KEY
for the identification of terricolous lichens occurring in Italy above the submediterranean belt on subneutral to basic 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 brigh 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.

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Structure of the keys

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 (Cladonia, Leprocaulon, Stereocaulon)	**13**

2 Thallus orange

Teloschistes contortuplicatus

Thallus fruticose, orange to dirty orange, grey in shade-forms, with conspicuous orange pycnidia, loosely attached, with thin transparent hairs, K+ red, C-, KC-, P-. Branches 0.5-1 mm wide, elongate, flattened, imbricate. Edge deeply incised. Apothecia rare, lecanorine. Surface orange, K+ red. Epihymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, polar-diblastic, 8 per ascus, 10.5-12 x 6-7.5 µ. Photobiont chlorococcoid. - Note: esp. in south-facing niches and underhangs, relatively common also in the central Apennines, on the Adriatic side of the peninsula.

2 Not as above **3**

3 Thallus dark, from black to dark brown **4**

3 Thallus neither dark nor orange **7**

4 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.

4 Photobiont chlorococcoid **5**

5 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.

5 Lobes width < 3 mm. Medulla P- **6**

6 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. - Note: on siliceous, often sandy mineral soil in clearings of Calluna-heathlands in more or less wind-exposed situations..

6 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. - 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.

7 Lobes flat **8**

7 Lobes somehow inflated **10**

8 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. - Note: on bark of deciduous, rarely coniferous, more or less isolated trees, sometimes also on rock and amongst terricolous mosses in open situations, locally common in the Apennines and in the islands.

8 Marginal cilia absent **9**

9 Thallus smooth. Lobes cucullate, red-purple below

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.

9 Thallus wrinkled. Lobes not cucullate, brownish below

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).

10 Thallus white **11**

10 Thallus yellowish green **12**

11 Thallus P+ orange, becoming pinkish in the herbarium. Medulla UV -. With thamnolic acid

Thamnolia vermicularis

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

11 Thallus P+ yellow, remaining white in the herbarium. Medulla UV +. With baeomycic and squamatic acids

Thamnolia vermicularis v.subuliformis

Thallus fruticose, white, remaining white in the herbarium, K+ yellow, P+ yellow. Pseudopodetia (2)3-6 mm wide, bacilliform, smooth, ascending, non squamulose. Medulla UV +. Photobiont chlorococcoid. With baeomycic and squamatic acids. - Note: in open, wind-exposed Alpine tundras, much rarer in the Italian Alps than the previous variety.

12 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.

12 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.

13 Pseudopodetia without a central cavity **14**

13 Podetia with a central cavity **15**

14 Pseudopodetia very small, with greenish sorediod-leprose granules. Thallus K-, P-

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. 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.

14 Pseudopodetia much larger, without greenish sorediod granules. Thallus K+ yellow, P+ yellow

Stereocaulon rivulorum

Thallus fruticose, grey, densely covered by squamulose, lobulate phyllocladia, loosely attached, with cephalodia, K+ yellow, P+ yellow. Pseudopodetia very brittle, elongate, tomentose, ascending, terete. Apothecia frequent, without a thalline margin, terminal. 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 - 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.

15 Thallus densely ramified, shrub-like **16**

15 Thallus not or scarcely ramified, never shrub-like **23**

16 With soredia

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.

16 Without soredia **17**

17 Thallus K+ brownish

Cladonia furcata

Thallus fruticose, greenish grey, shrubby, K+ brownish, C-, KC-, P+ red. Podetia 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.

17 Not as above **18**

18 Thallus K- **19**

18 Thallus K+ yellow **20**

19 Thallus P+ red. Podetia greenish-grey, sparsely squamulose

Cladonia furcata

Thallus fruticose, greenish grey, shrubby, K-, C-, KC-, P+ red. Podetia 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.

19 Thallus P-. Podetia pale yellowish, without squamules

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.

20 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. 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.

20 Thallus P+ red **21**

21 Podetia without cortex, with an arachnoid surface

Cladonia rangiferina

Thallus fruticose, grey, shrubby, K+ yellow, C-, P+ red. Podetia ramified, tetrachotomous, with tips strongly bent to one side, 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. - Note: one of the most abundant elements of lichen-rich tundra-like vegetation on mineral soil in exposed habitats, common only in the Alps.

21 Podetia at least in part corticate **22**

22 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 tuft, with pointed apices and a distinctly areolate surface, sparsely to densely squamulose

Cladonia rangiformis

Thallus fruticose, greenish grey to whitish grey, K+ yellow, C-, KC-, P+ red. Podetia ramified, to 6 cm tall, richly branched, forming tufts, 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.

22 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, 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. - 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.

23 With cups **24**

23 Without cups **27**

24 With soredia **25**

24 Without soredia **26**

25 Podetia <4 cm tall, trumpet-shaped. Primary squamules medium-sized (1-3mm)

Cladonia fimbriata

Thallus fruticose, greyish-green, K-, C-, KC-, P+ red. Podetia 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.

25 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 bacilliform to irregular, 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. 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.

26 Thallus brownish-greyish green. Primary squamules 1-2 mm thick, brownish, flat, forming a subrosulate crust

Cladonia pocillum

Thallus fruticose, brownish-greyish green, K-, C-, KC-, P+ red. Podetia trumpet-shaped, non proliferating, areolate, non squamulose. Primary squamules medium-sized (1-3mm), 1-2 mm thick, brownish, flat, forming a subrosulate crust. Undersurface of squamules white. Medulla UV -. Photobiont chlorococcoid. - Note: on soil and amongst bryophytes in dry, open grasslands, one of the most common Cladonias of Italy, the distinction towards C. pyxidata is well-worthy of a DNA study, in my opinion, the two taxa might prove to be well-distinct.

26 Thallus greyish-green. Primary squamules thin, greenish grey, ascending, never forming a subrosulate crust

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. Primary squamules medium-sized (1-3mm), thin, greenish grey, ascending. 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).

27 With soredia or isidia **28**

27 Without soredia or isidia **29**

28 Thallus K+ yellow changing to red, P+ yellow. Podetia very thick-walled, medullary hyphae running parallel to the surface

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.

28 Thallus K-, P+ red. Podetia not very thick-walled, medullary hyphae not running parallel to the surface

Cladonia coniocraea

Thallus fruticose, grey, K-, C-, KC-, P+ red. Podetia bacilliform, 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. - 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.

29 Thallus K+ red

Cladonia polycarpoides

Thallus fruticose, grey, K+ red, C-, KC-, P+ red. Podetia rare. 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.

29 Not as above **30**

30 Thallus K+ yellow **31**

30 Thallus K- **32**

31 Thallus KC-, P-. Primary squamules medium-sized (1-3mm)

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.

31 Thallus KC+ yellow, P+ orange. Primary squamules large (5-10 mm)

Cladonia symphycarpa

Thallus fruticose, grey, K+ yellow, C-, KC+ yellow, P+ orange. Podetia areolate, to 1 cm tall, very rare, with irregular cups. Primary squamules large, to 2-3 mm tall, horizontally spreading, with recurved margins, grey-green above. Undersurface of squamules white. 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 calcareous ground in dry grasslands or on the top of large, exposed calcareous boulders, certainly occurring throughout S Italy.

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

Cladonia caespiticia

Thallus fruticose, greenish grey, K-, C-, P+ red. Podetia elongate, to 3 mm tall, decorticate. Primary squamules medium-sized, 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.

32 Primary squamules more than 3 mm broad, yellowish below **33**

33 Primary squamules 15-40 x 2-10 mm, sometimes with black or white hairs at the margins, forming straggling clusters

Cladonia convoluta

Thallus fruticose, greenish grey, K-, C-, KC-, P+ red. Podetia to 1.5 cm tall, very rare. Primary squamules 15-40 x 2-10 mm, sometimes with black or white hairs at the margins, forming straggling clusters. 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: on mineral soil in dry grasslands, or in intradunal depressions, also occurring in dry-continental Alpine valleys.

33 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 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.

Subkey B - Foliose lichens

1 Thallus bright yellow

Vulpicida tubulosus

Thallus foliose, bright yellow, loosely attached, K-, C-, KC-, P-. Lobes (2)3-6 mm wide, elongate. Undersurface yellowish. Rhizines pale, simple. Medulla K-, C-, KC-, P-. Apothecia rare, lecanorine. Surface brown. Ascospores 1-celled, hyaline, 8 per ascus. Pycnidia dark, stipitate. Photobiont chlorococcoid. - Note: on more or less calcareous mineral soil in dry Alpine grasslands and on wind-exposed ridges. Absent from the Apennines.

1 Not as above **2**

2 Thallus dark, from black to dark brown **3**

2 Thallus neither dark- nor very bright-coloured **11**

3 With soredia or isidia **4**

3 Without soredia or isidia **6**

4 Thallus heteromerous

Nephroma parile

Thallus foliose, bluish grey to dark brown, K-, C-, KC-, P-. Lobes 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.

4 Thallus homeomerous **5**

5 Lobes width > 3 mm. Isidia spatulate. Thallus thin

Collema crispum

Thallus foliose, homeomerous, olive green-brown to black, smooth or isidiate, thin.

Lobes rounded, concave, contiguous, 1-6 mm wide, ear-like, ascending and crowded, forming colonies to 6 cm diam. 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.

5 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 euthyplectenchymatous 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.

6 Ascospores 1-celled

Lempholemma polyanthes

Thallus foliose, homeomerous, dark olivaceous to blackish, wrinkled, loosely attached, K-, C-, KC-, P-. Lobes 1-2(3) mm wide, elongate, flattened, granulose, adpressed to the substratum. Edge entire. Apothecia frequent, lecanorine, semi-immersed. Surface brown, concave, smooth. Margin indistinct. Subhymenium colourless. Paraphyses simple, not apically thickened, adglutinated. Ascospores hyaline, globose, 8 per ascus, 9-14 x 9-14 µ. Pycnidia dark, immersed. Conidia bacilliform. Photobiont cyanobacterial. - Note: on terricolous or epilithic bryophytes, over soil or on plant debris, sometimes on walls, much overlooked, probably more widespread.

6 Not as above **7**

7 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 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 more than 4-celled **8**

8 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.

8 Ascospores hyaline **9**

9 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.

9 Ascospores per ascus 4 **10**

10 Thallus thick. Lobes convex, ascending

Collema ceraniscum

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, cubical when young, submuriform, 4 per ascus, 20-36 x 13-22 µ. Photobiont cyanobacterial. Excipulum euthyplechtenchymatous. – Note: over frost-disturbed ground on weakly calcareous substrata, a northern species, to be looked for throughout the Alps.

10 Thallus thin. Lobes plane, subcrustose, adpressed to the substratum

Collema limosum

Thallus foliose to subcrustose, 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.

11 Photobiont chlorococcoid **12**

11 Photobiont cyanobacterial **23**

12 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 Without soredia **13**

13 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. - Note: on bark of deciduous, rarely coniferous, more or less isolated trees, sometimes also on rock and amongst terricolous mosses in open situations, locally common in the Apennines and in the islands.

13 Marginal cilia absent **14**

14 Apothecia lecanorine, with a thalline margin containing algal cells **15**
14 Apothecia non lecanorine, without a thalline margin **18**
15 Lobes width > 3 mm

Parmelia somloensis

Thallus foliose, greenish-yellow, 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. Medulla 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.

15 Lobes width < 3 mm **16**
16 Thallus pruinose, greenish

Physconia muscigena

Thallus foliose, grey to brownish grey, often densely white-pruinose, loosely attached, K-, C-, KC-, P-. Pruina at the periphery. 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.

16 Thallus non-pruinose, not greenish **17**
17 Substrata siliceous. Lobes <0.5 mm wide. Rhizines brown to black, spread through the whole lower surface

Anaptychia bryorum

Thallus foliose, brownish, lobes to 0.2 mm wide, lobulate, 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. - Note: amongst mosses and muribund plants on base-rich substrata, probably more widespread in the Alps.

17 Substrata 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 pale. 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.

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

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 >20 mm wide, 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. Rhizines dark. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia rare, without a thalline margin, subterminal. 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.

18 Apothecia laminal, semi-immersed in the upper surface **19**

19 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.

19 Not as above **20**

20 Ascospores per ascus 2 **21**

20 Ascospores per ascus 4 **22**

21 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.

21 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.

22 Lobes (2)3-6 mm wide.

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.

22 Lobes 0.5-1 mm wide, reduced to a collar around the urceolate apothecia

Solorina spongiosa

Thallus foliose, pale grey, often white pruinose, K-, C-, KC-, P-. Lobes 0.5-1 mm wide, rounded, adpressed to the substratum, reduced to a collar around the urceolate

apothecia, on a dark layer of coralloid to nodulose cephalodia. Undersurface white, tomentose. Medulla white, 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, ornamented, 4 per ascus, 30-60 x 18-28 µ. Photobiont chlorococcoid. External cephalodia well-developed. - Note: a species of moist calcareous soil, probably restricted to the Alps in Italy.

23 With soredia or isidia **24**

23 Without soredia or isidia **26**

24 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, 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.

24 With isidia **25**

25 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, subterminal. 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.

25 Isidia spatulate, clustered. Lobes >10 mm wide

Peltigera praetextata

Thallus foliose, brownish, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes broad, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Isidia spatulate, clustered, simple. Undersurface whitish. Veins on undersurface raised, pale. Rhizines pale, simple. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

26 Veins on undersurface absent

Peltigera elisabethae

Thallus foliose, grey-brown, shiny, smooth, loosely attached, K-, C-, KC-, P-. Lobes broad, elongate, contiguous, adpressed to the substratum, non imbricate, with rounded ends. 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, subterminal. 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.

26 Veins on undersurface present **27**

27 Upper surface with sparse erect tomentum (use lens!)

Peltigera kristinssonii

Thallus foliose, grey brown to brown, often with a yellowish hue, smooth, loosely attached, with thin transparent hairs, tomentose, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Undersurface whitish. Veins on undersurface flat, dark. Rhizines pale, squarrose. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

27 Upper surface without erect tomentum, if tomentose, tomentum not erect **28**
28 Thallus non tomentose **29**
28 Thallus tomentose **34**
29 Veins on undersurface raised **30**
29 Veins on undersurface flat **31**
30 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, subterminal. 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.

30 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 raised, dark. Rhizines dark. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

31 Veins <1.5 mm broad **32**
31 Veins >2 mm broad **33**
32 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. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

32 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. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

33 Thallus matt. Rhizinae pale. 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. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

33 Thallus shiny. Rhizinae dark. Veins dark

Peltigera neopolydactyla

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 up-turned, undulate. Undersurface pale at the margin, darker in the center. Veins on undersurface flat, dark. Rhizines dark, simple. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

34 Lobes <10 mm wide **35**

34 Lobes >10 mm wide **36**

35 Rhizinae simple

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. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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. Isidia marginal and along cracks of the upper cortex Lobes <1 cm broad, Rhizines and raised veins long remaining pale. - Note: often confused with P. rufescens in the past, this lichen is probably more widespread, also along the Apennines.

35 Rhizinae squarrose

Peltigera rufescens

Thallus foliose, brownish, often grey-whitish tomentose, 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, squarrose. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline

margin, subterminal. 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 **37**

36 Rhizinae squarrose **38**

37 Veins on undersurface flat, dark. Lobes <1 cm broad

Peltigera monticola

Thallus foliose, brownish, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Undersurface whitish. Veins on undersurface flat, dark. Rhizines pale, simple. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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: a recently-described and still rarely collected taxon, related to P. rufescens and P. ponojensis, found on soil and amongst mosses over calcareous substrata.

37 Veins on undersurface raised, pale. Lobes >1 cm broad

Peltigera praetextata

Thallus foliose, brownish, smooth, loosely attached, tomentose, K-, C-, KC-, P-. Lobes >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge up-turned, entire. Isidia simple. Undersurface whitish. Veins on undersurface raised, pale. Rhizines pale, simple. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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. Isidia marginal and along cracks of the upper cortex Lobes >1 cm broad. - 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.

38 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. Rhizines pale, squarrose. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

38 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 >10 mm wide, elongate, flattened, contiguous, adpressed to the substratum, with rounded ends. Edge down-turned, entire. Undersurface whitish. Veins on undersurface raised. Rhizines squarrose. Upper cortex paraplectenchymatous. Lower cortex absent. Apothecia frequent, without a thalline margin, subterminal. 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.

Subkey C - Squamulose lichens

1 Thallus red

Psora decipiens

Thallus squamulose, bright red to reddish brown, often white-pruinose esp. at the margin. Squamules (2)3-6 mm wide, rounded, adpressed to the substratum, non imbricate. Edge up-turned, crenulate, paler than thallus. Lower cortex absent. Apothecia frequent, without a thalline margin, lateral, sessile. Surface black, sometimes white-pruinose, convex, smooth. Margin indistinct, thin, concolorous with disk. Epihymenium reddish brown, K+ violet. Subhymenium brownish. Paraphyses anastomosing, adglutinated. Asci clavate. Ascospores hyaline, ellipsoid, thin-walled, 8 per ascus, 11-18 x 6-8 µ. Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on bare, more or less calciferous soil, esp. common in dry grasslands, rare only in areas with intensive grazing, high trampling.

1 Not as above **2**
2 Thallus dark, from black to dark brown **3**
2 Thallus neither dark- nor very bright-coloured **16**
3 Photobiont cyanobacterial **4**
3 Photobiont chlorococcoid **8**
4 Thallus heteromerous **5**
4 Thallus homeomerous **6**
5 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 only when young. 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.

5 Apothecia non lecanorine, without a thalline margin.

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, lecanorine only when young. 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.

6 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.

6 Thallus without thin transparent hairs **7**

7 Squamules with entire margin

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.

7 Squamules with deeply dilacerate margin

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.

8 Pseudocyphellae present

Toninia 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. 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.

8 Pseudocyphellae absent **9**

9 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. Epihymenium 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.

9 Not as above **10**

10 Ascospores 2-celled **11**

10 Ascospores 4-celled **13**

11 Thallus with punctiform depressions

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. Epihymenium 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.

11 Thallus without punctiform depressions **12**

12 Hypothecium pale to colourless. Thallus medium to dark olivaceous brown with grey rim. Epiphymenium olivaceous brown to bright green

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. Epihymenium 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.

12 Hypothecium dark. Thallus dark brown to dark grey, never white-spotted. Epiphymenium dark brown, often with a weak greenish tinge (and then N+ faintly violet)

Toninia verrucarioides

Thallus squamulose, dark brown to dark grey, never white-spotted, K-, C-, KC-, P-. Squamules crenate, flattened. 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. Epihymenium dark brown, often with a weak greenish tinge (and then N+ faintly violet), K-, C-, P-, N+ violet, KC-. Subhymenium dark brown. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, ellipsoid-cylindrical, 8 per ascus, 10.5-19 x 3.5-5 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: in fissures and fine crevices of calcareous rocks, often found on species of Placynthium when young.

13 Hypothecium dark **14**

13 Hypothecium pale to colourless **15**

14 Epihymenium N+ violet

Toninia verrucarioides

Thallus squamulose, dark brown to dark grey, never white-spotted, K-, C-, KC-, P-. Squamules crenate, flattened. 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. Epihymenium dark brown, often with a weak greenish tinge (and then N+ faintly violet), K-, C-, P-, N+ violet, KC-. Subhymenium dark brown. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, ellipsoid-cylindrical, 8 per ascus, 10.5-19 x 3.5-5 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: in fissures and fine crevices of calcareous rocks, often found on species of Placynthium when young.

14 Epihymenium N-

Toninia verrucarioides

Thallus squamulose, dark brown to dark grey, never white-spotted, K-, C-, KC-, P-. Squamules crenate, flattened. 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. Epihymenium dark brown, often with a weak greenish tinge (and then N+ faintly violet), K-, C-, P-, N-, KC-. Subhymenium dark brown. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, ellipsoid-cylindrical, 8 per ascus, 10.5-19 x 3.5-5 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: in fissures and fine crevices of calcareous rocks, often found on species of

Placynthium when young.

15 Squamules imbricate. Ascospores ellipsoid-cylindrical, 2-4-celled, 13.5-30.5 x 3-4.5 µ

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. Epihymenium 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.

15 Squamules adpressed to the substratum. Ascospores acicular, 4-8-celled, 23-41.5 x 2.5-4.5 µ

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.

16 Photobiont cyanobacterial **17**

16 Photobiont chlorococcoid **18**

17 Apothecia non lecanorine, without a thalline margin. Prothallus absent. Squamules concave

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. Epihymenium 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, some records of H. lutosa might belong here.

17 Apothecia lecanorine, with a thalline margin containing algal cells. Prothallus present, dark. Squamules convex

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.

18 Squamules subfoliose, ascending, bifacial, without ascocarps (Cladonia) **19**

18 Squamules of different form, but not thin, subfoliose, bifacial and ascending **24**

19 Thallus K+ red **20**

19 Thallus K- **21**

20 Thallus P+ red. Primary squamules forming dense mats

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.

20 Thallus P+ orange.

Cladonia symphycarpa

Thallus squamulose, grey, K+ red, C-, KC-, P+ orange. Podetia to 1 cm tall, very rare, with irregular cups. Primary squamules large, to 2-3 mm tall, horizontally spreading, with recurved margins, grey-green above. Undersurface of squamules white. Ascospores 8 per ascus. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on calcareous ground in dry grasslands or on the top of large, exposed calcareous boulders, certainly occurring throughout S Italy.

21 Squamules not white below **22**

21 Squamules white below **23**

22 Primary squamules 15-40 x 2-10 mm, forming straggling clusters

Cladonia convoluta

Thallus squamulose, greenish grey, K-, C-, KC-, P+ red. Podetia to 1 cm tall, very rare. Primary squamules very large (>10 mm), 15-40 x 2-10 mm, sometimes with black or white hairs at the margins, forming straggling clusters. Undersurface of squamules yellowish. Pycnidia dark, semi-immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on mineral soil in dry grasslands, or in intradunal depressions, also occurring in dry-continental Alpine valleys.

22 Primary squamules 4-15 x 1-3 mm, forming compact mats

Cladonia foliacea

Thallus squamulose, greenish grey, K-, C-, KC-, P+ red. Podetia to 1 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. 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.

23 Thallus greenish grey. Primary squamules thin, irregularly incised and ascending, often forming low cushions

Cladonia caespiticia

Thallus squamulose, greenish grey, K-, C-, P+ red. Podetia 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 -. 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.

23 Thallus brownish-greyish green. Primary squamules 1-2 mm thick, flat, forming a subrosulate crust

Cladonia pocillum

Thallus squamulose, brownish-greyish green, K-, C-, KC-, P+ red. Primary squamules medium-sized (1-3mm), 1-2 mm thick, flat, forming a subrosulate crust. Undersurface of squamules white. Medulla UV -. Ascospores 8 per ascus. Photobiont chlorococcoid. - Note: on soil and amongst bryophytes in dry, open grasslands, one of the most common Cladonias of Italy, the distinction towards C. pyxidata is well-worthy of a DNA study, in my opinion, the two taxa might prove to be well-distinct.

24 With isidia. Thallus C+red, KC+ red

Trapeliopsis wallrothii

Thallus squamulose, whitish to pale grey, thick, 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. Epihymenium 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.

24 Without soredia or isidia. Thallus C-, KC- **25**

25 Pseudocyphellae present

Toninia 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. 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.

25 Pseudocyphellae absent **26**

26 With perithecia **27**

26 With apothecia **41**

27 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).

27 Not as above **28**

28 Ascospores more than 4-celled **29**

28 Ascospores 1-celled **31**

29 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.

29 Ascospores not hyaline. Squamules >0.5 mm **30**

30 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.

30 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.

31 Perithecial wall dark throughout **32**

31 Perithecial wall pale throughout **36**

32 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.

32 Perithecia with involucrellum **33**

33 Perithecia laminal **34**

33 Perithecia marginal **35**

34 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.

34 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 All spores clearly one-celled. 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.

35 Rhizohyphae pale. Involucrellum apical. Lower cortex absent

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.

35 Rhizohyphae dark. Involucrellum all around the perithecium. Lower cortex present

Catapyrenium waltheri

Thallus squamulose, brownish, sometimes with a grey tinge, thin, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, crenate, flattened, smooth, contiguous, adpressed to the substratum. Edge crenulate. Hypo/prothallus present, dark. Undersurface dark. Upper cortex paraplectenchymatous. Lower cortex paraplectenchymatous. Perithecia frequent, marginal, globose, protruding, not flattened, with an involucrellum extending all around the perithecium. Paraphyses absent. Perithecial wall dark throughout. Asci unitunicate, clavate. Ascospores 1-celled, hyaline, ovoid, thin-walled, 8 per ascus, Ascospores(15) 17-21 (23) x (7.5) 8-10(11) µ. Photobiont chlorococcoid. Rhizohyphae dark. - Note: on more or less calciferous ground in alpine grasslands, probably more widespread in the Alps.

36 Pycnidia laminal, or absent

Catapyrenium squamulosum

Thallus squamulose, brown, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, rounded, flattened, smooth, adpressed to the substratum. Edge concolorous with thallus. Undersurface pale, but often blackening esp. in the centre. 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, 12-16 x (5)5.5-7.5(8) µ. Conidia ellipsoidal. Photobiont chlorococcoid. Pycnidia laminal, or absent Cells of lower cortex not arranged in vertical rows, Conidia 3-5 µ long, Squamules without hairs. Rhizohyphae pale. - Note: on more or less calcareous soil, often amongst bryophytes, in open dry grasslands, this is probably the most common species of the genus in Italy.

36 Pycnidia marginal, prominent **37**

37 Cells of lower cortex arranged in vertical rows **38**

37 Cells of lower cortex not arranged in vertical rows **39**

38 Squamules >6 mm, margin of squamules thin. Thallus reddish brown. Mainly Mediterranean.

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, Squamules >6 mm, margin of squamules thin. 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. Mainly Alpine

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, Squamules <6 mm, margin of squamules thickened. Rhizohyphae pale. - Note: on humus and terricolous bryophytes on calciferous soil, certainly occurring throughout the Alps.

39 Squamules >10 mm wide

Catapyrenium rufescens

Thallus squamulose, reddish brown, thick, K-, C-, KC-, P-. Squamules >10 mm wide, rounded, flattened, smooth, adpressed to the substratum. Edge up-turned, undulate. 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, 15-20(22) x (7) 7.5-9(10) µ. Conidia ellipsoidal. Photobiont chlorococcoid. Pycnidia marginal, prominent Cells of lower cortex not arranged in vertical rows, Conidia 3-5 µ long, Squamules without hairs. Rhizohyphae pale. - Note: on vertical seepages of calcareous rocks, almost always with colonies of cyanobacteria, more rarely on plant debris, calcareous soil, terricolous or epilithic bryophytes.

39 Squamules (2)3-6 mm wide **40**

40 Squamules without hairs. Conidia bacilliform.

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.

40 Squamules with very thin hairs, at least at the periphery. Conidia ellipsoidal.

Catapyrenium pilosellum

Thallus squamulose, brownish, thin, K-, C-, KC-, P-. Squamules (2)3-6 mm wide, rounded, flattened, smooth, adpressed to the substratum. Edge up-turned, undulate. 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, (10)12-17(19) x (5) 5.5-7(7.5) µ. Conidia ellipsoidal. Photobiont chlorococcoid. Pycnidia marginal, prominent Cells of lower cortex not arranged in vertical rows, Conidia 3-5 µ long. Rhizohyphae pale. - Note: on calciferous soil rich in humus, often growing amongst bryophytes, several Italian records require reconfirmation.

41 Apothecia lecanorine, with a thalline margin containing algal cells **42**

41 Apothecia non lecanorine, without a thalline margin **44**

42 Ascomata dark. Squamules < 2 mm diam.

Phaeorrhiza nimbosa

Thallus squamulose, from brownish to pale ochraceous yellowish, sometimes fainly 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 Ascomata neither bright nor dark-coloured. Squamules >2 mm diam. **43**

43 Medulla P-. Specimens with a P- medulla belong to v. pseudocrassa (Mattick) D.Hawksw.

Squamarina cartilaginea

Thallus squamulose, yellowish green to greenish grey, often white-pruinose, esp. at the margin of squamules, thick, K-, C-, P-. Squamules flattened, contiguous, imbricate, with rounded ends. Edge entire. Undersurface brown. Upper cortex paraplectenchymatous. Medulla P-. Apothecia frequent, lecanorine, sessile, strongly constricted, up to 4 mm diam. Surface brownish to reddish brown, smooth. Margin distinct. Paraphyses slightly thickened above. Ascospores 1-celled, hyaline, oblong-obtuse, thin-walled, 8 per ascus, (10)12-14(15) x (4)4.5-6 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. Specimens with a P- medulla belong to v. pseudocrassa (Mattick) D.Hawksw. - Note: on calcareous rocks and thin soil layers, most common in dry grasslands, with optimum in the submediterranean belt, chemically variable.

43 Medulla P+ yellow. Specimens with a P+ yellow medulla belong to the typical variety

Squamarina cartilaginea

Thallus squamulose, yellowish green to greenish grey, often white-pruinose, esp. at the margin of squamules, thick, K-, C-, P-. Squamules flattened, contiguous, imbricate, with rounded ends. Edge entire. Undersurface brown. Upper cortex paraplectenchymatous. Medulla P+ yellow. Apothecia frequent, lecanorine, sessile, strongly constricted, up to 4 mm diam. Surface brownish to reddish brown, smooth. Margin distinct. Paraphyses slightly thickened above. Ascospores 1-celled, hyaline, oblong-obtuse, thin-walled, 8 per ascus, (10)12-14(15) x (4)4.5-6 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on calcareous rocks and thin soil layers, most common in dry grasslands, with optimum in the submediterranean belt, chemically variable.

44 Ascospores 4-celled **45**

44 Not as above **47**

45 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.

45 Hypothecium pale to colourless **46**

46 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.

46 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.

47 Ascospores 1-celled **48**

47 Ascospores 2-celled **52**

48 Thallus yellowish green

Psora rubiformis

Thallus squamulose, yellowish green to pale brownish green with paler, sometimes pruinose margins. Squamules (2)3-6 mm wide, elongate, contiguous, ascending, imbricate. Edge crenulate, paler than thallus. Medulla K-, P-. Apothecia without a thalline margin, sessile, up to 2 mm diam. Surface dark brown to black, convex. Margin indistinct, thin. Epihymenium brownish, K+ red. Subhymenium brown. Paraphyses anastomosing, adglutinated. Asci clavate. Ascospores hyaline, ellipsoid, thin-walled, 8 per ascus, 9-14 x 5-7 µ. Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on loess and calciferous soil, in fissures of calciferous siliceous rocks (e.g. calciferous schists), chemically heterogeneous (with and without gyrophoric acid).

48 Thallus not yellowish green **49**

49 Epihymenium K+ red **50**

49 Epihymenium K- **51**

50 Squamules pale, 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.

50 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, paler than thallus. 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. Epihymenium 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).

51 Squamules pale brown, plane, densely imbricated, 1-2(3) mm wide. 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. Epihymenium 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.

51 Squamules chectnut to dark brown, convex, non imbricated, (2)3-6 mm wide. Apothecial margin distinct

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. Epihymenium 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.

52 Epihymenium K-

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. Epihymenium 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.

52 Epihymenium K+ violet **53**

53 Hypothecium pale to colourless **54**

53 Hypothecium dark **55**

54 Thallus densely white pruinose.

Toninia rosulata

Thallus squamulose, pale grey, densely white-pruinose, thick, orbicular, lobulate, K-, C-, KC-, P-. Pruina diffuse. Squamules convex, contiguous, with rounded ends. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, faintly pruinose, plane, smooth. Margin indistinct, thin, smooth, concolorous with disk. Epihymenium grey, K+ violet, C-, P-, N+ violet, KC-. Subhymenium colourless. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, fusiform, 8 per ascus, 14.21.5 x 3.5-5 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on soil and in fissures and crevices of calciferous rocks, often on cyanobacteria or cyanobacterial lichens when young.

54 Thallus non-pruinose.

Toninia taurica

Thallus squamulose, olivaceous brown, K-, C-, KC-, P-. Squamules 1-2(3) mm wide, bullate, convex, finely divided by small fissures, contiguous. Edge concolorous with thallus. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, but densely pruinose, plane, smooth. Margin distinct, smooth, black, faintly or non pruinose, concolorous with disk. Epihymenium grey, K+ violet, C-, P-, N+ violet, KC-. Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, fusiform, 8 per ascus, 16.5-24.5 x 3-4.5 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: on calciferous soil and in fine crevices of the rocks, often associated with cyanobacterial lichens when young, rare in the eu-Mediterranean belt.

55 Thallus entirely pruinose

Toninia diffracta

Thallus squamulose, grey, densely white-pruinose, K-, C-, KC-, P-. Pruina diffuse. Squamules convex, contiguous. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, more or less white pruinose, plane, smooth. Margin distinct, smooth, concolorous with disk. Epihymenium grey, K+ violet, C-, P-, N+ violet, KC-.

Subhymenium brownish. Paraphyses anastomosing, distinctly thickened above, free. Asci clavate. Ascospores hyaline, fusiform, 8 per ascus, 14.5-26 x 3-4.5 µ. Pycnidia dark, immersed. Conidia filiform. Photobiont chlorococcoid. - Note: in small fissures on steeply inclined faces of calcareous rocks, often on cyanobacteria or cyanobacterial lichens when young, sometimes on soil, optimum at low altitudes, but reaching the Alpine belt.

55 Thallus non prunose, or only partly pruinose **56**

56 Squamules more or less flat, with a white-pruinose rim

Toninia albilabra

Thallus squamulose, reddish brown, often with greenish tinge, white pruinose at margin, K-, C-, KC-, P-. Pruina at the periphery. Squamules 1-2(3) mm wide, flattened, contiguous. Edge paler than thallus. 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. Epihymenium 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. Upper cortex thick, with deep cracks. - 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.

56 Squamules bullate,or if flat without white rim **57**

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

Toninia opuntioides

Thallus squamulose, olivaceous brown to reddish brown, whitish pruinose at the tips, K-, C-, KC-, P-. Pruina at the periphery. Squamules (2)3-6 mm wide, bullate, convex, contiguous, ascending, flattened. Edge entire, concolorous with thallus. Undersurface pale. Medulla K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, strongly constricted. Surface black, sometimes weakly prunose, plane, smooth. Margin distinct, smooth, concolorous with disk. Epihymenium 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. Upper cortex thin, sometimes with shallow cracks Squamules vertically flattened and imbricate, Squamules convex to bullate. - Note: on rock and soil, often amongst bryophytes, and always associated to cyanobacterial lichens when young.

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

Toninia sedifolia

Thallus squamulose, olivaceous green to brown, often white-pruinose, K-, C-, KC-, P-. Pruina at the periphery. Squamules 1-2(3) mm wide, convex, 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. Epihymenium 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 Squamules not vertically flattened, Squamules convex to bullate. - Note: on soil and wheathered calciferous, more rarely basic siliceous rocks, often overgrowing mosses and asociated 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 **2**
1 Not as above **4**
2 Photobiont trentepohlioid. With perithecia

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 Photobiont cyanobacterial. With apothecia **3**
3 Ascospores more than 4-celled, 4 per ascus. 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.

3 Ascospores 1-celled, 8 per ascus. 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.

4 Thallus from bright yellow to red **5**
4 Thallus neither dark- nor very bright-coloured **17**
5 With soredia

Caloplaca epiphyta

Thallus crustose, pale orange yellow, continuous, K+ red. Soredia diffuse, pale orange yellow, K+ red. Upper cortex paraplectenchymatous. Apothecia rare, substipitate. Surface K+ red. Margin distinct, thick, sorediate, K+ red. Epihymenium K+ red. Ascospores hyaline, polar-diblastic, 4 per ascus. Pycnidia orange-yellow, immersed. Conidia narrow ellipsoid, 1-celled. Photobiont chlorococcoid. Thallus initially subsquamulose, but often transformed into a more or less uniform sorediate crust with age Septum > 3 µ long. - Note: on mosses, soil and plant debris over calcareous substrata in rather sheltered, but light-rich situations, very much overlooked in the Alps, it probably occurs also in Abruzzi (Majella and Gran Sasso Massives), and should be looked for there.

5 Without soredia **6**
6 Thallus margin effigurate **7**
6 Thallus margin non effigurate **10**
7 Ascospores 1-celled **8**
7 Ascospores 2-celled **9**
8 Without schizidia. Ascomata frequent

Fulgensia fulgens

Thallus crustose, orange-yellow, effigurate, orbicular, K+ red, C-, P-. Lobes 1-2(3) mm wide, flattened, 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, 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 Thallus placodioid-monophyllous. - Note: on calcareous rocks and thin layers of soil, often in rock fissures.

8 With schizidia. Ascomata rare

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. Epihymenium 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, howhever, are also present in other, related species, a revision is badly needed.

9 Ascospores polar-diblastic, narrowly ellipsoid.

Caloplaca aurea

Thallus crustose, ochraceous yellow, thick, effigurate, areolate, K+ red, C-, P-. Lobes 1-2(3) mm wide, rounded, flattened, smooth, contiguous. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1.5 mm diam. Surface orange, smooth, K+ red, C-, P-. Margin distinct, thin, yellow, paler than disk. Epihymenium orange, K+ red. Subhymenium colourless. Paraphyses not anastomosing, simple. Asci clavate. Ascospores 2-celled, hyaline, narrowly ellipsoid, polar-diblastic, 8 per ascus, 12-20 x 4-6 µ. Pycnidia orange-yellow, immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum shorter than 3 µ. - Note: in fissures and cracks of calcareous rocks and dolomite, the record from Abruzzi is the southernmost in Europe.

9 Ascospores non polar-diblastic, fusiform.

Fulgensia pruinosa

Thallus crustose, orange-yellow, effigurate, K+ red, C-, P-. Pruina at central part. Lobes 1-2(3) mm wide, flattened, contiguous, adpressed to the substratum. Apothecia frequent, lecanorine, sessile. Surface orange ro brownish orange, plane, smooth, K+ red. Margin distinct, thin, orange-yellow, K+ red. Epihymenium K+ red. Ascospores 2-celled, hyaline, fusiform, thin-walled, 8 per ascus, 18-27 x 5-8 µ. Pycnidia orange-yellow, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on steeply inclined to underhanging faces of calcareous rocks, mostly in fissures, sometimes on epilithic bryophytes, var. fissiseda: on the top of birds' perching boulders.

10 Apothecia non lecanorine, without a thalline margin **11**

10 Apothecia lecanorine, with a thalline margin containing algal cells **12**

11 Apothecia dark, not perithecioid. Ascospores more than 4-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. epinecral layer present. - Note: on weakly calcareous soil rich in humus, first parasymbiontic on Baeomyces, later an autonomous lichen.

11 Apothecia bright yellow, perithecioid. Ascospores 1-celled

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. Periphyses present Lichenized. - Note: an ephemeral early colonizer of different substrata, incl. roofing tiles, rotten wood, soil, probably more widespread, but very much overlooked.

12 On slightly calciferous, siliceous substrata **13**

12 On calcareous substrata **14**

13 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. Thallus of closely packed, granular elements Thallus elements not elongated, not clearly coralloid. - Note: on the top of poles and wooden fences, on plant debris and soil, more rarely on rocks, certainly more widespread in the Alps.

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

14 Thallus K- or K+ orange

Candelariella unilocularis

Thallus crustose, yellow, thin, K-. Apothecia lecanorine, sessile, up to 1.5 mm diam. Surface yellow, K-, C-, KC-, P-. Margin distinct, thin, yellow, concolorous with disk, K-. Epihymenium yellow, K-. Hymenium J+ violet. Subhymenium colourless. Margin (section) yellow. Ascospores 1(2)-celled, hyaline, oblong-obtuse, 8 per ascus, 16-26 x 7-8 µ. Photobiont chlorococcoid. - Note: on epilithic mosses on limestone and dolomite, a characteristic element of calcareous mountains, well-distinct from C. aurella.

14 Thallus K+ red **15**

15 Ascospores 2-celled

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 ro 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.

15 Ascospores 1-celled **16**

16 Squamules convex. Thallus thick, little dissected at margin, more or less pruinose

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, the record of Grillo (1998) from the coast of Sicily, is certainly due to a misidentification.

16 Squamules plane. Thallus thin, areolae dissected at margin, not or faintly pruinose

Fulgensia bracteata v.alpina

Thallus crustose, orange-yellow, K+ red, C-, P-. Areolae rounded, flattened, 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 thin, areolae dissected at margin, not or faintly pruinose. - Note: on soil and over mosses in fissures of calciferous, mostly schistose rocks, a poorly known taxon, well worthy of further study, certainly more widespread in the Alps.

17 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.

17 Not as above **18**
18 Photobiont trentepohlioid **19**
18 Photobiont chlorococcoid **23**
19 With perithecia **20**
19 With apothecia **21**

20 Ascospores fusiform, 8 per ascus. 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, 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.

20 Ascospores oblong-obtuse, more than 32 per ascus. 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.

21 Ascomata sessile

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.

21 Ascomata immersed **22**

22 All septa of the ascospores 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.

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

Gyalecta geoica

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.

23 With soredia **24**

23 Without soredia **25**

24 Apothecial disk pale. Apothecia non lecanorine, substipitate. Thallus KC+ yellow

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, 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.

24 Apothecial disk brown. Apothecia lecanorine, sessile Thallus KC-

Lecanora epibryon v. bryopsora

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

25 With perithecia **26**

25 With apothecia **36**

26 Ascospores 1-celled **27**

26 Not as above **28**

27 Perithecia fully immersed. Thallus continuous. Ascospores clavate

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.

27 Perithecia protruding. Thallus verrucose. Ascospores narrowly ellipsoid

Verrucaria xyloxena

Thallus crustose, grey, thin, verrucose, K-, C-, KC-, P-. Perithecia frequent, protruding, not flattened, up to 0.3 mm diam. Surface black. Perithecial wall dark throughout. Ascospores hyaline, narrowly ellipsoid, 8 per ascus, 14-25 x 5-8 µ. Photobiont chlorococcoid. - Note: on more or less calcareous soil, often associated with acrocarpous mosses, easily overlooked, and perhaps more widespread in the Alps.

28 Ascospores 2-celled **29**

28 Not as above **30**

29 Ascospores 32 per ascus, fusiform, with appendages at both ends.

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.

29 Ascospores 8 per ascus, ellipsoid, without appendages

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.

30 Ascomata neither bright nor dark-coloured

Leucocarpia biatorella

Thallus crustose, greenish white to yellowish white, thin, granulose, K-, C-, KC-, P-. Perithecia frequent, half immersed, up to 0.8 mm diam. Surface yellowish or yellowish-pinkish. Paraphyses absent. Asci clavate. Ascospores many-celled, ellipsoid, muriform, 8 per ascus, (25)28-38(45) x (10)11-14 µ. Photobiont chlorococcoid. - Note: inconspicuous lichen of thin layers of calciferous, humus-rich ground, or over epilithic mosses in upland areas, probably overlooked, and more widespread.

30 Ascomata dark **31**

31 Ascospores 4-celled **32**

31 Ascospores more than 4-celled **33**

32 Ascospores narrowly ellipsoid, (18)24-70(86) x (10)11-15(16) µ. 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.

32 Ascospores ellipsoid, 26-36 x 10-14 µ. 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.

33 Perithecial wall light-coloured below.

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.

33 Perithecial wall dark throughout **34**

34 Ascospores not hyaline, 2 per ascus

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.

34 Ascospores hyaline, 8 per ascus **35**

35 Ascospores <40 µ long. Perithecia half immersed. Thallus continuous

Polyblastia sendtneri

Thallus crustose, grey-white, sometimes tinged brown, thick, continuous, 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. Thallus cartilaginous, gelatinous when wet. - Note: on organic soil, mosses and plant debris, most common in the Alps.

35 Ascospores >40 µ long. Perithecia protruding. Thallus granulose

Polyblastia terrestris

Thallus crustose, grey, thick, granulose, K-, C-, KC-, P-. Perithecia frequent, globose, protruding, with an involucrellum extending to the upper half, 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. Perithecia covered by a thalline layer. - Note: on more or less calcareous soil, both on bare ground and amongst bryophytes, a very polymorphic taxon, which needs revision.

36 Apothecia non lecanorine, without a thalline margin **37**

36 Apothecia lecanorine, with a thalline margin containing algal cells **63**

37 Ascospores 4-celled **38**

37 Not as above **41**

38 Ascomata dark **39**

38 Ascomata neither bright nor dark-coloured **40**

39 Ascospores fusiform, 1-4-celled, 14-20(26) x 3-5(6) µ . Ascomatal disk convex

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.

39 Ascospores ellipsoid-cylindrical, 2-6-celled, 16-30 x 5-6 µ. Ascomatal disk plane

Mycobilimbia microcarpa

Thallus crustose, whitish to greenish white, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.7 mm diam. Surface reddish brown to blackish brown, plane. Margin indistinct, thin, smooth, concolorous with disk. Epihymenium brownish, K-. Hymenium J+ violet. Subhymenium pale reddish brown to colourless. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 2-6-celled, hyaline, ellipsoid-cylindrical, 8 per ascus, 16-30 x 5-6 µ. Photobiont chlorococcoid. - Note: on mosses in dry grasslands, perhaps overlooked throughout the country.

40 Apothecia whitish. Ascospores fusiform, (1)4-celled, (12)13-22 x 4-7 µ.

Biatora carneoalbida

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.

40 Apothecia reddish to blackish brown. Ascospores ellipsoid-cylindrical, 2-6-celled, 16-30 x 5-6 µ

Mycobilimbia microcarpa

Thallus crustose, whitish to greenish white, granulose, K-, C-, KC-, P-. Apothecia frequent, without a thalline margin, sessile, up to 0.7 mm diam. Surface reddish brown to blackish brown, plane. Margin indistinct, thin, smooth, concolorous with disk. Epihymenium brownish, K-. Hymenium J+ violet. Subhymenium pale reddish brown to colourless. Paraphyses simple, slightly thickened above, adglutinated. Ascospores 2-6-celled, hyaline, ellipsoid-cylindrical, 8 per ascus, 16-30 x 5-6 µ. Photobiont chlorococcoid. - Note: on mosses in dry grasslands, perhaps overlooked throughout the country.

41 Ascospores more than 4-celled **42**

41 Not as above **45**

42 Ascomata neither bright nor dark-coloured

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. Epihymenium 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).

42 Ascomata dark **43**

43 Ascospores more than 4 µ large

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. Epihymenium 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).

43 Ascospores less than 4 µ large **44**

44 Ascomata black. Epiphymenium 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. Epihymenium 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.

44 Ascomata brownish. Epiphymenium 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. Epihymenium 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.

45 Thallus margin effigurate

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. Epihymenium yellowish brown. Subhymenium brownish. Paraphyses distinctly thickened above, with dark cap. Ascospores 2-celled, not hyaline, ellipsoid, constricted at septa, thin-walled, 8 per ascus, (12)13-20(23) x (5.5)6-10(10.5) µ. Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. Ascospores with rugulate ornamentation. - Note: on soil deriving from calciferous schists in open grasslands.

45 Thallus margin non effigurate **46**

46 Thallus K+ yellow **47**

46 Thallus K- **50**

47 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.

47 Not as above **48**

48 Thallus KC+ yellow. Apothecia not dark. Spores hyaline

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.

48 Thallus KC-. Apothecia dark. Spores not hyaline **49**

49 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.

49 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.

50 Ascomata neither bright nor dark-coloured **51**

50 Ascomata dark **52**

51 Ascospores cylindrical, 8-13 x 2.3-3 µ. Ascomata up to up to 1 mm diam.

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. Epihymenium 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, most Italian records must be checked against the latter species.

51 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. Epihymenium 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.

52 Ascospores 2-celled **53**

52 Ascospores 1-celled **55**

53 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 wheathered gypsum and gypsum soil.

53 Ascospores hyaline **54**

54 Ascospores <4 µ broad, ellipsoid-cylindrical, 2-celled, 3-5 µ broad

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.

54 Ascospores >4 µ broad, ellipsoid, 1(-4)-celled, 4.5-6(7) 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.

55 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. Epihymenium 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.

55 Not as above **56**

56 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 prown, 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.

56 Ascospores 8 per ascus **57**

57 Hypothecium pale to colourless **58**

57 Hypothecium dark **60**

58 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.

58 Ascospores <25 µ long **59**

59 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.

59 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.

60 Epihymenium K+ green

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 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.

60 Epihymenium K- **61**

61 Apotecial margin (section!) deep black, not transparent in thick sections

Farnoldia muscigena

Thallus crustose, whitish, thin, areolate, K-, C-, KC-, P-. Medulla J+ blue. Apothecia frequent, without a thalline margin, sessile, strongly constricted, up to 1 mm diam. Surface black, plane, smooth. Margin distinct, thick, black, concolorous with disk. Epihymenium greenish to brownish green, K-. Hymenium J+ violet. Subhymenium black to dark brown, often greenish in upper part. Paraphyses anastomosing, ramified, slightly thickened above. Margin (section) black. Asci bitunicate, clavate. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 10-18 x 6-8 µ. Pycnidia dark, immersed. Conidia cylindrical. Photobiont chlorococcoid. - Note: on muribund bryophytes and plant debris over calcareous substrata, probably more widespread in the Alps. (Tatra and Alps).

61 Apotecial margin (section!) not deep black, transparent **62**

62 Thallus thick. Ascospores 1-celled. Ascomatal disk convex

Mycobilimbia berengeriana

Thallus crustose, white, thick, granulose, K-, C-, KC-, P-. Areolae convex, contiguous. Apothecia frequent, without a thalline margin, sessile, up to 1.2 mm diam. Surface dark brown to black, convex. Margin distinct, thin, smooth. Epihymenium pale brown, K-. Hymenium J+ violet. Subhymenium dark reddish brown. Paraphyses simple, distinctly thickened above, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, 8 per ascus, (9.5)11-16(19) x 4-5(6) µ. Photobiont chlorococcoid. - Note: on mosses and plant debris over calcareous substrata, most common in the Alps, but probably occurring throughout the Apennines.

62 Thallus thin. Ascospores 1(-4)-celled. Ascomatal disk plane

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. - Note: on mosses, plant debris, soil, bark and lignum.

63 Thallus K+ yellow **64**
63 Not as above **66**
64 Thallus KC+ 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.

64 Thallus KC- **65**
65 Ascospores 1-celled, hyaline. Thallus continuous

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.

65 Ascospores 2-celled, not hyaline. Thallus areolate

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.

66 Thallus K+ yellow changing to red **67**
66 Thallus K- **70**
67 Thallus KC+ red **68**
67 Thallus KC- **69**
68 Ascospores 4-8 per ascus. 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.

68 Ascospores 4 per ascus. Parasitic on other lichens. Thallus non-pruinose

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. symphycarpa), generally on mosses and plant debris in dry grasslands on limestone, not always distinguished from D. diacapsis in the older literature.

69 Apothecia < 3 mm diam. Thallus P-. Ascospores 1-celled, hyaline

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. Ascospores always one-celled. - Note: on soil, mosses, plant remains and on other lichens in Alpine grasslands.

69 Apothecia > 3 mm diam. Thallus P+ orange. Ascospores muriform, not hyaline

Diploschistes ocellatus

Thallus crustose, pale grey to white, thick, areolate, K+ yellow changing to red, C-, KC-, P+ orange. Pruina diffuse. Areolae (2)3-6 mm wide, angular, convex, contiguous. Apothecia frequent, lecanorine, sessile, up to 6 mm diam. Surface black, mostly faintly white-pruinose, plane. Margin distinct, thick, smooth, paler than disk, pruinose. Paraphyses simple, not apically thickened, free. Asci bitunicate, cylindrical. Ascospores many-celled, not hyaline, broadly ellipsoid, muriform, 8 per ascus. Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on limestones, dolomite and calciferous sandstone, more rarely on soil, esp. common in the SW part of the Peninsula.

70 Ascospores 4-celled

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.

70 Not as above **71**

71 Ascospores 1-celled **72**

71 Ascospores 2-celled **75**

72 Thallus KC+ red

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.

72 Thallus KC- **73**

73 Ascomata immersed in thalline warts at least when young

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. Epihymenium 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.

73 Ascomata not immersed in thalline warts, sessile **74**

74 Apothecia <1 mm diam. 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.

74 Apothecia > 1 mm diam. Apothecial margin thick. Ascospores 50-75 x 25-40 µ

Ochrolechia upsaliensis

Thallus crustose, whitish, thin, continuous, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile, strongly constricted, up to 3 mm diam. Surface brownish, plane, K-, C-, KC-, P-. Margin distinct, thick, smooth, whitish, K-, C-, KC-, P-. Paraphyses anastomosing, ramified, adglutinated. Ascospores 1-celled, hyaline, ellipsoid, thick-walled, 8 per ascus, 50-75 x 25-40 µ. Pycnidia dark, immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: an arctic-alpine species of calcareous soil and plant debris.

75 Ascomata dark **76**

75 Ascomata from bright yellow to red **82**

76 Ascospores hyaline **77**

76 Ascospores not hyaline **79**

77 Ascospores polar-diblastic

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. Epihymenium 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.

77 Ascospores non polar-diblastic **78**

78 Thallus thin, granulose. Ascospores 8 per ascus, 16-23 x 6-8 µ. Apices of paraphyses distintctly thickened above

Halecania lecanorina

Thallus crustose, greyish, thin, granulose, K-, C-, KC-, P-. Apothecia lecanorine, sessile, up to 1 mm diam. Surface dark brown to blackish brown, plane. Margin indistinct, thin, (thalline) thin and ephemeral, proper margin dark. Paraphyses simple, distinctly thickened above, with dark cap. Ascospores 2-celled, hyaline, narrowly ellipsoid, 8 per ascus, 16-23 x 6-8 µ. Pycnidia immersed. Conidia bacilliform. Photobiont chlorococcoid. - Note: on thin layers of soil, on mosses and plant debris over calcareous substrata, perhaps more widespread in the Alps, but certainly not common.

78 Thallus consisting of more or less triangular lobes around the apothecium. Ascospores per ascus more than 32, 7-17 x 2-4 µ. Apothecial margin distinct. Apices of paraphyses not apically thickened

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.

79 Apothecial margin (section!) with a well-developed cortex

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.

79 Apothecial margin (section!) without a well-developed cortex **80**

80 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.

80 Hypothecium >60 µ tall **81**

81 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.

81 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.

82 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. Epihymenium 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.

82 Ascospores per ascus 8 **83**
83 Apothecial margin neither dark nor bright-coloured **84**
83 Apothecial margin from bright yellow to red **86**
84 Thallus brownish grey, thick, on epilithic mosses

Caloplaca congrediens

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-. Epihymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, polar-diblastic, 8 per ascus, 12-15 x 4-8 µ. Photobiont chlorococcoid. Septum > 3. - Note: on epilithic mosses overgrowing base-rich, often volcanic, siliceous rocks.

84 Thallus grey to whitish, thin **85**
85 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-. Epihymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, polar-diblastic, 8 per ascus, 12-15 x 4-8 µ. Photobiont chlorococcoid. Septum > 3. - 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.

85 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-. Epihymenium K+ red. Ascospores 2-celled, hyaline, ellipsoid, polar-diblastic, 8 per ascus, 12-15 x 4-8 µ. Photobiont chlorococcoid. Septum > 3. - 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.

86 Apothecia at least when young bright yellow to orange **87**
86 Apothecia rusty red or dirty (brownish) orange, sometimes blackish orange when old **88**
87 Ascomata orange. Ascospores 10-13 x 4-8 µ

Caloplaca saxifragarum

Thallus crustose, pale grey to whitish, thin, continuous, K-, C-, KC-, P-. Apothecia frequent, lecanorine, sessile, slightly constricted, up to 1 mm diam. Surface orange, plane, K+ red. Margin distinct, thin, smooth, orange, K+ red. Epihymenium K+ red. Ascospores hyaline, ellipsoid, polar-diblastic, 8 per ascus, 10-13 x 4-8 µ. Pycnidia immersed. Conidia ellipsoidal, 1-celled. Photobiont chlorococcoid. Septum > 3 µ long. - Note: on plant debris (esp. on dead leaves of Saxifraga, Dryas and Carex firma), and on muribund bryophytes in open habitats over calcareous or dolomitic substrata, widespread throughout the Alps, and to be looked for in the highest mountains of the south.

87 Ascomata yellow, becoming greenish yellow and darker with age. Ascospores 11-16 x 6-9 µ

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. Epihymenium 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.

88 Apothecial margin indistinct

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, smooth, concolorous with disk. Epihymenium 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.

88 Apothecial margin distinct **89**

89 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. Epihymenium 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 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. Epihymenium 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.

Subkey E - Leprose lichens

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

1

Thallus C+ yellow

Leproloma diffusum

Thallus leprose, whitish to yellowish grey, not sharply delimited, C+ yellow, P+ orange. Medulla UV + reddish violet. Photobiont chlorococcoid. With 4-oxypannaric acid-2-methylester, with or without pannaric acid. - Note: in niches and fissures of calcareous or dolomitic boulders, but also on soil in dry grasslands, probably present throughout the country.

1 Thallus C- **2**

2 Thallus P+ yellow **3**

2 Not as above **4**

3 Thallus K-. Thallus KC+ red. Medulla UV -

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) μ, 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.

3 Thallus K+ yellow. Thallus KC+ yellow. Medulla UV + pinkish violet to ochre

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.

4 Substrata siliceous or very weakly calcareous

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 μ, 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.

4 Substrata calcareous **5**

5 Thallus P+ orange **6**

5 Thallus P- **7**

6 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.

6 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.

7 Thallus with a yellowish tinge

Leproloma diffusum

Thallus leprose, whitish to yellowish grey, C-, P-. Medulla UV + reddish violet. Ascospores Thallus not sharply delimited. Photobiont chlorococcoid. Thallus with a yellowish tinge With 4-oxypannaric acid-2-methylester, with or without pannaric acid. - Note: in niches and fissures of calcareous or dolomitic boulders, but also on soil in dry grasslands, probably present throughout the country.

7 Thallus without a yellowish tinge **8**

8 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.

8 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.