersed in thalline warts, globose, not flattened, with apical involucrellum, up to 0.5 mm diam. Surface black. Paraphyses simple, not apically thickened, free. Asci cylindrical. Ascospores hyaline, fusiform, 8 per ascus, 25-40 x 4-6 μ . Pycnidia dark, sessile. Conidia cylindrical. Photobiont trentepohlioid. - Note: on bryophytes and plant debris.

27 Ascospores per ascus more than 32, oblong-obtuse. Conidia filiform

Thelopsis melathelia

Thallus crustose, reddish-brown, K-, C-, KC-, P-. Perithecia frequent. Surface black. Asci cylindrical. Ascospores 4-celled, hyaline, oblong-obtuse, more than 32 per ascus, 11-20 x 4-7 μ . Conidia filiform. Photobiont trentepohlioid. - Note: on muribund bryophytes, humic soil and plant remains in areas with calcareous, or

basic siliceous rocks.

- 28 Ascomata immersed 29
28 Ascomata sessile 30
29 All septa of the spores parallel. Ascospores 10-16 x 4-6 μ . Ascomata up to up to 2 mm diam.

Gyalecta foveolaris

Thallus crustose, whitish, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, immersed, not constricted, up to 2 mm diam. Surface yellowish, concave, K-, C-, KC-, P-. Margin distinct, thick, whitish, paler than disk, K-, C-, KC-, P-. Ascospores 4-celled, hyaline, ellipsoid, 8 per ascus, 10-16 x 4-6 μ . Photobiont trentepohlioid. All septa of the spores parallel. - Note: on more or less calcareous soil, occasionally on rocks in humid and shaded situations, to be looked for throughout the calcareous Alps.

- 29 Some septa of the spores not parallel with each other. Ascospores 12-20 x 5-7 μ . Ascomata up to up to 1 mm diam.

Gyalecta geioca

Thallus crustose, whitish, thin, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, immersed, not constricted, up to 1 mm diam. Surface yellowish, concave, K-, C-, KC-, P-. Margin distinct, thick, whitish, paler than disk, K-, C-, KC-, P-. Ascospores 4-celled, hyaline, ellipsoid, 8 per ascus, 12-20 x 5-7 μ . Photobiont trentepohlioid. Some septa of the spores not parallel with each other. - Note: on soil, bryophytes and plant debris over more or less base-rich or calcareous substrata, often in rock fissures in sheltered situations.

- 30 Ascomatal disk plane. Ascomata up to up to 5 mm diam.

Gyalecta friesii

Thallus crustose, whitish, thin, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 5 mm diam. Surface yellowish, plane, K-, C-, KC-, P-. Margin distinct, thick, whitish, paler than disk, K-, C-, KC-, P-. Ascospores 4-celled, hyaline, ellipsoid, 8 per ascus, 14-21 x 3-6 μ . Photobiont trentepohlioid. All septa of the spores parallel. - Note: on bryophytes and plant debris, more rarely on bark of conifers and on siliceous rocks.

- 30 Ascomatal disk concave. Ascomata up to up to 3 mm diam.

Gyalecta peziza

Thallus crustose, whitish, thin, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 3 mm diam. Surface yellowish, concave, K-, C-, KC-, P-. Margin distinct, thick, whitish, paler than disk, K-, C-, KC-, P-. Ascospores 4-celled, hyaline, ellipsoid, 8 per ascus, 14-21 x 3-6 μ . Photobiont trentepohlioid. All septa of the spores parallel. - Note: on slightly calcareous soil rich in humus, and on terricolous bryophytes.

- 31 With soredia or isidia 32
31 Without soredia or isidia 38
32 With isidia

Pertusaria oculata

Thallus crustose, whitish grey, thin, K+ yellow changing to red, C+ red, KC+ yellow changing to red, P+ red. Isidia cylindrical, diffuse, darker than thallus surface. Medulla UV -. Apothecia rare, lecanorine, semi-immersed, not constricted. Surface black, plane, rough. Margin distinct. Epithemium K+ violet. Paraphyses ramified, free. Asci cylindrical. Ascospores hyaline, ellipsoid, thick-walled, 8 per ascus, (16)23-28(30) x 10-14 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soil and plant remains, mostly above treeline, restricted to the Alps in Italy.

- 32 With soredia 33
33 Thallus K+ yellow 34
33 Thallus K- 36
34 Apothecia non lecanorine, without a thalline margin

Baeomyces rufus

Thallus crustose, grey-green to dull greenish, thick, areolate, K+ yellow, KC+ yellow, P+ orange. Areolae convex, contiguous, adpressed to the substratum. Soredia diffuse, greenish grey. Medulla UV -. Apothecia frequent, without a thalline margin, stipitate. Surface red brown, convex. Paraphyses simple. Asci cylindrical. Ascospores hyaline, fusiform, 8 per ascus. Conidia bacilliform. Photobiont chlorococcoid. - Note: an early colonizer of acid soils with high clay content and of weathered siliceous rocks, often in disturbed sites, mostly sterile in upland areas.

34 Apothecia lecanorine, with a thalline margin containing algal cells

35

35 Ascomata dark. Thallus KC-, C-

Lecanora epibryon v. bryopsora

Thallus crustose, whitish to pale grey, continuous, K+ yellow, C-, KC-, P-. Areolae rounded, convex, contiguous, adpressed to the substratum. Soredia granular, whitish to very pale yellowish white. Soralia prominent. Apothecia rare, lecanorine, sessile, strongly constricted, up to 1 mm diam. Surface brown, plane, C-, P-. Margin distinct, thick, crenulate, whitish to pale grey, K+ yellow, C-, KC-, P-. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 10-16 x 5-8 μ . Photobiont chlorococcoid. - Note: certainly occurring in the Alps, but difficult to recognize, being often sterile.

35 Ascomata neither bright nor dark-coloured. Thallus KC+ red, C+ red

Pertusaria geminipara

Thallus crustose, whitish grey to yellowish white, granulose, K+ yellow, C+ red, KC+ red, P+ orange. Areolae convex, verrucose, contiguous. Soredia whitish tending to very pale ochraceous, P+ orange. Soralia maculiform, apical, prominent. Apothecia rare, lecanorine, sessile, strongly constricted, up to 2.5 mm diam. Surface pale reddish brown, plane, smooth. Margin distinct, thick, crenulate. Paraphyses anastomosing, ramified, adglutinated. Asci bitunicate. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 2 per ascus, 22-40 x 15-20 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on mosses, plant debris and soil over acid substrata, certainly more widespread in the Alps, but overlooked and undercollected in the past.

36 Thallus KC-

Ochrolechia androgyna

Thallus crustose, whitish, K-, C-, KC-, P-. Hypo/prothallus present, pale. Soredia granular, yellowish to grey-green, K-, C+ red, KC+ red, P-. Soralia maculiform, prominent. Medulla UV -. Apothecia rare, lecanorine, sessile. Surface plane. Margin distinct, thick, whitish, paler than disk. Ascospores hyaline, ellipsoid, 8 per ascus. Photobiont chlorococcoid. - Note: on bark and on steeply inclined rock faces in humid montane forests, sometimes also on soil and terricolous bryophytes, absent from warm-dry areas, a polymorphic species, closely related to *O. tartarea*.

36 Thallus KC+ red

37

37 Thallus without orange-red, K+ red patches. Thallus areolate, whitish to pale grey

Trapeliopsis granulosa

Thallus crustose, whitish to pale grey, thick, areolate, granulose, K-, C+ red, KC+ red, P-. Areolae convex, contiguous. Soredia diffuse, granular, whitish to brownish yellow, K-, C+ red, KC+ red, P-. frequent sessile, up to 1.5 mm diam. Surface extremely variable in colour, pale pink to reddish brown or dark grey-green. Margin distinct, thin. Epithemium pale to brownish. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 9-14 x 4-6 μ . Pycnidia dark, immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil rich in humus, bryophytes, peat, rotting wood.

37 Thallus with orange-red, K+ red patches. Thallus continuous, grey to greenish-white with dirty orange patches

Trapeliopsis pseudogranulosa

Thallus crustose, grey to greenish-white with dirty orange patches, continuous,

granulose, K-, C+ red, KC+ red, P-. Soredia granular, greenish white, in part orange-pigmented, K-, C+ red, KC+ red, P-. Medulla UV + deep orange-red in the pigmented parts. Apothecia rare, without a thalline margin, sessile, up to 1.5 mm diam. Surface greenish grey to grey-black. Margin distinct, thin. Epithymenium pale to brownish. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 9-14 x 4-6 μ . Pycnidia dark, immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: in humid Castanea woodlands, on mosses on basal parts of trunks, decaying lignum and acid organic soil, esp. in areas with siliceous substrata, certainly more widespread, but certainly not common in Italy.

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|----|-----------------|----|
| 38 | With perithecia | 39 |
| 38 | With apothecia | 51 |
| 39 | Thallus C+ red | |

Protothelenella leucothelia

Thallus crustose, whitish, granulose, K-, C+ red, P-. Perithecia frequent, immersed in thalline warts, up to 0.5 mm diam. Surface black. Perithecial wall light-coloured below. Asci cylindrical. Ascospores many-celled, hyaline, fusiform-elongate, muriform, thick-walled, 8 per ascus, 24-36 x 9-14 μ . Photobiont chlorococcoid. Outer spore wall distinctly thicker than septa. - Note: on soil, muribund bryophytes, plant debris and lichens (Cladonia), sometimes on rotting wood, probably ranging throughout the Alps.

- | | | |
|----|---------------------|----|
| 39 | Thallus C- | 40 |
| 40 | Ascospores 1-celled | |

Thrombium epigaeum

Thallus crustose, yellowish to greyish, indistinct, subgelatinous when wet, thin, continuous, K-, C-, KC-, P-. Perithecia frequent, globose, fully immersed, not flattened, up to 0.4 mm diam. Surface black. Paraphyses simple, not apically thickened, free. Perithecial wall dark throughout. Asci cylindrical. Ascospores 1-celled, hyaline, clavate, 8 per ascus, (15)18-25(30) x 5-10(12) μ . Photobiont chlorococcoid. - Note: an ephemeral early colonizer of more or less calciferous, clayey soil in rather disturbed habitats, such as on track sides, in dry pastures, etc., very easy to overlook, and probably undercollected in Italy.

- | | | |
|----|--|----|
| 40 | Not as above | 41 |
| 41 | Ascospores 2-celled | 42 |
| 41 | Not as above | 43 |
| 42 | Ascospores 32 per ascus, with appendages at both ends. Ascospores fusiform | |

Epigloea grummannii

Thallus crustose, inconspicuous, subgelatinous, more or less greenish, thin, continuous, K-, C-, KC-, P-. Perithecia frequent, globose, not flattened, up to 0.13 mm diam. Surface black. Paraphyses simple, not apically thickened. Ascospores 2, hyaline, fusiform, thin-walled, not ornamented, 32 per ascus, (13-16.5(18) x 1.5-2(2.5) μ . Photobiont chlorococcoid. with appendages at both ends. - Note: on algal colonies developing on dying mats of Grimmia and Hypnum, certainly overlooked, and more widespread in the Alps.

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| 42 | Ascospores 8 per ascus, without appendages at the ends. Ascospores ellipsoid | |
|----|--|--|

Epigloea soleiformis

Thallus crustose, inconspicuous, subgelatinous, more or less greenish, thin, continuous, K-, C-, KC-, P-. Perithecia frequent, globose, up to 0.15 mm diam. Surface green-black with a thin gelatinous coat, and with a depression around the ostiole. Paraphyses simple, not apically thickened. Ascospores 2, hyaline, ellipsoid, constricted at septa, thin-walled, not ornamented, 8 per ascus, (8.5)9.5-12.5(14) x 3.5-4.5(5) μ . Photobiont chlorococcoid. without appendages at the ends. - Note: on algal colonies developing on muribund bryophytes, squamules of Cladonia, decaying wood and humus, certainly overlooked, and more widespread in the Alps.

- | | | |
|----|-------------------------------|----|
| 43 | Ascospores 4-celled | 44 |
| 43 | Ascospores more than 4-celled | 45 |

- 44 Ascospores narrowly ellipsoid. Paraphyses present. Thallus inconspicuous, subgelatinous, more or less greenish

Epigloea medioincrassata

Thallus crustose, inconspicuous, subgelatinous, more or less greenish, thin, continuous, K-, C-, KC-, P-. Perithecia frequent, globose, flattened, up to 0.22 mm diam. Surface brown to rarely black, covered by a thin gelatinous layer, apex with a circular swelling. Paraphyses simple, not apically thickened. Ascospores 2, hyaline, narrowly ellipsoid, thin-walled, not ornamented, 8 per ascus, (18)24-70(86) x (10)11-15(16) μ. Photobiont chlorococcoid. with appendages at both ends. - Note: on algal colonies on muribund bryophytes and, more rarely, on lignum, certainly overlooked, and more widespread in the Alps.

- 44 Ascospores ellipsoid. Paraphyses absent. Thallus grey to pale brownish grey

Thelidium zwackhii

Thallus crustose, grey to pale brownish grey, thin, continuous, K-, C-, KC-, P-. Perithecia frequent, up to 0.3 mm diam. Surface black. Hymenium J+ red. Paraphyses absent. Perithecial wall light-coloured below. Ascospores hyaline, ellipsoid, 8 per ascus, 26-36 x 10-14 μ. Photobiont chlorococcoid. - Note: on calcareous and basic siliceous rocks and thin layers of soil, e.g. on walls, pebbles, etc., one of the few species of the genus which are most common at low altitudes in Italy, overlooked, and to be searched for more intensively throughout the country.

- 45 Perithecial wall light-coloured below

46

- 45 Perithecial wall dark throughout

48

- 46 Ascospores submuriform

Protothelenella sphinctrinoidella

Thallus crustose, whitish, thin, continuous, K-, C-, P-. Perithecia frequent, semi-immersed, up to 0.3 mm diam. Surface black. Perithecial wall light-coloured below. Asci cylindrical. Ascospores many-celled, hyaline, broadly ellipsoid, submuriform, thick-walled, 8 per ascus, 22-23 x 7-10 μ. Photobiont chlorococcoid. Thallus greenish when wet Outer spore wall distinctly thicker than septa. - Note: on soil, muribund bryophytes and lichens, more rarely on decaying plants, often in rather disturbed habitats, e.g. on mountain track sides, certainly more widespread in the Alps.

- 46 Ascospores muriform

47

- 47 Ascospores 2-4 per ascus, colourless when young, straw-coloured when old.

Chromatochlamys muscorum

Thallus crustose, whitish to pale brown, thin, continuous, K-, C-, KC-, P-. Perithecia frequent, semi-immersed, up to 0.6 mm diam. Surface brownish, convex. Perithecial wall light-coloured below. Ascospores muriform, 2 per ascus, 60-110 x 20-27 μ. Photobiont chlorococcoid. Ascospores colourless when young, straw-coloured when old, 2-4 per ascus. - Note: on more or less muribund pleurocarpous mosses on rocks and soil, when epiphytic, on basal parts of old trunks.

- 47 Ascospores 8 per ascus, colourless or not

Protothelenella sphinctrinoides

Thallus crustose, whitish, thin, continuous, K-, C-, P-. Perithecia frequent, semi-immersed, up to 0.5 mm diam. Surface black. Perithecial wall light-coloured below. Asci cylindrical. Ascospores many-celled, hyaline, broadly ellipsoid, muriform, thick-walled, 8 per ascus, 38-50 x 10-15 μ. Photobiont chlorococcoid. Thallus greenish and gelatinous when wet Outer spore wall distinctly thicker than septa. - Note: on muribund bryophytes on soil and rock, more rarely on soil, in rather disturbed sites (e.g. on mountain track sides) with a long snow-lie, often in crevices or small depressions of the ground, much undercollected, probably ranging throughout the Alps.

- 48 Ascospores not hyaline

Polyblastia helvetica

Thallus crustose, pale to rather dark grey, thin, continuous, K-, C-, KC-, P-. Perithecia frequent, semi-immersed, globose. Paraphyses absent. Margin (section) black in the upper part, brown below. Perithecial wall dark throughout. Asci verrucarial. Ascospores many-celled, not hyaline, ellipsoid-cylindrical, muriform, 2 per ascus, 70-160 x 30-60 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: both on calciferous soil and amongst bryophytes.

- 48 Ascospores hyaline 49
49 Ascospores <40 μ long

Polyblastia sendtneri

Thallus crustose, grey-white, sometimes tinged brown, thick, continuous, cartilaginous, gelatinous when wet, K-, C-, KC-, P-. Perithecia frequent, globose, half immersed, with an involucrellum extending to the upper half, up to 0.2 mm diam. Surface black. Paraphyses absent. Perithecial wall dark throughout. Asci verrucarial. Ascospores many-celled, hyaline, ellipsoid-cylindrical, muriform, 8 per ascus, 15-30 x 9-16 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on organic soil, mosses and plant debris, most common in the Alps.

- 49 Ascospores >40 μ long 50
50 Thallus thin, continuous. Ascospores 45-60 x 18-25 μ

Polyblastia evanescens

Thallus crustose, grey, thin, continuous, not gelatinous when wet, K-, C-, KC-, P-. Perithecia frequent, globose, protruding, up to 0.2 mm diam. Surface black. Paraphyses absent. Perithecial wall dark throughout. Asci verrucarial. Ascospores many-celled, hyaline, ellipsoid-cylindrical, muriform, 8 per ascus, 45-60 x 18-25 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on bryophytes (Rhacomitrium, Distichum, Encalypta), very rarely collected, but perhaps more widespread in the Alps.

- 50 Thallus thick, granulose. Ascospores 50-90 x 18-40 μ

Polyblastia terrestris

Thallus crustose, grey, thick, granulose, K-, C-, KC-, P-. Perithecia frequent, globose, protruding, with an involucrellum extending to the upper half, covered by a thalline layer, up to 0.8 mm diam. Surface black. Paraphyses absent. Perithecial wall dark throughout. Asci verrucarial. Ascospores many-celled, hyaline, ellipsoid-cylindrical, muriform, 8 per ascus, 50-90 x 18-40 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on more or less calcareous soil, both on bare ground and amongst bryophytes, a very polymorphic taxon, which needs revision.

- 51 Ascospores 4-celled 52
51 Not as above 58
52 Apothecia lecanorine, with a thalline margin containing algal cells

Rinodina conradii

Thallus crustose, whitish grey to brown, thin, areolate, K-, C-, KC-, P-. Areolae rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1 mm diam. Surface dark brown to blackish, convex. Margin distinct, thin, smooth. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, narrowly ellipsoid, thick-walled, 8 per ascus, 25-35 x 10-15 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: a short-lived early colonizer of more or less base-rich soil and terricolous bryophytes in open habitats, sometimes on mosses on basal parts of ancient trees.

- 52 Apothecia non lecanorine, without a thalline margin 53
53 Ascomata dark 54
53 Ascomata neither bright nor dark-coloured 56
54 Thallus C+ red

Micarea peliocarpa

Thallus crustose, grey, thin, areolate, K-, C+ red, P-. Areolae convex. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 0.7 mm diam. Surface pale to dark grey-black, convex. Margin indistinct. Epihymenium K-, C+ orange, P-, N+ red. Hymenium K-, C+ orange, + red. Subhymenium colourless. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci unitunicate, clavate. Ascospores 2-6-celled, hyaline, fusiform-elongate, thin-walled, 8 per ascus, (11)15-23(24) x 3-5(6) μ . Photobiont chlorococcoid. Macroconidia less than 50 μ long. Apothecia sometimes tuberculate, Reactions of apothecial sections often ephemeral. - Note: an ecologically wide-ranging species, found on acid bark of deciduous (esp. old oaks and Fagus) and coniferous trees, lignum, peaty soil.

54 Thallus C-

55 Hypothecium dark. Epihymenium N-

55

Micarea botryoides

Thallus crustose, grey, thin, granulose, K-, C-, KC-, P-. Apothecia rare, without a thalline margin, sessile, often tuberculate, up to 0.4 mm diam. Surface brownish, convex, K-, C-, KC-, P-. Margin indistinct. Epihymenium colourless to brownish, K-, C-, P-, N-, KC-. Hymenium K-, C-, KC-, P-, N-. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci unitunicate, clavate. Ascospores 1-4-celled, hyaline, oval, thin-walled, 8 per ascus, 8-13(16) x 2.3-3.7(4) μ . Pycnidia dark, sessile. Photobiont chlorococcoid. - Note: on a wide variety of substrata, including soil, bryophytes, muribund plants, siliceous rocks, conifer bark, mostly on vertical or underhanging faces, certainly much overlooked, and present in the Alps, but never common in Italy.

55 Hypothecium pale to colourless. Epihymenium N+ red.

Mycobilimbia lobulata

Thallus crustose, whitish grey to grey, darker in the centre of the squamules, K-, C-, KC-, P-. Squamules <0.5 mm wide, crenate, flattened, smooth, contiguous, adpressed to the substratum. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface dark brown to black, convex. Margin indistinct. Epihymenium pale greenish grey, K-, N+ red. Hymenium J+ violet. Subhymenium red-brown. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 1-4-celled, hyaline, fusiform, 8 per ascus, 14-20(26) x 3-5(6) μ . Photobiont chlorococcoid. - Note: on terricolous mosses and bare calciferous soil, from the Alps to the high Mediterranean mountains.

56 Thallus K+ orange

Icmadophila ericetorum

Thallus crustose, pale green, glaucous green to whitish grey, continuous, granulose, K+ orange, C-, KC+ orange, P+ orange. Medulla UV + glaucous. Apothecia frequent, without a thalline margin, sessile, up to 3 mm diam. Surface pink to pale orange-pink, sometimes faintly pruinose. Margin distinct, thin, smooth. Epihymenium colourless, K+ orange. Subhymenium colourless. Ascospores (1)4-celled, hyaline, fusiform-elongate, 8 per ascus, 13-27 x 4-6 μ . Pycnidia immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on decaying wood and muribund bryophytes, common in the Alps, rarer on the high Mediterranean mountains.

56 Thallus K-

57 Thallus C-. Epihymenium C-, N-

57

Biatora carnealbida

Thallus crustose, grey, thin, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface white, convex, K-, C-, KC-, P-. Margin indistinct, thin. Epihymenium colourless, K-, C-, P-, N-, KC-. Subhymenium colourless. Margin (section) colourless. Ascospores (1)4-celled, hyaline, fusiform, 8 per ascus, (12)13-22 x 4-7 μ . Photobiont chlorococcoid. - Note: on mosses growing on bark of old deciduous trees, esp. near the base of the trunks, in old, humid forests.

57 Thallus C+ red. Epihymenium C+ orange, N+ red

Micarea peliocarpa

Thallus crustose, grey, thin, areolate, K-, C+ red, P-. Areolae convex. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 0.7 mm diam. Surface pale to dark grey-black, convex. Margin indistinct, paler than disk. Epihymenium K-, C+ orange, P-, N+ red. Hymenium K-, C+ orange, + red. Subhymenium colourless. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci unitunicate, clavate. Ascospores 2-6-celled, hyaline, fusiform-elongate, thin-walled, 8 per ascus, (11)15-23(24) x 3-5(6) μ . Photobiont chlorococcoid. Macroconidia less than 50 μ long. Reactions of apothecial sections often ephemeral. - Note: an ecologically wide-ranging species, found on acid bark of deciduous (esp. old oaks and Fagus) and coniferous trees, lignon, peaty soil.

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| 58 | Ascospores more than 4-celled | 59 |
| 58 | Not as above | 71 |
| 59 | Apothecia lecanorine, with a thalline margin containing algal cells | 60 |
| 59 | Apothecia non lecanorine, without a thalline margin | 62 |
| 60 | Thallus K-. Apothecia <0.5 mm broad, perithecioid. Ascospores acicular | |

Belonia incarnata

Thallus crustose, greyish white to greenish grey, subgelatinous when wet, thin, K-, C-, KC-, P-. Apothecia frequent, lecanorine, immersed in thalline warts, up to 0.5 mm diam. Surface pinkish to yellowish grey, concave, not exposed. Hymenium K-, C-. Paraphyses not anastomosing, simple, not apically thickened, free. Asci cylindrical. Ascospores many-celled, hyaline, acicular, 8 per ascus, 120-160 x 3-4 μ . Photobiont chlorococcoid. Ascocarps opening by a wide pore. - Note: on soil rich in humus, often in rather disturbed habitats, such as on mountain track sides, mostly above treeline, easy to overlook and probably more widespread throughout the Alps.

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| 60 | Thallus K+ yellow changing to red. Apothecia >0.5 mm broad, non perithecioid. Ascospores non acicular | 61 |
| 61 | Ascospores per ascus 4-8. Non parasitic. Thallus pruinose | |

Diploschistes diacapsis

Thallus crustose, grey to greyish white, areolate, K+ yellow changing to red, C+ red, KC+ red, P-. Areolae 1-2(3) mm wide, angular, convex, contiguous. Apothecia frequent, lecanorine, immersed, not constricted. Surface black, often faintly white-pruinose, concave. Margin distinct. Paraphyses simple, not apically thickened, free. Asci bitunicate, cylindrical. Ascospores many-celled, not hyaline, broadly ellipsoid, muriform, 4-8 per ascus, 20-38 x 9-17 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on more or less calcareous, or base-rich soil in open, dry situations, certainly much more widespread in dry grasslands throughout the country.

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| 61 | Ascospores per ascus 4. Parasitic on other lichens. Thallus non-pruinose | |
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Diploschistes muscorum

Thallus crustose, greenish to whitish grey, thick, areolate, loosely attached, K+ yellow changing to red, C+ red, KC+ red, P-. Areolae 1-2(3) mm wide, convex, contiguous. Apothecia frequent, lecanorine, immersed, not constricted. Surface black, often faintly pruinose, concave. Margin distinct. Paraphyses simple, not apically thickened, free. Asci bitunicate, cylindrical. Ascospores many-celled, not hyaline, broadly ellipsoid, muriform, 4 per ascus, 18-32 x 6-15 μ . Parasitic on *Cladonia* spp. when young. Photobiont chlorococcoid. - Note: often - but apparently not always - parasitic on *Cladonia squamules* (esp. *C. pocillum* and *C. symphyarpa*), generally on mosses and plant debris in dry grasslands on limestone, not always distinguished from *D. diacapsis* in the older literature.

- | | | |
|----|---|----|
| 62 | Ascomata neither bright nor dark-coloured | 63 |
| 62 | Ascomata dark | 64 |
| 63 | Apothecial margin distinct. Ascospores acicular | |

Absconditella annexa

Thallus crustose, greenish, thin, continuous, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.5 mm diam. Surface yellowish brown, concave, smooth, K-, C-, KC-, P-. Margin distinct, smooth, yellowish brown. Ascospores 6-10-celled, hyaline, acicular, thin-walled, 8 per ascus, 35-50 x 2-4 μ .

Photobiont chlorococcoid. - Note: an ephemeral lichen of muribund bryophytes and soil on siliceous substrata, rarely collected, but perhaps more widespread in the Alps.

- 63 Apothecial margin indistinct. Ascospores ellipsoid-cylindrical

Mycobilimbia sabuletorum

Thallus crustose, whitish to greenish white, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface pinkish brown to blackish brown, convex. Margin indistinct, thin, smooth, concolorous with disk. Epithymenium brownish, K-. Hymenium J+ violet. Subhymenium pale reddish brown to colourless. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 6-12-celled, hyaline, ellipsoid-cylindrical, 8 per ascus, 18-40 x (4)5-8 μ . Photobiont chlorococcoid. - Note: on mosses overgrowing soil, calcareous rocks, tree bark, also found in urban environments (e.g. on walls).

- 64 Ascospores muriform/submuriform

65

- 64 Ascospores not muriform/submuriform

67

- 65 Ascospores <35 μ broad

Gyalidea scutellaris

Thallus crustose, greyish, thin, continuous, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.8 mm diam. Surface pale to very dark brown, concave. Margin distinct, thick, rough, brown, paler than disk, paler than disk. Paraphyses simple, not apically thickened, adglutinated. Ascospores many-celled, hyaline, ovoid, muriform, 4-8 per ascus, 28-35 x 15-25 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: an arctic-alpine species, found on humid, more or less acid substrata, such as muribund bryophytes and soil rich in humus, restricted to the Alps in Italy.

- 65 Ascospores >35 μ broad

66

- 66 Epithymenium bluish green

Schadonia alpina

Thallus crustose, greyish brown, thin, continuous, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1.5 mm diam. Surface black, matt, plane, smooth. Margin distinct, thick, smooth, black, often shiny, concolorous with disk. Epithymenium bluish green. Subhymenium brown. Paraphyses anastomosing, ramified, not apically thickened. Asci cylindrical. Ascospores many-celled, hyaline, broadly ellipsoid, muriform, 4-8 per ascus, (30)40-50(60) x 10-18(20) μ . Photobiont chlorococcoid. - Note: on soil and muribund bryophytes in areas with siliceous substrata.

- 66 Epithymenium dark brown

Schadonia fecunda

Thallus crustose, greyish brown, thin, continuous, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1.5 mm diam. Surface black, matt, plane, smooth. Margin distinct, thick, smooth, black, often shiny, concolorous with disk. Epithymenium dark brown, K+ brownish. Subhymenium brown. Paraphyses anastomosing, ramified, not apically thickened. Asci cylindrical. Ascospores many-celled, hyaline, broadly ellipsoid, muriform, 4-8 per ascus, (30)40-50(60) x 10-18(20) μ . Photobiont chlorococcoid. - Note: on mosses and plant remains over acid siliceous substrata.

- 67 Parasitic on *Baeomyces* when young

Arthrorhaphis grisea

Thallus crustose, whitish grey to dark grey-green, immersed in the thallus of the host, thin, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, not constricted. Surface black, at first urceolate, then disc-shaped, concave, smooth. Margin distinct, thick, smooth, black. Epithymenium K-. Hymenium interspersed. Paraphyses anastomosing, ramified, not apically thickened, free. Asci bitunicate, clavate. Ascospores 10-16-celled, hyaline, acicular, thin-walled, 8 per ascus, (20)30-50(70) x 2-2.5(4) μ . Photobiont chlorococcoid. - Note: on soil and weathered siliceous rocks, with optimum in subalpine-Alpine habitats, first parasymbiotic on *Baeomyces*, later an autonomous lichen.

- 67 Non parasitic 68
 68 Ascospores less than 4 μ large 69
 68 Ascospores more than 4 μ large 70
 69 Ascomata black. Epithymenium greenish. Ascospores 25-45 x 2-2.5(3) μ

Bacidia bagliettoana

Thallus crustose, whitish, thin. Apothecia without a thalline margin, sessile, strongly constricted, up to 1 mm diam. Surface black, plane. Margin distinct, black. Epithymenium greenish, K-, C-, P-, N+ violet, KC-. Subhymenium reddish-brown. Paraphyses simple. Ascospores hyaline, acicular, 8 per ascus, 25-45 x 2-2.5(3) μ . Photobiont chlorococcoid. Apothecial margin reddish brown in upper and outer parts, colourless below. - Note: on muribund bryophytes and plant debris in dry grasslands, or in fissures of calcareous rocks and dolomite.

- 69 Ascomata brownish. Epithymenium brownish. Ascospores 36-60 x 2-2.5 μ

Bacidia herbarum

Thallus crustose, whitish. Apothecia without a thalline margin, sessile. Surface brownish, plane. Margin distinct. Epithymenium brownish, K-. Ascospores 4-8-celled, hyaline, acicular, 8 per ascus, 36-60 x 2-2.5 μ . Photobiont chlorococcoid. - Note: on plant remains and muribund bryophytes on calciferous ground, probably more widespread, also along the Apennines.

- 70 Thallus P+ red. Ascospores fusiform-elongate, 4-8-celled

Micarea lignaria

Thallus crustose, grey, thin, areolate, K-, C-, KC-, P+ red. Areolae convex. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 0.7 mm diam. Surface black, convex, K-, C-, KC-. Margin indistinct. Epithymenium olivaceous to greenish, K-, C-, P-, N+ red. Hymenium K-, C-, + red. Subhymenium olivaceous. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci unitunicate, clavate. Ascospores 4-8-celled, hyaline, fusiform-elongate, thin-walled, 8 per ascus, 16-36(38) x 4-6(7) μ . Pycnidia immersed. Photobiont chlorococcoid. Minute granules of violet (K+intensely aeruginose) pigment present in the hymenium - Note: the most common species of the genus in Italy, found on a wide variety of substrata such as plant remains, bark, and lignum.

- 70 Thallus P-. Ascospores ellipsoid-cylindrical, 6-12-celled

Mycobilimbia sabuletorum

Thallus crustose, whitish to greenish white, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface pinkish brown to blackish brown, convex. Margin indistinct, thin, smooth, concolorous with disk. Epithymenium brownish, K-. Hymenium J+ violet. Subhymenium pale reddish brown to colourless. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 6-12-celled, hyaline, ellipsoid-cylindrical, 8 per ascus, 18-40 x (4)5-8 μ . Photobiont chlorococcoid. - Note: on mosses overgrowing soil, calcareous rocks, tree bark, also found in urban environments (e.g. on walls).

- 71 Thallus margin effigurate 72
 71 Thallus margin non effigurate 73
 72 Ascomata neither bright nor dark-coloured, substipitate. Ascospores hyaline

Baeomyces placophyllus

Thallus crustose, glaucous grey-green, thick, effigurate, orbicular, lobulate, K+ yellow, C-, KC+ orange, P+ orange. Lobes (2)3-6 mm wide, elongate, flattened, contiguous, adpressed to the substratum. Edge up-turned, entire, paler than thallus. Medulla P+ orange. Medulla UV + orange. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface red brown, plane. Paraphyses simple. Asci cylindrical. Ascospores hyaline, fusiform, 8 per ascus, 8-14 x 2-4 μ . Conidia bacilliform. Photobiont chlorococcoid. - Note: on sandy-clay soil in rather open stands (e.g. montane-subalpine grasslands), often in moderately disturbed habitats, sometimes reaching the Alpine belt.

- 72 Ascomata dark, sessile. Ascospores not hyaline

Buellia elegans

Thallus crustose, white, effigurate, orbicular, farinose, K+ yellow. Lobes elongate, flattened, contiguous, adpressed to the substratum. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface black, rarely faintly pruinose, plane. Margin distinct, thin. Epithymenium yellowish brown. Subhymenium brownish. Paraphyses distinctly thickened above, with dark cap. Ascospores 2-celled, not hyaline, ellipsoid, constricted at septa, thin-walled, with rugulate ornamentation, 8 per ascus, (12)13-20(23) x (5.5)6-10(10.5) μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soil deriving from calciferous schists in open grasslands.

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| 73 | Ascospores 2-celled | 74 |
| 73 | Ascospores 1-celled | 103 |
| 74 | Ascomata neither bright nor dark-coloured | 75 |
| 74 | Ascomata either dark or bright coloured (yellow to orange) | 76 |
| 75 | Apothecia lecanorine, with a thalline margin containing algal cells. Thallus K+ yellow, KC+ red | |

Anzina carneonivea

Thallus crustose, whitish grey, thin, hemiendosubstratic, continuous, K+ yellow, C+ red, KC+ red, P-. Apothecia lecanorine, sessile. Surface yellowish to orange, plane. Margin indistinct, thin, smooth, paler than disk. Epithymenium K-. Hymenium J-. Paraphyses anastomosing, ramified, not apically thickened. Asci cylindrical. Ascospores hyaline, ellipsoid, not ornamented, 8 per ascus, 11-15 x 5-7 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on bark, esp. of conifers, wood, plant debris.

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| 75 | Apothecia non lecanorine, without a thalline margin. Thallus K-, KC- | |
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Micarea prasina

Thallus crustose, grey, thin, composed of goniocysts, finely granular, gelatinous when wet, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 0.5 mm diam. Surface brownish, convex. Margin indistinct. Epithymenium olivaceous, K+ violet, C-, P-, N+ red, KC-. Hymenium K+ violet, C-, KC-, P-, + red. Subhymenium colourless to yellowish. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci unitunicate, clavate. Ascospores (1)2(4)-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 8-14(17) x 2.3.4(5) μ . Pycnidia immersed. Photobiont chlorococcoid. - Note: a morphologically and chemically variable species, found on basal parts of old, acid-barked trees in montane forests, and on a wide range of other substrata, one of the most common species of the genus in Italy.

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| 76 | Ascomata from bright yellow to red | 77 |
| 76 | Ascomata dark | 86 |
| 77 | Ascospores non polar-diblastic | 78 |
| 77 | Ascospores polar-diblastic | 79 |
| 78 | Thallus C-. Ascomata not immersed in thalline warts. Ascospores per ascus 8 | |

Caloplaca nivalis

Thallus crustose, grey, thin, granulose, K-, C-, P-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 0.5 mm diam. Surface yellowish to brownish-yellowish green, plane, K+ red, C-, P-. Margin distinct, thin, smooth. Epithymenium orange, K+ red. Subhymenium colourless. Paraphyses not anastomosing, simple, distinctly thickened above. Asci clavate. Ascospores 2-celled, hyaline, fusiform-elongate, 8 per ascus, 22-31 x 5-7 μ . Pycnidia orange-yellow, immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. - Note: on silicicolous mosses (esp. *Andraea* and *Grimmia*).

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| 78 | Thallus C+ red. Ascomata immersed in thalline warts. Ascospores per ascus 1 | |
|----|---|--|

Varicellaria rhodocarpa

Thallus crustose, yellowish grey to whitish, granulose, K-, C+ red, KC+ red, P-. Apothecia frequent, immersed in thalline warts, immersed. Surface yellow to reddish, plane. Margin indistinct. Ascospores 2-celled, hyaline, oblong-obtuse, thick-walled, 1 per ascus, 200-400 x 70-140 μ . Photobiont chlorococcoid.

Ascocarps 1-3 per wart, warts fissured at the margin. - Note: on acid soil, and plant remains, more rarely on lignum or on rocks, in tundra-like environments, restricted to the Alps in Italy.

79 Ascospores 4 per ascus

Caloplaca tetraspora

Thallus crustose, grey, thin, areolate, granulose, K-. Soredia K-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1 mm diam. Surface rusty red, convex, K+ red. Margin indistinct, thin, smooth, concolorous with disk. Epithymenium orange, K+ red. Subhymenium colourless. Ascospores hyaline, ellipsoid, polar-diblastic, 4 per ascus, 24-34 x 12-16 µ. Pycnidia orange-yellow, immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum > 3 µ long. - Note: on bryophytes and plant debris in areas with base-rich or somehow calciferous siliceous substrata, certainly more widespread in the Alps.

79 Ascospores 8 per ascus

80

80 Apothecial margin neither dark nor bright-coloured

81

80 Apothecial margin from bright yellow to orange

83

81 Thallus brownish grey, very thick

Caloplaca congregiens

Thallus crustose, brownish grey, thick, thick, K-, C-, KC-, P-. Areolae convex, subsquamulose, contiguous. Apothecia frequent, lecanorine, sessile, up to 0.6 mm diam. Surface orange, plane, K+ red. Margin distinct, thick, smooth, K-, C-, KC-, P-. Epithymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, polar-diblastic, 8 per ascus, 12-15 x 4-8 µ. Photobiont chlorococcoid. - Note: on epilithic mosses overgrowing base-rich, often volcanic, siliceous rocks.

81 Thallus grey, thin

82

82 Ascomata greenish-yellow

Caloplaca cerina v. chloroleuca

Thallus crustose, grey, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile. Surface greenish-yellow, K+ red. Margin distinct, smooth, grey, K-, C-, KC-, P-. Epithymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, polar-diblastic, 8 per ascus, 12-15 x 4-8 µ. Photobiont chlorococcoid. - Note: on mosses and plant debris in tundra-like habitats, esp. in areas with calcareous or basic siliceous rocks, to be looked for in the mountains of Sicilia.

82 Ascomata orange

Caloplaca cerina v. muscorum

Thallus crustose, grey, thin, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile. Surface orange, K+ red. Margin smooth, grey, K-, C-, KC-, P-. Epithymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, polar-diblastic, 8 per ascus, 12-15 x 4-8 µ. Photobiont chlorococcoid. - Note: on mosses and plant debris in tundra-like habitats, esp. in areas with calcareous or basic siliceous rocks, to be looked for in the mountains of Sicilia.

83 Apothecia at least when young bright yellow to orange

Caloplaca tirolensis

Thallus crustose, pale grey to whitish, thin, continuous, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1 mm diam. Surface yellow, becoming greenish yellow and darker with age, plane, K+ red. Margin distinct, thin, smooth, paler than disk, K+ red. Epithymenium K+ red. Ascospores hyaline, ellipsoid, polar-diblastic, 8 per ascus, 11-16 x 6-9 µ. Pycnidia immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum > 3 µ long. - Note: mainly on mosses and plant debris in Carex firma stands, often on leaves of Saxifraga, common throughout the calcareous Alps, rarer and localized in the Apennines.

83 Apothecia rusty red or dirty (brownish) orange, sometimes blackish orange when old

84

84 Apothecial margin indistinct also in young apothecia

Caloplaca sinapisperma

Thallus crustose, grey, thin, granulose, K-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1 mm diam. Surface rusty red, convex, K+ red. Margin indistinct. Epithymenium orange, K+ red. Subhymenium colourless. Ascospores hyaline, ellipsoid, polar-diblastic, 8 per ascus, 12-23 x 6-12 μ . Pycnidia orange-yellow, immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum > 3 μ long. - Note: on mosses and plant debris on more or less calcareous or base-rich siliceous substrata, sometimes reaching the montane belt in open habitats, common in the Alps, restricted to the highest areas of the Apennines.

84 Apothecial margin distinct

85

85 Thallus grey. Ascomata rusty red to blackish. Ascospores 13-17 x 6-8 μ

Caloplaca ammiospila

Thallus crustose, grey, thin, continuous, K-, C-, P-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1 mm diam. Surface rusty red to blackish, plane, K+ red. Margin distinct, thin, smooth. Epithymenium orange, K+ red. Subhymenium colourless. Ascospores hyaline, ellipsoid, polar-diblastic, 8 per ascus, 13-17 x 6-8 μ . Pycnidia orange-yellow, immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum > 3 μ long. - Note: on terricolous mosses and plant debris, more rarely on decaying, rather soft lignum.

85 Thallus pale grey to whitish. Ascomata brownish orange. Ascospores 18-21 x 7-10 μ

Caloplaca jungermanniae

Thallus crustose, pale grey to whitish, thin, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 2 mm diam. Surface brownish orange, plane, K+ red. Margin distinct, thin, smooth, brownish orange, clearly paler than disk, paler than disk, K+ red. Epithymenium K+ red. Ascospores hyaline, ellipsoid, polar-diblastic, 8 per ascus, 18-21 x 7-10 μ . Pycnidia immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum > 3 μ long. - Note: a circumpolar species of terricolous bryophytes and plant debris near and above treeline, on more or less calciferous substrata, but less common in areas with pure limestone, probably much more widespread in the Alps.

86 Apothecia lecanorine, with a thalline margin containing algal cells

87

86 Apothecia non lecanorine, without a thalline margin

94

87 Thallus K+ yellow

Rinodina mniaraea v. mniaereiza

Thallus crustose, whitish to pale brown to reddish brown, thin, areolate, K+ yellow, C-, KC-, P-. Areolae rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Medulla white. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1.5 mm diam. Surface dark brown to blackish, convex. Margin distinct, thin, smooth. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, 8 per ascus, 20-34 x 10-15 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soil, mosses, plant debris, in tundra-like environments.

87 Thallus K-

88

88 Ascospores hyaline

89

88 Ascospores not hyaline

90

89 Ascospores polar-diblastic, 8 per ascus, not constricted at septum

Caloplaca ammiospila

Thallus crustose, grey, thin, continuous, K-, C-, P-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1 mm diam. Surface rusty red to blackish, plane, K+ red. Margin distinct, thin, smooth. Epithymenium orange, K+ red. Subhymenium colourless. Ascospores hyaline, ellipsoid, polar-diblastic, 8 per ascus, 13-17 x 6-8 μ . Pycnidia orange-yellow, immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum > 3 μ long. - Note: on terricolous mosses and plant debris, more rarely on decaying, rather soft lignum.

89 Ascospores non polar-diblastic, more than 32 per ascus, constricted at septum

Solorinella asteriscus

Thallus crustose, white-pruinose, reduced to a few triangular lobes all around the apothecia, more visible in the wet state, thin, K-, C-, KC-, P-. Pruina diffuse. Apothecia frequent, lecanorine, sessile, up to 4 mm diam. Surface brownish black when dry, paler when wet, plane, smooth. Margin distinct, lobulate, pruinose. Paraphyses simple, not apically thickened, free. Asci clavate. Ascospores 2-celled, hyaline, narrowly ellipsoid, constricted at septa, curved, more than 32 per ascus, 7-17 x 2-4 μ . Photobiont chlorococcoid. - Note: a typical lichen of steppe grasslands on loess, restricted to a few alpine valleys with a strongly continental climate.

- 90 Apothecial margin (section!) with a well-developed cortex 91
90 Apothecial margin (section!) without a well-developed cortex 92
91 Apothecial cortex J-. Ascomata dark brown to greyish brown. Ascospores 16-24 x 7-10 μ

Rinodina olivaceobrunnea

Thallus crustose, grey-brown, thin, areolate, K-, C-, KC-, P-. Areolae rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Upper cortex paraplectenchymatous. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 0.7 mm diam. Surface dark brown to greyish brown, convex. Margin distinct, thin, smooth. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, 8 per ascus, 16-24 x 7-10 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. Apothecial cortex J-. - Note: on soil, bryophytes and plant debris in tundra-like environments, certainly widespread throughout the Alps.

- 91 Apothecial cortex J+ violet. Ascomata black. Ascospores 24-34 x 9-14 μ

Rinodina turfacea

Thallus crustose, grey-brown, thin, areolate, K-, C-, KC-, P-. Areolae rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1.7 mm diam. Surface black, convex. Margin distinct, thin, smooth. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, 8 per ascus, 24-34 x 9-14 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. Apothecial cortex J+ violet. - Note: on soil rich in humus and plant remains in tundra-like habitats.

- 92 Hypothecium <60 μ tall

Rinodina roscida

Thallus crustose, whitish grey, thin, areolate, K-, C-, KC-, P-. Areolae rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 3 mm diam. Surface black, often white-pruinose. Margin distinct, thin, smooth. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, 8 per ascus, 25-36 x 8-13 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. Medulla with crystals of oxalates. - Note: on soil, bryophytes and plant debris over more or less calcareous substrata in tundra-like habitats.

- 92 Hypothecium >60 μ tall 93
93 Medulla orange at least in lower parts. Ascomata dark brown to reddish brown. Ascospores 21-34 x 10-15 μ

Rinodina mniaraea v. cinnamomea

Thallus crustose, pale brown to reddish brown, thin, areolate, K-, C-, KC-, P-. Areolae rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Medulla orange at least in lower parts, K+ red. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1.5 mm diam. Surface dark brown to reddish brown, convex. Margin distinct, thin, smooth. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, 8 per ascus, 21-34 x 10-15 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soil, mosses, plant debris, in tundra-like environments.

- 93 Medulla white. Ascomata dark brown. Ascospores 20-34 x 10-15 μ

Rinodina mniaraea v. mniaraea

Thallus crustose, pale brown to reddish brown, thin, areolate, K-, C-, KC-, P-. Areolae rounded, flattened, smooth, contiguous, adpressed to the substratum, non imbricate. Medulla white. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1.5 mm diam. Surface dark brown, convex. Margin distinct, thin, smooth. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thick-walled, 8 per ascus, 20-34 x 10-15 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soil, mosses, plant debris, in tundra-like environments.

- 94 Thallus C+ orange

Buellia hypophana

Thallus crustose, greyish white, C+ orange, KC+ orange. Apothecia frequent, without a thalline margin, sessile. Surface black. Margin distinct, smooth, black. Hymenium inspersed. Subhymenium dark brown K+ reddish. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thin-walled, 8 per ascus, 16-20 x 6-8 μ . Pycnidia dark, immersed. Photobiont chlorococcoid. - Note: on *Grimmia* spp., probably more widespread in the Alps.

- 94 Not as above

95

- 95 Thallus C+ red

Buellia reagens

Thallus crustose, pale yellowish brown, C+ red. Apothecia frequent, without a thalline margin, sessile. Surface black. Margin distinct, smooth, black. Subhymenium dark. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thin-walled, 8 per ascus, 15-18 x 7-9 μ . Pycnidia dark, immersed. Photobiont chlorococcoid. - Note: on bryophytes overgrowing siliceous rocks.

- 95 Thallus C-

96

- 96 Thallus K+ yellow

97

- 96 Thallus K-

98

- 97 Thallus granulose. Ascospores 22-32 x 9-13 μ

Buellia insignis

Thallus crustose, whitish to pale grey, granulose, K+ yellow, C-, KC-. Apothecia frequent, without a thalline margin, sessile. Surface black, convex. Margin distinct, smooth, black. Hymenium inspersed. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thin-walled, 8 per ascus, 22-32 x 9-13 μ . Pycnidia dark, immersed. Photobiont chlorococcoid. - Note: on terricolous mosses and plant debris, rarely on rock, lignum and rather acid bark, esp. on basal parts of trunks.

- 97 Thallus verrucose. Ascospores 18-24 x 8-10 μ

Buellia papillata

Thallus crustose, whitish to pale grey, thick, verrucose, K+ yellow, C-, KC-. Areolae convex, contiguous. Apothecia frequent, without a thalline margin, sessile. Surface black, convex. Margin distinct, smooth, black. Hymenium inspersed. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline, ellipsoid, thin-walled, 8 per ascus, 18-24 x 8-10 μ . Pycnidia dark, immersed. Photobiont chlorococcoid. - Note: on terricolous bryophytes, related to *B. insignis*, but with smaller spores.

- 98 Ascospores not hyaline

Buellia epigaea

Thallus crustose, white, thick, areolate, K-, C-, KC-, P-. Areolae flattened, contiguous. Apothecia frequent, without a thalline margin, sessile. Surface black, convex, smooth. Margin distinct, smooth, black. Epihymenium brownish. Hymenium inspersed. Subhymenium colourless to pale brown. Paraphyses distinctly thickened above. Asci clavate. Ascospores 2-celled, not hyaline,

ellipsoid, thin-walled, ornamented, 8 per ascus, (14)15-21(26) x (6)7-10(11) μ . Pycnidia dark, immersed. Photobiont chlorococcoid. - Note: on base-rich mineral soil, on weathered gypsum and gypsum soil.

- 98 Ascospores hyaline 99
99 Hypothecium pale to colourless 100
99 Hypothecium dark 101
100 Epihymenium K-. Thallus areolate. Ascospores oblong-obtuse

Catillaria contristans

Thallus crustose, whitish to grey or brownish grey, areolate, granulose, K-, C-, KC-, P-. Areolae convex, contiguous. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface black, convex. Margin indistinct. Epihymenium dark green, K-, C-, N+ red. Subhymenium colourless to pale brown. Paraphyses slightly thickened above. Ascospores 2-celled, hyaline, oblong-obtuse, constricted at septa, thin-walled, 8 per ascus, 9-16.5 x 2.5-4.5 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on dead bryophytes (*Andreaea*, *Grimmia*) and soil rich in humus over acid siliceous rocks, it does not belong to *Catillaria* s. str.

- 100 Epihymenium K+ violet. Thallus granulose. Ascospores ellipsoid

Micarea prasina

Thallus crustose, grey, thin, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 0.5 mm diam. Surface brownish, convex. Margin indistinct. Epihymenium olivaceous, K+ violet, C-, P-, N+ red, KC-. Hymenium K+ violet, C-, KC-, P-, + red. Subhymenium colourless to yellowish. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci unitunicate, clavate. Ascospores (1)2(4)-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 8-14(17) x 2.3.4(5) μ . Pycnidia immersed. Photobiont chlorococcoid. Thallus composed of goniocysts, finely granular, gelatinous when wet. - Note: a morphologically and chemically variable species, found on basal parts of old, acid-barked trees in montane forests, and on a wide range of other substrata, one of the most common species of the genus in Italy.

- 101 Ascospores >4 μ broad

Mycobilimbia hypnorum

Thallus crustose, whitish to pale grey, thin, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1.2 mm diam. Surface dark brown to black, plane. Margin distinct, thin, smooth, concolorous with disk. Epihymenium pale brown, K-. Hymenium J+ violet. Subhymenium dark reddish brown, with scattered bluish granules reacting K+ green. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 1(-4)-celled, hyaline, ellipsoid, 8 per ascus, 10-16(19) x 4.5-6(7) μ . Photobiont chlorococcoid. Some spores 4-celled. - Note: on mosses, plant debris, soil, bark and lignum.

- 101 Ascospores <4 μ broad

102

- 102 Thallus continuous. Apothecial margin distinct. Ascospores ellipsoid-cylindrical

Catillaria melaenida

Thallus crustose, greyish, thin, continuous, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface black, plane. Margin distinct, thin, smooth, concolorous with disk. Epihymenium brownish, K-, C-, N-. Subhymenium dark brown. Paraphyses slightly thickened above. Ascospores 2-celled, hyaline, ellipsoid-cylindrical, thin-walled, 8 per ascus, 9-14 x 3-5 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: an ephemeral terricolous species, with optimum on clay soil in rather disturbed habitats.

- 102 Thallus granulose. Apothecial margin indistinct. Ascospores oval

Micarea botryoides

Thallus crustose, grey, thin, granulose, K-, C-, KC-, P-. Apothecia rare, without a thalline margin, sessile, up to 0.4 mm diam. Surface brownish, convex, K-, C-, KC-, P-. Margin indistinct. Epihymenium brownish, K-, C-, P-, N-, KC-. Hymenium K-, C-, KC-, P-, N-. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci unitunicate, clavate. Ascospores 1-4-celled, hyaline,

oval, thin-walled, 8 per ascus, 8-13(16) x 2.3-3.7(4) μ . Pycnidia dark, sessile. Photobiont chlorococcoid. Apothecia often tuberculate. - Note: on a wide variety of substrata, including soil, bryophytes, muribund plants, siliceous rocks, conifer bark, mostly on vertical or underhanging faces, certainly much overlooked, and present in the Alps, but never common in Italy.

103 Thallus K+ orange

Dibaeis baeomyces

Thallus crustose, grey, sometimes with soft, rounded, white to pale pink schizidia, thick, areolate, K+ orange, C-, KC+ orange, P+ orange. Areolae convex, contiguous, adpressed to the substratum. Medulla P+ orange. Medulla UV + orange. Apothecia frequent, without a thalline margin, stipitate. Surface rose-pink, convex. Paraphyses simple. Asci cylindrical. Ascospores hyaline, fusiform, 8 per ascus, 10-26 x 2-3 μ . Conidia bacilliform. Photobiont chlorococcoid. - Note: on rather humid, disturbed clay soil, often in Calluna-heaths.

103 Not as above

104

104 Thallus K+ yellow changing to red

105

104 Not as above

107

105 Apothecia non lecanorine, substipitate, pale-coloured

Baeomyces carneus

Thallus crustose, grey-green to dull greenish, thick, areolate, K+ yellow changing to red. Areolae convex, contiguous, adpressed to the substratum. Medulla P+ orange. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface red brown, convex. Margin K+ red. Paraphyses simple. Asci cylindrical. Ascospores hyaline, fusiform, 8 per ascus. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soils high in clay and on weathered siliceous rocks, a mainly boreal species.

105 Apothecia lecanorine, non stipitate, with a thalline margin containing algal cells, dark-coloured

106

106 Ascospores <17 μ long. Thallus thin, greyish

Bryonora castanea

Thallus crustose, greyish, thin, continuous, K+ yellow changing to red, C-, KC-, P-. Medulla UV -. Apothecia frequent, lecanorine, sessile, up to 3 mm diam. Surface dark reddish brown, plane. Margin distinct, thick, crenulate. Paraphyses simple, distinctly thickened above, adglutinated. Asci bitunicate, cylindrical. Ascospores 1-celled, hyaline, ellipsoid-cylindrical, thick-walled, 8 per ascus, 14-17 x 5-7 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soil, mosses, plant remains and on other lichens in Alpine grasslands.

106 Ascospores >17 μ long. Thallus thick, grey to brownish grey

Bryonora rhypariza

Thallus crustose, grey to brownish grey, thick, granulose, K+ yellow changing to red, C-, KC-, P-. Medulla UV -. Apothecia frequent, lecanorine, sessile, up to 4 mm diam. Surface dark brown to blackish brown, plane. Margin distinct, thick, crenulate. Paraphyses simple, distinctly thickened above, adglutinated. Asci bitunicate, cylindrical. Ascospores 1-celled, hyaline, ellipsoid-cylindrical, thick-walled, 8 per ascus, 17-27 x 4-7 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on mosses (Andraea, Grimmia), often associated with cyanobacteria (Stigonema), almost certainly restricted to the Alps in Italy.

107 Thallus K+ yellow

108

107 Thallus K-

115

108 Apothecia lecanorine, with a thalline margin containing algal cells

109

108 Apothecia non lecanorine, without a thalline margin

110

109 Thallus KC-, C-, P-

Lecanora epibryon

Thallus crustose, whitish to pale grey, continuous, K+ yellow, C-, KC-, P-. Areolae rounded, convex, contiguous, adpressed to the substratum. Hypo/prothallus present, dark. Apothecia frequent, lecanorine, sessile, strongly

constricted, up to 1 mm diam. Surface brown, plane, C-, P-. Margin distinct, thick, crenulate, whitish to pale grey, K+ yellow, C-, KC-, P-. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 10-16 x 5-8 μ . Photobiont chlorococcoid. - Note: on mosses and plant debris in open calcareous grasslands and alpine tundras, often on ridges in *Carex firma* stands, common in the Alps, rarer in the Apennines.

109 Thallus KC+ red, C+ red, P+ red

Pertusaria bryontha

Thallus crustose, whitish grey, continuous, K+ yellow, C+ red, KC+ red, P+ red. Medulla UV ++ glaucous to orange. Apothecia frequent, lecanorine, immersed in thalline warts, semi-immersed, not constricted, up to 2.5 mm diam. Surface brown-black, paler when young, plane, rough. Margin distinct. Epihymenium brown-black, K+ violet. Paraphyses ramified, free. Asci cylindrical. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 1 per ascus, (110)150-210(230) x (40)60-90(100) μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on mosses and plant debris, mostly on calcareous substrata, probably widespread throughout the Alps.

110 Apothecia stipitate

Baeomyces rufus

Thallus crustose, grey-green to dull greenish, thick, areolate, K+ yellow, KC+ yellow, P+ orange. Areolae convex, contiguous, adpressed to the substratum. Medulla UV -. Apothecia frequent, without a thalline margin, subterminal, stipitate. Surface red brown, convex. Paraphyses simple. Asci cylindrical. Ascospores hyaline, fusiform, 8 per ascus. Conidia bacilliform. Photobiont chlorococcoid. - Note: an early colonizer of acid soils with high clay content and of weathered siliceous rocks, often in disturbed sites, mostly sterile in upland areas. (Eur, N Amer).

110 Apothecia sessile

111

111 Ascomata neither bright nor dark-coloured

Lecidea rufofusca

Thallus crustose, whitish, greyish to pale greenish brown, granulose, K+ yellow, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.7 mm diam. Surface pale to dark reddish brown, convex. Margin indistinct, thin. Epihymenium brownish, K-. Subhymenium colourless to pale yellowish brown. Paraphyses free. Ascospores hyaline, ellipsoid, 8 per ascus, 11-18 x 6-9 μ . Photobiont chlorococcoid. - Note: on terricolous mosses and plant debris in siliceous areas.

111 Ascomata dark

112

112 Thallus KC+ orange

Lecidella wulfenii

Thallus crustose, grey to yellowish, K+ yellow, C+ orange, KC+ orange. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 1.5 mm diam. Surface black. Margin distinct, black, concolorous with disk. Epihymenium greenish, K-, C-. Subhymenium brown, paler above. Paraphyses simple, slightly thickened above, free. Margin (section) dirty black outside, reddish within. Asci clavate. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 7-16 x 7-8 μ . Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on muribund bryophytes and plant remains in exposed habitats, most common in the Alps, but also present in the high mountains of the south.

112 Thallus KC-

113

113 Epihymenium bright blue-green

Lecidea alpestris

Thallus crustose, whitish to grey, granulose, K+ yellow, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.7 mm diam. Surface black, convex. Margin indistinct, thin. Epihymenium bright blue-green, K-. Subhymenium colourless to brownish. Paraphyses adglutinated. Ascospores hyaline, ellipsoid, 8 per ascus, 14-25 x 3-9 μ . Photobiont chlorococcoid. - Note: on naked soil, mosses and plant debris over siliceous substrata, more rarely on bark,

on basal parts of conifers in the subalpine belt, systematic position and delimitation of this species are still not clear.

- 113 Epihymenium greenish brown to brown 114
114 Paraphyses adglutinated. Thallus whitish to grey. Ascomata dark brown to black

Lecidea miscella

Thallus crustose, whitish to grey, granulose, K+ yellow, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.7 mm diam. Surface dark brown to black, convex. Margin indistinct, thin. Epihymenium dark greenish brown, K-. Subhymenium brownish. Paraphyses adglutinated. Ascospores hyaline, ellipsoid, 8 per ascus, 12-18 x 5-7 μ . Photobiont chlorococcoid. - Note: on soil and terricolous bryophytes over siliceous substrata.

- 114 Paraphyses free. Thallus whitish, greyish to pale greenish brown. Ascomata pale to dark reddish brown

Lecidea rufofusca

Thallus crustose, whitish, greyish to pale greenish brown, granulose, K+ yellow, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.7 mm diam. Surface pale to dark reddish brown, convex. Margin indistinct, thin. Epihymenium brownish, K-. Subhymenium colourless to pale yellowish brown. Paraphyses free. Ascospores hyaline, ellipsoid, 8 per ascus, 11-18 x 6-9 μ . Photobiont chlorococcoid. - Note: on terricolous mosses and plant debris in siliceous areas, closely related to *Biatora leprosula*.

- 115 Thallus KC+ red 116
115 Thallus KC- 117
116 Apothecia at least when young lecanorine, with a thalline margin containing algal cells. Thallus thin, continuous. Ascospores 15-25 x 7-13 μ

Trapelia coarctata

Thallus crustose, whitish, pale grey to pale pinkish, thin, continuous, K-, C+ red, KC+ red, P-. Apothecia frequent, lecanorine, sessile, up to 0.8 mm diam. Surface rose-pink to red-brown. Margin distinct, concolour with disk, surrounded by a paler thalline margin forming a halo-like rim. Paraphyses anastomosing, ramified, not apically thickened. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 15-25 x 7-13 μ . Photobiont chlorococcoid. - Note: an early colonizer of pebbles near the soil surface, sometimes on bare clayey soil, rare, and mostly Tyrrhenian, in the eu-Mediterranean belt.

- 116 Apothecia non lecanorine, without a thalline margin. Thallus thick, areolate. Ascospores 9-14 x 4-6 μ

Trapeliopsis granulosa

Thallus crustose, whitish to pale grey, thick, areolate, granulose, K-, C+ red, KC+ red, P-. Areolae convex, contiguous. Soredia K-, C+ red, KC+ red, P-. Apothecia frequent, without a thalline margin, sessile, up to 1.5 mm diam. Surface extremely variable in colour, pale pink to reddish brown or dark grey-green. Margin distinct, thin. Epihymenium pale to brownish. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 9-14 x 4-6 μ . Pycnidia dark, immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on soil rich in humus, bryophytes, peat, rotting wood.

- 117 Ascospores not hyaline. Apothecia on long stalks, pin-like

Chaenotheca furfuracea

Thallus crustose, yellowish green, farinose, K-, C-, KC-, P-. Apothecia on long stalks, pin-like. Asci disintegrating early, often producing a mass of spores (maezedium) which accumulates on the surface of the ascomata. Ascospores 1-celled, not hyaline, globose, ornamented, more than 32 per ascus, 2.3-3 x 2.3-3 μ . Photobiont chlorococcoid. Capitulum, maezedium and stalk covered by a dense yellowish green pruina. Ascospores with a minute verrucose ornamentation. Thallus K-, P-. - Note: beneath overhanging faces protected from rain, esp. in forests, often on exposed roots, but rather indifferent to the substrata (also found on siliceous rocks and lignum), in the Mediterranean belt

restricted to very humid forests.

- 117 Ascospores hyaline. Apothecia not as above. 118
118 Apothecia lecanorine, with a thalline margin containing algal cells 119
118 Apothecia non lecanorine, without a thalline margin 123
119 Thallus yellowish to yellowish green

Lecanora leptacina

Thallus crustose, yellowish to yellowish green, areolate, K-, C-, KC-. Areolae convex, contiguous, adpressed to the substratum, non imbricate. Hypo/prothallus present, dark. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1.5 mm diam. Surface olivaceous, becoming blackish with age, often faintly white-blue pruinose. Margin distinct, crenulate. Epithymenium yellowish brown, K+ green. Paraphyses anastomosing, ramified, slightly thickened above. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, (9)10-13(15) x (4.5)6-9 μ . Photobiont chlorococcoid. - Note: on mosses (*Andraea*, *Grimmia*) and plant debris in sites with a long snow-lie, perhaps more widespread in the Alps.

- 119 Thallus not yellowish green, max greenish grey 120
120 Thallus not whitish to whitish grey 121
120 Thallus whitish to whitish grey 122
121 Thallus thin. Apothecial margin crenulate. Ascospores ellipsoid-cylindrical, 5-6.5(8) μ broad

Bryonora curvescens

Thallus crustose, grey to dark grey brown, thin, granulose, K-, C-, KC-, P-. Medulla UV -. Apothecia frequent, lecanorine, sessile. Surface dark brown to blackish brown, initially faintly grey-pruinose, plane. Margin distinct, thick, crenulate, grey to deep red-brown, sometimes paler than disc. Paraphyses simple, distinctly thickened above, adglutinated. Asci bitunicate, cylindrical. Ascospores hyaline, ellipsoid-cylindrical, thick-walled, 8 per ascus, indistinctly 0- to 6-septate (18)24-35(41) x 5-6.5(8) μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on bryophytes (e.g. *Andraea*, *Grimmia*) in sites with periodic seepage of water.

- 121 Thallus thick. Apothecial margin verruculose. Ascospores ellipsoid, 8-10 μ broad

Psoroma hypnorum

Thallus crustose, green-grey to yellowish brown, bright green when wet, thick, lobulate, with cephalodia, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile, up to 5 mm diam. Surface brown, concave, smooth. Margin distinct, thick, verruculose. Paraphyses simple, not apically thickened. Asci bitunicate, cylindrical. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, ornamented, 8 per ascus, 19-28 x 8-10 μ . Pycnidia pale, semi-immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on soil, often in and amongst bryophytes, in moist habitats, most frequent in the Alps.

- 122 Ascomata sessile. Apothecial margin thin. Ascospores 10-16 x 5-7 μ

Lecanora hagenii v. fallax

Thallus crustose, whitish, thin, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile, strongly constricted, up to 0.5 mm diam. Surface from brownish-black to pale brown, densely white-pruinose, plane. Margin distinct, thin, smooth, pruinose. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, 10-16 x 5-7 μ . Photobiont chlorococcoid. - Note: this taxon is well worthy of further study, in my opinion it could represent a distinct species growing on plant debris on more or less calciferous substrata from the Oromediterranean belt to the Arctic zone.

- 122 Ascomata immersed. Apothecial margin thick. Ascospores (30)35-50(60) x (21)25-39(42) μ

Megaspora verrucosa

Thallus crustose, whitish to grey, continuous, granulose, K-, C-, KC-, P-. Pruina diffuse. Apothecia frequent, lecanorine, immersed in thalline warts, up to 1.5 mm diam. Surface black, concave, rough, partly exposed. Margin distinct, thick, whitish to grey, pruinose. Epithymenium grey-black, K+ brownish, C-, P-, N+

green, KC-. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Asci clavate. Ascospores 1-celled, hyaline, broadly ellipsoid, thick-walled, 8 per ascus, (30)35-50(60) x (21)25-39(42) μ . Photobiont chlorococcoid. - Note: on mosses and plant debris over calciferous ground in open situations, descending to lower altitudes in particularly dry-continental areas, common also in the Apennines.

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|-----|---|-----|
| 123 | Ascomata neither bright nor dark-coloured | 124 |
| 123 | Ascomata dark | 127 |
| 124 | Ascospores 8 per ascus | 125 |
| 124 | Ascospores more than 32 per ascus | 126 |
| 125 | Excipulum colourless outside, pale brown inside. Thallus continuous, whitish grey | |

Biatora subduplex

Thallus crustose, whitish grey, continuous, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, not constricted. Surface orange-brown to dark brown, K-, C-, KC-, P-. Margin distinct, thin, smooth, paler than disk, K-, C-, KC-, P-. Epithymenium K-, C-, P-, KC-, absent. Hymenium K-, C-, KC-, P-, N-. Subhymenium brownish. Paraphyses adglutinated. Ascospores 1(2)-celled, hyaline, narrowly ellipsoid, 8 per ascus, 8-21 x 3-5.5 μ . Photobiont chlorococcoid. - Note: one of the commonest *Biatora*-species in the Alps, esp. on plant remains and on basal parts of subalpine shrubs, overlooked, and certainly more widespread in the Alps.

- | | | |
|-----|---|--|
| 125 | Excipulum more or less pale brown, uniformly coloured. Thallus granulose, greyish-green | |
|-----|---|--|

Biatora vernalis

Thallus crustose, greyish-green, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 0.7 mm diam. Surface orange-brown to reddish brown, K-, C-, KC-, P-. Margin distinct, thin, smooth, paler than disk, K-, C-, KC-, P-. Epithymenium K-, C-, P-, KC-, absent. Hymenium K-, C-, KC-, P-, N-. Paraphyses adglutinated. Ascospores 1(2)-celled, hyaline, narrowly ellipsoid, 8 per ascus, 11.5-23 x 4-7 μ . Photobiont chlorococcoid. - Note: on bryophytes, plant debris, soil and bark, a holarctic species, ranging from N Scandinavia to the Alps.

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| 126 | Ascospores cylindrical, 8-13 x 2.3-3 μ . Ascomata up to up to 1 mm diam. | |
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Biatorella fossarum

Thallus crustose, pale grey, thin, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 1 mm diam. Surface bright to dull orange-red, convex. Margin indistinct. Epithymenium pale to orange-yellow, K-, with a layer of crystals. Subhymenium pale grey-yellow. Paraphyses anastomosing, distinctly thickened above, adglutinated. Asci bitunicate, cylindrical. Ascospores 1-celled, hyaline, cylindrical, more than 32 per ascus, 8-13 x 2.3-3 μ . Photobiont chlorococcoid. - Note: on calciferous, often slightly decalcified soil in rather disturbed habitats, chiefly southern in Europe, closely related to *B. hemisphaerica*.

- | | | |
|-----|--|--|
| 126 | Ascospores narrowly ellipsoid, 5-8 x 2-3.5 μ . Ascomata up to up to 2 mm diam. | |
|-----|--|--|

Biatorella hemisphaerica

Thallus crustose, pale grey, thin, granulose, K-, C-, KC-, P-. Apothecia without a thalline margin, sessile, not constricted, up to 2 mm diam. Surface bright to dull orange-red, convex. Margin indistinct. Epithymenium pale to orange-yellow, K-, with a layer of crystals. Subhymenium pale grey-yellow. Paraphyses anastomosing, distinctly thickened above, adglutinated. Asci bitunicate, cylindrical. Ascospores 1-celled, hyaline, narrowly ellipsoid, more than 32 per ascus, 5-8 x 2-3.5 μ . Photobiont chlorococcoid. - Note: on calciferous soil and amongst bryophytes, most often in rock fissures, see note on *B. fossarum*.

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|-----|---|-----|
| 127 | Thallus P+ red | 128 |
| 127 | Thallus P- | 129 |
| 128 | Apothecial disk pruinose. Ascospores ellipsoid, (12)15-19(24) x 5-7(9) μ . Asci Lecanora- type, with a broad apical cushion | |

Lecidea caesioatra

Thallus crustose, grey to dark grey or almost blackish, areolate, granulose, K-, C-, KC-, P+ red. Areolae convex, granulose, contiguous, adpressed to the substratum. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface black, often bluish-pruinose, convex. Margin indistinct. Epithymenium deep bluish green, K-, C-, KC-. Subhymenium reddish brown. Paraphyses anastomosing, ramified, not apically thickened. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, (12)15-19(24) x 5-7(9) μ . Conidia bacilliform. Photobiont chlorococcoid. Apothecia often tuberculate, thallus sometimes P+ faintly yellowish. - Note: on silicicolous mosses, esp. *Andraea* and *Grimmia*, in places with a long snow-lie, more rarely directly on rock.

- 128 Apothecial disk non pruinose. Ascospores fusiform, (8)10-14(15) x 3-4.5(5) μ . Asci Catillaria type, but sometimes with an indistinct orcular chamber

Lecidea limosa

Thallus crustose, whitish grey to grey, sometimes with a white prothallus, areolate, granulose, K-, C-, KC-, P+ red. Areolae convex, granulose, contiguous, adpressed to the substratum. Apothecia frequent, without a thalline margin, sessile, up to 1 mm diam. Surface black, convex. Margin indistinct. Epithymenium deep bluish green, K-, C-, KC-. Subhymenium reddish brown. Paraphyses anastomosing, ramified, not apically thickened. Ascospores 1-celled, hyaline, fusiform, 8 per ascus, (8)10-14(15) x 3-4.5(5) μ . Conidia bacilliform. Photobiont chlorococcoid. - Note: on naked soil in sites with a rather long snow-lie, in clearings of Alpine grasslands, more rarely on muribund bryophytes and plant debris.

- 129 Ascospores 16 per ascus

Steinia geophana

Thallus crustose, pale grey to dull grey-green, subgelatinous when wet, thick, continuous, K-, C-, KC-, P-. Medulla UV -. Apothecia frequent, without a thalline margin, sessile, up to 0.6 mm diam. Surface dark brown, convex. Margin indistinct. Epithymenium red brown to brown. Hymenium J+ violet. Paraphyses simple, not apically thickened, adglutinated. Ascospores 1-celled, hyaline, subglobose, thick-walled, 16 per ascus, 5-7 x 5-7 μ . Pycnidia dark, immersed. Conidia ellipsoidal. Photobiont chlorococcoid. - Note: ephemeral on moist, sometimes slightly calciferous soil, rotten wood, small pebbles, terricolous *Peltigeras* and plant debris, often found in rather disturbed habitats as on earth banks along white roads and on track sides, certainly overlooked and more common, at least in the Alps.

- 129 Not as above

130

- 130 Ascospores more than 32 per ascus

Sarcosagium campestre

Thallus crustose, greenish to blackish brown, gelatinous when wet, thin, continuous, granulose, with thin transparent hairs, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, slightly constricted, up to 0.5 mm diam. Surface dark reddish brown, translucent when wet, concave, smooth, K-, C-. Margin distinct, thick, concolorous with disk, pruinose. Paraphyses simple, distinctly thickened above, free. Asci cylindrical. Ascospores 1(2)-celled, hyaline, ellipsoid-cylindrical, thin-walled, more than 32 per ascus, 5-8 x 2-2.3 μ . Photobiont chlorococcoid. - Note: an early colonizer of more or less calcareous soil, muribund bryophytes, plant debris, sometimes on decaying wood, mostly in rather disturbed habitats.

- 130 Ascospores 8 per ascus

131

- 131 Hypothecium dark

132

- 131 Hypothecium pale to colourless

133

- 132 Epithymenium K+ green. Ascomata substipitate. Ascospores ovoid, (9)20-27(21) x (2.5)3-4.5 μ

Helocarpon crassipes

Thallus crustose, whitish to pale grey brown to ash-grey in part, thin, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, substipitate, not constricted, up to 0.6 mm diam. Surface black, plane, K-, C-, KC-, P-. Margin

distinct, thin. Epihymenium greenish to purple-brown above, pale purplish below, K+ green, C-, P-. Hymenium K-, C-. Subhymenium dark purple-brown. Paraphyses anastomosing, ramified, not apically thickened, adglutinated. Margin (section) greenish in the outer part, the inner part concolorous with hypothecium. Asci unitunicate, clavate. Ascospores 1-2-celled, hyaline, ovoid, thin-walled, 8 per ascus, (9)20-27(21) x (2.5)3-4.5 μ . Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. Conidia bacilliform, 4.5-5.7 x 1.2-1.5 μ . Reactions of apothecial sections often ephemeral. - Note: on bryophytes and plant debris on the ground and amongst rocks, in areas with siliceous substrata, probably more widespread in the Alps.

- 132 Epihymenium K-. Ascospores ellipsoid, 10-16(19) x 4.5-6(7) μ

Mycobilimbia hypnorum

Thallus crustose, whitish to pale grey, thin, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 1.2 mm diam. Surface dark brown to black, plane. Margin distinct, thin, smooth, concolorous with disk. Epihymenium pale brown, K-. Hymenium J+ violet. Subhymenium dark reddish brown, with scattered bluish granules reacting K+ green. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 1(-4)-celled, hyaline, ellipsoid, 8 per ascus, 10-16(19) x 4.5-6(7) μ . Photobiont chlorococcoid. Some spores 4-celled. - Note: on mosses, plant debris, soil, bark and lignum

- 133 Ascospores >25 μ long

Aphanopsis coenosa

Thallus crustose, greyish green to brownish green, gelatinous when wet, composed of goniocysts of pseudoparenchymatous hyphae surrounding a few algal cells, thin, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.5 mm diam. Surface brown to brown-black, convex. Margin indistinct. Subhymenium pale brown. Paraphyses simple, not apically thickened. Asci cylindrical. Ascospores hyaline, broadly ellipsoid, thin-walled, 8 per ascus, 25-38 x 13-18 μ . Photobiont chlorococcoid. - Note: on humid, bare, clayey or fine-grained sandy soil on track sides or ditch margins in woodlands, easy to overlook, but certainly not common.

- 133 Ascospores <25 μ long

134

- 134 Epihymenium N-. Ascospores thick-walled, subglobose, (15)17-20(24) x (8)12-15 μ .

Japewia tornoensis

Thallus crustose, brownish, thin, continuous, smooth, K-, C-, KC-, P-. Apothecia without a thalline margin, sessile, up to 0.8 mm diam. Surface dark reddish brown, convex, K-, C-, KC-, P-. Margin indistinct. Epihymenium brownish, K-, C-, P-, N-, KC-, absent. Hymenium K-, C-, KC-, P-, N-. Subhymenium colourless. Paraphyses anastomosing, ramified. Margin (section) reddish-brown. Ascospores 1-celled, hyaline, subglobose, thick-walled, 8 per ascus, (15)17-20(24) x (8)12-15 μ . Photobiont chlorococcoid. - Note: on twigs of shrubs, on terricolous mosses and plant debris, certainly widespread throughout the Alps.

- 134 Epihymenium N+ red. Ascospores thin-walled, ellipsoid, 6.5-10.5 x 2.5-4 μ .

Micarea bauschiana

Thallus crustose, grey, thin, continuous, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, not constricted, up to 0.3 mm diam. Surface pale bluish grey to brownish black, convex, K-, C-, KC-, P-. Margin indistinct. Epihymenium colourless, K-, C-, P-, N+ red, KC-. Hymenium K-, C-, KC-, P-. Subhymenium colourless. Paraphyses anastomosing, ramified, slightly thickened above, adglutinated. Asci unitunicate, clavate. Ascospores 1-celled, hyaline, ellipsoid, thin-walled, 8 per ascus, 6.5-10.5 x 2.5-4 μ . Pycnidia immersed. Photobiont chlorococcoid. Apothecia often tuberculate. - Note: on a wide variety of substrata (rocks, exposed roots, consolidated soil) in shaded-dry situations (e.g. in underhangs), but restricted to humid areas, probably overlooked and more widespread in Italy, esp. in the Alps.

Subkey E - Leprose lichens

(Warning: most of these lichens can be identified with certainty only with chromatographical methods)

- | | | |
|---|--|---|
| 1 | Thallus from bright yellow to red | 2 |
| 1 | Thallus neither dark- nor very bright-coloured | 4 |
| 2 | Thallus bright deep yellow | |

Chrysothrix chlorina

Thallus leprose, bright yellow, forming a thick, continuous to cracked crust, granules 0.1-0.2 mm diam, C-, P-. Photobiont chlorococcoid. With calycin and vulpinic acid. - Note: in underhangs and crevices of siliceous rocks in shaded, humid situations, limited to areas with high air humidity, widespread throughout the Alps, it should be looked for in the siliceous mountains of the south and of Sardegna.

- | | | |
|---|--|---|
| 2 | Thallus greenish yellow to pale lemon yellow | 3 |
| 3 | Photobiont cells elongated-cylindrical. With vulpinic and pulvinic acids | |

Chaenotheca furfuracea

Thallus leprose, greenish yellow, farinose, K-, C-, KC-, P-. Photobiont chlorococcoid. With vulpinic and pulvinic acids. - Note: beneath overhanging faces protected from rain, esp. in forests, often on exposed roots, but rather indifferent to the substrata (also found on siliceous rocks and lignum), in the Mediterranean belt restricted to very humid forests.

- | | | |
|---|--|--|
| 3 | Photobiont cells isodiametric. With rhizocarpic acid | |
|---|--|--|

Psilolechia lucida

Thallus leprose, greenish yellow, K-, C-, KC-, P-. Medulla UV + dull to bright orange. Photobiont chlorococcoid. With rhizocarpic acid. - Note: in underhangs of siliceous rocks protected from rain in humid areas, but also on a wide range of substrata (soil, exposed roots, bases of ancient trees), in Italy restricted to natural habitats, far from urban settlements, and more frequent in the north and the in the most humid parts of the Mediterranean belt.

- | | | |
|---|-------------------|--|
| 4 | Thallus C+ orange | |
|---|-------------------|--|

Lepraria neglecta

Thallus leprose, whitish to whitish gray, often somehow darker in the center, K+ yellow, C+ orange, KC+ orange, P+ yellow. Photobiont chlorococcoid. With alectorialic and angardianic acids. - Note: on moss cushions and stony siliceous ground, chiefly in open mountain summits and in snow-beds.

- | | | |
|---|---|---|
| 4 | Thallus C- | 5 |
| 5 | Thallus P+ orange | 6 |
| 5 | Not as above | 9 |
| 6 | Substrata acid | 7 |
| 6 | Substrata calcareous to subneutral | 8 |
| 7 | Thallus without a yellowish tinge. With fumarprotocetraric acid, with or without atranorin, angardianic and rangiformic acids. Thallus whitish to pale grey, often darker in the center | |

Lepraria caesioalba

Thallus leprose, whitish to pale grey, often darker in the center, K+ yellow, C-, P+ orange. Photobiont chlorococcoid. Thallus without a yellowish tinge Granules (50)80-200 micron, With fumarprotocetraric acid, with or without atranorin, angardianic and rangiformic acids. - Note: on bryophytes, more rarely on siliceous rocks wetted by rain, esp. on basal parts of boulders with a long snow-lie, certainly more widespread.,

- | | | |
|---|---|--|
| 7 | Thallus with a yellowish tinge. With pannaric and roccellic acids. Thallus grey-yellowish, more yellowish at the margin | |
|---|---|--|

Leproloma membranaceum

Thallus leprose, grey-yellowish, more yellowish at the margin, K+ yellow, C-, KC-, P+ orange. Ascospores Thallus very sharply delimited. Photobiont chlorococcoid. Thallus with a yellowish tinge With pannaric and roccellic acids. - Note: on steeply inclined to weakly underhanging siliceous rocks, sometimes on epilithic bryophytes, much more rarely on bark, often forming monospecific stands, certainly much more widespread throughout the country, in natural habitats.

- 8 With alectorialic, barbatolic and protocetraric acids

Lepraria eburnea

Thallus leprose, whitish to greenish grey, K-, C-, KC+ orange, P+ orange. Medulla UV + reddish violet. Photobiont chlorococcoid. Granules without protruding hyphae, never clam-shaped White medulla evident, With alectorialic, barbatolic and protocetraric acids. - Note: in underhangs protected from rain, also on walls in anthropized habitats, certainly more common, also in urban and polluted situations, throughout the country.

- 8 With pannaric acid-6 methylester

Leproloma vouauxii

Thallus leprose, whitish to greenish grey, C-, P+ orange. Medulla UV + reddish violet. Ascospores Thallus not sharply delimited. Photobiont chlorococcoid. Thallus without a yellowish tinge Granules without protruding hyphae, never clam-shaped, With pannaric acid-6 methylester. - Note: on isolated trees with nutrient-rich bark in places which are seldom wetted by rain, sometimes on brick walls, certainly more common throughout Italy.

- | | | |
|----|---|----|
| 9 | Thallus P+ yellow | 10 |
| 9 | Thallus P- | 13 |
| 10 | Thallus K+ yellow | 11 |
| 10 | Thallus K- | 12 |
| 11 | With atranorin and porphyrylic acid. Thallus whitish to pale grey, often darker in the center | |

Lepraria cacuminum

Thallus leprose, whitish to pale grey, often darker in the center, K+ yellow, C-, P+ yellow. Photobiont chlorococcoid. Thallus without a yellowish tinge Granules 50-125 micron, With atranorin and porphyrylic acid. - Note: on epilithic mosses and soil in grasslands on siliceous substrata.

- 11 With atranorin and nephrosteranic acid. Thallus whitish to pale bluish grey

Lepraria rigidula

Thallus leprose, whitish to pale bluish grey, K+ yellow, C-, KC+ yellow, P+ yellow. Medulla UV + pinkish violet to ochre. Photobiont chlorococcoid. Thallus without a yellowish tinge Granules with protruding long hyphae, almost igle-shaped, With atranorin and nephrosteranic acid. - Note: an ecologically wide-ranging species, with optimum in the montane belt, certainly more common, also in the Alps, and to be looked for there.

- 12 Substrata calcareous to subneutral. Thallus KC+ red. With alectorialic acid, sometimes also with barbatolic and protocetraric acids

Lepraria eburnea

Thallus leprose, whitish grey with a pale greenish hue, K-, C-, KC+ red, P+ yellow. Medulla UV -. Ascospores Thallus not sharply delimited. Photobiont chlorococcoid. Granules <150(200) micron, with protruding long hyphae With alectorialic acid, sometimes also with barbatolic and protocetraric acids. - Note: in underhangs protected from rain, also on walls in anthropized habitats, certainly more common, also in urban and polluted situations, throughout the country.

- 12 Substrata acid. Thallus KC+ orange. With alectorialic and angardianic acids

Lepraria neglecta

Thallus leprose, whitish to whitish gray, often somehow darker in the center, K-, C-, KC+ orange, P+ yellow. Ascospores Thallus sharply delimited. Photobiont chlorococcoid. Thallus without a yellowish tinge With alectorialic and angardianic

acids. - Note: on moss cushions and stony siliceous ground, chiefly in open mountain summits and in snow-beds.

- 13 Substrata calcareous to subneutral 14
13 Substrata acid 15
14 Granules with protruding short hyphae, but never clam-shaped. With atranorin, stictic acid, zeorin. Thallus greenish grey to bluish grey

Lepraria lobificans

Thallus leprose, greenish grey to bluish grey, K+ yellow, C-, KC+ orange, P-. Medulla UV + reddish violet. Photobiont chlorococcoid. Thallus without a yellowish tinge Granules with protruding short hyphae, but never clam-shaped, White medulla evident, With atranorin, stictic acid, zeorin. - Note: in the lower parts of trunks, but also on rocks, lignum, soil and mosses, also occurring in rather polluted areas.

- 14 Granules without protruding hyphae, never clam-shaped. With pannaric acid-6 methylester. Thallus whitish to greenish grey

Leproloma vouauxii

Thallus leprose, whitish to greenish grey, C-, P-. Medulla UV + reddish violet. Ascospores Thallus not sharply delimited. Photobiont chlorococcoid. Thallus without a yellowish tinge Granules without protruding hyphae, never clam-shaped, With pannaric acid-6 methylester. - Note: on isolated trees with nutrient-rich bark in places which are seldom wetted by rain, sometimes on brick walls, certainly more common throughout Italy.

- 15 Thallus K+ yellow

Lepraria cacuminum

Thallus leprose, whitish to pale grey, often darker in the center, K+ yellow, C-, P-. Photobiont chlorococcoid. Thallus without a yellowish tinge With atranorin and porphyritic acid. - Note: on epilithic mosses and soil in grasslands on siliceous substrata.

- 15 Thallus K- 16
16 Thallus KC-. Thallus yellowish green to bright green. With vulpinic and pulvinic acids

Chaenotheca furfuracea

Thallus leprose, yellowish green, farinose, K-, C-, KC-, P-. Photobiont chlorococcoid. With vulpinic and pulvinic acids. - Note: beneath overhanging faces protected from rain, esp. in forests, often on exposed roots, but rather indifferent to the substrata (also found on siliceous rocks and lignum), in the Mediterranean belt restricted to very humid forests.

- 16 Thallus KC+ yellow. Thallus not yellowish green to green. With divaricatic acid, zeorin, rarely gyrophoric acid and atranorin

Lepraria incana

Thallus leprose, whitish to greenish/bluish grey, K-, C-, KC+ yellow, P-. Medulla UV + white to bluish. Photobiont chlorococcoid. Thallus without a yellowish tinge Granules without protruding long hyphae, With divaricatic acid, zeorin, rarely gyrophoric acid and atranorin. - Note: on acid bark of coniferous and deciduous trees, in sites protected from rain, sometimes on siliceous rocks, soil and lignum.